DOCUMENT

THE CONTRIBUTION OF INFRASTRUCTURE TO REGIONAL DEVELOPMENT

Final report

COMMISSION
OF THE EUROPEAN COMMUNITIES

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This publication is also available in the following language:

FR, Parts 1-2: ISBN 92-825-5887-8

Cataloguing data can be found at the end of this publication

Luxembourg: Office for Official Publications of the European Communities, 1986

Part 1 : ISBN 92-825-5882-7
Parts 1-2: ISBN 92-825-5886-X

Catalogue number: CB-45-85-001-EN-C

Printed in Belgium

Commission of the European Communities

THE CONTRIBUTION OF INFRASTRUCTURE TO REGIONAL DEVELOPMENT

Final Report

by

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INTRASTRUCTURE STUDY GROUP

Document

FOREWORD AND ACKNOWLEDGEMENTS

With this Report the Study Group on the Contribution of Infrastructure to Regional Development presents the results of some years of both theoretical and empirical endeavours. The Group was faced with many expected and some unexpected difficulties, first in reaching agreement on a common research approach, and second, in defining common criteria for collecting data for an empirical analysis covering 141 regions of the actual 10 member countries of the European Community.

This research covers some new ground and brings together a wealth of information on regional infrastructure equipment and its link with regional development that has not been available before. By implication, both the theoretical approach and the empirical analysis represent only the first steps into a field of research that need to be improved and to be continued.

The first version of the Final Report was produced already in June 1982. Since then, a number of controls revealed some data and aggregation errors so that all calculations have been completaly redone for the present text.

The members of the Study Group wish to express their sincere gratitude to their personal collaborators and secretaries without whose help and sense of commitment the present Study could not have been undertaken. Among them, Urban A. Muenzer assumed a special responsibility for data bank organization, programming and the essential parts of the computerised Community Analysis. They also like to thank for the continuous advice and the critical remarks received from the Staff of the Commission and of the Statistical Office of the European Communities. Last but not least they thank all National Statistical Officies and all the many other Institutions who supported the work of the Group by making available data and advice. Our special thanks are extended to the Grossrechenzentrum fuer die Wissenschaft in Berlin, where all the calculations for the Community Report, the German and the Greek Reports for the 1982 version have been carried through. The revised final version was produced with the support of the Hochschulrechenzentrum of the Johann Wolfgang Goethe-Universitaet Frankfurt am Main. Their assistance is also very much appreciated.

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P A R T T W O

S U M M A R Y O F T H E R E P O R T

I. AIM AND SCOPE OF THE STUDY

In October 1979, the Commission of the European Communities established a Study Group in order to investigate the contribution of infrastructure to regional development. The Group presented a first version of its final Report in June 1982 and a revised version in June 1984. The study should help the Commission and the member countries in better assessing the role of infrastructure and in setting priorities for subsidizing infrastructure in the framework of Community regional policy.

The Report is divided into two parts, a theoretical and an empirical one. In the theoretical part, the Group presents a rough summary of existing views on the nature of infrastructure and its role as one of the main determinants of regional development having special characteristics in form of "capitalness" and "publicness". This idea is the basic element of the socalled regional development potential approach. It allows to estimate quasi-production functions that can be used to quantify the contribution of infrastructure and other factors to regional development measured in terms of income, productivity, and employment. The theoretical insights are exploited in order to derive definitions for more than 70 types of facilities grouped in 11 main infrastructure categories. In the empirical part, regional endowment with infrastructure is first described with the aid of an indicator system on the base of statistical data collected by the members of the Group for the regions of their respective countries. Although the Group was faced with many serious statistical problems, the data collected represent a first comprehensive infrastructure inventory for 141 regions according to a common set of definitions and covering facilities ranging from transportation to cultural facilities and natural endowments like parks and forests. However, for many empirical analyses, the data set had to be reduced to less than 141 regions.

II. INFRASTRUCTURE AS A DETERMINANT OF REGIONAL DEVELOPMENT POTENTIAL

The first part of the Report starts with a brief analysis of regional disparities and their causes, and infrastructure is identified as being one of them. As a result of a rough summary of existing views, the development potential approach is chosen and extended in order to analyse the contribution of infrastructure to regional development.

Infrastructure is seen as a part of the overall capital equipment of a region, namely that part characterized by relatively high degrees of "capitalness" and "publicness". The latter terms refer to the properties of immobility, indivisibility, non-substitutability, and polyvalence. These properties, albeit in differing degrees, can be used in order to classify the different infrastructure categories.

According to the regional development potential approach, infrastructure besides location (distance of a region from the core centers of economic activities), agglomeration and settlement structure (spatial concentration of population and production) and sectoral structure (relationship between agriculture, industry and service sectors) determine the development possibilities of a region. A given infrastructure endowment e.g. permits a region to obtain a certain income from utilizing this capacity. The basic proposition is that this specific class of resources limits regional development and that knowing the endowment with these resources allows to evaluate the chances for regional development and the possible returns from regional policy measures. Among a group of regions having a similar endowment as to location, agglomeration and sectoral structure, basically a region with a better infrastructure endowment will in general also be able to have higher income, productivity and employment. But due to the indivisibility of infrastructure capacities, there may exist significant differences in rates of utilization. As a consequence, the actual levels of income, productivity and employment can deviate from the potential levels determined by infrastructure and endowment with the other potentiality factors. Although the infrastructure endowment is not fixed for all times, the existing equipments represent such large capacity blocks of a relatively long life time that they significantly influence regional development in the medium run. Infrastructure can, therefore, be a limiting or bottleneck factor in the medium run if its capacities are fully utilized or even overutilized. In the long run, especially location and agglomeration may become more important as determinants of regional development because infrastructure endowments can be changed by obsolescence and investments.

Given the capitalness property of infrastructure, despite a high degree of non-substitutability in general, it is possible to use some infrastructure categories to a certain extent in order to compensate for unfavourable endowments with the other potentiality factors. A "bad" regional location can e.g. be improved by a better transportation infrastructure which reduces communication costs for peripheral regions. A spatial concentration of infrastructure can also help the growth of underagglomerated regions or regional centers.

Basically, actual income, productivity and employment can only reach their potential levels determined inter alia by the regional infrastructure endowment, if the potentiality factor capacities are optimally utilized by private capital and qualified labour, including entrepreneurial capabilities. This allows two important conclusions for regional policy measures: regions with a comparably low degree of infrastructure capacity utilization need more private capital and qualified labour in order to more fully exploit the existing development potential; regions showing a relative overutilization or bottleneck of infrastructure need public investments to increase their infrastructure capacity.

From the point of view of this policy and instrument oriented approach, the definition of infrastructure relevant for the regional development has to be separated, on the one hand, from private factors of production like private material and human capital, and from other types of public services on the other hand, like facilities for legislation, defence, general administration, police etc. The first types of resources do not represent infrastructure because their publicness properties are low, and because they normally can and will be supplied by private decision making through markets. The latter facilities can be considered to possess sufficient publicness properties, but not sufficient capitalness in the sence of directly productive inputs into regional production processes. In addition, they represent basic public services closely linked to the sovereignty function of any system of government which will have to be provided independently of the level of regional development. These basic or sovereignty infrastructure facilities should, therefore, not be subsidized by regional policy and especially not by the Regional Fund of the Community.

The list of infrastructure categories retained by the Group is presented as MATRIX TABLES I. A. and I. B. [cf. TABLES 5 and 6] in the Report. Infrastructure categories are classified there on the basis of a tentative evaluation according to decreasing degrees of publicness and in combination with the additional criteria of price excludability (e.g. fee financing), their complementary relation with other infrastructure categories (system effects), their degree of labour intensity and the required degree of labour qualifications needed in order to use these capacities efficiently.

III. MAIN RESULTS OF THE EMPIRICAL ANALYSES

The statistical problems faced by the Group when trying to collect comparable data for all the infrastructure categories retained for the 141 regions of the Community have been much more serious than anticipated. The Group had, therefore, to invest much more time and effort than originally expected in data collection and in checking comparability. As a consequence, not all types of analysis which should have been done could be realized. In addition, non-available data and lack of comparable data may have affected the results especially of the econometric estimates which certainly could have been better if the statistical data base would have been more reliable. Despite these problems, the empirical results based on the methodology developed in the first part of the study merit serious consideration.

In order to profit from the fact that the data base for the regions of one and the same member country is larger and its comparability higher, each expert prepared a National Report for his country. Due to the statistical problems already mentioned, only a smaller data set could be used for a Community-wide analysis. The Group Report, therefore, contains both a summary of findings of the National Reports and the results of the Community Analysis.

In the present summary, only a small selection of the findings can be given which naturally cannot cover all the wealth of information and insight gained.

A first series of analyses is based on the values obtained for the total infrastructure indicator IGES. This indicator is derived as follows: First, the indicator value for each subcategory of infrastructure is standardized and normalized in order to obtain a figure of 100 for the best equipped region and to measure all other regions in percent of this best equipped one. Second, the algebraic mean of these subindicators per region is then used to calculate the indicator for each main infrastructure category A-L. Third, these main category indicators are aggregated in order to obtain the geometric mean for IGES. The geometric mean has been chosen because it implies limited substitutability of the main categories.

A first rough comparison of total infrastructure endowment measured by IGES according to the National Reports yields an interregional distribution of infrastructure which can be characterized by calculating the Maximum-Minimum-Ratio (MMR). MMR varies between 1.3 and 3.5 in the two cross sections chosen, i.e. 1970 and 1978 [cf. TABLE 9]. This simple distribution measure, though not capable in taking account of the distribution in-between the extreme values, nevertheless informs about the total span. MMR for the different main categories are larger; they increase upto infinity if one region really does not possess an equipment with the special infrastructure category retained for the analysis. In these cases ">100" is used. Very high MMR are obtained for Natural and Cultural infrastructure; relatively high values appear for Energy Supply, Urban infrastructure and Water Supply in some countries. Medium level disparities were observed for Health, Sports/Tourism, Social infrastructure and Transportation. If the values for the two cross section years are compared, disparities tend to decrease.

If interregional infrastructure disparities are measured for 139 EC-regions [cf. TABLE 13], MMR for IGES is about 12 times the national maximum in the first (43.5) and about 5 times (17.2) in the second year, provided those regions are disregarded that do not have an equipment. The best equipped region in both years is Noord-Holland; the region with the lowest equipment is North East in Ireland with 2.3 per cent of Noord-Holland in the first and 5.8 per cent in the second year. There are seven main categories in the first and still five in the second year for which the indicator values range from 0 to 100 as indicated by ">1000". Very low MMR are obtained for Health (3.9/4.0). In general, again disparities tend to decrease from the beginning to the end of the seventies. If coefficients of variation are used as a distribution measure, disparities become smaller, too. In addition, these coefficients indicate that the in-between distribution has improved.

Additional insights are gained if all regions are grouped into five classes whereby each class covers 20 percentage points [cf. TABLE 15]. In general, the highly agglomerated, urbanized and richer regions exhibit a better infrastructure endowment than other regions, particularly when compared with rural, sparsely populated and peripheral poor regions. One country (Italy) shows the largest spread since its regions are to be found in all five classes, whereas others (e.g. Belgium, United Kingdom and Greece) only cover two quintiles and Ireland even only one, the lowest quintile.

As a result, overall disparities decrease both as far as the span of the distribution and the in-between changes of relative positions are concerned. But at the same time, a majority of regions improve considerably their relative positions, whereas a minority, unfortunately belonging to the less well developed member countries, could not keep pace with the general development.

A simple correlation analysis between infrastructure and development indicators based on the data sets used in the National Reports yields relatively high coefficients except for Ireland [cf. TABLE 16]. High coefficients exist especially for direct income generating infrastructure categories with high degrees of publicness like Transportation, Communication, Energy Supply and partly also for Water Supply and Environmental Infrastructure. Socio-cultural infrastructure facilities (Education, Health, Sports/Tourism, Social Infrastructure in the narrow sense, Cultural facilities) as a group do not perform as well; besides being low, some coefficients are even negative. However, Social Infrastructure in the narrow sense as one single main category sometimes has the highest figures. But here, the degree of publicness is lower and the extent to which Socio-cultural Infrastructure reflects more income use or consumption may be higher and their income determining character lower.

The quasi-production function concept is then applied to a restricted set of roughly comparable data covering as much regions as possible across the whole Community in order to explicitly test what infrastructure contributes to regional development measured in terms of income per capita, per employed person or emplopyment. The results of a very large number of functions estimated for three different types of regional production functions (simple infrastructure quasi-production functions, modified Cobb-Douglas functions, fully specified quasi-production functions) can be roughly summarized as follows [cf. TABLES 18 to 22]:

(1) With a few exceptions, infrastructure measured in form of indicators for main categories or for total infrastructure endowment (IGES) is a significant exogenous variable for explaining regional development in terms of income per capita, productivity per employed person and different employment indicators. In general, regional development is higher the better a region is endowed with infrastructure.

(2) The estimated contribution of infrastructure to regional development declines if the other potentiality factors, location, agglomeration and sectoral structure are explicitly introduced into the production functions. Infrastructure nevertheless remains significant in the large majority of cases. This supports the theoretically derived proposition that infrastructure is one of the main determinants of regional development, but that the other determinants exert significant influence, too. Regional development, therefore, cannot be based on infrastructure policy alone.

(3) Infrastructure endowment is a better explanator of regional income and productivity than of employment. This may be due to the fact that income per capita and productivity reflects both the contribution of infrastructure to absolute income and employment, and that the employment effect is not independent of the income effect. In addition, the awkward problem of defining "active" persons especially in case of family aids (agriculture!) may be responsible for the weak results.

(4) The existing interregional differences in infrastructure endowment are larger than disparities in actual and potential income per capita. If Berlin and Groningen due to their special economic situations and Irish regions due to some data problems are disregarded, infrastructure disparities e.g. in the first year are as large as 6.6 MMR (Noord-Holland 100:15.17 Thrace), whereas actual income MMR is 5.8 (4030 ECU Hamburg: 693 ECU Thrace) and potential income MMR 4.1 (3274 ECU Koeln: 795 ECU Thrace). Similar results are shown for productivity. That actual disparities in income and employment can be expected to be larger than potential ones is explained by the fact that highly developed regions normally also have higher rates of infrastructure utilization whereas less developed regions generally show lower utilization ratios.

The potential income and productivity estimates are obtained under the assumption that the explicitly measured regional production capacities are combined with all the other "private" factors of production in the traditional meaning of e.g. entrepreneurial capabilities, private human and material capital, and qualified labour. These estimates are implicitly based on a sort of "normal" or "average" rate of utilization of regional capacities. The difference between actually observed and estimated "potential" income can, therefore, be interpreted to represent a rough indicator for relative capacity utilization. A region is said to underutilize its production potential if actual income is lower than potential income, and to overutilize it if the reverse is true.

This interpretation can be applied both to the singular infrastructure functions and to the fully specified functions. In the first case, the contribution of infrastructure is presumably overestimated, because the other determinants of regional development potential are not explicitly considered. In a fully specified function, on the other hand, the contribution of infrastructure can sometimes be underestimated, if one of the other exogenous variables represents a "dominant" variable. In a certain sense, singular infrastructure functions can, therefore, provide hints as to the possible existence of an "upper" boundary and fully specified functions as to a "lower" boundary of infrastructure influence.

The main findings of this analysis can be summarized as follows [cf. TABLES 23 to 35]:

(1) Richer regions tend to utilize their infrastructure capacities more intensively than normal, whereas poorer regions in general show a relative underutilization. There are, however, notable exceptions.

(2) Relative underutilization or overutilization ranges from -36% to +70% in the first year, Irish regions included, or from -24 % to +51% without them. The figures for the second year are -33% to +43%, Irish regions included that no longer represent extreme cases. The higher values of the first year may be partly caused by data problems. Potential productivity figures are similar, although the difference between lowest and highest utilization rates is smaller (-23% to +59% in the first and -29% to +36% in the second year). This asymmetrical distribution of utilization ratios seems to be a special characteristic of infrastructure because it appears also if other production functions are used.

(3) The relative excess capacity or bottleneck situation of a region does not only seem to be determined by its level of development in relation to say a Community average, but also in relation to the economic position of a region in the national context. This can be inferred from the fact that among the regions with relatively high rates of under- or overutilization, there are regions both from poorer and from richer member countries.

At first sight, regions showing a significantly large underutilization of infrastructure capacities seem to suffer not so much from a possible bottleneck, but from being incapable of attracting and maintaining mobile factors of production and of paying market rates of remuneration for entrepreneurs and labour. Richer regions seem to be able to use these instruments in order to attract more easily those "private" factors of production upto the point that they exploit their capacities excessively. A straightforward policy conclusion would then be to subsidize private factors of production e.g. by investment and/or employment premiums in less developed regions and to subsidize infrastructure investment in the better developed regions.

However, this simple two-tier strategy has to be qualified in several respects:

First, the apparent underutilization of infrastructure can have its cause in a relatively inferior endowment with other potentiality factors so that infrastructure excess capacities have to compensate deficits in other resource endowments. A high equipment with transportation and communication infrastructure can e.g. compensate for a peripheral location.

Second, there may be a certain "minimum capacity" which is required if a region should reach the stage of self-sustaining growth. Less developed regions may, therefore, have relatively higher infrastructure needs than already more developed ones.

Third, the particular characteristics of each region must also be taken into account. A mountain region e.g. needs more road kilometers per square kilometer in order to secure minimum access to all of its centers compared with a region situated in the plain or profiting from a good coastal position with many natural harbours.

Whereas the second and the third argument could not be analysed in more detail by the Study Group, the first one has been put to test. The basic idea is as follows:

In case a region has a well balanced endowment with a full set of potentiality factors, potential income estimated with a singular infrastructure quasi-production function will yield approximately the same value as potential income estimated with the aid of the fully specified function. If infrastructure endowment is comparatively smaller than endowment with these other factors, potential infrastructure income will be lower than potential income predicted with the fully specified function.

Infrastructure bottlenecks may exist side by side with bottlenecks or with excess capacities of other factors, and the same applies for infrastructure excess capacities compared with bottlenecks of other resources. Whether or not a region can be allocated to one of these four cases, can be checked by comparing relative rates of under- or overutilization estimated with the aid of a singular infrastructure production function on the one hand and a fully specified potentiality function on the other.

The main results and the conclusions that can be drawn from these results for income per capita (BEPO) can be summarized as follows [cf. TABLES 29 and 36 to 38]:

(1) The results obtained with the aid of the fully specified potentiality factor function are in general compatible with the results obtained with the singular infrastructure function. Rates of relative under- or overutilization range between -23% and +42% in the first and -27% and +43% in the second year. The asymmetrical distribution apparently still exists, although, it is less pronounced, especially in the first year, compared with the singular functions.

(2) Regions showing relative underutilization or overutilization both of infrastructure and of total development potential most frequently remain in their category from the first to the second year.

(3) Regions showing utilization rates inside a band of +/- 1.5 percentage points around zero are classified as having "normal" capacity utilization rates. If differences between two rates are only considered to be significant if they are larger than 3 percentage points, a vast majority of regions shows either constant or changing rates of over- or underutilization. Only very few regions are characterized by changes from negative to positive utilization rates or vice-versa. In general, the frequency distribution remains the same for the two years with the exception of two subcategories of regions: Those showing increasing or decreasing under- or overutilization. Of all the 118 regions analysed, 55 remain in the same seven subgroups from first to second year.

(4) In a large number of cases, the degree of relative over- or underutilization is reduced if the full set of potentiality factors is explicitly taken into account. This supports the hypothesis that infrastructure partly compensates for a bad endowment with other resources. On the other hand, an infrastructure deficit in a better developed region can be compensated by a relative better endowment with those other factors.

In summing up, the experiment to interprete differences between actual and estimated "potential" incomes as indicators of relative under- or overutilization of existing infrastructure and total resource endowments offer plausible results. A much more differentiated picture as to types of regional problems can be obtained if this method is adopted. Despite the many statistical problems, the results in general seem to be reliable.

IV. POLICY AND RESEARCH CONCLUSIONS

The results presented in the Study are to be evaluated from its special context. The task assigned to the Study Group was both a difficult one and a restricted one at the same time as far as the analysis of only one instrument of regional policy, namely infrastructure is concerned. The difficulty also arises from the fact that we do not possess a general theory of infrastructure or of determinants of regional development potential in general. The statistical and data collection problems have been much greater than anticipated and the Group had to devote much more of its scarce research time for solving these problems. As a consequence, the results and the conclusions of this Study only represent a first step towards the analysis of the contribution of infrastructure to regional development. It is, nevertheless, the first time that both a theoretical approach intended to define and measure infrastructure in its effects, and an empirical investigation as to the possibilities of quantifying these concepts for all European regions has been undertaken.

Despite these limitations, a number of conclusions for Community regional policy can be drawn:

(1) In general, infrastructure does contribute to regional development. Even if the problems of demand versus supply influences could not be fully dealt with, it follows from the infrastructure properties of capitalness and publicness that there exists a significant supply-side effect.

As has been demonstrated, the better the infrastructure endowment, the higher is regional development measured in terms of income, productivity and employment. An infrastructure policy, therefore, remains an important element of regional policy, be it on a local, regional, national or a Community level.

(2) There is no similarly clear-cut answer to the question of whether or not different infrastructure categories exercise different influences on regional development. On the one hand, the statistical problems prevented a more detailed analysis in this respect and on the other hand, more hypotheses need to be developed in order to better understand the role of individual infrastructure categories in regional development.

(3) Infrastructure is one of the four main determinants of regional development potential, the other three being location, agglomeration, and sectoral structure. This supports the position of the Commission of the European Communities that comprehensive regional development programs are needed in order to guide investment decisions and decisions on subsidizing them.

(4) With the aid of the estimates obtained through the quasi-production functions, it is possible to rank all regions according to potential income, productivity and employment. A first policy decision that can be based on this information, is to select a threshold figure in order to separate underdeveloped regions. In addition, these regions can be classified according to their relative degree of under- or overutilization.

On the basis of these findings, a first policy conclusion would be to subsidize private factors of production in regions with excess capacities of infrastructure and infrastructure investments in bottleneck regions. There is, however, a number of qualifications to be considered:

First, an infrastructure surplus region can need an infrastructure subsidization as well. An example are those regions that have an overall resource deficit except in infrastructure and where infrastructure partly compensates this deficit. A second case covers all least developed regions possibly needing a minimum capacity to be able to develop at all and where the existing capacity is below the minimum.

Second, the aggregate infrastructure indicator used may hide serious bottlenecks in individual infrastructure categories. Those are due to the possibility that substitutability between the individual categories of infrastructure is lower than implied by the aggregation procedure of the geometric mean.

Yet, there are also qualifications as to highly developed regions. They do not necessarily need an infrastructure expansion if only infrastructure is in deficit, but compensated by a better endowment with e.g. location or agglomeration. Another reason for not automatically enlarging infrastructure bottlenecks is the relationship between high development and overagglomeration or congestion. Given the importance of a policy intended to protect the environment and to reduce the deleterious effects of pollution and congestion in densely populated areas, the policy conclusion as to infrastructure expansion should not only be taken on the basis of the relative rate of overutilization.

(5) Infrastructure categories also differ as to their degree of excludability. In the case of infrastructure facilities offering paid services (railways, electricity, telephones), pricing policies may be of higher importance than availability as such. A particularly efficient infrastructure policy would consist in paying subsidies to private entrepreneurs or to

households in cases where the costs of creating new infrastructure facilities providing the same economic advantages would be higher compared with the direct aids to be paid.

A special case for subsidization can be made in the context of innovation policy. If a region is disadvantaged because it has too many old and declining industries, it may be an efficient policy to subsidize a transfer of know-how concerning business management, exploitation of new markets, adoption of new technologies and the use of patents. This does not imply that new bureaucratic institutions have to be created. On the contrary, this would justify a subsidization also of certain kinds of privately marketable services e.g. for small and medium size enterprises. In some cases, e. g. in mass transportation services, competition is distorted at the disadvantage of less developed regions by massive subsidization of the integrated railway, bus and underground transportation systems in highly urbanized and agglomerated regions.

(6) Finally, it must be stressed that infrastructure is but one category of the whole range of instruments which can be used to aid regional development. This implies that infrastructure should not be used as an isolated instrument, but always as an integrated part of a comprehensive development strategy.

These conclusions for regional infrastructure policy have to be supplemented by specific research conclusions. It is well known that new research does not always answer old questions, but also ends up in formulating new desiderata. A list of possible research projects which originated from the work and the experience of the Study Group forms a part of the conclusion chapter of the Report.

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INTRODUCTION

I. AIM AND SCOPE OF THE STUDY

I.1. ASSIGNMENT OF THE STUDY GROUP

In November 1979, the Directorate General for Regional Policy established a group of experts and asked them to study the contribution of infrastructure to regional development. This decision must be seen within the context of the regional policy of the Community. According to the regulation of the Council of the European Economic Community No. 274/75 of 18th March 1975, which established the European Regional Development Fund (ERDF), subsidies for infrastructure investments were limited to those infrastructures which were directly linked with the development of industrial, handicraft and service activities. This regulation has been amended by the Council Regulation No. 214/79 of 6th February 1979 to include a wider range of infrastructure categories which are eligible for Regional Fund aid. According to the amended Regulation, the ERDF can subsidize infrastructures which "contribute to the development of the region or area in which they are situated", provided that they are justified by a regional development program. In cases where these projects are of "particular importance" to the development of the region or area concerned, the matching ratio could also be 40% instead of 30% of the investment expenditure, which was fixed as a maximum at that time.

In its resolution of 6th February 1979 regarding the guidelines for Community regional policy, the Council stressed the need to develop a comprehensive system of analysis and policy formulation in order to enable a common basis of assessment to be established. To this end, the Commission is asked to prepare Periodic Reports on the general position and socio-economic development of the regions of the Community. In the first Periodic Report, it is stressed that the influence of infrastructure on regional development remains to be analysed and that this will have to be done in the second Periodic Report to be presented in 1983.

It is in this context that the Study Group has been asked to give its advice to develop a general methodology which can be used to identify the contribution of infrastructure to regional development and to present a first quantitative evaluation of this contribution to productivity, income and employment. The Study should also enable the Commission to facilitate the setting of priorities for infrastructural intervention, not only for the ERDF, but also for the other financial instruments of the Community such as the New Community Instrument for Investment Financing (NIC), the European Investment Bank (EIB) and the European Monetary System (EMS) interest rebates which may also participate in favour of infrastructure investments in the less developed regions.

The assigned task of the Study Group, therefore, is to develop a methodology which can be applied to identify those types of infrastructure which contribute to regional development, and in which the Regional Fund and other financial instruments of the Community may participate. This includes an attempt to develop an inventory of the actual infrastructure endowment of European regions in order to show the differences between them and the deficiencies in the endowment of the less favoured ones. Finally, the analysis should help to quantify the impact of differences in infrastructure equipment on regional productivity, income and employment, and to draw meaningful conclusions as to the design of a Community infrastructure policy.

Since the establishment of the Study Group signifiant progress has been made in the field of regional policy. In the Communication of the Commission to the Council of 24th July 1981 new regional policy guidelines were formulated. According to these, "the best way to solve regional problems is to improve competitiveness and productivity throughout the entire European economy." First priority will have to be given to the creation of new productive jobs and to raising productivity generally by realizing more fully the indigenous regional development potential of the European regions.

A number of policy conclusions are drawn by the Commission. In the first instance they envisage concentrating intervention in those regions suffering from serious structural underdevelopment. In addition, they also envisage carrying out increasingly "integrated operations" involving the coordinated application of various instruments in specific areas. Furthermore, they also desire to achieve greater coordination between Community regional policy and other instruments on the one hand and Community and national regional policy on the other. The regional development programs to be submitted to the ERDF by the member states are to be extended in order to explain more clearly, and in a more operational manner, the link between Community and national measures and their contribution to the development goals. The infrastructure and investment programs will form a part of these regional development programs. In summarizing, the Commission states that its regional activities will have to change from "the functioning of a financing body to those more clearly identified with a development agency."

In order to give substance to these guidelines the Commission proposed to the Council on 26th October 1981 another amendment to the ERDF regulation of 1975. As far as infrastructure is concerned the Commission expressed its intention of gradually replacing the system of financing individual projects by a system of financing programs. According to Article 7 of the new regulation, infrastructures to be financed under investment programs will have to contribute to the development of the region or the area in which they are located. In the application for Fund assistance submitted the member states will have to state what the infrastructure investment contributes to the development of a region in question (Article 14, previously Article 7). The ERDF financial participation will be equal to 30 per cent of the total investment costs if there are less than 5 million ECU, or between 10 per cent and 30 per cent if the project is more expensive (Article 12 modifying former Article 4/2).

These new developments in the regional policy field during the working period of the Study Group again highlight the role of infrastructure in a more comprehensive and better coordinated Community policy. They stress the need for a consistent and operational infrastructure assessment scheme based on uniform Community criteria which could be used both by local, regional and national authorities to explain infrastructure needs and to plan infrastructure investments, and by the Commission services to evaluate the development programs as they are submitted.

I.2. SCOPE AND METHODOLOGY OF THE STUDY

Whilst it would have been an extremely interesting task to formulate the framework for a broad based regional policy which would contribute to convergence inside the Community, the Group has been asked to deal with only one important instrument of such a policy, infrastructure or social overhead capital. Nevertheless, this task requires a comprehensive approach such that the contribution both of infrastructure as one instrument of regional policy and of regional policy as one of many policies available at the Community and national levels, may be adequately evaluated. The Group, therefore, adopted the following terms of reference for its work:

(1) The Group took as given the explicit and implicit policy goals contained in the Community documents discussed above. These can all be subsumed under the general heading of convergence, as has already been formulated in the 1977 and 1981 regional policy guidelines of the Commission. Accordingly, the contribution of infrastructure to regional development is taken as meaning a contribution to more convergence between European regions. More convergence is equivalent to less regional disparity. It appeared useful, therefore, for the Group to commence its work with a brief description of the existing disparities between regions.

(2) If infrastructure is to be used as an instrument for the promotion of convergence or the reduction of disparities, then the particular role of infrastructure as a determinant of regional development must be analysed. Since the Group was asked to make an operational contribution, it had to develop a theoretical concept which would facilitate the identification of infrastructure and its contribution to the accepted goals. In addition, a simplified measurement system was required which, even though it cannot reflect all the facets of the theoretical construct, does permit a first approximate quantitative evaluation.

(3) The basic notion underlying the theoretical approach of the present study is that infrastructure is the public or social overhead capital element of the overall regional capital stock. From this point of view, the contribution of infrastructure to regional development is equivalent to the

contribution of the quantities and qualities of the "services" inherent in the different types of infrastructure. On the one hand, these infrastructure services require complementary labour inputs, and on the other they also depend on the existing demand for those services. A fully articulated theoretical approach would have required the construction of a highly differentiated model to be used for assessing the contribution of infrastructure. However, given the financial and time constraints, the Group was not able to undertake this task. It decided, therefore, to concentrate on the infrastructure capacity or supply aspects. They are of particular importance if we wish to examine areas such as the contribution of infrastructure to productivity and employment.

(4) The results which can be obtained with the aid of an appropriate measurement system always depend on the quality and comparability of the statistical data available. It has to be admitted that, when commencing its work, the Group underestimated the inherent difficulties in the statistical field. Much more time than anticipated had to be devoted to the selection and collection both of appropriate infrastructure indicators and of data which can be used as development indicators with a view to establish a link between the two data sets. In consequence, it did not prove possible to undertake the full range of analyses originally intended, and the poor quality of many data also prevented a more detailed analysis. This also implies, as will be shown in the second part of this Report, that the results differ strongly between member countries and that it is difficult to reconcile some of the findings from a purely theoretical point of view. To a large extent data difficulties can explain these otherwise rather surprising results. But there remains much which can be demonstrated with the aid of an imperfect data base. This is the first time that such a large data set has been constructed for all European regions, and it is now awaiting further refinement and additional analysis.

(5) In order to accomplish the defined tasks, the Study has been broadly divided into a theoretical and an empirical part. These are some of the theoretical issues to be dealt within the first part:

- What is meant by the term "infrastructure"?

- What criteria can be used to separate development infrastructure from non-development infrastructure and from other types of "public" facilities and what infrastructure categories are involved?

- What is the role of infrastructure as an instrument of regional policy and which regional development goals can be and/or should be pursued with this type of instrument?

- To what extent can infrastructure types be considered as potential or actual bottleneck factors which, if they are lacking or crowded, limit the possibilities for regional development?

- What is the relative contribution of various infrastructure categories to regional development?

- What is understood at the conceptual level by "infrastructure of particular importance to the development of a region"?

In the second part of the Report, an operational measurement system on the basis of the preceding theoretical approach is developed. To apply this approach, the members of the Study Group had to engage in defining and collecting statistical data for the regions of their respective countries. These data will be used to construct infrastructure capacity indicators in order to describe relative infrastructure equipment of all regions in the European Community. The same indicators will then be entered as exogenous variables in quasi-production functions to obtain estimates for potential income, productivity and employment. Furthermore, a special analysis will be undertaken to measure relative infrastructure bottlenecks and excess capacities.

The following tasks will form a section of the empirical part of the Study:

- Definition and calculation of infrastructure equipment indicators,

- Estimation of quasi-production functions and selection of other statistical techniques in order to assess the influence of infrastructure on regional development,

- Identification and measurement of infrastructure bottlenecks and excess capacities,

- Evaluation of the results.

The final two chapters of the Report present summaries of the National Reports by the members of the Study Group and some policy and research conclusions.

Finally, this Report includes as an Appendix a summary of a special study on the contribution of infrastructure to regional development in Portugal and Spain. This study was carried through by Dieter Biehl and Urban A. Muenzer with the assistance of Alfred Boltz and Peter Ungar after the Study Group had finished its work.

An Annex comprising additional informations and especially the basic data collected for this Study is available as a companion volume.

PART ONE

INFRASTRUCTURE AS AN INSTRUMENT FOR REGIONAL DEVELOPMENT
CONCEPT AND MAIN THEORETICAL ASPECTS

II. REGIONAL DEVELOPMENT, REGIONAL DISPARITIES AND THE ROLE OF INFRASTRUCTURE IN REGIONAL POLICY

II.1. INTRODUCTORY REMARKS

In this chapter of the Report, we want to discuss the following questions:

- What is meant by "regional development"?

- What are "regional disparities" and what is the extent and the structure of regional disparities according to the various theories of regional development?

- What conclusions can be drawn from this analysis as to successful regional development strategies and as to the role of infrastructure within such a strategy?

Guided by these questions, first the notion of regional development is briefly discussed and some figures describing regional disparities are presented. Then the literature on the causes of regional disparities is roughly summarized and finally, some conclusions as to the role of infrastructure are drawn.

II.2. ON THE NOTIONS OF "REGION" AND "DEVELOPMENT"

We are accustomed to speaking about a "region" in relation to geographical, political, cultural or economic characteristics. In principle then, "region" normally means a set of spatial "points" representing locations of consumers, producers, public decision making institutions, capital equipments etc. which can be linked on the basis of a particular homogeneity criterion such as a common climate, a common governmental organization, a common language, a common currency, intensive input-output, trade or labour market relationships. The choice of the homogeneity criterion will depend on either the research interest or the policy problem to be studied.

From the point of view of the present Study, it would seem desirable at first sight to delimit regions on the basis of infrastructure servicing areas, as the question to be answered is whether and to what extent differences in regional development are caused by differences in regional infrastructure investment or equipment. However, infrastructure is an abstract concept; there are roads, railways, electricity supply networks, hospitals, schools and so on, which may or may not be considered to be a part of infrastructure. As the service areas of the different infrastructure categories differ (e.g. a road subsystem has a larger service area than a primary school), it seems to be difficult to define "the" infrastructure region. In addition, infrastructure is not the only factor influencing regional development.

It seems, therefore, preferable to start from the concept of "development" as a policy goal in order to define both notions simultaneously. In general terms, development, whether it is on a local, a regional, a national or a Community-wide level, refers to changes in the level and the composition of welfare over time. Such "growth" in the widest meaning of the term includes all components of the welfare of the members of a society - goods and services (private and public), leisure, environmental quality, health, human relations, freedom and justice and anything else which conveys satisfaction to individuals, families or groups of people. However, such an all-embracing concept of welfare is not unambigously measurable for an individual, and aggregation over individuals is impossible. Even if we would replace the notion of welfare by a number of well-defined and measurable indicators, we could end up with an unnecessarily large list. The reason is that a number of those indicators may simply represent subissues and are taken up in a higher level indicator. As a consequence, it is possible to look for a restricted number of main indicators under which numerous subindicators can be subsumed.

It can be argued that income and employment represent two important main indicators of regional welfare. Income reflects both productive performance of a set of resources and purchasing power in the hands of producers and consumers in order to obtain private and public goods and services. Employment is not only one of the means of producing income, but a value in itself as far as human self-realization through activity and cooperation is concerned. Furthermore, statistical data for regional income and employment are normally available whereas other attempts to quantify "welfare" have not yet been successful.

The next question to be asked then is what consequences this understanding of development has for the choice of the concept of "region". The answer is that a region is to be defined to mean a spatial unit that can be considered to represent a bundle of resources with the aid of which income and employment can be produced. As employment represents the productive capabilities of the inhabitants of a region and as unemployment is considered to be a socially and politically undesirable wastage of human resources, the concept of a "travel-to-work" or "labour market" region represents an appropriate definition of a region.

A labour market region is based on the idea that a "central place" such as a large city normally offers more jobs than its own inhabitants will be able to fill. Hence, a job surplus exists which attracts people interested in finding work but residing in smaller local communities of the city's hinterland. If these daily commuter flows are used as indicators of functional links between local communities, an identity of resident and working population results. A similar idea underlies the socalled central place concept of Christaller and Loesch. They considered the intensity of using the particular services of a city or the special market linkages between such a city and its hinterland, as constituent elements in determining a region as a hierarchical system of settlements.

Labour market regions may be large for highly qualified labour and they may be smaller for less qualified workers. As a result, the size of a labour market region may differ according to labour qualifications considered, such that a sort of hierarchy again arises. A person may at the same time be a member of a smaller, a medium-sized and a larger labour market unit. Although this particular factor does not make the delineation of an appropriate region an easy task, the coincidence of labour and income interests appears to be a good precondition for defining a region. Regional development would then relate to the growth of income and employment in so-defined labour market regions.

The question remains as to the relationship between a labour market region and an infrastructure service area. As commuting requires transportation infrastructure, labour market regions will roughly coincide with the service areas of that kind of infrastructure. Furthermore, the accessibility of most of the other infrastructure categories will also depend on transportation and communication facilities. Finally, the smaller a servicing area and the larger a labour market region, the more congruence will be achieved because a labour market region will then embrace a large number of such infrastructure facilities. There is, therefore, no significant problem as to kindergartens, schools, general hospitals. The difficulty exists, however, e.g. for large international airports and harbours or universities that are located in one region but serve also other regions. But this does not generally invalidate the proposition that labour market regions do represent reasonable proxies for infrastructure service areas.

Unfortunately, some of the difficulties reemerge if the statistical data problem is considered. Most frequently, available data refer to administrative units that are not necessarily congruent with labour market regions. As a consequence, administrative regions will have to be checked as to whether they seriously deviate from a functional region concept. If incongruence exists, it is possible to collect data at a lower regional level (e.g. a county level) and to combine several of these lower level administrative units in order to obtain a higher level functional unit. To give an example: The French and the Italian "program regions" are composed of a number of "Departements" respectively provinces for which data are available, and German planning program regions are each composed of a number of "Kreise".

If significant incongruence remains, infrastructure service areas may still be "cut through" by the borders of certain administrative units. As a consequence, the full capacity of an infrastructure facility will possibly be allocated to a region that is smaller or larger than the true servicing area. If the region is smaller, a part of the infrastructure services are exported, if it is larger, the region will import some of those services from another area. This could weaken e. g. the correlation between infrastructure equipment and regional income or employment, but will not invalidate the approach as such.

If this approach is accepted, the question as to what are regional disparities can be easily answered. Disparities are then regarded as deviations from a generally accepted level and distribution of regional income and employment. However, this implies that there exists an authority that fixes these level and distribution targets. This is already difficult in a national context and even more difficult in a European context. For the present Study, it was agreed to simply measure the differences in regional income and regional employment and qualify these differences as "disparities". Stating that there are disparities among European regions does not imply that these disparities should be reduced to zero, but only that they should be reduced. This is in line with the spirit and the letter of the Treaties on which the European Communities are based.

II.3. EXTENT AND STRUCTURE OF REGIONAL DISPARITIES IN THE MEMBER COUNTRIES OF THE EUROPEAN COMMUNITY

(a) Income Disparities

Income should conceptionally refer to total real income, i.e. both pecuniary and non-pecuniary ("psychic") income derived from net positive externalities such as climate, clean air and water, natural beauty of the landscape, a good neighbourhood, and public goods. Unfortunately, such a comprehensive income concept is not operational. Normally, only the pecuniary part is measurable, and even pecuniary income figures are not always available in every country for all types of regions and for all periods. Many proposals have been put forward to fill this gap, either in form of a revision of the existing system of social accounting or in developing a separate and independent system of "social indicators". However, as long as these improved indicators are not yet available, we are obliged to measure with the aid of the present data sources, such as regional product per capita figures, as surrogates for the unavailable, all-embracing ideal indicators. In any case, real income figures would be preferable to money income figures even if they do not cover non-pecuniary income elements.

Regional income disparities in the narrow meaning naturally also depend on the precise definition used on the one hand, and on the regional breakdown on the other. Disparities measured e.g. with the aid of gross figures are normally larger than measured with net ones. In addition, differences in the national systems of regional accounts influence the results. At the time when the data for this study were collected, regional income data have been mainly based on the concept of gross domestic product, i.e. they comprise also indirect taxes. As a result, regions which by technical reasons collect larger amounts of indirect taxes (e.g.

because of being important import harbours), appear to have higher gross incomes per capita. But such net figures are not yet available. As far as the gross domestic product figures are concerned, they could have been replaced by more recent data for gross value added, calculated on a consistent basis for all regions of the Community by the European Statistical Office. These figures could first not be used, because they would have required a recalculation of all the indicators on which this Report is based and of all the regression functions estimated on the basis of the data collected by each member of the Study Group for the regions of his country. Second, the data collected by the experts do not always refer to the same regional breakdown as used by the European Statistical Office.

As far as the regional breakdown is concerned, it would have been desirable to use figures for "functional" regions which represent resonable socio-economic entities. Again however, data are not always available for such a type of region. The figures on which this Report is based refer mainly to the socalled level-II regions of the Community. They are basically administrative regions, sometimes also combinations of administrative regions which form approximately a functional region as it is the case in the Italian and French "program regions". In the case of Denmark, Germany and Ireland, not the level-II regions, but other regions have been used. For Denmark, the 14 counties which have significant regional policy competences, have been used instead of the three regions contained in the level-II list. Since two of these counties together with the city of Copenhagen form the Copenhagen region, a total of 12 Danish regions was obtained. For Germany, the level-II breakdown based on 33 Laender and Regierungsbezirke, a typical administrative structure, was replaced by the 38 territorial units of the Federal physical planning program (Gebietseinheiten des Bundesraumordnungsprogramms) which are functional regions. Ireland, which normally is considered to be one region, was split up into the nine regions established for physical planning purposes. As to Greece, the nine development regions have also been selected as functional units. They have already been included in the data set for the first cross section year (1970) in order to facilitate the comparison with the indicators for the second cross section year (1977/78). Given this changed regional breakdown, the European Community comprises 141 regions. Although, the size of these regions differs more than that of the level-II regions, the advantage of the new regional breakdown is that it takes better account of existing national functional system of regions used for purposes of regional policy making.

TABLE 1 shows the results obtained if GDP per capita, measured in current prices and current exchange rates, is considered to be a reasonable proxy indicator for pecuniary regional income despite all the caveats to be applied. The overall spread of regional product per capita (RPC) is about 6 to 1 in 1970, if the ratio of maximum RPC to minimum RPC across the whole Community is taken to give a first idea as to the existing regional income differences. This Maximum-Minimum ratio (MMR) increases to about 11:1 for the second cross section year 1977/78. It has to be noted that about half of this increase is due to one single region, i.e. the province of Groningen in the Netherlands. The price explosion for energy catapulted this region from a RPC of 2611 EUA in 1970 (rank 28) on the top rank in 1977/78 with an RPC of 14294. If Groningen is excluded, the Community MMR reduces to only 8.2. This means nevertheless a significant increase in income disparities for the period studied.

Disparities inside the member countries are first significantly lower and second increased less. They range from 2.61:1 in Italy to 1.48:1 in the United Kingdom in 1970. The low disparities in the United Kingdom are certainly partially due to the fact that the country is only divided into 11 regions. In 1977/78, apart from the Netherlands due to the Groningen effect, only Greece shows a marked increase in national disparities. Other countries increased less, some remained with a relatively constant degree of disparities, whereas some others exhibit decreasing differences, as it is seen in Germany (1.76 instead of 2.04), Denmark (1.30 instead of 1.53) and Ireland (1.51 instead of 1.68). This suggests that a significant part of the deteriorated income situation seems to be caused by a national income drift. Given that 1970 is the year before the serious deterioration of the exchange rates, a part of the changes may also have to be attributed to the currency situation; the underlying exchange rates may not always be the "right" ones, i.e. equilibrium exchange rates.

A partial test of this hypothesis can be seen in the figures of TABLE 2 presenting the results of recalculating the nominal RPC figures with the aid of purchasing power parities. Community disparities increase much less than they did in the first case, only from 4.5 to 5.3. If the Groningen-effect is excluded, the disparities even decrease between 1970 and 1977/78; the MMR for the latter year being only 3.94. The lower level of disparities compared with TABLE 1, besides using the real income concept, may also be due to the exclusion of Greece as for that country no purchasing power standards are available.

As far as the disparities inside the member countries are concerned, they do not change at all. The reason for this effect is that the purchasing power parities only apply to national, but not to regional prices inside a member country. They allow, therefore, a comparison among national groups of regions, but not among regions of one and the same country. Since the purchasing power parities are meant to make national expenditure for goods and services more comparable, the conclusion appears justified that a large part of the income disparities measured with the aid of the nominal RPC figures is due to differences in inflation rates which are not fully compensated by exchange rate changes. Income disparities across the Community, therefore, are less pronounced on the basis of purchasing power than on a nominal income basis. They remain nevertheless important enough such that the political decision makers cannot afford to ignore them.

In order to illustrate the importance of these figures in income disparities, a rough comparison can be made with national figures for the industrialized countries on the one hand and e.g. Latin American developing countries on the other. For these countries, on the basis of a conversion into US Dollars, a MMR of 5.3 results for 1968. A similar result is obtained if the industrialized countries are compared with developing countries in Asia; the MMR here is 5.4. If all developing countries for which data are available for 1968 are included, the MMR increases to 12.7. This shows, that the income disparities across the Community on a regional basis are considerably high.

TABLE 1.: Regional Domestic Product at Market Prices per Inhabitant (1) (EC-Average = 100), Conversion with European Units of Accounts (2)

Country	1st Year			2nd Year		
	Max	Min	MMR	Max	Min	MMR
BR	173	84	2.04	205	116	1.76
FR	155	75	2.06	160	76	2.10
IT	105	40	2.61	91	35	2.58
NL	112	72	1.58	273 (3)	86	3.17
BE	124	75	1.66	149	91	1.64
LU	132		-	132		-
UK	114	77	1.48	77	50	1.53
IR	53	32	1.68	53	35	1.51
DK	140	91	1.53	148	114	1.30
GR	61	30	2.05	58	25	2.32
EC10	173	30	5.82	273 (4)	25	10.98

Note: The MMRs are calculated on the basis of the original RPC figures in EUA.

Source: Own calculations based on the Study Group's data set; [cf. Annex, TABLES A.6.]. Footnotes: see below TABLE 2.

TABLE 2.: Regional Domestic Product at Market Prices per Inhabitant (1) (EC-Average = 100), Conversion with Purchasing Power Parities (2)

Country	1st Year			2nd Year		
	Max	Min	MMR	Max	Min	MMR
BR	158	77	2.04	174	99	1.76
FR	144	70	2.06	151	72	2.10
IT	112	43	2.61	114	44	2.58
NL	120	77	1.56	232 (3)	73	3.17
BE	119	71	1.66	123	75	1.64
LU	126		-	114		-
UK	121	81	1.48	98	64	1.53
IR	59	35	1.68	68	45	1.51
DK	129	84	1.53	116	89	1.30
EC9	158	35	4.49	232 (4)	44	5.25

Note: The MMRs are calculated on the basis of the original RPC figures in Purchasing Power Parities

Source: Own calculations based on the Study Group's data set; [cf. Annex, TABLES A.6.].
Footnotes: see next page

Footnotes TABLE 1.:

(1) Regional breakdown: 141 regions.

(2) Conversion rates are reproduced in TABLES A.4.1. - A.4.10. under the code BECU.. in the Annex.

(3) The strong increase of the maximum value is due to drastic price increases for natural gas which increased the regional domestic product for the province of Groningen considerably. Without Groningen, the maximum value per Capita is 126 instead of 273, and the Maximum-Minimum-Ratio (MMR) 1.47 instead of 3.17.

(4) Due to the Groningen-effect in the Netherlands [cf. footnote(3)], that province now has the highest regional domestic product per capita also in the European Community. Without Groningen, the figures are 205 and 8.26.

Footnotes TABLE 2.:

(1) Regional breakdown: 132 regions; no data available for the 9 Greek regions.

(2) Purchasing power parities have been kindly supplied by the Statistical Office of the European Communities. They are reproduced in TABLES A.4.1. - A.4.10. under the Code BKKS.. in the Annex.

(3) The strong increase of the maximum value is due to drastic price increases of natural gas which increased the Regional Domestic Product for the province of Groningen considerably. Without Groningen, the maximum value per capita is 107 instead of 232, and the Maximum-Minimum-Ratio (MMR) 1.47 instead of 3.17.

(4) Due to the Groningen-effect in the Netherlands [cf. footnote(3)], that province now has the highest regional domestic product per capita also in the European Community. Without Groningen, the figures are 174 and 3.94.

It should be noticed that the MMR is a crude indicator which only takes account of the range of the extreme values. If more differentiated measures such as the unweighted and weighted coefficients of variation are used which take account of the distribution between the extreme values, and if the dispersion is weighted with the aid of the size of regional population which has particularly low or high RPC, the picture is less dramatic. Such figures are presented in the First Periodic Report on Regions by the European Commission.

(b) Employment Disparities

Despite the usual practice to measure differences in regional employment in terms of unemployment rates, unemployment is an inadequate indicator of employment disparities:

- if two regions suffer from the same economic problems, the one with the lower rate of outmigration (lower mobility) will show a higher rate of unemployment;

- even when mobility is the same, unemployment figures relate only to people who normally belong to the active population, but activity rates differ among regions.

In order to present a less distorted picture of employment disparities, it is, therefore, more appropriate to consider the regional population as being an economic "capacity" or productive potential whose rate of utilization can be characterized by age and sex specific activity rates. At any rate, the overall regional activity rates are better employment indicators than are the regional unemployment rates.

TABLE 3 shows the differences in regional labour force participation or activity rates within the individual member countries and within the Community as a whole. When comparing the maximal with the minimal activity rates within the Community, disparities increased from a span of 49.87/27.97 to 54.21/24.56 as reflected in a MMR of 1.78 and 2.21. This is due to a rising upper rate in Denmark and a falling lower rate in the Netherlands.

TABLE 3.: Regional Labour Force Participation Rates (1), (in Per Cent)

Country	1st Year			2nd Year		
	Max	Min	Aver.	Max	Min	Aver.
BR	49.87	36.39	43.47	46.03	34.10	39.90
FR	48.32	35.44	42.34	49.55	34.18	41.53
IT	43.03	29.07	36.85	44.98	31.53	38.21
NL	36.90	27.97	33.19	30.75	24.56	29.09
BE	39.25	32.83	36.57	38.62	32.98	36.29
LU	38.03		38.03	42.44		42.44
UK	49.63	34.06	45.18	45.19	35.98	43.36
IR	- (2)	-	-	-	-	-
DK	47.07	42.74	45.27	54.21	50.14	52.07
GR	40.95	34.81	37.02	47.04	35.96	42.00
EC9	49.87	27.97	41.26	54.21	24.56	40.21

Notes: (1) Regional breakdown: 132 Regions (without Ireland).
(2) Data only available for 1st cross section year; in order to secure comparability, 1st year data have also been excluded.

Source: Data collected by the members of the Study Group; various National and Community Sources [cf. National Reports].

Even highly developed and integrated economies like the United Kingdom, France and Germany exhibit relatively large differences. Despite the fact that the lowest activity rates are to be found in the Netherlands (which may at least partly be due to statistical and data problems), in general the highest rates are to be found in the more developed, agglomerated and urbanized high income regions whereas the lowest rates are reported for the less developed regions especially in the South. Employment disparities seem to have become larger inside the Community.

As a rule, employment disparities are smaller than income disparities. This fact is partly to be explained by the differences in employment opportunities: even with equal income per employed person, the income per inhabitant will be lower, the lower the activity rate in a region. Regional income differences can, therefore, also be interpreted as a sort of "double" indicator: They reflect both the effects of differences in pay or in productivity per employed person, and also of differences in labour force participation rates.

(c) A Final Remark

It is important to note that regional disparities within any one of the nine member states and within the Community do not run parallel. Accordingly, the disparities within the EC as a whole are larger than those within any individual member state. Some of the least developed regions in a richer member state show a higher level of development than Community average regions, and they are always clearly better off when compared with the least developed regions in a poorer member country. Thus, the minimum RPC in Germany is more than twice as high as the lowest RPC in Italy, and the lowest regional activity rate in the United Kingdom is as high as the highest activity rate in Italy.

To a certain extent, these remarkably large disparities may be due to statistical problems arising as a consequence of the definitions of the indicators used not always being fully comparable. But even if the statistical distortions were known exactly, the size of the remaining disparities would still justify public concern inside a Community that considers convergence to be a desirable goal. Whatever the Community intends to do in order to realize a more or less ambitious reduction in disparities, it is necessary to have sufficient knowledge of the causes of regional differences. Any successful regional development strategy presupposes a well founded regional development theory. It seems appropriate, therefore, to undertake a brief survey of the existing regional development theories in general and their conclusions regarding the possible contribution of infrastructure in particular.

II.4. ANALYSIS OF THE CAUSES OF REGIONAL DISPARITIES

The theoretical analysis regarding the causes of regional disparities was mostly concerned with growth disparities. In this context, growth is taken as the rate of increase of real output per capita. We feel it is important to note that there may be disparities which are caused by factors that are not covered by the usual theoretical analysis.

If one analyses the causes for regional growth disparities, several factors may be at work, such as immobility of factors of production, economic structure, natural and geographical circumstances, demographic reasons, institutional and political structure.

There are several different theoretical approaches which can be used to explain differences in regional growth rates:

(1) the neo-classical approach,
(2) the export-base approach,
(3) the polarization hypothesis approach,
(4) the social overhead capital approach, and
(5) the meso-structure approach.

As each of these theories of regional growth presents the policy maker with a different explanation of regional growth disparities, we will briefly discuss their basic elements and their conclusions which can be drawn from these approaches.

(a) The Neo-Classical Approach

Whilst neo-classical theory is supply-orientated, Keynesian growth theories, such as the Harrod-Domar models, are demand-orientated.

The basis of the neo-classical models of growth is the aggregate production function. In this theory, the output of an economy depends upon its productive capacity, which is determined by the supply of factor inputs. Two special features of neo-classical theories are:

(1) factors of production are assumed to be substitutable and
(2) factor prices are perfectly flexible.

The result is that no production factor can remain idle for very long. If such a factor is (temporarily) unemployed, this will cause a pricefall of that factor and hence both, a rise in quantity of the factor demanded and a fall in quantity of the factor supplied will be the result.

The rate of growth is determined by three elements:

(1) capital accumulation,
(2) an increase in labour supply and
(3) technical progress.

Technical progress, besides capital and labour, represents a separate element in the production function:

$$Q = F(C,L,T)$$

where: Q = output,
C = capital,
L = labour and
T = technical progress.

By converting this equation into a regional one, we may write:

$$Qi = Fi\ (C,L,T)$$

where i stands for region i.

According to neo-classical theory, regional differences in the growth of output per worker are explained by regional differences in the rate of technical progress and/or in the rate of increase of capital per worker. The growth of capital and labour depends on intra-regional as well as on interregional movements. It seems a reasonable assumption that capital is more mobile than labour and, given this, neo-classical theory predicts that capital will flow faster into the low-wage regions than labour will flow out of such regions into high-wage regions. The influence of technical progress on this process is very difficult to assess. To the extent that technical progress is "embodied" in new capital equipment and plants, the rate of progress will be a function of the rate of new investment.

A more realistic version of the neo-classical model assumes that regions produce not just one, but many, commodities. In this version growth of output can be achieved through intersectoral shifts of productive factors as well as through interregional ones. A special variant of neo-classical theory is the theory of international and interregional trade developed by Heckscher and Ohlin. Starting from the assumption that both labour and capital are immobile at least among nations, they concluded that the differences in resource endowment determine the comparative advantage of a national or regional economy. This basic idea that specific factors of production cause differences in regional development still seems relevant in explaining regional disparities.

The relevance of neo-classical growth theory for the analysis of the impact of infrastructure on regional development is fairly limited. Important parameters in the neo-classical approach, such as labour productivity and technical progress may, however, play a part as changes in infrastructure will normally affect these parameters either directly or indirectly. This framework offers an analysis of the influence of market forces, and a description of the mechanism of regional development rather than an explanation.

(b) The Export-Base Approach

Export-base theory rests on the observation, made primarily by economic historians, that economic growth tended to be attracted by the export of staple products to metropolitan markets. The central proposition of the model is that the initial stimulant for a regions's economic development can be traced back to the exploitation of its natural resource endowment. The geographical distribution of natural resources may, therefore, help to explain why different regions grow at different rates.

Within national boundaries, regions can trade free of trade restrictions. Therefore, we may use the theory of comparative advantage to explain regional export specialization. According to the Heckscher-Ohlin Theorem, regions will specialize in the production of those commodities, which intensively use their relatively abundant factor(s) of production. Once specialization is established, the role of external demand for the output of a region becomes obvious. Via multiplier processes, total income in a region will increase more than the income from exports. Regions with a strong export orientation and high multipliers will be much more sensitive to the impact of an initial stimulant than those with low multipliers. Other export base multipliers being generated are the employment and the investment multipliers. Thus with the increase in the export base - a concept denoting all exportable commodities and services of a region - begins a multiplier process in which the multiplier is equal to the total regional output divided by total exports.

However, the orginal export activity for some reasons may not continue to growth, possibly because preferences in world demand may change. Provided factor prices are flexible and factors are sufficiently mobile between industries, the law of comparative advantage suggests the region affected will have a chance to survive through reallocation of productive factors to the production of more viable export commodities. Structural change, therefore, becomes an important aspect of regional growth.

Export-base theory has provided valuable insights into the operation of the growth process and has an advantage over neo-classical theory in that it includes the role of demand factors. However, it is difficult to identify precisely which activity forms the export base as many enterprises serve both the export and the local markets. Furthermore, the theory offers no systematic explanation of the demand determinants for export commodities of a region, without which it is impossible to predict regional growth differences.

The relationship between infrastructure and regional development is not made explicit in the export-base theory, although one might argue that better infrastructure may lead to a higher comparative advantage for the region concerned, and thereby strenghten its export position.

(c) Theories Based on the Polarization Hypothesis

The various theories based on the polarization idea are comprised more of a collection of concepts than the framework of a theory. These theories are more concerned with the study of the reinforcement or reduction of growth disparities between regions than with the origin of these disparities. However, the question "How do these disparities emerge?" is at least as important to the policy-maker as is the question of "How are they reduced or reinforced?".

Polarization theories are based on the assumption that economic development, once triggered by an initial driving force, tend to be a cumulative process. How strong such a trigger is, what kind of trigger it is and where it occurs may be a very important question. To the policy-maker who is dealing with growth disparities, the cumulative causation process will be more important. This process may be explained by the presence of internal and external economies of scale. At least in the early stages of growth there are substantial cumulative, self-multiplying forces at work. At a later stage, the growth rate will slow down as diseconomies begin to appear.

The roots of these theories lie in the work of Perroux, Myrdal and Hirschman. The growth pole theory is based on the work of Perroux, amongst others. Myrdal called the polarizing effects "backwash effects". Hirschman discussed a strategy of economic development which partly uses the polarization argument.

According to Perroux, space is a set of relationships that define an object. As there are many systems of relationships, there are many different topological spaces for every object. The growth pole concept is the logical derivation of one such Perrouxian type of abstract space. Perroux made a distinction between geographical space and economic space, the later being defined in terms of the transactions and economic linkages between firms and consumers in an economy. Many activities are neither equally dispersed nor are they homogeneous in economic space, they are polarized. Thus, a "pole" simply means a concentration of elements in an abstract space. Every economic activity has consequences for the use of geographical space. It is, however, not necessarily true that polarization in economic space runs parallel with polarization in geographical space. In more recent literature about the growth pole concept, much emphasis is also placed on the scale advantages of industrial growth centres located in a particular geographical space.

The concept of a growth pole becomes clearer if one introduces the "propulsive unit", which is the driving force that might generate other (economic) activities. This propulsive unit might be an industry, a group of industries, an infrastructure investment, etc. The assumption is that the benefits of the induced economic expansion in the zones of influence surrounding each centre will offset the disadvantages of the tendency for economic activities to be attracted from the peripheral zones to the central ones. Once this initial stimulus has taken place and the new industry is established, the process of cumulative causation starts.

It is important to note that after some time these propulsive units may become sterile due to lack of innovative power. This may cause the decline of the region if another propulsive unit is not established in time.

Myrdal called these centrifugal benefical effects in the less developed regions, caused by interaction with the region where the propulsive unit is established, "spread effects". On the other hand, "backwash effects" are the detrimental centripetal effects suffered by the less developed regions as a result of the same interaction, such as the migration of skilled labour. Myrdal disputes the effectiveness of the spread effects. He argues that the market mechanism does not inevitably produce stronger spread effects than backwash effects. It is his thesis that regional inequalities are caused by the play of the market forces.

A crucial component of Hirschman's theory of development is the recognition of interdependence linkages (input-output) between industries and the emphasis on their significance for the process of induced economic growth. His "master industries", characterized by the fact that the degree of complementarity between these industries is stronger than between others, appear to have much in common with the propulsive industries, or "industries clefs" by Perroux. The master industries tend to have large forward and backward linkage effects.

(d) The Social Overhead Capital Approach

Hirschman believes as does Perroux in the inexorability of polarized development. But he disagrees with Perroux, in that he believes that the best way to reduce the negative effects of geographical polarization is not by setting up compensating poles. Rather, he maintains, it is better to

(1) foster the growth of the existing poles in the hope that they will eventually "filter down", and

(2) increase the attractiveness of the less developed regions in order to increase their own growth posibilities.

In addition to that and in contrast to the neo-classical theories of economic growth which neglect the public sector (i.e. the influence of public investment and its spatial distribution), Hirschman puts much emphasis on specific characteristics of public infrastructure investments, which he calls Social Overhead Capital (SOC) as opposed to the Directly Productive Activities (DPA). The main characteristics of SOC which he defines as comprising those basic services without which primary, secondary, and tertiary productive activities cannot function, are the following ones:

(1) SOC facilitates the carrying out of a great variety of private economic activities,

(2) SOC is provided for free of charge or at rates regulated by public agencies,

(3) SOC services cannot be imported, but are embodied in the regional SOC stock,

(4) the material investment capital which provides these basic services is characterized by "lumpiness", i.e. technical indivisibilities in production , and

(5) SOC has a high capital-intensity and relatively low capital-productivity.

Rodenstein-Rodan distinguished between four different types of indivisibilities of SOC:

(1) indivisibility by time,
(2) an indivisible lifecycle which implies a minimum push of investment,
(3) a minimum push of a bundle of different types of SOC and
(4) a relatively long construction phase.

Cootner completed Rosenstein-Rodan's criteria by adding a relatively long period of utilization.

All these properties of SOC are relevant for the DPA as they explain how bottlenecks and/or excess capacities could exist and/or originate. They make it impossible or possible only at a high cost to adapt the SOC capacities to the growing or changing demand for those services. As a result, two strategies are possible: to create excess capacities as an incentive for economic growth, or to tolerate bottlenecks and to invest the unused resources for other purposes whilst awaiting a sufficiently strong pressure of demand, which would later enforce the provision of the required SOC capacities. In both strategies the public sector is of a great importance: it favours regional development either via a "pull"-effect through the excess supply of SOC capacities, or via a "push"-effect through SOC bottlenecks. Regional development strategies which do not take account of this interplay of pull- or push-effects risk being inefficient and causing additional regional disparities.

Hirschman's approach in particular is very important to our Study, as it emphasizes the intricate relationship between entrepreneurial activities and the conditions for implementing such activities. This complementarity between regional economic growth and infrastructure is also a basic ingredient of the approach adopted in our Study. It may also serve to obtain a better insight into the phenomenon of (un-)balanced regional growth.

(e) The Meso-Structure Approach

This approach has been developed primarily by Stuart Holland, who has emphasized that indirect public intervention (subsidies, provision of facilities) is highly ineffective in promoting regional development. The reason for the failure of such indirect regional policies is the emergence of the meso-economic sector in the form of leading enterprises, multi-regional and multi-national firms. The meso-economic sector leads to a rigidity of prices and wages as all smaller firms have to adjust themselves to the leaders. In Holland's view neo-classical analysis fails to provide a good explanation of the investment and location decisions due to its one-sided focus on the micro-economic decisions of competitive firms while leaving aside the impacts of the meso-structure.

The meso-structure has a great economic power and is less sensitive to indirect stimuli, with the result that public policies have only a marginal impact.

In addition, the strong and widespread power of trade unions in a country tends to lead to a factor price equalization for labour, such that there is no reason to invest in lagging regions. The peripheral locations are not characterized by lower wages, and there is, therefore, no comparative advantage of peripheral regions. Such advantages can only be gained by transferring production to less developed countries.

In so far the entrepreneurs are prepared to invest in lagging regions in their country, they will choose those locations with the highest growth potential (with all negative consequences of the growth centre phenomena; see above). In Stuart Holland's view it is considerably more effective to give direct incentives via the centralized planning of investment and location decisions.

It should be noted that this approach places more emphasis on the reasons why public policies may be ineffective rather than on the real causes of disparities. The plea for centralized planning neglects in particular the numerous causes of inefficiencies in the public sector such as the structure of the political decision-making process, motivation of politicians and bureaucrats, and time-lags.

II.5. CONCLUSIONS FOR A REGIONAL DEVELOPMENT STRATEGY AND THE ROLE OF INFRASTRUCTURE

From this summary of the basic elements of some important regional development theories, the following conclusions can be drawn:

(1) Neo-classical theory appears to be relevant in explaining market determined growth processes relying on the concept of optimal factorcombinations, such as labour and private capital, in a production function. The Heckscher-Ohlin approach to interregional and international trade on the other hand points to the importance of special resource endowments and their immobility.

(2) The export base theory focusses on the factors which cause a regional economy to grow in response to the demand for exports from other regions, and it highlights the importance of both sectoral structure and sectoral change.

(3) The polarization and growth pole theories emphasize agglomeration and scale economies which are closely linked to indivisibilities, and stress the importance of spatial spread and backwash effects in regional development.

(4) The meso-structure approach takes account of the growing importance of leading multiregional and multinational enterprises and the dangers of wage equalization policies. It also explains why a policy which only relies on influencing private investment fails to be successful under these conditions.

(5) The Hirschman/Rosenstein-Rodan concept of social overhead capital appears to be a useful starting point for defining infrastructure and for evaluating its role in regional development.

Each one of these theories appears to be orientated towards explaining a particular set of the regional development phenomena, but none is capable of covering all the relevant features. They are, therefore, more complementary than rival. This suggests that a satisfactory theory of regional development must be based on a combination of these basic ideas in order to obtain a successful regional development strategy.

This is particularly important for social overhead capital or infrastructure. As infrastructure is only one aspect of the general problem, it is not possible to assess the contribution of infrastructure to regional development if infrastructure is separated out and dealt with in isolation. The role of infrastructure within a successful regional development strategy can, therefore, only be determined if the interrelationships between infrastructure and the other determinants of regional development are taken into account.

In the next chapter, the regional development potential approach is presented as a combination and extension of the basic ideas summarized in the preceding pages. It is shown that infrastructure is one of the main determinants of regional development in the framework of that approach. However, the conditions for the successful use of infrastructure as an instrument for development purposes must be considered carefully.

III. THE REGIONAL DEVELOPMENT POTENTIAL APPROACH

III.1. BASIC HYPOTHESIS AND ASSUMPTIONS

The basic rationale underlying the approach adopted by the Study Group is that regional disparities are in the nature of a long-term type of problem, and not the result of short-term cyclical fluctuations. As a consequence, the emphasis both of analysis and of policy actions must be on the supply or capacity side and not on the demand side of a regional economy. This can be justified by arguing that a single region is small in comparison with the world economy and finds itself in a situation where world demand can be considered as given and quasi-infinite. The regional problem, therefore, is to attract a sufficiently large part of the world demand in order to fully utilize regional production potential. This demand-attraction has to be achieved in a highly competetive environment as the regions are more "open" than national economies, and are more intensively engaged in the interregional and international division of labour.

This approach implies two types of questions which require further consideration:

(1) What determines the regional development potential (RDP), and thus "limits" the regional potential per capita income or employment?

(2) What determines the relative competitiveness of a region, its demand attraction capability, and through this, its rate of capacity utilization?

The first question is discussed in this section III.1. and the following section III.2., whereas section III.3. deals with the second problem.

RDP is a function of a special class of resources having common characteristics, and this allows us to separate them from the usual "factors of production" such as labour and private capital. These "potentiality factors" (PF) can be thought of as resources which are fixed to a given location, consist of relatively large capacity "blocks", are costly to substitute if they do not exist or if their capacities are exhausted, and which provide services that can be used as inputs in a large number of production lines. Examples of these PF are the natural resource endowment of a region, its regional population, its geographical location, its settlement system or agglomeration, its sectoral structure, and, last but not least, its social overhead or infrastructure capital stock. All these resources have in common that they are so strongly "fixed" to a special location that they determine the regional production possibilities.

If the capacities of these PF's are optimally combined with the appropriate quantities and qualities of the mobile factors of production such as highly qualified labour, managerial and entrepreneurial abilities and private capital, a region can make full use of its development potential. In this sense, the PF endowment "limits" regional development. Thus, RDP can be defined as being equivalent to that income per capita or per employed person, that income "density" (i.e. the spatial concentration of income) or that employment which could be attained if the PF-capacities were to be optimally combined with mobile factors of production.

The different PF-types can be explained as follows:

(1) The natural resource endowment of a region, understood in its broadest sense. Regions possessing relatively large amounts of these resources can profitably specialize along Heckscher-Ohlin lines whereas those regions which are not so well endowed have to bear additional costs when trying to compete with them.

(2) The regional population, and its age and sex structure as the basis of the regional labour force potential. Population can be considered as providing the "natural" labour base for productive activities, whereas investment in education, training and learning by experience increase labour productivity. Whilst "natural" labour is relatively immobile and indivisible, investment in private human capital increases mobility. This also accounts for segmentation in the labour market with respect to both geographical location and occupational categories.

(3) The geographical location of a region. The higher the accessibility of the region concerned (the supply side) with respect to those regions to which commodities, services and information must be transported (the demand side), the fewer are the resources which must be spent in overcoming distance frictions and in covering communication costs. The result is that market prices per destination (cif) for the competing region are given, with the result that the regional export price (fob) is correspondingly lower the more peripheral the region's location.

(4) The size and structure of the settlement system within a region and the position of a region in the worldwide or European settlement system. Agglomeration provides particular economies of scale which range from large and differentiated labour markets, higher consumer densities, and the supply of intermediate private and public services to an intensive general information/communication environment. Up to a certain optimal level, regions with a higher degree of agglomeration can yield higher returns per unit of private factors of production. However, above a certain critical level, the degree of agglomeration can lead to a situation in which regional development is hindered more than helped. In this case external economies are transformed into external diseconomies, thereby diverting new industries, factors of production and private households to other areas.

(5) The sectoral structure of a region's economy. There is conclusive evidence that the percentage shares of agriculture, industry and service activities, either in value added or employment terms, follow a certain pattern depending on either the level of development or that of per capita income. The share of agriculture decreases with an increasing level of development, industry's share first increases, reaches a maximum and then decreases whilst the tertiary sector (including government) first decreases, reaches a minimum and then increases. [Fels, Schatz, Wolter, Biehl, Hussmann, Schnyder]. Thus, if a region has a favourable sectoral structure, it can profit not only from economies of scale internal to firms but also from those internal to branches and sectors. However, both a region dominated by agriculture and whose growth prospects depend on industrialization, and a highly industrialized region experiencing industrial decline and forced to reorient its structure more

toward service activities, must incure high costs in order to change their obsolete sectoral structure.

(6) The capital stock of a region. The term capital is often used in a very broad sense which may obscure its true multidimensional meaning. In the first instance, it is necessary to recognize the distinction between material and non-material or human capital. Material capital is the actual physical equipment, e. g. a factory, a bank or an electricity supply network. Non-material capital comprises elements such as knowledge, information, planning/organizing capabilities, education and skill acquisition through training and experience. In addition to this basic division between material and non-material, capital categories also differ in other important respects. Private cars, houses and machinery have characteristics which are distinct from those of other capital categories such as transportation networks, water supply systems or hospitals. The categories of capital goods of the first kind are normally considered to be a part of the private capital stock while those of the second type are generally regarded as social overhead capital or infrastructure. Both these types of capital normally are the outcome of investing public and private savings. However, if the savings are used to create private capital elements of the kind mentioned above, they will lose relatively little of their mobility, divisibility, and substitutability compared with being invested in the provision of infrastructure, which often have large capacities, a long lifecycle and which cannot easily be replaced. Whereas private savings can also be invested in the production of almost all goods and services, and hence are highly polyvalent, the resulting private capital elements are usually highly specialized, and, therefore, monovalent. By contrast, most infrastructure categories retain much more of this characteristic of polyvalence.

This is also true for non-material capital. A fundamental distinction is the one between basic research, which is very close in nature to material infrastructure on the one hand, and labour qualifications acquired through training and experience, which are more akin to private material capital. This arises because, in the latter case, the benefits can be internalized to the advantage of the individual worker, whereas in the former the benefits can spill over to other people, or even to society as a whole. Thus, it appears to be useful to consider capital, despite its multi-dimensional nature, as being comprised of two fundamental categories: infrastructure, which includes public material and non-material capital, and private capital, again both material and non-material. In the long run it is only the infrastructure part of the total capital stock that can be regarded as a true potentiality factor.

The particular importance of public capital elements such as transportation infrastructure has been stressed as opportunity for productive public activity since the time of Mercantilism. However, other types of social overhead capital are equally important: the education and research system as the source of human capital, health service as a means of preventing or reducing losses of human labour and skills due to the morbidity or mortality, the agglomeration-supporting types of canalization, energy supply, sewage systems etc. Here again, regions with an extensive and well structured infrastructure network have higher productivity per unit of factor combinations of private capital and private qualified labour, whilst those regions lacking these infrastructure facilities have to use current resources in order to establish them.

The basic hypothesis of the PF approach is that there is a specific class of resources exhibiting common characteristics that effectively determine RDP. Knowing the endowment with these resources allows one to quantify potential income and employment, evaluate the chances for regional development and assess the possible returns from regional policy measures.

These common features of PF are immobility, indivisibility, non-substitutability and polyvalence.

(1) Immobility, as already explained, refers to the geographical location of a PF. The importance of immobility stems from the fact that an immobile PF represents a bundle of services which can be used in general at low costs of accessibility or communication at the respective location. The more distant the user, the higher the cost of information, of transportation and/or access. Immobility can exist both for production and consumption. It is possible that a PF has immobility in production, but mobility in consumption as it is the case in

television or radio broadcasting, where the "services" can be "sent" to many consumer locations inside the area covered by the transmitting station.

(2) Indivisibility, too, applies both to production and consumption. The benefits of a "good" and the disadvantages of a "bad" location for example affect the entire population, all producers and all consumers of a region. Like immobility, indivisibility can vary from low to high. Potentiality factors in general have relatively high degrees of indivisibility, although the indivisibility of location is higher compared with the indivisibility of e.g. a road network or educational infrastructure. In the case of indivisibility in production, the notion refers to the "lumpiness" of a PF, whereas indivisibility in consumption refers to the concept of jointness in supply meaning that any additional user, be it a producer or a consumer, does not reduce the quantity and quality available to other users. Nevertheless, with increasing rates of utilization, congestion may arise and decrease the possibility of jointness in use.

(3) Non-Substitutability or Limitationality refer to the cost of replacing a not available PF by another PF or by private factors of production. Again, in general the degree of non-substitutability between the potentiality factors ranges from very high in the case of e.g. the natural resource endowment of a region through relatively high in case of geographical location and settlement structure upto intermediate levels in the case of infrastructure. In effect, infrastructure can be regarded as a substitute created artificially for natural PF's which lack or are of low quality in a region. This can be illustrated by reference to a peripheral region which can improve accessibility despite its bad "natural" location, through the provision of a high quality transportation network.

(4) Polyvalence in contrast to monovalence reflects the degree to which PF services can be used as inputs into a large number of production and consumption processes. The higher a number of "uses" to which the service can be put, the greater is the polyvalence of the PF providing that service. Accordingly, the degree of polyvalence of a PF is a function of a number of possible uses of the service provided for by that factor. This can be illustrated by

reference to a region with an "optimal" settlement structure which provides the necessary basis for the production of a wide range of goods and services. The settlement structure can, therefore, be regarded as exhibiting a high degree of polyvalence as no or only limited restructuring will be necessary in order to allow a region to produce additional goods and services or to replace obsolete ones by new ones.

In summary, the four characteristics immobility, indivisibility, limitationality, and polyvalence can be used in order to distinguish PF from other resources. These other resources or "production factors" in the traditional meaning are those which are highly mobile, divisible, substitutable and monovalent (i.e. specialized) such as invested private capital or qualified labour. Because these latter characteristics represent properties of "private" goods and are, therefore, necessary prerequisits for allocating resources by markets, they can be subsumed under the notion of "privateness". The opposite characteristics immobility, indivisibility non-substitutability and polyvalence determine the "publicness"-properties which cause partial or total market failure. The total set of resources then forms a resource continuum which ranges from the polar case of full publicness to full privateness.

It has to be noted that the four pairs of privateness/publicness characteristics are not necessarily linked with eachother to the extent that e.g. savings may exhibit high mobility, divisibility and substitutability on the one hand, but high polyvalence on the other. Road transportation infrastructure may have relatively high degrees of immobility and indivisibility, but only intermediate degrees of substitutability due to the fact that there are substitutes like rail, water and air transportation. Yet, all kinds of transportation infrastructure taken together may be very difficult to replace by e.g. educational or energy infrastructure. The intensity of the privateness or publicness properties, therefore, depends on what level of analysis is chosen. In addition, it also depends on the time horizon selected for the analysis. In the short run, i.e. for cyclical and demand management policy purposes, even the private capital stock may exhibit a relatively high degree of immobility and non-substitutionality, given the fact that the existing capital stock can only be changed with the aid of new investments. In the long run, this is possible to the effect that the private capital stock loses its character as a determinant of RDP. Location and agglomeration, on the other hand, are resources which do not lose their publicness properties with increasing time. On a long-term perspective, the above mentioned PF from natural resource endowment upto infrastructure represent potentiality factors which are relevant for regional development.

As already mentioned, the differentiation between publicness and privateness of resources is reflected in cost-differences. The more immobile, indivisible, non-substitutable and polyvalent a resource, the higher the costs involved in creating potentiality factors in a region where they do not yet exist or where the existing PF capacity is already fully utilized. Immobility can be considered to be measurable in terms of accessibility or communication costs, indivisibility in terms of separation costs, limitationality in terms of substitution costs and polyvalence in terms of specialization costs.

Regions which from a long term point of view are not well equipped with PF will be faced with relatively high costs if they try to provide either those resources which are lacking or services they offer. However, particularly as a result of the mobility of private factors of production such as savings and highly skilled people, the market prices for these privateness resources and thus the income of these private factors do not depend so much on regional supply and demand, but rather on national or even international conditions. The possibility of having specific regional resource prices therefore partly depends on their degree of publicness, and particularly on the immobility of the resource in question. Resources with a high degree of "privateness" can be attracted into a region or drawn away from any region or area simply by paying a slightly higher factor remuneration or price. The higher the degree of immobility, the greater the possible deviations of regional from national or international prices.

However, there is an important qualification to the argument that the more well endowed a region is with PF, the greater its cost-decreasing effect will be, and, therefore, the lower the price for the services provided by that factor. For example, if the central government of a country introduces a uniform pricing system for transportation services or energy supply, any benefit which may arise from a better endowment with these resources will be distributed throughout the economy, and will not only benefit the region concerned. If differential pricing policies are applied which explicitly favour highly agglomerated regions at the expense of other regions, the result will be even worse. The improved resource endowment of a developing region with water, gas or electricity supply, for example, will not result in sufficiently lower regional prices.

To indicate the degree of publicness, the criteria immobility, indivisibility, limitationality and polyvalence have been used. An additional criterion which brings the notion of publicness into sharper focus is that of non-excludability. Non-excludability is a standard element in the theory of public goods. Specifically, non-excludability can arise, due to the nature of the good itself, either because a feasible exclusion technology does not exist or, if such a technology does exist, it is too expensive to apply. In both cases, the market will fail to assign property rights for the exclusive use of the private consumption benefits rendered by the service. That is to say there is "market failure", and such goods can only be publicly provided. This is also relevant for the provision of infrastructure, the characteristics of which are such that in many instances a feasible or low cost exclusion technology does not exist.

But there is also a case against the use of exclusion technologies even where they are feasible. If the possible gain in efficiency is smaller than the loss in distributive equity, it would not be worthwhile applying the feasible exclusion technology. This is certainly a bold theoretical statement because it implies a well defined social welfare function which allows us to evaluate the utilities and disutilities involved. In practice, such decisions are sometimes taken when, for example, prices of public transportation services, educational facilities and cultural events are deliberately fixed below the equilibrium price, even at zero price, in order to subsidize low income groups.

It remains to take into consideration the second element that helps to separate potentiality from other factors, the time horizon. This will be done in the next section in the context of discussing the bottleneck properties of PF.

III.2. POTENTIALITY RESOURCES AS BOTTLENECK FACTORS

Given their high degree of publicness, PF are not provided for in sufficient quantity and quality by the market. It is, therefore, up to regional policy to ensure a satisfactory level, quality and mix of those resources. As long as there exist sufficient unused capacities of PF, regional development is not restricted. But it may be that some PF-capacities in a region do not exist at all or are already fully utilized to the effect that regional development is hindered or even stopped. In this case, it is important to identify that resource which is in minimum supply and constitutes a bottleneck factor. This approach recognizes that other potentiality factors which have sufficiently large unused capacity will not need to be expanded at the same time as the resource which constitutes the bottleneck.

In the short run, factors such as the regional stock of private capital can limit the production, and, therefore, the supply possibilities of a region or a country. For short-term demand management purposes it is appropriate to consider the private capital stock as some sort of bottleneck factor, as it is the most scarce, and in the short-term rarely a modifiable resource category as long as labour can be imported relatively easily. However, in a country where the labour market is relatively "closed", by virtue of factors such as a rigid immigration policy, the labour force potential represented by the resident population can also be considered to be such a short-term bottleneck factor.

In general, it can be argued that the longer the time horizon, the more the private capital stock and a given employed labour force will lose its bottleneck property. The reason for this is that a fixed private capital stock can be changed through capital depreciation, obsolescence and new investment, whilst a given active population can change through variations in the sex and age specific, or labour market, participation rates, or through other means such as "investment" in private human capital. In the medium-term, therefore, private capital assets and employment are not permanently fixed in either quantitative or qualitative terms and accordingly no longer constitute bottleneck factors. For this extended time horizon, other resources such as infrastructure, agglomeration or sectoral structure will not represent potential bottleneck factors. In the very long run, the only limiting factor may be the capacity of natural resources, particularly the environment and the innovative capability as long-term public human capital.

Although limitationality is a characteristic of potentiality factors, substitution effects between them are not completely excluded. For example, the economic distance of a peripherally located region can be reduced with the aid of investment in communication infrastructure linking this region to the dominant centres of economic activity. However, if general tax receipts are used to subsidize underground transportation schemes in centrally-located large cities, it is likely that the agglomeration effect and the attracting power of these cities will be increased, relative to that of a peripheral region. But, if environmental capacity limits industrial expansion (by increasing the costs involved), changing the sectoral structure towards a larger share service activities will create opportunities for further growth. Since these substitution processes are time consuming, such possibilities may be large or small depending on the given time horizon. In the extreme case, a single resource category can be the dominant bottleneck factor both in the short and the long run, as only by expanding its capacity will further growth be possible. Whether this would also be an efficient strategy depends on whether the opportunity costs of the mobile resources required are higher or lower than the gain from further growth.

In investigating possible strategies, one can also identify those regions which exhibit similar characteristics such as a dominant agriculture sector or a high degree of agglomeration. These characteristics can, therefore, be used as the basis of a simple cluster analysis intended to identify relatively homogeneous groups of regions. By employing this kind of analysis it becomes possible to identify those potentiality factors which would make the greatest contribution to the development of specific types of regions. This would enable a set of criteria for priorities in public intervention to be established, not only at the level of individual regions as discussed previously, but also at the level of groups showing similar characteristics.

If the notion of bottleneck is defined in such a comprehensive way, each PF represents a potential bottleneck category. It then depends upon the time horizon of the analysis as to which resources can be identified as PF in general, and which one among them is the actual bottleneck factor in a given region at a particular time. If an appropriate methodology for identifying bottlenecks in this widest sense would be available, regional policy making could be significantly improved. Such an attempt will be made by the Study Group by adopting the PF approach presented here, and by applying it to the data collected on regional resource endowments and development indicators. It also implies the use of a particular measurement tool, the "quasi-production function", which will be explained later in the text. The basic approach is to quantify the contribution of infrastructure as one important PF by comparing the actual income of a region with its potential one, as estimated with an appropriate type of production function.

III.3. FACTORS DETERMINING RELATIVE COMPETITIVENESS

Income and employment obviously cannot be created without "private" factors of production where private is used to designate the opposite of "public" in the theoretical sense outlined above. If RDP is measured in terms of potential per capita income, actual per capita income can only be raised to its potential level if regionally fixed public resources are combined with the optimal amount of private factors of production. Whilst it is possible to measure potential per capita income with the aid of information on public resources, it is not possible to produce an actual per capita income equally high without private resources. We, therefore, must now turn to the second one of the two questions raised in the opening paragraph of section III.1.: what determines the relative competitiveness of a region, its demand attraction capability, and through this, its rate of capacity utilization?

One implication of the RDP approach is that actual income is a function of the relative rate of capacity utilization, which itself is a function of the relative competitiveness of a region. There is ample evidence that resource endowments in the European regions differ to a large extent. As a result, even if rates of capacity utilization were the same in all regions, actual per capita income differences would remain in proportion to differences in RDP. However, as differences in utilization rates do exist, as our brief analysis of interregional employment disparities has shown, actual per capita incomes differ by more than potential ones.

The most plausible explanation for this appears to be in part the segmentation of the labour market discussed previously, and in part the effects of wage bargaining strategies between entrepreneurial associations and trade unions. Wages for workers highly endowed with private human capital are more or less equal within a national economy, and, for some categories such as managers, possibly international. This means that these labour qualities can only be used if a region pays market rates. If the region lacks relevant consumer amenities such as educational and cultural facilities or high environmental standards, then the rate to be paid could be even higher than the average market price. However, since productivity per capita is lower in regions with a lower RDP, the proprietors of "public", and particularly immobile, resources will have to accept rates of remuneration which are correspondingly below their specific productivity. Under normal circumstances, provided there is no collective wage bargaining, we would expect the scarcity wage rates and land rents to be enforced by the market. In practice, wage bargaining does exist, and is often dominated by a trade union strategy intended to achieve a redistribution in favour of the low paid, and usually less qualified workers. If such workers are paid high wages relative to their productivity, the regions with a low RDP are confronted with high costs of wage labour, and hence their productivity/wage ratio is low. In contrast, those regions with a high RDP having the same labour costs as the poorly equipped regions show a higher productivity/wage ratio. As a result, the former type of region experiences low activity rates, high rates of unemployment and/or outmigration of low per capita income groups. In the latter type of region the labour force is fully employed or even over-employed and there is increased inmigration comprising higher per capita income groups.

These developments also have repercussions on the flows of private investment capital between the two types of regions. In practice, it has been noted that the relatively well endowed regions will tend to attract both capital and qualified labour away from the less-favoured regions due to the possibilities of obtaining a greater return on material and human capital and better employment opportunities in the former types of regions. This process is also reinforced by the existence of larger external economies, particularly agglomeration economies, and a greater degree of technological and innovative development in the well endowed regions.

General regional competitiveness is admittedly difficult to measure and to influence. However, to the extent that one or more of the PF represent a true bottleneck in a region, an appropriate policy would require expansion of the bottleneck capacities. This is relatively easy in the case of infrastructure, but much more difficult for other PF such as location or agglomeration. To some extent, infrastructure could even be used as a substitute for location and agglomeration as was discussed above. In the case of significant regional underdevelopment, the regional problem will not only be of the bottleneck type, but will also be caused by too low a level of resource endowment generally, and to high a level of regional wages. Such a situation requires a comprehensive regional development program which uses all types of appropriate instruments, ranging from infrastructure investment to mobility and training subsidies. Given the high costs of such a regional development strategy, the available funds must be distributed and controlled very carefully.

III.4. A DIGRESSION: AGGLOMERATION ECONOMIES AND MINIMUM CAPACITIES

Agglomeration economies generally refer to external economies associated with size and spatial concentration. The benefits of size and concentration vary between the different groups in society. Three types of benefits may be identified:

(1) Consumer agglomeration economies: large concentrations of population can provide consumers with a greater variety of goods and services than smaller ones.

(2) Producer agglomeration economies: intra-industry concentration and/or metropolitan location offer many advantages to firms, often resulting in reductions in long run average costs.

(3) Social agglomeration economies: which affect all groups in society. A well known example of social agglomeration economies is efficiency in public services.

The forces of agglomeration have been widely acknowledged to be of great importance in the development and growth of metropolitan regions. In order to analyse the contribution of scale economies in metropolitan and/or regional growth, the producer agglomeration economies can be disaggregated into three separate elements: internal scale economies, localization economies, and urbanization economies.

- Internal economies refer to the different advantages, technical, managerial and financial, which can be realized in a firm by expanding the scale of operations.

- Localization economies occur within an industry through the spatial concentration of firms operating within the same industry. The concentration enables a single firm to reduce the inventory levels of factors of production.

- Urbanization economies permit a firm to reduce the "stock piles" of factors it needs to maintain per unit of time as a result of increases in the total economic size at a given location. They are similar to the localization economies, except that they now apply to all industries.

One of the main forces leading to economies of scale are indivisibilities of the production factors or processes. These indivisibilities do not permit proportionality to be maintained between all inputs in the production process at all levels of production, and lead to increasing returns to scale. Increasing returns to scale imply that an increase in all inputs in the same proportion leads to a more than proportional increase in output.

In terms of a cost function increasing returns to scale lead to decreasing production costs per unit of product as production levels go up, at least up to some point.

In FIGURE 1 a long run average cost curve (LAC) is represented.

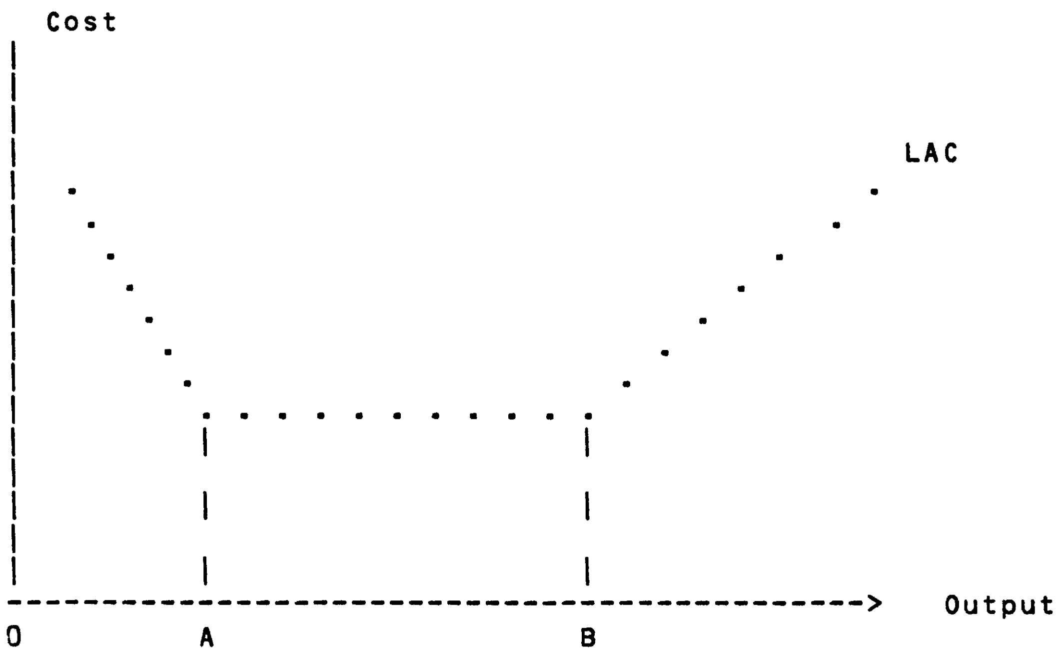


FIGURE 1: Long Run Average Cost Curve

We have increasing returns to scale up to output 0A, and constant returns to scale between 0A and 0B. After output 0B decreasing returns to scale set in. Since indivisibilities also occur to a large extent in public infrastructure, agglomeration economies and urbanization economies in particular can be expected here, too. In terms of the development potentiality factors this means that urbanization economies permit a region to reduce the "stock piles" of development factors it needs to maintain a certain level of development potential.

In FIGURE 2, the influence of agglomeration on the effiency of other (potentiality) factors can be seen.

At time t we need 0C1 of potentiality factor 1 and 0A1 of potentiality factor 2 to get a development potential DP1. C1D1 and A1B1 are needed to increase the level of development potential to DP2.

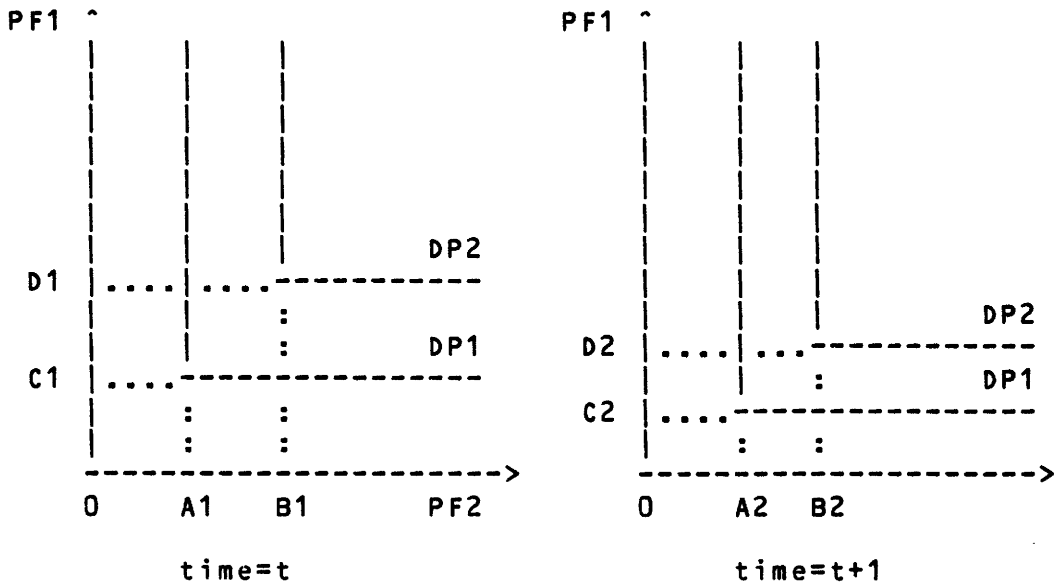


FIGURE 2: Influence of Agglomeration on the Efficiency of other (Potentiality) Factors

At time t+1 we see that economies of scale have influenced the efficiency of the other potentiality factors. The efficient amounts of PF1 and PF2 to maintain a given development potential level are reduced and also the increases in PF1 and PF2 required to obtain a higher RDP are less than at time t.

Traditionally, economies of scale have been viewed as a reduction in the long run average cost curve, as shown in FIGURE 1. As has been shown by Shephard in 1951, there is a duality between cost and production functions which allows one to replace a cost function by the equivalent production function and vice versa. Since the production function approach corresponds to the RDP approach chosen here, economies of scale can also be interpreted in terms of production functions.

There are two ways of introducing economies of scale into production functions:

(1) to let returns to scale be reflected in a special efficiency parameter, or

(2) to explicitly introduce those resources which determine economies of scale into the production function.

The basic idea regarding the first approach is that returns to scale are reflected in the efficiency parameters. Assuming two factors of production, capital (K) and labour (L), and a homogeneous Cobb-Douglas production function

$$Q = a*L^{b} * K^{c}$$

where a is a shift parameter, Q is output and b and c the efficiency parameters, returns to scale can be defined as

$$h = b + c >=< 1,$$

h being the homogeneity or total scale parameter.

The intention is to explore the relationship between h and internal/external returns to scale. Production function analysis employing time series and cross section data relating to infrastructure equipment in particular regions could be an appropriate method for estimating agglomeration effects or the effects of other potentiality factors. A proxy variable for K, information regarding infrastructure endowment, could help to explain otherwise inexplicable differences between regions with approximately equal private capital stock.

There naturally are some problems linked with such an approach, for example how to separate technological progress and economies of scale. But this is a problem more important for time series analysis than for cross section analysis, where the state of technology could be considered to be given. The limitations of this approach are that problems of indivisibilities and other dynamic aspects are usually ignored.

The second possibility explicitly introduces those resource inputs into a production function which in the previous approach were reflected in the efficiency parameter. Given the special importance of agglomeration, this could be an appropriate agglomeration indicator, although other potentiality factors do also exhibit economies of scale.

Agglomeration is also a good example to use when discussing another important problem of regional development, namely whether and to what extent a minimum resource capacity for regional growth exists. It seems plausible that if a long term cost function of the type presented in FIGURE 1 or the equivalent production function exist, regions already profiting from economies of scale due to agglomeration have comparative, or even absolute, advantages compared with other less developed regions. According to the theory of spatial market networks (Loesch) and of central places (Christaller), there exists a minimum population size ("threshold population" in the sense of Loesch) or a minimum level or rank of "centrality" (Christaller) below which local and regional production is not profitable and, therefore, will not be present. The argument is both that there is not enough demand in a given local or regional market if they are too small and if significant economies of scale exist for the respective goods and services, and that the inputs needed for these goods services, and especially all types of low to highly qualified labour, are in insufficient or overpriced supply. Population can be considered to represent a sort of "catch-all" indicator for the different categories of minimum size requirements.

Since the information and transportation costs (total communication costs) are a function of distance, the problem in the last resort becomes one of minimum size in relation to space, i.e. spatial concentration or density of demand and supply factors. As a consequence, there is a sort of hierarchical organization of production in space. Small size/low density may be sufficient for the profitable production of some products and services, but not for others. The latter ones are only to be found in larger and more agglomerated locations and regions. This also explains why there is not simply one, but a multitude of optimal degrees of agglomeration in the sense of a fully developed system of cities, ranging from high level central places through the medium level down to small village centers. The hierarchy of the market networks can also be used in order to delineate functional regions such as in the form of labour markets. Only a central place of a sufficient size and density will offer a general job surplus because of the concentration of production at these locations. In addition, the structure of the job supply in these centers will range from low to high qualification requirements. People living in the hinterland will then be attracted by this supply of jobs, and commute into the central place in order to fill the vacancies. Other commuting flows will be based on consumer and recreational trips. In combination, these commuter flows can be used to establish functional types of regions as already explained [cf. II.2.].

A more dynamic interpretation can be given to the minimum size concept if it is defined in terms of a "critical minimum effort" (Harvey Leibenstein, 1957). The idea here is that there are two opposing forces at work, an income raising and an income depressing effect, and that underdevelopment is characterized by some sort of "balance" between these two forces. The problem of development, therefore, is that whether any growth impulse leads to any improvement or not depends on the relative strength and the relative duration of the two forces. Leibenstein's idea is similar to the concept of Myrdal, discussed above as to the countervailing forces of the positive "spread" and the negative "backwash" effect in regional growth.

The critical minimum effort argument can be combined with the minimum capacity argument if the elements of the latter are seen as representing the conditions for a successful growth strategy. If there are sufficient potential capacities available when a growth process starts, the risk that growth is stopped simply because increasing economic activities cause congestion or excess utilization of existing potential is reduced. For example, two regions with the same actual level of employment and income, but different potentiality factor endowments, the one with the better endowment also has the better chance of reaching a long-term sustainable growth. This interpretation is still in line with Leibenstein's concept as he also pointed to the importance of indivisibilities and economies of scale. Both approaches basically belong to the category of unbalanced growth theories as opposed to the more neo-classical balanced growth ones.

These reflections presented only a simplified picture of reality, but nevertheless they stress the importance of economies of scale. For example, if the dynamics of inventions and innovations is introduced, it may be that a producer will be able to retain a low ranking central place for his production location even if he is exporting all over the world provided that he possesses a technological-legal (Patent!) advantage securing him a monopoly position on the world market. On the other hand, the innovative potential of optimally agglomerated regions in developed countries is high, given the fact that they possess universities, research institutes, highly qualified labour, capable entrepreneurs and risk-ready banks, in other words all those factors which contribute to the successful exploitation of inventions. Thus, it is often found that innovations start in these regions and spread in space, although this process takes time and is linked with communication costs which are particularly high for small and medium sized enterprises. This again stresses the importance of well developed and optimally agglomerated regional centers for the growth process.

The problem of minimum size is also relevant for infrastructure. Normally, one would expect that a well developed and optimally agglomerated region also has good infrastructure equipment. This allows an intensive process of production linkages and spatial division of labour inside a region. In the extreme, a peripherally located and backward region could dispose of a reasonably large regional center in the same way as another more developed region. However, if the backward region is not optimally equipped with infrastructure, it may be that the connections with its hinterland are poor and the intraregional division of labour is too low, due to a bad endowment with transportation, communication, energy, education and training infrastructure. If in addition the hinterland is dominated by agriculture or by declining old industries, economic exchange may be more intensive with other regional centers in more developed countries than with its own hinterland. The regional capital is thus unable to profit from an optimal intraregional division of labour on the one hand, and its income and productivity levels are correspondingly low.

Neither can the hinterland profit from those spread effects which would otherwise have been created. As can be observed in developing countries, this can cause a typical dual economic development: intensive international exchanges in the urban area with a relatively high level of welfare, but poor hinterland connections and a drastic decline in welfare a few miles away.

The threshold size/minimum capacity problem is particularly important for the network types of infrastructure such as transport, communication and energy. The total development potential of a region including its hinterland can only be fully realized if the region is sufficiently "accessible" to economic influences. Whilst this is certainly not a problem of infrastructure alone, infrastructure does play a major role. Due to the high degree of indivisibility of the network infrastructures, a region having a large area but a small population, for example, will appear to be either underutilizing its infrastructure capacity or to be endowed with excess capacities. If a road is needed to connect a number of small villages and towns with the regional capital, the less populated region may have the same network infrastructure capacity as another richer region, if this capacity is measured in terms of road kilometers per square kilometer for example. Hence, if the number of inhabitants or the number of road users or automobiles is used as capacity utilization indicator, it is quite clear that the less populated region will appear to be relatively over-supplied with infrastructure. The minimum size of large indivisible infrastructure categories will, therefore, be frequently reflected in low capacity utilization or high excess capacity in backward regions. This problem has to be confronted again in the empirical part of the study when infrastructure capacities have to be measured and evaluated.

An important issue in the analysis of the contribution of infrastructure to regional development is the stage of development of a certain region. Various infrastructure data collected in the national and the international studies indicate the existence of a certain saturation level on the basis of an S-shaped (logistic) curve, which is a usual growth path in a dynamic economic system [cf. FIGURE 3].

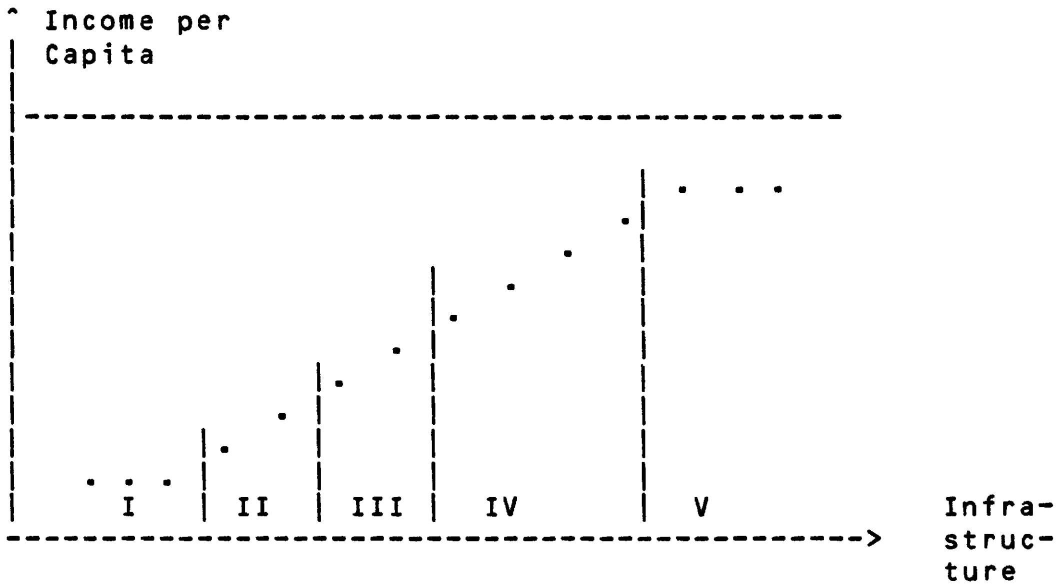


FIGURE 3: Growth Path in a Dynamic Economic System

The S-shaped curve in FIGURE 3 can be divided into several stages of economic development of the region in question. Each stage corresponds to a specific type of region:

I : underdeveloped regions which have insufficient infrastructure equipment (for example, peripheral and rural areas).

II : regions which are reaching the 'take-off' stage, so that the minimum infrastructure requirements for a growing economy are fulfilled.

III : rapidly growing regions which have a sufficient infrastructure endowment.

IV : regions which are characterized by a 'drive to maturity' and which show the first signs of the negative externalities related to rapid growth.

V : regions which have grown rapidly but which cannot grow any more due to bottlenecks in their infrastructure endowment.

It should also be added that in a period of structural economic recession, many regions will show an economic decline. In this case these areas are also becoming problem regions, such that infrastructure policy could require planning for decline with the fine tuning of infrastructure endowment and economic framework conditions.

Whilst the previous situation can be studied in a satisfactory way by means of catastrophe and/or bifurcation theory, a more detailed discussion of this topic falls outside the scope of this Study [See P. Nijkamp, Long Waves or Catastrophes in Regional Development, Research Memorandum, Dept. of Economics, Free University, Amsterdam, 1981].

A basic problem is of course the question of whether or not a typical and specific "package" of infrastructure endowment can be identified for each stage of regional development. There is some empirical evidence that network infrastructure is particularly important during the first stages of the development.

During the next stage, urban infrastructure is also becoming more important, and finally, social infrastructure may play an important role. In order to arrive at clear conclusions a shift-share analysis might be helpful. This has not yet been done, but it is certainly a worthwhile area for future research. In this case, a classification into regional and structural components would also be possible, and each component could be either positive or negative. [cf. TABLE 4.]

TABLE 4.: Regional and Sectoral Components

Components	regional	
	positive	negative
sectoral		
positive	I	II
negative	III	IV

The four cells I - IV represent four groups of regions characterized by different combinations of regional and sectoral problems.

group I : Regions with a satisfactory industrial structure and locational conditions that favour the realization of agglomeration economies.

group II : Regions with favourable conditions to attract growth industries but where other industries tend to stagnate due to bottlenecks in either potentiality factors (e.g. available floor space, accessibility) or governmental restrictions [see also Pellenbarg, 1977 and Andrioli et al., 1979].

group III : Regions where growth industries are relatively underrepresented but the locational conditions favourable so that they are able to benefit from the spread effects occuring in industries in group II. These are the so-called 'intermediate' regions, located at the fringe of the national core areas.

group IV : Regions in this category are losing in both grounds, i.e. industrial mix and regional share respectively, because the locational conditions are so unfavourable that neither growth industries nor spread effects are likely to be attracted to those areas. In short, the development prospects in these regions are not too promising.

Since infrastructure is one of the factors determining the regional component of development, cells II and IV represent the case for infrastructure policies. Cell II reflects a situation where only infrastructure is a bottleneck, whereas Cell IV characterizes a situation where infrastructure policy has to be combined with sectoral policies. This would apply e.g. for "old" industrial regions like the coal and steel regions of the Community. But even in cells I and III, infrastructure policy can be relevant if there is a sufficient infrastructure capacity in general, but if some categories which are very important for sectoral change are lacking (e.g. communications, specialized (re)training facilities, environmental infrastructure).

IV. INFRASTRUCTURE AS A DETERMINANT OF REGIONAL DEVELOPMENT POTENTIAL ("POTENTIALITY FACTOR")

IV.1. DEFINITION OF INFRASTRUCTURE AND ITS CHARACTERISTICS

(a) The Dual Nature of Infrastructure: Capitalness and Publicness

The characteristic which is common to all potentiality factors, including infrastructure, is that they represent bundles of services which are relevant for regional development and which are either not sufficiently provided, or not provided at all by the private or market sector, due to the high degree of publicness. The difference between infrastructure and other potentiality factors, such as the location of the region or its natural resource endowment, is that the service bundles inherent in infrastructure have been "artificially" created through investment, whereas location and natural resources are "naturally" given. Infrastructure, therefore, is a good which displays simultaneously the properties of both public goods and capital goods. With the aid of the publicness criterion, infrastructure can be distinguished from private goods and with the aid of the capital criterion, infrastructure can be distinguished from non-capital (public) goods.

(1) The capital criterion implies that infrastructure capacity comprises a bundle of services which has to be created by a process of investment at the beginning of the life cycle. Although this is, in principle, true both for private and public capital, infrastructure capital in general has a longer life cycle and/or a larger capacity compared with private capital.

(2) As a public (capital) good, infrastructure cannot be provided efficiently by the market mechanism and its publicness prevents a private investor from obtaining an adequate return on his investment. In some cases an adequate return could be obtained if the State granted the private investor monopoly status, thereby enabling him to collect fees or prices.

However, even if private pricing was possible in such cases (in Musgravian terminology, if "exclusion" was possible) a different evaluation of the respective allocational, and particularly distributional, effects may induce the public authorities concerned not to finance the investment via prices or fees according to the benefit principle, but via general taxation based on the ability-to-pay principle. As market failure will generally occur more often the greater the degree of publicness, the probability that such infrastructure types will be planned and financed publicly will increase.

The capital good character of infrastructure implies that the publicness property of infrastructure is, in general, "anchored" on the production side, such that the services to be provided by an infrastructure category exhibit a high degree of immobility, indivisibility and limitationality. At the same time, infrastructure services generally also have a high degree of polyvalence in consumption or of joint use in the sense that, once a bundle of infrastructure services has been made available through investment, these services can be used simultaneously by a relatively large number of users located within the servicing area of the respective infrastructure capacity. Infrastructure can, therefore, be said (in principle) to exhibit simultaneously both publicness in production and publicness in consumption or use.

It is in relation to publicness in consumption or in use that non-excludability becomes important. An infrastructure service can be considered to be highly non-excludable if the costs of making individual users pay for their personal consumption are extremely high. In this context, costs include also those caused by trying to identify and to measure the individual consumption of the services in question. The road network (with the exception of toll highways) is an example for high costs of exclusion. On the other hand, excludability is much cheaper and in practice is much more frequently applied e.g. in the case of railway fares, telephone fees or museum tickets. This indicates that the degree of non-excludability, in the same way as the degree of immobility, indivisibility, limitationality and polyvalence, can vary between low and high according to the type of infrastructure considered and the costs of the exclusion devices required.

A ranking of infrastructure categories according to their degree of capitalness and publicness can, therefore, also be considered as equivalent to ranking them according to the presumed intensity of market failure and the "need" for the public provision, public regulation or public subsidization of the services involved.

As infrastructure must be created by using other resources as inputs, it may be useful for some types of analysis to distinguish between the production phase and the utilization phase. Normally, in short-term Keynesian analysis where the income effect of investment spending is taken into account, only the multiplier effects of investment spending on income and employment are considered. However, from the point of view of a long-term development analysis, we are more interested in the capacity effects of public spending. Naturally, in the context of a dynamic analysis, a continuing process of public investment spending can also be considered which includes a continued multiplier effect. However, it must be stressed that the purpose of creating infrastructure is not to establish such a continuous spending process, but to provide the infrastructure capacities required in the respective regions. To the extent that infrastructure categories have relatively large capacities and a long life cycle, there will not be a continuous stream of public infrastructure investment if the regions to be considered are not very large. For example, if a region has been connected with a well designed highway system, it may be that there is no need for additional highway spending for the next ten years. However, the larger the region under consideration, the higher the probability that there will always be some need for public investment spending.

(b) Basic Public Services and Development Infrastructure

According to the criteria of capitalness and publicness, a large number of facilities and institutions can be labeled "infrastructure". In principle, this definition would also apply to public administration buildings, military airports, prisons, police stations and the like. Governments at all levels, whether central, state/provincial or local, have to fulfil some basic or "sovereignty" functions such as national defence, legislation, police, justice and general administration. Although the facilities required to supply these basic services are relevant for regional development, in so far as they provide a favourable general framework for public and private activities and welfare, they should not be classified as infrastructure contributing to regional development for the purpose of regional policy. This would deteriorate the Regional Fund into a general "Finanzausgleich" or fiscal equalization scheme, or into an intergovermental transfer system subsidizing insufficiently developed governmental organization. In order to prevent the Regional Fund becoming merely an instrument of equalization, in the sense that it only channels funds from richer regions and member countries to poorer ones, the definition of infrastructure relevant to regional development must be more limited. All types of infrastructure which are exclusively or predominantly used for fulfilling general political, sovereignty or equity functions should, therefore, not be included in the list of regional development infrastructure. This excludes public capital assets such as general administration buildings, military barracks, naval ports, airforce bases, ammunition stocks, police stations, and any other defence and security facilities. It could even be argued that obligatory primary education and general health care systems also belong to these basic public services which governments have to provide in all parts of their territory on a roughly equal basis per inhabitant.

Wherever a dividing line is to be drawn between the sovereignty types of infrastructure and development infrastructure, there will be infrastructure facilities close to the dividing line which require a more detailed definition in order to separate them. Such a separation would have to follow the basic notion mentioned above: if sovereignty or general political or equity goals predominate, then the respective infrastructure categories should be excluded as instruments of regional policy. The Group was of the opinion that the dividing line should be put between infrastructure facilities such as police stations and defence and security radio and communication networks on the one hand, and fire protection facilities such as fire stations, special fire warning network systems and similar facilities on the other. Only the latter categories are considered to belong to regional development infrastructure. Comparable cases should also be decided on with the aid of similar delineation criteria.

(c) Development Infrastructure and Private Capital Assets

A similar delineation problem arises in the separation of development infrastructure and private capital assets. Here, the purpose is not so much to exclude one of the two elements of the regional capital stock, but rather to clearly separate public and private ownership, decision making and risk distribution, and to prevent possible distortions of competition and incentives for governments to maximize subsidy payments out of the Regional Fund.

If all the elements of the regional capital stock could be ranked according to their relative degrees of capitalness and publicness, and if we are able to clearly define at what degree of these characteristics market failure would result (such that we knew exactly which types of capital assets would, or would not be provided by private market decisions), the problem would be easily solved; we would simply have to define x% relative publicness as the cut off-line. But because this information is not available, a more pragmatic approach must be chosen which involves using proxy indicators for actual and potential market failures due to publicness. Information on these indicators can be obtained with the aid of the following questions:

(1) Is the type of investment under consideration normally provided in EC member countries by public bodies or by private investors, and to what extent does this reflect the perceived degree of publicness?

(2) Are the goods and services produced with the aid of the respective equipment normally sold on the basis of prices in markets, or supplied fully or partly free of charge?

(3) What is the decision making unit that will have to support the risk of investment and will obtain a possible profit from it?

(4) Is the subsidy scheme likely to induce subsidy maximization and wastage of public funds?

In the case of both advanced factories and housing, there are undeniable infrastructure services such as the provision of road access, street lighting, energy supply, sewage and water systems and waste disposal. But if an area is equipped with these and similar types of infrastructure, the building of a factory or an apartment house under normal conditions is a profitable private investment. The investor is a private risk taking decision making unit, the goods produced (from the factory) or the services rendered (from housing) are sold on the market. As soon as public bodies engage in the same or similar investments, distortion of competition will arise in comparison with countries and regions where these private and capital assets are still provided by private decision making units. First, if a public body builds the factory, the private investor has a reduced risk when compared with the same investment at another place or by another firm. Since the public body will not be forced to break even, it can set a low rent and subsidize the private entrepreneur. From the point of view of regional policy, this can also result in other undesirable effects, for example if the investor, after having fully used up the subsidy, simply gives up the site and closes the factory down. Second, if the subsidy rate for infrastructure is higher than the subsidy rate for private investments, not only will the private investor try to obtain the higher subsidy, but also the respective governments will seek to maximize the subsidy payments from the Regional Fund and will eventually build factory buildings where they are not needed at all or where private investors, even if subsidized, would not have built one. As a result, scarce Community funds would be wasted. This last disadvantage can of course be avoided if infrastructure and private capital investments are subsidized at the same rate.

As far as the subsidization of private housing is concerned, infrastructure policy is both a part of regional development policy and a part of social policy. As far as is known, in all member countries the criteria for eligibility for investment aid or subsidies to private housing are based on general income or welfare criteria independent of the region or location of the project. There seems to be, at least in principle, no distinction between high income and low income regions. Here again, infrastructure as an instrument of regional development policy should not be defined so broadly as to encroach into the field of social policy, and thus acquire the character of a general fiscal equalization system or of a general social equity policy.

Where, from the point of view of social policy, housing subsidies are considered to be necessary in order to improve a bad housing situation, the Social Fund could naturally be used to contribute subsidies to these projects. If they are to be undertaken in an area recognized as a development region or a region to be subsidized within the framework of national or Community policy, the housing projects could be included in the relevant development program. However, in that case this part of the regional development program should be financed out of the Social Fund and out of the appropriate national funds.

The Group thinks that this procedure is also in line with the most recent Regional Fund Regulation of 1981, which is intended to coordinate all the instruments used to promote regional development. However, it is stressed that this decision regarding the borderline between public infrastructure subsidization and private capital subsidization is basically a political one to be decided upon by the competent authorities, and the Group as a team of experts can only give its advice.

In any case, wherever the borderlines in these and other cases are drawn, the Community needs to base its decision on distinct and clear criteria which can be applied in all member countries. Despite the fact that the Regional Fund had been used until now as a form of Finanzausgleich or repayment scheme for national regional policy expenditures, this previous strategy should no longer be followed. This also seems to be the basic orientation of the new regional policy guidelines of the Commission, and the new Regional Fund regulation. The Regional Fund can only fulfil its task, and genuinely contribute to more convergence, if its resources are used in the most efficient way, if the contribution of other funds are taken into account and if all available instruments are used in a coordinated way.

(d) Band Infrastructure, Point Infrastructure and Infrastructure Subsystems

The infrastructure categories which can be subsumed under the definition discussed above can be further characterized according to whether they represent a "band", a "point" or an infrastructure subsystem or network. Band types of infrastructure include roads, railways, communication and electricity supply networks or pipelines. Point infrastructure are bridges, tunnels, radio stations, electricity power stations, schools and hospitals. However, in order to build a road, railway track or pipeline for use by consumers or producers, the band types of infrastructure have to be combined with the point types of infrastructure in order to form an efficient subsystem. In the case of roads and railways it is the combination of roads and railway tracks with tunnels, bridges, stations, parking spaces and other complementary facilities. In the case of energy supply subsystems it is, for example, the electricity supply or gas distribution network or the pipelines combined with the power stations, transformer units or pumping stations. Infrastructure categories of the point type such as schools, museums and hospitals must also be connected through the transportation and communication subsystem. This implies that these latter categories of infrastructure, which provide for easy access to all the point types of infrastructure, but particularly in the education, health and social fields, are indispensible. They not only provide directly utilizable services for consumers and producers, but they also link together other types of point infrastructure subsystems.

Therefore, in addition to the previously discussed characteristics of infrastructure (immobility, indivisibility, limitationality, polyvalence, and non-excludability), there also exists for some categories of infrastructure the additional characteristic of improving the access to other types of infrastructure. This additional characteristic of improving the access to other types of infrastructure will be referred to as the "spill-over" or "system-effect".

(e) Public Human Capital as Infrastructure

As discussed previously, some types of human capital such as knowledge, information and planning/organizing capabilities, can also be considered as displaying aspects of both capitalness and publicness. Technological knowledge or information is, in principle, available to all potential users as soon as it has been produced, and, therefore, indivisible in use. As a result, this information can be used at zero marginal cost by any additional private person or public authority. This is one of the reasons why in all countries, as far as it is known, most basic research and particularly that undertaken in universities and public research institutes, is both publicly financed and made available to other users without charging them either cost prices or any fee at all. But a potential user is confronted with relatively high costs of search, information checking, selection and implementation. In order to reduce these "user costs" and in order to speed up the distribution of these types of basic technological information, adequate facilities like Technology Transfer Agencies and Urban and Regional Planning Agencies can be included in the list of infrastructure categories.

If these types of public human capital are taken into account, the problem of distinguishing it from private capital becomes more important than in the material capital case. This is because the borderline in the area of human capital must be drawn very carefully in order to avoid public interference with private human capital production and utilization on the one hand and excess subsidization of labour on the other.

The Group decided to consider some types of knowledge, information and planning/organizing capabilities as such examples of public human capital. In addition to the band and point infrastructure it was decided to include in the list of infrastructure categories a special subcategory of services in the form of public human capital of the following types:

- Planning Agencies at the urban and regional level, whose function it is to make available any relevant existing information on planning and coordination;

- Technological Transfer Agencies whose function it is to make available existing knowledge, particularly to small and medium scale industries in the weaker regions.

In the same way as the borderline must be determined between material public and private capital, for example in the form of industrial estates and machinery for advanced factories, the borderline in this case must be drawn such that part of human capital where the elements of the private sphere dominate is excluded. Examples of this would include scientific personnel employed in private laboratories, development departments of private enterprises, construction and design bureaux. As in the case of material capital, this implies that there could, or even should, be the possibility of giving investment premiums for the creation or extension of such private human services of the private capital type to private investors if they are located in less developed regions.

As human capital is normally more important and costly compared with the material equipment such as laboratories, it can even be argued that subsidization might also be envisaged in the form of a percentage subsidy of current expenditure on scientific personnel in laboratories, engineering research departments and other similar private institutions. This appears to be particularly important in view of the theoretical and empirical considerations regarding the importance of technological progress for the growth and employment prospects in the member states of the European Community which, in a world-wide perspective, belong to the category of highly developed countries and, therefore, must increasingly rely on research and innovation for regional development purposes.

As far as the problem of a borderline between public and private human capital is concerned, the problem would not be as serious if the subsidy rate for both was equal. If this was the case there would be no incentive to label as many of the existing types of human capital as possible as "infrastructure" in order to obtain a higher investment premium for them. However, as in the case of material capital, the borderline must be clearly drawn to avoid the rules of competition being violated and subsidies being paid for private activities which easily can and which indeed in some countries effectively are left to private market decisions. Here also, the argument applies that the Regional Fund should not become a (or remain) a general fiscal equalization fund.

(f) A List of Regional Development Infrastructure Categories

If the above mentioned considerations and criteria are applied, the resulting list of infrastructure main categories and sub-categories relevant for regional development, as recognized by the Group, will be as shown in the left-hand column of MATRIX TABLE I.A. [cf. TABLE 5.].

IV.2. INFRASTRUCTURE SERVICES AS A COMBINATION OF CAPITAL AND LABOUR INPUTS

Until now infrastructure has been defined in relation to its public capital or asset character. However, it is quite clear that the services which the different infrastructure types offer, can only be obtained if labour inputs are combined with these capital assets. If one compares, for example, a road system with an educational infrastructure or health system, the capital or labour intensity of these infrastructure subsystems may be significantly different. The Group, therefore, was of the opinion that it might be useful to include in the characteristics of infrastructure a classification of the relative degree of labour intensity in addition to the requirements of private human capital or labour qualification. A ranking of infrastructure subsystems on the basis of their degree of labour intensity appears to be similar to a ranking on the basis of the importance of the band types or network types of infrastructure relative to the point types. In general, transportation infrastructure is relatively capital intensive, whereas the point type infrastructures such as schools, hospitals and museums tend to be more labour intensive. In addition, the labour qualifications required in the education and health fields in particular appear to be higher than for other types of infrastructure.

Information on the relative labour intensity and labour qualification requirements is also important in another respect: an infrastructure category with a high labour intensity is at the same time one which "creates" high employment effects either if it is introduced into a region or if the existing infrastructure equipment is expanded. The direct employment effect of a labour intensive infrastructure is of course greater than that of a capital intensive infrastructure. Particularly if it requires highly skilled or educated labour, such an infrastructure might improve the local labour market not only quantitatively but also qualitatively. Here again, a distinction must be made between the initial construction phase and the subsequent utilization phase. In the initial construction phase, the employment effects are mainly those of the construction industries which produce the material infrastructure equipment. Once the infrastructure project has been completed, the next phase is that of operating and maintaining it, at which time different personnel will be required.

The relative degree of capital or labour intensity also provides information regarding capital and labour requirements, particularly in relation to the labour market or employment effects of infrastructure. As has already been discussed in the context of the production and utilization phase of material infrastructure capital, the employment effect of the initial construction phase is not as relevant in the long-term, but is rather of a short-term nature. The employment effects of the utilization phase clearly dominate and determine the employment effects either of an infrastructure subsystem or of all infrastructure categories combined.

The differences in both labour intensity and labour qualifications also have important consequences for the subsidization of infrastructure. According to the regulation in force during the period this Report was written, the Regional Fund can pay up to a 40% subsidy for investment expenditure on material infrastructure capital. Such a rule can give rise to serious distortions as far as the effective rate of subsidization of the total costs of infrastructure services is concerned. For example, we can take the total costs of infrastructure as 100 and we can assume that roads, which are more capital intensive, have a material component of 80, whilst hospitals, which are more labour intensive, have a material investment component of only 30. Given the subsidy rate of 40% the effective rate of subsidization of the total cost of 100 would be 40% of 80 = 32% of costs in the case of roads, and 40% of 30 = 12% in the case of hospitals.

The differences in labour intensity and in labour qualification requirements also have important consequences for the infrastructure planning process. They can create an incentive in relation to the infrastructure itself to choose the most advanced technology (at a greater cost of investment and a lower running cost) or they can create an incentive to favour infrastructure categories of the capital intensive type compared with the more labour intensive ones. Such distortions will be less severe the lower the rate of subsidization of infrastructure material capital, and the better the solution of fiscal equalization problems within the regional system of any member state.

If regional and local authorities do not possess sufficient resources of their own and are, therefore, financed by a relatively high level of specific purpose grants, as appears to be the case in many countries, there may be a risk that these authorities would be encouraged to plan more material infrastructure equipment than they really need or to invest too much in capital intensive types. This is because the subsidy (the special purpose grant) is a function of the amount to be spent on capital investment. This gives rise to a danger that the authorities would be unable to operate them after they had been established due to a lack of funds for paying the wages and salaries of the requisite personnel.

However, if this became a criterion for distributing subsidies from the Regional Fund, the risk again arises that the Fund would be used to compensate for an inefficient system of regional and local public finance. As far as the functioning of the Regional Fund is concerned, it must be assumed that the member state governments fulfil their role of endowing their local and regional governments with sufficient funds to provide the services for which they are responsible. Under no circumstances could the Regional Fund be made responsible for such political failure.

If the differences in labour intensity were really very large - an issue which can only be resolved on the basis of empirical information which is not available to the Group - one remedy could be to give a higher matching ratio to labour intensive infrastructure categories. However, it must be stressed that distortions and inefficiencies can only be prevented if national governments fulfil their obligation to provide their own tax resources, tax sharing facilities and/or general grants, and thereby permit regional and local governments to cover the costs of personnel for infrastructure services. Furthermore, as the subsidy from the Community is paid in addition to national subsidies, regional and local governments will be required to contribute a smaller percentage of the investment costs and will, therefore, be able to use the remaining funds to finance the running costs. Such an effect would obviously not be expected if the Regional Fund only repaid expenditure by national governments on regional and local investments, as has been the case in the past.

IV.3. EVALUATION OF THE RELATIVE DEGREE OF "INFRASTRUCTURENESS" AND RANKING OF INFRASTRUCTURE CATEGORIES

Since the nature and the effects of infrastructure depend on the different types of characteristics, it is clearly desirable to evaluate and to rank the individual infrastructure categories according to their relative degree of publicness, non-excludability, system effects, labour intensity and labour qualification requirements. Unfortunately, little information is available. Any ranking can, therefore, only be of a very crude and tentative nature based more on supposition than empirical evidence. However, even a more or less subjective evaluation based on the experience of the members of the Group may nevertheless be of some value when decisions relating to the Regional Fund and to infrastructure policy in general have to be made anyway.

The following assumptions have been made when evaluating the degree of "infrastructureness" of the different infrastructure categories:

(1) The basic assumption is that a band or network type of infrastructure normally has a higher degree both of immobility and indivisibility compared with a point infrastructure category (e.g. roads and railway tracks, compared with stations, bridges, schools and museums), as the costs of "mobilization" and "separation" are higher due to the fact that they are determined by the size of the indivisible capacity.

(2) If infrastructure categories of the band and the point type are combined to form an infrastructure network system, as in the case of an energy supply system comprising energy supply networks, power stations and transformer stations, then the network will normally have a higher degree of capitalness/publicness than its components.

(3) The same hierarchical evaluation procedure has been used to characterize the degree of infrastructureness of the main infrastructure categories A to L. The different energy sub-systems which are relatively close substitutes for each other (e.g. gas, electricity) obtained lower values for characteristics such as limitationality than

the total energy supply system comprising all types of energy, and when compared with the other main groups of infrastructure such as transportation, communication or education. The basic assumption in this respect is that the degree of substitutability between the main infrastructure categories is very low, and limitationality very high as a result. This can be illustrated by taking the extreme case of a region which has no transportation system at all, and hence an almost complete bottleneck which cannot be overcome by the substitution for this type of infrastructure of any of the other infrastructure categories. In practice, such a complete absence of any of the main categories cannot be substituted by any other main category of infrastructure. If substitution is defined in terms of money costs then it must follow that the money costs are higher the higher the degree of non-substitutability. Again, limitationality is considered to be less for point type infrastructure than for network types.

(4) As discussed above, in addition to the band and point types of infrastructure two further types have been introduced; public human capital and "combinations" of all three types. Although it is considerably more difficult to evaluate the degree of infrastructureness in these cases, the same basic principle has been applied. Wherever human knowledge, information and technology exhibit significant degrees of indivisibility they can be considered as a special infrastructure category of the non-material capital type. As with the other types of infrastructure it has been assumed that the degree of public human capital intensity can also vary.

Conceptually, the different degrees of infrastructureness and its elements should be measurable along a continuous scale. Given the enormous quantification problems, a tentative evaluation has to be restricted to distinguish three degrees or levels only:

"L" for low intensity,

"M" for medium or average intensity,

"H" for high intensity.

TABLE 5.: Subcategories of Regional Infrastructure
(Matrix Table I.A.)
Characteristics of Infrastructure
(Degree of "Infrastructureness")

	1	2	3	4	5	6	7	8	9
A. Transportation									
A.1. Road subsystem		H	H	M	H	H	H	L	L
roads, highways	B	H	M	M	H	M	-	-	-
bridges, tunnels, parking places, highway entrances and exits	P	<M	L	L	L	L	-	-	-
A.2. Railway subsystem		H	H	M	H	M	M	M	M
railway tracks	B	H	M	M	M	L	-	-	-
bridges, tunnels, rail-stations	P	<M	L	M	L	L	-	-	-
A.3. Waterway subsystem		H	H	M	M	M	L	L	L
canals, rivers	B	H	H	M	M	L	-	-	-
ports (incl. quays, docks, cranes, silos, storehouses)	P	L	L	M	L	L	-	-	-
A.4. Airports	P	M	M	M	H	L	>M	M	M
A.5. Coastal/deep sea harbours	P	<M	M	M	M	L	L	M	<M
A.6. Pipeline subsystem		M	M	L	L	L	L	L	M
pipelines	B	M	M	L	L	L	-	-	-
pumping works, storage facilities	P	L	L	M	L	L	-	-	-
A.7. Urban transport	C	M	M	H	M	M	>M	M	<M
A.8. Funiculars	B	L	L	L	L	L	L	M	M

Table 5 continued

	1	2	3	4	5	6	7	8	9
B. Communication Infrastructure									
B.1. Telephone and telex subsystem		H	M	M	H	L	H	L	<M
cable network	B	M	M	L	L	L	-	-	-
call boxes, telephone exchanges	P	L	L	M	L	L	-	-	-
B.2. Radio and television subsystem		L	M	M	H	M	M	M	H
radio wireless	P	L	L	L	L	M	M	L	M
radio and TV stations	P	L	L	L	L	M	L	M	H
B.3. Computer and information centers	P	L	L	L	L	L	L	L	H
C. Energy Supply Infrastructure									
C.1. Electricity subsystem		M	M	M	M	L	M	L	M
electricity network	B	M	M	H	L	L	-	-	-
power, transformer stations	P	L	L	L	L	L	-	-	-
C.2. Gas subsystem		M	M	M	L	L	L	L	M
gas pipelines	B	M	M	M	L	L	-	-	-
power stations, gasometers	P	L	L	M	L	L	-	-	-
C.3. Petroleum (oil) subsystem		M	M	M	L	L	L	L	M
pipelines	B	M	M	M	L	L	-	-	-
refineries, tanks	P	L	L	M	L	L	-	-	-

Table 5 continued

		1	2	3	4	5	6	7	8	9
C.4.	Long distance heating district heating subsystem		M	M	L	L	L	L	L	M
	pipelines	B	M	M	L	L	L	-	-	-
	power stations, storage facil.	P	L	L	L	L	L	-	-	-
C.5.	Other energy sources (solar,wind etc.)	P	L	L	L	L	L	L	L	<M
D.	Water Supply Infrastructure									
D.1.	Water distribution subsystem		H	M	H	H	L	L	L	M
	pipelines	B	M	M	M	L	L	-	-	-
	pumping works, tanks	P	L	L	L	L	L	-	-	-
	dams	P	M	M	L	L	M	L	L	L
D.2.	Irrigation and draining subsystem		M	M	M	M	M	L	L	M
	pipelines	B	M	M	L	L	L	-	-	-
	pumping works, tanks	P	L	L	L	L	L	-	-	-
D.3.	River and brook regulation	B	M	M	M	M	M	M	M	L
E.	Environmental Infrastructure									
E.1.	Water purification subsystem		H	M	H	H	L	L	L	M
	canalization	B	M	M	M	L	L	-	-	-
	purification plants	P	L	L	L	L	L	-	-	-
	sewage fields	P	L	L	L	L	L	-	-	-

Table 5 continued

	1	2	3	4	5	6	7	8	9
E.2. Waste treatment	P	L	L	L	L	L	L	L	L
waste depots	P	L	L	L	L	L		L	L
waste incinerators	P	L	L	L	L	L		L	L
waste composting	P	L	L	L	L	L		L	L
E.3. Coastal protection	B	M	M	H	M	H	H	L	L
E.4. Soil protection	B	M	L	H	L	H	H	L	L
E.5. Pollution control stations	P	L	L	L	L	H	L	L	M
F. Education Infrastructure									
F.1. Schools (all types)	P	L	L	M	H	M	L	H	H
F.2. Universities	P	M	M	H	H	M	L	H	H
F.3. Research centers	P	L	L	M	M	M	L	H	H
F.4. Training centers	P	L	L	M	M	M	L	H	H
G. Health Infrastructure									
G.1. Hospitals, ambulance stations	P	L	L	M	L	<M	L	H	M
G.2. Emergency, ambulatory services	S	L	L	L	L	<M	L	M	>M
G.3. Rehabilitation centers	P	L	L	L	L	<M	L	M	M
G.4. Centers for handicapped people	P	L	L	L	L	<M	L	>M	M

Table 5 continued

	1	2	3	4	5	6	7	8	9
H. Special Urban Infrastructure									
H.1. Fire protection subsystems		M	L	M	L	<M	L	L	<M
cable network	B	M	L	L	L	<M	-	-	-
fire stations, watches, calls	P	L	L	L	L	<M	-	-	-
H.2. Industrial estates	C	M	L	L	M	L	L	L	L
H.3. Urban redevelopment, rehabilitation	C	L	L	M	L	H	L	M	M
H.4. Conservation of historical and artistic heritage	P	L	L	L	L	H	L	M	M
H.5. Urban parks	P	L	L	L	L	M	L	L	L
H.6. Communal market centers	P	L	L	L	M	L	L	L	L
H.7. Urban and regional planning	S	L	L	M	L	H	L	H	H
H.8. Technological transfer agencies	S	L	L	L	L	L	L	H	H

Table 5 continued

	1	2	3	4	5	6	7	8	9
I. Sportive, Touristic Facilities									
I.1. General sportive	P	L	L	<M	<M	M	L	L	L
I.2. Swimming	P	L	L	<M	<M	M	L	<M	L
I.3. Water sport	P	L	L	L	L	<M	L	L	L
I.4. Winter sport	P	L	L	M	L	L	L	M	L
I.5. Camping grounds	P	L	L	<M	L	L	L	L	L
I.6. Youth hostels	P	L	L	L	L	L	L	M	L
J. Social Infrastructure									
J.1. Senior homes	P	L	L	L	L	L	L	M	L
J.2. Social assistance	S	L	L	L	L	L	L	H	M
J.3. Creches, day nurseries	P	L	L	L	L	L	L	M	M
J.4. Kindergartens	P	L	L	L	L	L	L	M	M
J.5. Children's homes	S	L	L	L	L	L	L	M	<M
J.6. Homes for handicapped people	P	L	L	L	L	L	L	M	<M
J.7. Mother-child groups	S	L	L	L	L	L	L	M	<M
K. Cultural Facilities									
K.1. Museums	P	L	L	L	L	L	L	M	<M
K.2. Theaters, concert houses, similar institutions	P	L	L	L	L	L	L	H	H

Table 5 continued

	1	2	3	4	5	6	7	8	9
K.3. Libraries	P	L	L	L	L	L	L	<M	M
K.4. Community centers	P	L	L	L	L	L	L	M	M
K.5. Congress centers	P	L	L	L	L	L	L	L	<M
L. Natural Endowment									
L.1. Natural parks		H	L	M	<M	M	L	L	L
L.2. Forests/reforestation		H	L	M	M	M	L	L	L
L.3. Beaches		H	L	H	M	M	L	L	L

Legend:

Col.1: Nature of Infrastructure Category
B: Band-type Infrastructure
P: Point-type Infrastructure
S: Human capital services
C: Combination of B, P and S

Col.2: Degree/intensity of immobility
L=low, M=medium or average, H=high
The sign "<" means: intensity decreases to lower category,
">" means: intensity increases to higher category

Col.3: Degree/intensity of Indivisibility (L,M,H)

Col.4: Degree/intensity of Limitationality or restricted Substitutability (L,M,H)

Col.5: Degree/intensity of Polyvalence (L,M,H)

Col.6: Degree/intensity of Non-excludability (L,M,H)

Col.7: Degree/intensity of System-effects (L,M,H)

Col.8: Labour intensity of the specific infrastructure service (L,M,H)

Col.9: Degree/intensity of labour qualification required for specific infrastructure service (L,M,H)

TABLE 6.: Main Categories of Regional Infrastructure
(Matrix Table I. B.)
Characteristics of Infrastructure (Degree of "Infrastructureness")

		2	3	4	5	6	7	8	9
A.	Transportation	H	H	H	H	M	H	M	M
B.	Communication	M	M	H	H	<M	H	M	H
C.	Energy Supply	H	M	H	H	L	H	L	M
D.	Water Supply	H	M	H	H	M	M	L	<M
E.	Environmental	M	M	H	M	>M	M	L	<M
F.	Education	L	L	H	H	M	M	H	H
G.	Health	L	L	H	H	<M	M	H	H
H.	Special Urban	M	L	M	L	M	M	M	M
I.	Sportive, Touristic Facilities	L	L	<M	L	<M	L	<M	L
J.	Social	L	L	M	L	L	L	H	M
K.	Cultural Facilities	L	L	M	L	L	L	M	M
L.	Natural Endowment	H	L	M	M	M	L	L	L

Legend for Columns 2-9: see Table 5.

As far as these tentative entries L, M and H are concerned, they are based on the assumption that in principle, it is possible to measure them in terms of resource or opportunity costs. For example, immobility can be considered to be measurable in terms of mobilization costs, in the sense that resources are needed to compensate for the effects of immobility. In the same way, the evaluation of the degree of non-excludability is based on the assumed costs of applying an appropriate exclusion technology. The scope of these exclusion costs depends in particular on the number of potential or existing check points, such as toll-booths at the exits and entrances of highways or box offices in theatres intended to sell tickets and thus achieve exclusion. The possible application of different exclusion technologies may even be strong enough in particular instances to enforce the exclusion principle. To the extent that an explicit exclusion technology can be avoided this would imply reduced exclusion costs. In any event, our evaluation of exclusion technology commences with the cheapest method of exclusion technology.

A second point which must be considered is the non-static nature of such exclusion costs. To the extent that exclusion technology changes, costs will also vary. With increasing costs of labour-intensive, relative to capital-intensive, control technologies substitution would be probable. Therefore, the actual state of applied and assumed exclusion technology is not fixed over time.

The system effects can be measured by the reduction in costs which arise from the improved accessibility to other types of infrastructure. The remaining two elements of infrastructureness can also be considered in cost terms. Labour intensity is the ratio of the quantity of labour inputs to the quantity of capital (material and human) inputs employed in the production process of the respective infrastructure services. Labour qualification refers to the requirements for private human capital, which can be measured in terms of costs such as those incurred in providing the necessary training and specialized education.

A relative evaluation on the basis of the spill-over or system effects has not been applied to infrastructure sub-subcategories. The evaluation only takes into account whether the specific infrastructure subsystem in question can make access to other types of infrastructure easier as is the case with the transport or communication infrastructure improving the accessibility of point type infrastructures such as schools, hospitals, cultural facilities, or fire stations.

Given the basic division between "privateness" and "publicness", it is contended that infrastructure categories with a low degree of infrastructureness, and particularly of publicness, are relatively close to being private facilities or capital assets. As a consequence, in these borderline cases the possibilities for substituting private activities for public activities and vice versa are obviously relatively great. This can be illustrated by reference to the fact that in some countries or regions, home help services may be preferred to old people's homes which could oblige people to leave their usual environment and to be concentrated in such homes. The same consideration applies in relation to kindergartens compared with mother-child groups as private initiatives. It may be that this more "private" form of tutoring children, where families or mothers are paid for the services they provide to the children of their neighbours, are preferred to the traditional type of kindergarten work.

Once again, serious problems arise regarding the consequences of transgressing the borderline between public and private activities. These cases should, therefore, remain as exceptions, and should only be included in the list of infrastructure categories where very close substitutes actually do exist, and where small changes in preferences would be sufficient to change the selection of the appropriate instrument. As far as the borderline between public and private capital is concerned, these types of activities could be appropriately subsidized in a similar way to private investment, as discussed previously in relation to advance factories and housing. However, it is also possible to argue the reverse: as kindergartens and old people's homes are such close substitutes for private activities, it would perhaps be better to pay a transfer to the people concerned thereby allowing them to pay for a place in a private kindergarten or in an old people's home, or to spend the money on hiring someone to come to the home and teach the children or look after the old person.

V. SUMMARY PRESENTATION OF THE BASIC CHARACTERISTICS OF INFRASTRUCTURE (INFRASTRUCTURENESS) IN MATRIX FORM

In summarizing all the preceding considerations, an attempt was made to present their results in a Matrix Table. The left hand column of MATRIX TABLE I.A. [cf. TABLE 5] contains the main categories of infrastructure and their sub-categories, which the Study Group considers to be relevant to regional development. The right hand columns contain all the relevant characteristics which, in combination, represent the degree of infrastructureness. TABLE 5 presents the results for the sub-categories, and TABLE 6 for the main categories. At the top of this list are those categories with a relatively high degree of infrastructureness, whilst the categories exhibiting the lowest degree are to be found at the bottom. Each main category comprises various sub-categories such as network systems, which represent possible combinations of band and point types of infrastructure and public human services.

All those infrastructure facilities which are required to maintain the infrastructure facilities considered (e.g. road building yards, storage places for repair materials, security offices etc.) are also covered by the infrastructure list. It should be noted that some special infrastructure equipment comprises a combination of various other infrastructure categories, such as industrial estates which are a combination of energy supply, water distribution and sewage infrastructure. In some cases the infrastructure stock also includes the provision of the necessary land.

Although the four criteria of publicness [immobility, indivisibility, limitationality, and polyvalence, see II.1.] exhibit simultaneously, at least in principle, publicness in both production and consumption, the evaluation contained in MATRIX TABLES I.A. and I.B. [cf. TABLES 5 and 6] refers particularly to the production side. The notion of polyvalence presumably has a smaller degree of variation compared with mobility/immobility for example, because a given infrastructure category can normally only provide the category-specific type of service; transportation infrastructure produces transportation services, not education services, energy infrastructure produces energy, not health services. The additional criterion of non-excludability, which brings the notion of publicness into sharper focus, refers to the exclusion technology on the use or consumption side.

It is assumed as explained that the intensity of each infrastructure characteristics increases from the sub-categories to the main categories because the degree e.g. of substitutability between transportation infrastructure and education is less than between e.g. roads and railways. In order to stress that the ordinal rankings cannot be simply added up, the result of the tentative ranking is presented in two Tables.

As already stated, the entries included in TABLES 5 and 6 (M, L and H) reflect only the provisional opinions of the Study Group. Their validity must be accepted as being of restricted value until such time as more empirical information is available. It is not possible to draw any more definite conclusions until serious empirical work has been undertaken. Furthermore, some elements of this matrix may vary from region to region depending, in part, on the standard of technology in the areas concerned. In no sense, therefore, can it be claimed that this analysis is definitive.

VI. THE EFFICACY OF INFRASTRUCTURE AS AN INSTRUMENT FOR REGIONAL DEVELOPMENT

VI.1. THE SUITABILITY OF INFRASTRUCTURE AS AN INSTRUMENT FOR REGIONAL DEVELOPMENT

As has been shown above in capter IV, infrastructure is but one of the resources which determine the development potential of a region. The different infrastructure categories provide services which, if they are lacking completely in a region or if the existing capacities are already fully used, limit the development possibilities of that region. The reason why infrastructure, compared with the other RDP factors, is of special importance for regional development, and why it represents an appropriate instrument for regional policy, can be summarized in terms of the following four considerations:

(1) Infrastructure represents a part of the overall capital stock of a regional (or national) economy. Its strong capital character, or high degree of capitalness, implies that the services being produced with the aid of different infrastructure equipments can only be provided in the form of relatively large capacities with a relatively long life-cycle. Whenever and wherever infrastructure services are needed, they can be created through investment. Direct infrastructure investment or subsidization of investment is, therefore, an appropriate instrument for regional development.

(2) At the same time infrastructure exhibits relatively strong public good characteristics or a high degree of publicness, which means that private market activities will fail more or less (depending on the degree of publicness) to supply these services in the desired quantity, quality and location. A special infrastructure policy is, therefore, required in order to satisfy the demand for infrastructure, and to overcome the possible limits to growth in a region.

(3) Infrastructure is not only important in so far as it provides these specific services, but it can also be used as a substitute for other potentiality factors which are lacking or under-supplied. This is particularly true for transportation and communication infrastructure which reduce the cost of spatial distance and, thus, compensate for a peripheral location. Infrastructure is also an important instrument for increasing the degree of agglomeration or for improving the sectoral economic structure of a region. This can facilitate the transition from an agriculture dominated production pattern to an industry dominated one, or from the latter towards a more service oriented sectoral structure. Normally, a certain adjustment and extension of the existing infrastructure equipment will be necessary. The usefulness of infrastructure in this respect lies in its adjustability and flexibility through new investments in the medium run, compared with the more long term determinants of RDP such as location, agglomeration and sectoral economic structure.

(4) In the short term, the multiplier effects of additional infrastructure investment spending are of some importance to the individual region. The short term income effects and the medium and long term capacity effects together represent the utility of infrastructure for regional development.

The effect of infrastructure improvements on regional development depends largely on the quality and structure of the infrastructure capacity. Increases in the capacity of infrastructure very often also lead to an improved quality of service. Thus a motorway not only has a larger capacity than a 2-lane road, it is also faster and safer. Hence, increased capacity of infrastructure may often also satisfy other needs and generate new demands.

In many cases increased infrastructure capacity can be provided in alternative ways, which may have very different consequences for regional development. For instance, the capacity of a road network may be improved by increasing the density of small roads, thus improving the local accessibility within the region. But it also can be improved by building a divided motorway and thus increasing speed and safety in the central part of the region. The capacity of hospitals might be increased by building more small hospitals, or by building one big hospital, which can provide more specialized services, but poorer accessibility. A final example might be energy production, where increased capacity might be obtained by building one very large power plant, for which most machinery has to be imported into the region, or by a more diverse strategy based on energy savings and smaller plants, which to a larger extent can be provided by local businesses.

VI.2. THE CONDITIONS FOR A SUCCESSFUL INFRASTRUCTURE POLICY

The basic condition which must be fulfilled in order that infrastructure can be used successfully as an instrument for regional development is that at least one infrastructure category represents an actual bottleneck and hence a limiting factor to the development of the region concerned. The identification of such an actual bottleneck implies a two-stage test:

(1) The identification of those infrastructure categories which are either totally lacking inside a region or, if they do exist, are already subject to excessive use such that no spare capacity exists for providing additional services.

(2) The assessment of whether, and to what extent, non-existing infrastructure categories are really needed or can be provided at all in the same sense that they represent a limiting factor to the development of the region concerned. It seems obvious that deep sea harbours can only be built in a coastal region and funiculars only in a mountain area. But problems such as whether or not the existing road network or the school system represent an actual bottleneck in a given region are not so trivial as these types of infrastructure would normally be needed in any region, albeit with a region-specific level of service.

If both tests are satisfied, increasing the bottleneck capacities will normally increase both potential and actual income and/or employment, or stop their possible decline. But this must not always imply that increasing an already existing excess capacity will not have these beneficial effects. It could be that an underdeveloped region with an absolutely low and qualitatively poor infrastructure equipment is not sufficiently attractive for private investors and qualified labour, to the effect that the existing capacities are underutilized. In such a situation, it will have to be analysed whether an improved infrastructure endowment will not also help to improve attractivity. However, such a strategy can cause unnecessarily high cost.

In the case of the existence of large excess infrastructure capacities, the presumption is that it is not the infrastructure that limits regional growth but other factors. Normally, the total influence of all the factors will show up in the productivity/labour cost ratio or the "efficiency wage" (Keynes) of a region; the higher the existing productivity compared to labour cost, the higher, presumably, is the regional competitiveness. The best strategy in such a case would clearly be not to create additional excess infrastructure capacities, but to try to improve the distorted productivity/labour cost ratio by attempting to keep the rate of increase in labour costs lower than in other regions, and to subsidize private capital investments temporarily in order to encourage a flow of qualified labour and new investments into the region. Through such a combined strategy, the relative labour costs of the region in question can be reduced and, at the same time, the productivity per job increased such that the productivity/labour cost ratio will improve. As a consequence, new jobs become profitable and employment increases.

The first test of whether or not there exists an actual infrastructure bottleneck is, therefore, of great importance for regional policy as the infrastructure development strategy will normally only work if infrastructure is the relevant bottleneck factor. The first test can be roughly applied by considering a list of infrastructure categories and examining whether or not a category is absent, or whether or not an existing capacity, compared with the infrastructure endowment and level of service in comparable regions, is sufficient.

Depending on whether an infrastructure category is "population serving" or "space serving", an individual infrastructure category will show some relationship with either population size and age/sex structure or with the size of the territory to be served. An infrastructure category can be considered to be "population serving" if its capacity is a function of the number of inhabitants, as in the case of hospitals, schools and theatres. It is "space serving" if the density per square kilometer is the more relevant capacity indicator as in the case of almost all network type infrastructure (e.g. roads, pipelines, waterways, energy supply networks). It is obviously possible to take both types of capacity criteria into account at the same time, if they are relevant.

To quantify such criteria requires that the existing infrastructure endowment of all regions, or of the group of the developed regions only, is analysed in order to determine whether there is any correlation between population or area on the one hand and the different infrastructure capacities on the other.

This simple procedure obviously implies that some sort of "normal" infrastructure endowment must be accepted as the reference standard. Basically, this means that the views of infrastructure planners, who have previously made infrastructure investment decisions in the different regions, are considered to be relevant guidelines for this evaluation. The more pronounced a deviation from that "normal" standard, the greater the suspicion that in the case of the individual region to be tested, a more or less serious bottleneck does exist.

The basic proposition of the Development Potential approach is that potential RPC is inter alia a function of the infrastructure endowment of that region. It would, therefore, not be appropriate to use a simple average as a standard reference criterion, as an average infrastructure equipment must also imply that an average RPC would or should follow. A more appropriate test is, therefore, to compare for example, the group of the least developed regions with the group of next best developed regions rather than directly comparing the first group with the average of all regions. It is also reasonable to compare an individual region with a group of comparable regions, that all show a certain higher degree of development which it seems possible for the single region to reach within the next say 10 - 15 years. Such an analysis has been carried out in several National Reports.

Such a procedure represents a transition towards the second test. In order to choose the most satisfactory group of "reference" regions, the differences in the regional development profile, or regional characteristics, must be taken into account. A simple procedure would be to classify all regions according to their most important regional characteristics, including other potentiality factors such as natural resources, location, agglomeration and sectoral structure, and to show the correlation between infrastructure endowment and the endowment with the other RDP-determinants. However, as, according to the RDP approach, these other factors also influence potential per capita income, quantified indicators of infrastructure endowment can also be correlated with RPC.

It could then be seen whether and to what extent there is, for example, a "typical" infrastructure endowment for agricultural regions compared with industrialized or service sector ones, or what differences in infrastructure endowment exist between regions with different degrees of agglomeration. These relationships could then be used to estimate statistically so-called quasi-production functions (Biehl), which would show the type and volume of infrastructure inputs needed to obtain a certain level or increase in regional income or employment for example.

These quasi-production functions can provide the following type of information: assume, that with a given infrastructure endowment of 60 (in index terms), a RPC of 30 could be reached. If region A has an infrastructure endowment of that level (60) but only an RPC of 20, the conclusion would be that it is presumably not the infrastructure endowment or the level of service which limits development in A. If there is a region B which shows an RPC of 40 with an infrastructure endowment of 60, this can be regarded as indicating a possible infrastructure bottleneck. Both assumptions obviously must be checked with the aid of additional information regarding the two regions, and, if this does not clearly contradict the assumptions, the appropriate policy measures may be taken: in the case of region A, additional incentives to increase the flow of private capital and qualified labour into the region; in the case of region B, the subsidization of new infrastructure investment. It is implied that both regions are considered to belong to the group of regions which have so low a fiscal capacity that they are assumed to be unable to finance the development measures out of their own revenues or that the infrastructures concerned are normally provided by a higher level of government.

The second test basically implies that a region-specific investigation must be made in order to describe the regional profile, and to identify the particular infrastructure bottlenecks which limit the development of the region in question. This requirement should be fulfilled by the regional development programs to be submitted to the Commission. If these programs are based on a common methodology, including both the specific characteristics of the regional profile and the regional infrastructure endowment, the most successful development possibilities with a given endowment of other RDP factors could be determined. To the extent that the European Community will then contribute by helping to finance the removal of existing infrastructure bottlenecks, development in the less developed European regions can be very much improved.

VI.3. CONSEQUENCES OF PRICE- OR FEE-FINANCING OF INFRASTRUCTURE

The productivity increasing capacity effects of infrastructure are maximized when infrastructure services are provided without charges or fees, and where infrastructure investment is financed via grants or direct payments from higher level governments, including the financial contribution of the European Commission. To the extent that the financing of infrastructure capacities requires the financial participation of a region, and to the extent that the services of the infrastructure categories are sold on the basis of the payment of prices or fees, the advantages to the region concerned are lower. Is is, therefore, necessary to distinguish between those categories of infrastructure where services would normally be supplied free of charge, as in the case of roads, coastal protection, pollution control, urban and regional planning, and those infrastructure categories where normally services have to be paid for (i.e. where exclusion is applied) as with railways, telephones, energy, kindergartens and theatres.

When an existing infrastructure bottleneck is removed, it is possible that the advantage obtained from the capacity extension is sufficiently large even if prices or fees are charged. However, this may depend on the basis upon which the calculation is undertaken. If these fees are calculated on the basis of a capacity utilization rate, it may be that the prices are higher the lower the capacity utilization. In such cases, fees or prices could remove a large part, if not all, of the benefits of an improved infrastructure endowment. In the case of a uniform national policy, as for telephone services and energy (electricity and gas), the net benefits for the less developed regions may be larger, compared with those for the more developed ones, because the contribution of users in the more developed regions may be higher due to the economies of scale arising from high degrees of agglomeration. However, some of the benefits of infrastructure, which would be available at a zero price or fee, would be reduced. Take for example the construction of a power plant in a region. The improved equipment will normally decrease the price of electricity supply in that region, but the benefit of this new investment will not go to the region if uniform national cost pricing is applied in that country. With uniform average national pricing, there would be no particular advantage to that region except in the case where, without the new investment, prices would have risen on average for the country as a whole.

In order to avoid that price policy reduces to almost zero the positive effects of improved infrastructure endowment, the implications of pricing policies for regional development must be taken into account. Even if, given the possibilities of applying the exclusion principle, some categories of infrastructure services are only provided when fees or prices are charged, the important question is whether or not the prices or fees for less developed regions should be lower relative to either the national average or to the level in more developed regions. This would be in line with the subsidization of private costs in less developed regions, as in the case of private investments or labour qualification.

To summarize, infrastructure is an important instrument for regional development, and, as one of the RDP factors, it can be used, and should be used, to encourage the development of the less developed European regions. Whether and to what extent infrastructure can be successfully used as a regional policy instrument will depend upon an investigation of each individual region on the basis of its development program. In evaluating the benefits of the improved infrastructure endowment for less developed regions, the possible effects of prices or fees and the financial participation of the less developed regions in financing the infrastructure investment must be taken into account. The greater the financial participation and the higher the prices or fees to the users of the infrastructure category services, the lower will be the comparative benefit for the aided region.

VI.4. A POSSIBLE REJOINDER: INFRASTRUCTURE AS A CONSEQUENCE BUT NOT A CAUSE OF REGIONAL DEVELOPMENT

From the point of view of the RDP approach chosen here, infrastructure is considered to represent primarily a factor determining regional development rather than a result of differences in regional wealth or poverty. As was explained above, the reason for this qualification is the relatively high degree of capitalness and publicness which stresses the importance of infrastructure for the creation of income and employment. This position does not imply that the influence of demand factors are denied, or that the interdependencies between demand and supply factors are overlooked. It can clearly be argued that wherever infrastructure exists, there must have been some pressure of demand, or at least the different governments must have perceived a certain demand for infrastructure before deciding to create infrastructure capacities. In a more elaborate and large-scale model, such interdependencies between demand and supply factors would obviously have to be taken into account.

However, in summarizing, the following arguments can be put forward to support the proposition that the influence of infrastructure on regional development dominates to such an extent that, in a simplified approach of the type undertaken here, attention can be concentrated on this particular aspect:

(1) It is an economic truism that most economic phenomena are to some extent related to supply and demand factors. Consequently, if any infrastructure capacity exists, it can be assumed that some "demand" has been identified, and that some income or tax capacity has been made available to finance that facility. However, two questions have to be clearly separated:

- the question of why an infrastructure capacity has been built and how and by whom it has been financed. As far as this particular question is concerned, infrastructure can be seen as a consequence of income: the higher the income the better, presumably, the infrastructure equipment.

- the question as to what effects are caused by the existence or lack of an infrastructure facility, i.e. what is infrastructure good for. Infrastructure capacities are not simply built in order to spend money, but rather to obtain the (real or perceived) benefits which can (only) be provided by the different kinds of infrastructure due to their publicness and capitalness characteristics. From this perspective, it is the capacity effect we are interested in rather than the demand aspects, although these will certainly have to be considered if a comprehensive infrastructure theory is to be developed.

The present research project is only concerned with the second type of question. We are interested to learn and to advise the EC-Commission what benefits in terms of income and employment for example are a consequence of the fact that region A has a smaller or larger infrastructure equipment than region B. Infrastructure is considered to represent a capital asset which contains a relatively large bundle of services that can be used as an input in order to generate welfare outputs.

(2) Even if we included into our analysis the first sequence of cause and effect, i.e. that a higher income per capita determines what quantity and quality of infrastructure was to be created, this cause and effect sequence differs between categories with a higher or lower degree of publicness, and particularly between network and point infrastructure that is not related to network infrastructure. A national highway or railway system is not normally financed out of local or regional funds, but rather via the national budget or the budget of the national railway company. There cannot, therefore, exist any direct causal relation between regional GDP and highway and railway investments or capacities. Indeed, some regions may be endowed with a highway route or a high voltage energy line only because two other, more distant regions are to be served.

(3) If spending on infrastructure in response to demand pressures was the dominant feature of the infrastructure phenomenon, one would expect infrastructure endowment to be more than proportionately higher in richer areas compared with the poorer ones. This would follow not only from the fact that infrastructure is a "normal", or even a "superior" good, but more particularly from the interplay of the political demand-revealing or demand-perceiving process which tends to give higher weights to large agglomerated regions with their great voter potential. As a consequence, one

would expect to find relatively better infrastructure endowments in those regions compared with the others. This would also imply that bottlenecks appear rather more frequently in smaller and poorer regions, and excess capacities in richer and larger ones. However, as will be shown later, this is not the case. If infrastructure is not distributed according to certain criteria of demand for private goods, such as income and fiscal capacity of local and regional governments, this may reflect the fact that governments consider infrastructure either as some type of "merit" good or as a redistributional instrument. This assumption seems to be true for less developed regions in many countries because better infrastructure equipment is frequently financed with the aid of large transfers and grants systems.

As a consequence, poorer regions can have a relatively larger, and richer regions a relatively smaller infrastructure endowment. The former type of region will then show relative underutilization or excess capacities, and the latter relative bottlenecks and overutilization. If one analyses more closely the justifications given by national governments for national regional policies, it is not so much demand that is stressed, but rather the intention or the hope of attracting more private investments, of creating more new jobs, of stopping outmigration or of allowing the indigenous labour force to be better used. All of these arguments are more supply than demand oriented.

(4) That infrastructure may appear to be relatively underutilized in poorer regions can also be expected from the point of view of the minimum-supply or critical minimum effort hypothesis discussed above. When governments try to provide a region with the possibilities for self-sustained regional development, they may have to invest much more in those regions than actual or perceived demand would require. Nevertheless, if regional development was not what it was expected to be even in the long run, it may be due either to the other potentiality factors or to the fact that regional private factors of production are overpriced compared with the level of productivity attainable in these regions. This points to the fact that a peripherally located region may be so disadvantaged that even a relatively, but nevertheless only slightly, better transportation infrastructure may not be sufficient to compensate

for a bad location. Furthermore, if only transportation networks are improved, it will sometimes benefit the producers in optimally agglomerated regions more due to the fact that a reduction of transportation costs is for them equivalent to a tariff reduction, and allows them to compete more efficiently with domestic producers. Finally, since infrastructure policies are time consuming, it may be that, until any significantly improved equipment can benefit fully the region in question, outmigration will continue, and competing private investments will already have been realized in other regions such that the prospects of a new "take-off" are seriously reduced during this relatively long period. The minimum-supply or the critical effort hypothesis may, therefore, provide a better explanation of empirical findings than does a demand hypothesis.

(5) The discussions of cause and effect relationship must be separated from the econometric possibilities of testing hypotheses based on these assumed relationships. The pure correlation operates in both directions, and it is not possible to resolve the cause and the effect issue with the aid of correlations. The specification of the regression equation to be tested has to be based on theoretical reasoning, which itself depends on the type of question to be answered. Whilst this Study tries to answer the question of what infrastructure contributes to regional development, and other questions related to the infrastructure phenomenon are not considered to be irrelevant, the position is simply that the Group has had to concentrate on this special type of problem.

(6) A decision on this issue cannot be taken without recognizing that infrastructure is only one determinant of regional income and employment. If the other potentiality factors in combination with infrastructure can explain a larger share of total regional income dispersion, it is no longer possible to claim that income is the relevant explanatory variable and not infrastructure. There is no theoretical basis for the proposition that income determines regional location measured by distance, or that agglomeration is an effect of income rather than being a cause. Admittedly, in the case of sectoral economic structure, measured with the aid of the GDP share of industry and services, the opposite hypothesis can also be justified. But here again, the potentiality factor approach is not

denying the influence demand exerts on structure. The proposition is only that there is not a continous and "costless" change from say an agriculture dominated regional structure to an industrialized one, and from an industrialized one into a structure dominated by service sector activities. In these critical phases of regional development, sectoral structure changes are not so much a consequence of changes in demand, but of the fact that regional competitiveness has decreased and more particularly, that comparative advantages in former export industries have been lost.

PART TWO

REGIONAL ENDOWMENT WITH INFRASTURCTURE AND ITS CONTRIBUTION TO REGIONAL DEVELOPMENT

EMPIRICAL ANALYSIS

VII. INTRODUCTORY REMARKS

The Second Part of this Study is devoted to the empirical questions outlined in the introduction to Part One - especially definition and calculation of infrastructure and development indicators, estimation of quasi-production functions and identification of bottlenecks and excess capacities. In addition, the findings of the nine National Reports are summarized. A final Chapter draws conclusions both for regional policy and for desirable new research. An Appendix contains the main results of two case studies on Portugal and Spain that have be carried through after the Study Group had finished its work with the present Report.

VIII. DEFINITION AND CALCULATION OF INFRASTRUCTURE AND DEVELOPMENT INDICATORS

VIII.1. DEFINITION, STANDARDIZATION AND NORMALIZATION OF INDICATORS

Given the publicness and capitalness of infrastructure, the most interesting aspect of infrastructure is its capacity effect. From a long term point of view of regional development, the income multiplier effects caused by infrastructure investment spending can be neglected.

There are three possible definitions of infrastructure capacity:

- absolute capacity;
- relative capacity, i.e. in relation either to population (INF/POP) or to area (INF/AREA);
- functional capacity, i.e. the individual infrastructure capacities are related to population if they represent point types of infrastructure which are assumed to be directly population serving, or are related to area if they are of the band or network type, having predominantly the purpose of opening up space, and thereby indirectly serving population needs. Even if there is not always a very strong correlation between point infrastructure and population on the one hand or network infrastructure and area on the other, usually one of the two correlations dominates.

All three definitions presuppose that an adequate measuring rod for capacity is available. A differentiated measurement would require information about the number of service units provided by each individual infrastructure category. This would also allow one to measure capacity in terms of the technologically maximum or the economically optimal number of units, and to directly compare them with those actually used. For a transportation facility this could be tons of goods and services per day, weighted with a characteristic speed and other quality indicators, or number of patients/day weighted by qualitative medical treatment. As a last resort, either ideal shadow-prices or appropriately constructed utility indices would have to be used. It becomes immediately clear from discussing these possibilities that such an endeavour is not feasible in the context of our study given the time and money constraints. Such a concept would involve a large number of case studies in order to identify the most appropriate technological characteristics and weighting procedures for each infrastructure category.

Consequently, the Group had to work with a much more simplified and crude approach, but one which is more easily made operational allowing the collection of basic information relating to the large number of infrastructure categories identified in the first part of this Report. Admittedly, such a crude approach will provoke easy criticisms by experts in the different infrastructure fields. However, we thought it more useful to have a broad approach which is generally applicable to any infrastructure category, rather than to select one category for a more detailed case study. These simplified measures are for example, kilometers of roads per road category, number of school places per category, kilometers of high voltage energy network, hospital beds, places in theaters, museums and so forth.

In addition, it seems more interesting to estimate quasi-production functions for a large number of infrastructure categories with such a crude indicator, rather than trying to develop a maximumly refined system for only one infrastructure category.

The approach adopted for the present Study starts from the assumption that it is possible to select one or very few physical or technical characteristics of an infrastructure facility in order to roughly measure capacity. This implies a certain intuitive judgement as to that characteristic of an infrastructure facility which could exercise the relatively strongest bottleneck influence. According to the publicness and capitalness criteria developed in Part One, this should be the relatively most non-substitutable and the relatively most polyvalent element of a complex infrastructure facility.

Take for example the case of airports. It is possible to look at the passenger service capacity of the main airport building, or at the number of gates, or at the technical equipment of air control, or at the size of runways. The choice was for airport runway surface (length times width) and, where possible, for hard surface only, weighted with load classification numbers which indicate whether a jumbo or smaller aircraft can take off and land there. If the runway has a certain quality, it can be assumed that the other elements of the respective airport are also designed so as to permit take-offs and landings by specific airplanes and to offer the appropriate passenger services. On the other hand, a marvellous building with large, spacious halls and a fast urban transport connection with the city center would not be very helpful if the runways were only built for light aircraft. In many cases, the selection made will represent no more than a guess, albeit from the point of view of experts in the different infrastructure fields. The Group cannot claim, therefore, to have used the best available criterion for describing economically relevant infrastructure facilities. It can claim, however, to have tried to select criteria according to similar degrees of approximation or simplicity in order to obtain roughly comparable results for a large spread of infrastructure categories ranging from transportation to museums and even to natural "infrastructure" like forests and parks.

As far as the choice between absolute, relative and functional capacity definitions is concerned, it would have been desirable to cover all three in the study. This was possible for some National Reports, such as the Dutch one, which is particularly interested in the sensibility of the different definitions, but was not possible for the Community Analysis. Most Reports and the Community Analysis are based on the functional approach. The indicators obtained with this functional approach are called standardized indicators.

The standardized indicators cannot be added up to build a complex infrastructure indicator due to the fact that each indicator is still expressed in the specific dimensions chosen like km/area or hospital beds/population. Hence, a transformation into dimensionless indices is required. This procedure is called normalization. Here again, several possibilities exist:

- a division of each standardized regional indicator by the indicator average for each category. This transformation is less sensitive to extreme values, but has the disadvantage of producing unequal scale lengths for each category.

- a division of each indicator by the corresponding maximum value of an indicator series. Here, transformation is more sensitive to extreme values, but leads to equal scale length. In addition, this transformation still implies a ratio scale so that the order of magnitude of each figure has a definite meaning.

- subtracting the row minimum and dividing the result by the difference between the row minimum and row maximum. The resulting interval scale is not invariant against a multiplicative operation such that a value 50, for example, does not imply twice the capacity 25.

- statistical standardization, i.e. subtraction the average and dividing by the standard deviation. This procedure suffers form the same drawback as does the preceding transformation.

The Group decided to apply the second normalization method, i.e. dividing by the maximum value of each standardized indicator series. This implies

$$a'_{ir} = \frac{a_{ir}}{a_i^{max}} * 100$$

where a imax is the maximum value of standardized a-values over all regions.

VIII.2. REGIONAL DELIMITATION AND DATA PROBLEMS

An empirical analysis of regional infrastructure endowment and its contribution to regional development will be basically affected by two types of problems: how to appropriately define and delimitate regions, and how to obtain the desired statistical data for those regions that are sufficiently coherent and comparable between member countries.

As explained in Part One [cf. II.2.], infrastructure categories have specific regional servicing areas or extend their services to smaller or larger groups of people. In order to measure infrastructure capacity in the functional sense as presented above in relation to area or population served, first the size of the category specific area or group should be known. However, if this condition would be fulfilled, as a result these servicing areas or groups would differ, as it cannot be assumed that the different servicing areas will always coincide. On the other hand, if the objective is to quantify total infrastructure equipment of a given region, some servicing areas by categories will be larger and others smaller compared with the given region.

Whenever a given region is larger than the appropriate servicing area, this can imply an import of infrastructure services from a neighbouring region, and whenever it is smaller, it will possibly export some of its infrastructure services. An airport or harbour for example may not only serve the region in which it is located, but also adjacent other regions, and a region without appropriate university facilities will have to let its students emigrate to another, better equipped region. Network types of infrastructure like a road or railway or an energy supply system may show large capacities even in less developed regions in order to allow for some transit-demand from more developed regions whose exchanges cross the territory of the less developed region. But what is important in our context is that these existing infrastructure capacities can also support economic activities of the "transit" region and therefore, nevertheless, represent some development potential. As a conclusion, the basic approach remains valid, but measurement problems may arise if the desired first-best statistical information is not available.

For the present Study, it has been intended to use the so called basic administrative units or level-II regions according to EC-classification. These level-II regions basically represent national preferences and choices as to appropriate regional delimitation. In most member countries, they are large enough and are sufficiently conformable with the congruence criterion. They nevertheless differ considerably in size. For example, member countries like the United Kingdom and the Federal Republic of Germany with roughly equal size have a significantly different number of regions: 11 in the first and 34 in the second case. [See First and Second Periodic Report on the Social and Economic

Situation of the Regions of the European Community, Brussels 1981 and 1984. These two Reports present a wealth of information as to the level-II regions and their development during the sixties and the seventies].

The German regions furthermore, are purely political-administrative units whose boundaries cut through economically interlinked areas. The three City-States of Berlin-West, Bremen and Hamburg only comprise the urbanized city territory and are separated from the economic hinterland. Also, some of the German Regierungsbezirke do not coincide with a reasonably defined functional region. It, therefore, was decided not to use the level-II concept in the German case, but rather to rely on another set of clearly functional regions. They were created for the purpose of analysing regional disparities in the context of the "Raumordnungspolitik". The only region for which it was not possible to apply this functional approach in Germany is Berlin-West. Due to its peculiar geographical location amidst the territory of the German Democratic Republic, the center-hinterland relationships practically do not exist. In addition, the high financial support granted by the German federal government allowed to maintain an infrastructure equipment considerably higher as the one needed for Berlin-West as such. As a result, Berlin-West would in many infrastructure categories have reached the maximum equipment of 100 and would have displaced even some of the economically best developed regions in the Community. For any statistical analysis tending to show the relationship between infrastructure equipment and economic performance, Berlin-West is, therefore, in a clear statistical "outlier"-position.

A similar problem arises concerning the region of Groningen in the Netherlands. Due to the high value added obtained from the natural gas production in that region, the regional GDP is quite outside any normal economic orders of magnitude as explained in Part One [cf. II.3.] in relation to the infrastructure equipment. In order to reduce the negative consequences resulting from these statistical distortions, both Berlin-West and Groningen were excluded from the analysis.

In some other countries, e.g. in Denmark, Belgium and Ireland, the national experts and members of the Study Group preferred a more differentiated regional breakdown compared with the level-II regions. Here again, the number of regions is relatively large and consequently the size of the regions relatively small. In the case of Greece, the national planning regions which are sufficiently functional have been retained.

The available statistical information on infrastructure equipment and on regional characteristics selected for the purpose of the present Study are documented in the Annex. It shows first basic data for the full set of 141 regions and then a number of Tables for the reduced set of 139 regions without Berlin-West and Groningen.

Starting from the List of Infrastructure Categories developed for TABLES 5 and 6 of this Report and taking into account the considerations presented in the previous section, it was tried to collect data containing a minimum information as to the capacity of the different infrastructure categories. The definitions for capacity are listed in TABLES A.1 and A.2 of the Annex [so-called Matrix-TABLES I and II]. Although, when formulating these definitions, feasibility and availability were already considered, it proved not to be possible to always obtain the desired information.

For many of the infrastructure categories appearing in our list, no statistical information is available in a centralized and easily comparable form. The Group, therefore, had to invest much more time and effort than originally expected in data collection and in checking comparability. In addition to the official statistical offices in each country, the experts had to contact many other public and private institutions. Fortunately, almost all of them were ready to support the Study. Without their help it would not have been possible to bring together the wealth of information now available for the Community. All in all, the statistical task was a formidable one. All experts, including their Institutes or Universities, contributed far beyond their normal research obligations. To the best of our knowledge, it is the first time that such a comprehensive and differentiated stock of information on this large set of infrastructure categories has been made available for the Community, the member states and their regions.

Despite the considerable efforts of the national experts and the Group as such, a number of serious deficiencies remains not only as far as the coverage and definitions are concerned, but also regarding international comparability. Many data, such as those for the railway system or the energy supply networks, had to be measured from maps in some member countries. As to social and cultural infrastructure, sometimes only simple number of facilities without any capacity characteristics could be obtained. This implies that e.g. the Louvre in Paris rates as "one museum" as does a small village museum in a rural area. The socio-cultural infrastructure indicators are, therefore, less comparable than the indicators for economic or productivity oriented infrastructure categories like transportation or communication.

Since only very few consistent and comparable time series could have been obtained, a cross section approach was chosen. It was tried to collect data for the beginning and the end of the seventies in order to be able to analyse also the changes in infrastructure equipment during this period. Unfortunately, it was not always possible to cover the same years, say 1970 and 1979. In some cases, the first cross section period, therefore, had to be extended to the years before 1970 and up to 1974, whereas the second period covers data from 1975 to 1980. This is due to the fact that some information is only collected for time intervals of five and more years.

In many cases, the experts were able to obtain data for their national regions that are not sufficiently comparable between member states. As a consequence, the data set used for the Community-wide analysis is considerably smaller. Here again, a pragmatic approach was chosen in order to avoid that only a small percentage of the national data collected could be used for the Community Analysis. If only fully comparable data for the same cross section years would have been selected, the Study would have been even more restricitive. On the other hand, given the relatively large number of data retained for the Community Analysis, the aggregated total infrastructure indicator IGES profitted from a sort of error compensation. The following analysis puts, therefore, more weight on this indicator than on the indicators for the different main infrastructure categories A to L.

However, it needs to be stressed that the theoretical approach developed in Part One of this Report is not affected by the data problems mentioned. On the contrary - if it is possible to test the regional development potential approach already so successfully, as will be shown below with the aid of imperfect data, the conclusion is that this approach would be even more relevant if better data were available. In any case, a renewed effort to improve consistency and comparability of regional infrastructure and development indicators appears to be worthwhile, because such information is of great value independent of the merits of the regional development potential approach. With the insight gained by the members of the Group into the peculiarities of the statistical national bases and definitions, it should be possible to improve infrastructure statistics significantly. This would not only help the Community, but also national and regional authorities and researchers to base their analysis and policy decisions on more reliable and comparable data.

According to the regional development potential approach, it is possible to predict the income per capita and the employment that can be expected on the basis of a given endowment with infrastructure and the other determinants like regional location, agglomeration and sectoral structure. In order to test these hypotheses, it is also necessary to have data on regional development characteristics like regional product, productivity, activity rates and employment. As to these data, the experts have been asked to use whenever possible the existing data of the Directorate General for Regional Policy of the European Commission and the data of the Statistical Office of the European Communities. Both Institutions supported the work of the Study Group most efficiently and allowed to use information that had not yet been published in the period when the empirical analyses for these Study were under way.

VIII.3. INFRASTRUCTURE CATEGORIES RETAINED FOR THE ANALYSIS

The infrastructure categories for which data should be collected are presented in TABLE A.1 in the Annex. Because of the comparability problems, the many redefinitions, changes of dimensions, and differences in data collection and aggregation, the codes of this Table could not always be retained. TABLE A.3 in the Annex informs about the codes selected for the Community Analysis. In addition, all the computer statements used for calculation of the indicators required for the Community Analysis on the basis of the data collected by each expert for his country are given in TABLE A.4. They cover both the infrastructure and the regional development indicators.

As discussed above, it has not been possible to use all the data collected by the experts for their respective countries, even not all those indicators on which the National Reports are based. The data set employed in the Community Analysis therefore, is smaller than the national sets. It is interesting to know the extent to which the reduced Community data set contains the same type of information embodied in the national data sets used for creating the infrastructure indicators. In order to give an impression as to the equivalence of the two sets, TABLE 7 summarizes the available information regarding the number of subindicators used for the construction of the main category indicators both for the National Reports and the Community Analysis. It also shows where subindicators have been weighted and which of the subindicators have been used in both data sets. It must be stressed that these figures are of different qualities. Only in some cases was it possible to directly count the subindicators whilst in others, estimates were entered. Nevertheless, the overall picture can be considered to be reliable. On the average, the Community data set comprises roughly half the national data. The percentage is higher where alternative capacity indicators could be used and lower where only numbers of facilities or percentage figures were generally available.

A simple test of exactly how representative the indicators are is to calculate the correlation coefficients between the national aggregated indicator values and the equivalent values obtained for the Community analysis for all the regions of a member country. This information is given in TABLE 8. High coefficients are found for Italy, Netherlands, Greece, France and Germany ranging between 0.96 and 0.73. As to Belgium, Denmark and Ireland, the figures are lower. They are between 0.69 and 0.34, if the completely insignificant value for the 2nd cross section year in Belgium is disregarded.

All in all, this is not a bad result given the large statistical and comparability problems. Since it is the first time that such a wealth of information has been brought together in a systematic way, it seems worthwile to attempt to obtain better data in order to continue and to improve the analysis presented here.

TABLE 7.: Comparison of Indicators Used in National Reports and Community Analysis

Category	BELGIUM						GERMANY					
	01			02			01			02		
	TN		IN	TN		IN	TN		IN	TN		IN
	NR	CA		NR	CA		NR	CA		NR	CA	
A.	17	5*	5	20	9*	7	19*	19*	19	19*	19*	19
B.	3	-	-	4	1	1	1	1	1	1	1	1
C.	11	4*	4	15	6*	6	10*	9*	7	10*	9*	7
D.	2	-	-	2	-	-	2	-	-	2	-	-
E.	4	1	1	9	3	3	2	2	2	2	2	2
F.	4	2	2	4	2	2	5	5	5	5	5	5
G.	4	1	1	4	1	1	1	1	1	1	1	1
H.	1	-	-	1	-	-	-	-	-	-	-	-
I.	7	-	-	9	-	-	4	-	-	4	-	-
J.	6	1	1	9	3	3	3	5	3	3	4	3
K.	2	1	1	5	3	2	2	2	-	2	2	-
L.	1	1	1	5	3	3	2	1	1	2	1	1
IGES	62	16*	16	87	31*	27	51*	45*	39	51*	44*	39

Table 7 continued

Category	DENMARK						FRANCE					
	01			02			01			02		
	TN		IN	TN		IN	TN		IN	TN		IN
	NR	CA		NR	CA		NR	CA		NR	CA	
A.	9*	-	-	14*	3*	3	22*	12	12	23*	16	16
B.	2	-	-	7	-	-	1	1	-	1	1	-
C.	17*	4*	4	20*	5*	5	8	8*	8	8	8*	8
D.	-	-	-	-	-	-	3	-	-	3	-	-
E.	-	-	-	4	1	-	4	3	1	5	4	4
F.	3	1	1	8	3	3	4	3	-	4	3	-
G.	8	1	1	8	1	1	1	1	1	1	1	1
H.	2	-	-	2	-	-	2	-	-	1	-	-
I.	6	-	-	6	-	-	5	-	-	6	-	-
J.	8	2	2	11	5	5	6	3	3	6	3	3
K.	3	1	1	5	1	1	2	-	-	4	3	3
L.	-	1	-	-	1	-	-	2	-	-	2	-
IGES	58*	10*	9	85*	20*	18	58*	33*	25	62*	41*	32

Table 7 continued

Category	GREECE						IRELAND					
	01			02			01			02		
	TN		IN	TN		IN	TN		IN	TN		IN
	NR	CA		NR	CA		NR+	CA		NR	CA	
A.	6*	3	3	7	3	3		4*	-	9	4*	3
B.	3	1	1	3	1	1		-	-	2	-	-
C.	5*	2	2	5*	4	-		-	-	7	2*	2
D.	-	-	-	-	-	-		-	-	3	-	-
E.	-	-	-	-	1	-		-	-	5	-	-
F.	3	3	3	3	3	3		-	-	4	-	-
G.	1	-	-	1	1	1		-	-	6	-	-
H.	1	-	-	1	-	-		-	-	2	-	-
I.	2	-	-	2	-	-		-	-	5	-	-
J.	-	-	-	-	5	-		-	-	2	-	-
K.	3	1	-	3	3	-		1	-	4	3	3
L.	1	1	-	1	2	1		1	-	-	2	-
IGES	25*	11	9	26*	23	9		6*	-	49	11*	8

Table 7 continued

Category	ITALY						LUXEMBOURG **					
	01			02			01			02		
	TN		IN	TN		IN	TN		IN	TN		IN
	NR	CA		NR	CA		NR	CA		NR	CA	
A.	9*	10*	8	26*	12*	8		5*			9*	
B.	6	1	1	6	1	1		1			1	
C.	2	2	2	7	4*	4		2*			2*	
D.	1	-	-	1	-	-		-			-	
E.	-	-	-	2	2	2		-			1	
F.	3	2	1	3	2	1		2			2	
G.	2	1	1	2	1	1		1			1	
H.	1	-	-	-	-	-		-			-	
I.	3	-	-	5	-	-		-			-	
J.	5	2	2	5	2	2		-			-	
K.	3	-	-	5	1	1		-			1	
L.	2	1	1	4	2	2		1			1	
IGES	37*	19*	16	82*	27*	22		12*			18*	

Table 7 continued

Category	Netherlands 01 TN NR	Netherlands 01 TN CA	Netherlands 01 IN	Netherlands 02 TN NR	Netherlands 02 TN CA	Netherlands 02 IN	United Kingdom 01 TN NR	United Kingdom 01 TN CA	United Kingdom 01 IN	United Kingdom 02 TN NR	United Kingdom 02 TN CA	United Kingdom 02 IN
A.	14*	11*	11	14*	11*	11	36	12	11	40	16*	15
B.	2	2	1	2	2	1	3	1	1	3	1	1
C.	7	8*	6	7	8*	6	9	7*	7	8	8*	8
D.	1	-	-	1	-	-	1	-	-	3	-	-
E.	5	2	2	5	2	2	1	-	-	1	-	-
F.	10	3	-	10	3	-	3	-	-	3	-	-
G.	6	1	1	6	1	1	1	1	1	1	1	1
H.	2	-	-	2	-	-	2	-	-	2	-	-
I.	6	-	-	6	-	-	-	-	-	7	-	-
J.	3	1	1	3	1	1	8	4	4	8	4	4
K.	4	2	2	4	2	2	2	1	1	9	4	4
L.	1	-	-	1	-	-	5	3	3	5	3	3
IGES	61*	30*	24	61*	30*	24	71	29*	28	90	37*	36

Legend for TABLE 7.:

1) First/second line: Name of country with 01 first and 02 second cross section year.
2) Third line: TN = Total number of subindicators used for main indicators,
IN = Number of identical subindicators used in National Reports and Community Analysis.
3) Fourth line: NR = National Report,
CA = Community Analysis.
*) Means that all or some subindicators are weighted.
+) No Information available in the Irish Report.
**) No National Report for Luxembourg prepared.

TABLE 8.: Correlation Between the Aggregate National and Aggregate Community Infrastructure Indicators IGES

National IGES	COMMUNITY IGES	
	1st cross section year	2nd cross section year
1. Belgium	0.69	*)
2. Denmark	0.53	0.42
3. France	0.55	0.76
4. Germany	0.87	0.73
5. Greece	0.86	0.83
6. Ireland		0.34
7. Italy	0.94	0.94
8. Netherlands	0.92	0.90
9.United Kingdom	0.96	0.85

Note:
*) Correlation coefficient is not significant in 1979 (0.05) and has been left out. The Belgian expert hesitated to accept the result of this comparison based on correlations.

IX. INFRASTRUCTURE ENDOWMENT OF THE EC-REGIONS

The Group decided to undertake the infrastructure analysis in two parts:

- First, by means of National Reports which also present information about the basic features of the national regional policies as far as they are of interest in relation to infrastructure.
- Second, by means of a Community-wide analysis in which all regions of the member countries, albeit with a few exceptions, were included.

In the subsequent sections, the results of the National Reports are first briefly summarized, and then the findings of the Community Analysis are presented.

IX.1. INFRASTRUCTURE ANALYSIS BASED ON MAXIMUM-MINIMUM-RATIOS OF NATIONAL REPORTS

In TABLE 9, a summary of the results of the National Reports regarding the description of infrastructure disparities is given. The measure used, Maximum-Minimum-Ratio (MMR), is admittedly a very simple one in that it only takes into account extreme values, and is not directly related to the distribution within this range. A MMR value of 1 means an exactly even distribution inside a set of regions. In case at least one of these regions does not have an infrastructure equipment, MMR formally would amount to infinity. Instead, >100 is used. More sophisticated measures of disparities are coefficients of variation or the Theil-coefficient. [For a detailed analysis of regional disparities in general, see the so-called Second Periodic Report of the EC-Commission on regional development]. Since the purpose of this Study is not so much to describe disparities, but to analyse the contribution of infrastructure to regional development, the disparity analysis here is not given much room.

TABLE 9: Maximum-Minimum Ratios (MMR) for Infrastructure and Selected Development Indicators According to National Reports

Category	BE01	BE02	DK01	DK02	FR01	FR02
A.Transportation	2.3	2.2	2.63	3.33	3.0	3.2
B.Communication	2.2	2.0	3.23	2.44	2.0	1.6
C.Energy Supply	5.5	6.8	4.55	5.0	4.5	5.9
D.Water Supply	n.a.	n.a.	n.a.	n.a.	4.0	3.4
E.Environmental	3.1	3.9	n.a.	n.a.	4.3	2.6
F.Education	1.6	1.8	3.13	3.03	2.9	1.6
G.Health	1.6	1.5	1.67	1.64	2.0	1.8
H.Special Urban	15.9	14.5	2.63	2.86	2.6	2.0
I.Sport, Tourism	4.2	6.4	2.94	3.57	3.0	2.7
J.Social	3.9	2.1	2.22	2.04	2.1	2.0
K.Cultural	2.1	2.5	3.13	2.94	2.7	2.7
L.Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IGES 1)	1.33	1.31	1.82	1.79	2.17	1.85
Pop. Density	n.a.	n.a.	12.37	11.41	n.a.	n.a.
GDP per Capita	n.a.	n.a.	1.54	1.29	n.a.	n.a.
GDP per employed Person	n.a.	n.a.	1.38	1.16	n.a.	n.a.

Table 9 continued

Category	GE01	GE02	GR01	GR02	IR01+	IR02
A.Transportation	4.89	5.14	1.87	1.87		2.12
B.Communication	3.69	2.01	7.05	4.87		1.45
C.Energy Supply	18.94	10.67	3.32	3.41		2.47
D.Water Supply	13.40	13.39	n.a.	n.a.		2.8
E.Environmental	2.81	2.14	n.a	n.a		2.86
F.Education	2.13	2.91	3.19	1.92		1.37
G.Health	1.90	1.90	9.06	8.2		1.31
H.Special Urban	n.a.	n.a.	2.48	4.27		4.5
I.Sport, Tourism	4.20	4.41	2.73	4.4		3.44
J.Social	6.85	5.15	n.a.	n.a.		3.02
K.Cultural	18.87	13.53	8.55	5.73		3.58
L.Natural	2.90	2.50	>100	>100		n.a.
IGES 1)	2.24	2.24	1.95	1.72		1.27
Pop. Density	16.70	14.30	3.96	4.67		7.36
GDP per Capita	2.04	1.75	2.05	2.33		1.51
GDP p. emplo- yed Person	1.85	1.79	2.29	2.61		1.29

Table 9 continued

Category	IT01	IT02	NL01	NL02	UK01	UK02
A.Transportation	2.78	4.17	5.0	4.55	3.5	3.2
B.Communication	2.22	1.92	2.70	2.38	3.7	4.8
C.Energy Supply	20.0	6.67	5.26	4.76	2.9	3.1
D.Water Supply	6.25	6.25	2.86	2.78	1.6	1.6
E.Environmental	n.a	>100	4.17	3.03	3.7	4.6
F.Education	2.86	2.86	1.23	1.30	2.0	1.5
G.Health	3.03	2.22	2.56	2.36	1.7	1.8
H.Special Urban	1.64	n.a.	1.64	1.59	1.6	1.5
I.Sport, Tourism	8.33	9.09	1.64	1.59	n.a.	2.8
J.Social	5.26	5.26	1.56	1.5	3.1	1.7
K.Cultural	14.29	5.88	2.22	2.22	25.0	2.0
L.Natural	5.0	6.67	6.66	8.33	50.0	16.7
IGES 1)	3.5	3.0	1.37	1.35	2.4	1.6
Pop. Density	6.25	6.25	n.a.	n.a.	12.5	12.5
GDP per Capita	2.63	2.33	1.56	1.45	1.43	1.54
GDP p. employed Person	2.33	1.92	n.a.	n.a.	1.25	1.22

Notes: 1)MMR based on geometric mean except for Ireland and Greece [arithmetic mean]. +) No Data present in the Irish Report. Sources: National Reports

Using a measurement concept like MMR should not be confused with any type of implicit statements regarding policy targets. Full equalization is not necessarily desirable, neither economically nor politically and it is not implied by MMR=1. Stating that there are "disparities" or "discrepancies" between regions should, therefore, not be misinterpreted as setting full equalization as a policy goal.

The descriptive and summary analysis presented here has to be complemented by a more differentiated approach which permits regional characteristics to be taken into account. This will be done in Chapter X. of the Study with the aid of quasi-production functions.

On the basis of the MMR taken from the National Reports, the following comments can be made:

(1) MMR for the total infrastructure indicator (IGES) are relatively low compared with the MMR for many single infrastructure categories; they range from 1.3 (BE) to 3.5 (IT). A comparison between the two cross section years shows that the MMR either are decreasing or remaining constant.

(2) An examination of the MMR for all the main categories considered together, shows a decreasing tendency from the first to the second year (decreasing MMR in 48 cases, increasing MMR in 26 cases, and constant MMR in 8 cases).

(3) Extremely high MMR are related with L (Natural Infrastructure). For GR, MMR are higher than 100 due to the fact that some regions in that country do not have natural parks. In UK, MMR is 50.0 for the first, but only 16.7 for the second year. Whenever a MMR figure changes significantly between the first and the second cross-section year, this may be due to changes in the number of available sub-indicators which form the respective main category indicator.

(4) Relatively high MMR values appear for Energy Supply in IT and GE (20.0 and 18.9 in the first year only), for Cultural Infrastructure in UK (25.0) and GE (18.9), Urban Infrastructure in BE (15.9/14.5) and Water Supply in GE (13.4/13.4).

(5) Medium level disparities were observed for Communication (7.1/4.9) and Health (9.1/8.2) in GR, for Sports/Tourism in IT (8.3/9.1) and GE (4.2/4.4), for Natural Infrastructure in NL (6.7/8.3) and IT (5.0/6.7), for Social Infrastructure in GE (6.9/5.2) and for Water Supply in IT (6.3/6.3). Transportation also shows medium-size disparities in GE (4.9/5.1) and in NL (5.0/4.6), whereas in the other countries the disparities are lower. Energy is the category with the highest disparity in DK with 4.6/5.0, and Urban Infrastructure shows the highest MMR in IR (4.5).

(6) Categories with relatively low and decreasing MMR are Health ranging from 1.3 up to 3.0 with the exception of GR, Education with a range of 1.2/3.2 and Communication with figures between 1.5 and 4.8, again with the exception of GR (7.1/4.9), and Environmental Infrastructure (2.1/4.6) except IT in the second year.

Despite the efforts made to obtain comparable statistical data for the National Reports, all these figures have to be interpreted with a good deal of caution. The values of the MMRs may differ, or may by pure chance appear very close, not only because of the general comparability problem, but also because the number and the definition of sub-indicators available to build up the main category indicators sometimes differ considerably between countries.

Comparability is better for the selected development indicators in TABLE 9, namely population density (POFL), income per inhabitant (BEPO) and income per employed person (BEEM). As far as population density is concerned, there are clear differences between GE (16.7/14.3), UK (12.5/12.5), IT (6.3/6.3) and GR (4.0/4.7). Here, GR is the only country with increasing disparities, whereas the MMR decrease in GE is presumably also influenced by the changes in territory and population of the German regions between 1970 and 1975.

The smallest disparities show up for income per employed person (ranging from 1.2 up to 2.6) and for income per inhabitant (1.4 to 2.6). Nevertheless, it should be recognized that a MMR even as low as 2.0 still means that income per capita or per employed person is twice as high in the best as compared to the worst region. Income per inhabitant and per employed person show a tendency to decrease between the first and second cross-section years, with the exception of the first indicator in UK and both indicators in GR.

In summary, despite the exceptions noted above, the general tendency, both as far as infrastructure and income indicators are concerned, appears to be a decrease in disparities. Given the fact that the MMR only relates the best to the worst-off region, it could naturally be the case that, despite a reduction in the span of these indicators, the number of inhabitants affected by increasing disparities is larger compared with the number of inhabitants profiting from decreasing ones or vice versa. In order to take account of changes in total distribution of these indicators, weighted coefficients of variation would have to be calculated. It should also be recognized that the figures presented are influenced by differences in the size of the regions. For example, if similarly large countries such as Germany are divided into 38 regions and the UK into only 11, it must be expected that the MMR will be higher in the former than in the latter case, as a certain "levelling-out" effect will take place in the larger regions. The same applies to smaller countries with a relatively large number of even smaller regions such as BE, DK, GR, IR in which disparities would have appeared smaller if larger regions could have been used.

IX.2. THE INFRASTRUCTURE INDICATORS OF THE COMMUNITY ANALYSIS AND THEIR REGIONAL DISTRIBUTION

In this section, the Community infrastructure data set for 139 regions is presented and analysed from the same points of view compared with the National Reports.

TABLE 10 gives the full list of regional infrastructure indicators by member countries and TABLE 14 according to an IGES-ranking. The Maximum-Minimum-Ratios (MMR) and the Coefficients of Variation (VC) for these regions are shown in TABLE 13. TABLES 11 and 12 list the best and the least equipped regions.

TABLE 10.: Infrastructure Indicators for 139 EC-Regions
1st and 2nd Cross Section Years

			IGES01	IGES02
	GERMANY			
1	GE- 1	Schleswig	44.62	41.18
2	GE- 2	Mittelholstein-Dithmarschen	57.86	59.24
3	GE- 3	Hamburg	67.48	64.47
4	GE- 4	Lueneburger Heide	49.80	49.23
5	GE- 5	Bremen	48.63	56.20
6	GE- 6	Osnabrueck	43.34	49.55
7	GE- 7	Ems	44.70	52.47
8	GE- 8	Muenster	57.08	65.35
9	GE- 9	Bielefeld	57.16	63.20
10	GE-10	Hannover	62.86	72.07
11	GE-11	Braunschweig	66.01	69.87
12	GE-12	Goettingen	56.43	67.57
13	GE-13	Kassel	61.42	67.79
14	GE-14	Dortmund-Siegen	70.41	76.53
15	GE-15	Essen	76.84	86.81
16	GE-16	Duesseldorf	79.11	82.72
17	GE-17	Aachen	54.03	67.27
18	GE-18	Koeln	88.03	91.81
19	GE-19	Trier	46.54	50.58
20	GE-20	Koblenz	64.36	61.95
21	GE-21	Mittel-Osthessen	58.08	61.54
22	GE-22	Bamberg-Hof	51.48	55.09
23	GE-23	Aschaffenburg-Schweinfurt	52.08	54.44
24	GE-24	Frankfurt-Darmstadt	79.77	83.30
25	GE-25	Mainz-Wiesbaden	79.61	79.11
26	GE-26	Saarland	68.65	74.00
27	GE-27	Westpfalz	58.50	61.06
28	GE-28	Rhein-Neckar-Suedpfalz	77.34	83.67
29	GE-29	Oberrhein-Nordschwarzwald	79.74	81.98
30	GE-30	Neckar-Franken	66.72	71.61
31	GE-31	Ansbach-Nuernberg	58.05	62.11
32	GE-32	Regensburg-Weiden	46.95	54.64
33	GE-33	Landshut-Passau	41.88	45.20
34	GE-34	Muenchen-Rosenheim	69.52	66.33
35	GE-35	Kempten-Ingolstadt	56.33	55.95
36	GE-36	Alb-Oberschwaben	62.84	65.67
37	GE-37	Oberrhein-Suedschwarzwald	66.21	73.02

Table 10 continued

			IGES01	IGES02
	FRANCE			
38	FR- 1	Ile de France	84.33	73.60
39	FR- 2	Champagne-Ardennes	33.47	49.60
40	FR- 3	Picardie	35.35	46.13
41	FR- 4	Haute Normandie	52.00	69.25
42	FR- 5	Centre	44.01	56.41
43	FR- 6	Basse Normandie	28.48	52.60
44	FR- 7	Bourgogne	38.68	57.66
45	FR- 8	Nord-Pas de Calais	35.13	48.52
46	FR- 9	Lorraine	51.66	59.75
47	FR-10	Alsace	44.70	74.95
48	FR-11	Franche Comte	41.57	64.98
49	FR-12	Pays de la Loire	23.62	50.63
50	FR-13	Bretagne	41.53	49.45
51	FR-14	Poitou-Charentes	21.63	45.16
52	FR-15	Aquitaine	46.53	60.30
53	FR-16	Midi-Pyrenees	42.00	61.27
54	FR-17	Limousin	25.14	50.27
55	FR-18	Rhone-Alpes	58.92	67.87
56	FR-19	Auvergne	28.38	45.22
57	FR-20	Languedoc-Roussillon	45.53	66.88
58	FR-21	Provence-Alpes-Cote d'Azur	57.67	69.58
	ITALY			
59	IT- 1	Piemonte	71.73	46.08
60	IT- 2	Valle d'Aosta	53.55	48.20
61	IT- 3	Liguria	94.04	76.83
62	IT- 4	Lombardia	62.51	58.46
63	IT- 5	Trentino-Alto Adige	66.72	45.83
64	IT- 6	Veneto	53.88	45.17
65	IT- 7	Friuli-Venezia Giulia	58.85	56.97
66	IT- 8	Emilia-Romagna	60.47	53.42
67	IT- 9	Toscana	61.82	53.52
68	IT-10	Umbria	63.69	41.94
69	IT-11	Marche	51.21	36.48
70	IT-12	Lazio	58.98	38.01
71	IT-13	Campania	44.45	22.88
72	IT-14	Abruzzi	42.81	39.51
73	IT-15	Molise	19.18	17.66
74	IT-16	Puglia	37.09	25.98
75	IT-17	Basilicata	26.17	18.08
76	IT-18	Calabria	26.71	24.14
77	IT-19	Sicilia	43.58	28.11
78	IT-20	Sardegna	48.83	30.39

Table 10 continued

			IGES01	IGES02
	NETHERLANDS			
79	NL- 2	Friesland	59.56	77.09
80	NL- 3	Drente	58.29	66.70
81	NL- 4	Overijssel	61.73	71.67
82	NL- 5	Gelderland	63.22	73.00
83	NL- 6	Utrecht	85.62	89.47
84	NL- 7	Noord-Holland	100.00	100.00
85	NL- 8	Zuid-Holland	89.36	96.53
86	NL- 9	Zeeland	49.42	57.63
87	NL-10	Noord-Brabant	63.49	69.59
88	NL-11	Limburg	60.99	69.75
	BELGIUM			
89	BE- 1	Antwerpen	55.42	75.57
90	BE- 2	Brabant	35.79	53.84
91	BE- 3	Hainaut	50.63	54.76
92	BE- 4	Liege	51.82	43.29
93	BE- 5	Limburg	42.01	57.88
94	BE- 6	Luxemburg	31.19	63.22
95	BE- 7	Namur	38.21	54.08
96	BE- 8	Oost-Vlaanderen	50.11	61.86
97	BE- 9	West-Vlaanderen	38.47	57.46
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	75.40	80.73
	UNITED KINGDOM			
99	UK- 1	North	24.06	53.89
100	UK- 2	Yorkshire/Humberside	31.34	42.70
101	UK- 3	East Midlands	25.77	44.50
102	UK- 4	East Anglia	29.56	40.53
103	UK- 5	South East	42.55	55.57
104	UK- 6	South West	40.28	43.91
105	UK- 7	West Midlands	24.68	42.66
106	UK- 8	North West	40.01	54.60
107	UK- 9	Wales	33.08	51.21
108	UK-10	Scotland	27.04	44.33
109	UK-11	Northern Ireland	11.36	20.64

Table 10 continued

			IGES01	IGES02
	IRELAND			
110	IR- 1	East	14.31	19.09
111	IR- 2	South West	14.14	12.78
112	IR- 3	South East	6.86	9.66
113	IR- 4	North East	2.30	5.81
114	IR- 5	Mid West	20.19	17.05
115	IR- 6	Donegal	4.98	5.84
116	IR- 7	Midlands	9.66	11.07
117	IR- 8	West	5.95	7.62
118	IR- 9	North West	5.41	7.46
	DENMARK			
119	DK- 1	Copenhagen Region	52.48	71.18
120	DK- 2	Vestsjaellands Amt	62.68	81.45
121	DK- 3	Storstroems Amt	37.42	57.40
122	DK- 4	Bornholms Amt	24.25	24.90
123	DK- 5	Fyns Amt	36.76	49.10
124	DK- 6	Soenderjyllands Amt	27.37	40.77
125	DK- 7	Ribe Amt	37.21	43.01
126	DK- 8	Vejle Amt	49.15	64.93
127	DK- 9	Ringkoebing Amt	31.34	45.41
128	DK-10	Arhus Amt	47.94	54.33
129	DK-11	Viborg Amt	32.19	40.25
130	DK-12	Nordjyllands Amt	33.70	41.46
	GREECE			
131	GR- 1	Eastern Cont. Greece, Isl.	25.87	24.27
132	GR- 2	Central/Western Macedonia	20.42	16.37
133	GR- 3	Peloponese	21.64	15.00
134	GR- 4	Thessaly	18.21	10.75
135	GR- 5	Eastern Macedonia	15.72	11.11
136	GR- 6	Crete	15.61	15.19
137	GR- 7	Epirus	22.61	14.45
138	GR- 8	Thrace	15.16	13.99
139	GR- 9	Isl. of Eastern Aegean Sea	29.22	26.66

Table 10 continued

			INDA01	INDA02
	GERMANY			
1	GE- 1	Schleswig	23.95	22.77
2	GE- 2	Mittelholstein-Dithmarschen	39.50	38.88
3	GE- 3	Hamburg	45.07	43.86
4	GE- 4	Lueneburger Heide	23.76	25.31
5	GE- 5	Bremen	35.51	32.98
6	GE- 6	Osnabrueck	30.34	31.02
7	GE- 7	Ems	30.52	30.76
8	GE- 8	Muenster	35.66	34.83
9	GE- 9	Bielefeld	38.40	36.42
10	GE-10	Hannover	41.63	37.28
11	GE-11	Braunschweig	29.31	31.23
12	GE-12	Goettingen	26.52	23.96
13	GE-13	Kassel	26.51	25.11
14	GE-14	Dortmund-Siegen	43.19	39.26
15	GE-15	Essen	79.52	79.04
16	GE-16	Duesseldorf	86.91	81.56
17	GE-17	Aachen	31.41	29.29
18	GE-18	Koeln	66.40	61.68
19	GE-19	Trier	29.63	28.95
20	GE-20	Koblenz	39.21	40.11
21	GE-21	Mittel-Osthessen	28.25	25.96
22	GE-22	Bamberg-Hof	28.35	25.96
23	GE-23	Aschaffenburg-Schweinfurt	30.72	31.27
24	GE-24	Frankfurt-Darmstadt	53.59	50.04
25	GE-25	Mainz-Wiesbaden	41.89	42.63
26	GE-26	Saarland	49.51	46.31
27	GE-27	Westpfalz	22.15	20.42
28	GE-28	Rhein-Neckar-Suedpfalz	47.05	47.95
29	GE-29	Oberrhein-Nordschwarzwald	38.61	38.19
30	GE-30	Neckar-Franken	35.94	33.83
31	GE-31	Ansbach-Nuernberg	34.18	31.50
32	GE-32	Regensburg-Weiden	23.72	22.71
33	GE-33	Landshut-Passau	27.84	26.79
34	GE-34	Muenchen-Rosenheim	29.49	26.03
35	GE-35	Kempten-Ingolstadt	24.50	22.64
36	GE-36	Alb-Oberschwaben	29.25	24.87
37	GE-37	Oberrhein-Suedschwarzwald	36.88	37.25

Table 10 continued

			INDA01	INDA02
	FRANCE			
38	FR- 1	Ile de France	72.10	55.33
39	FR- 2	Champagne-Ardennes	25.37	18.43
40	FR- 3	Picardie	36.74	26.40
41	FR- 4	Haute Normandie	51.87	39.82
42	FR- 5	Centre	23.32	15.99
43	FR- 6	Basse Normandie	26.44	19.52
44	FR- 7	Bourgogne	28.08	21.87
45	FR- 8	Nord-Pas de Calais	56.12	42.82
46	FR- 9	Lorraine	35.93	26.55
47	FR-10	Alsace	55.57	46.80
48	FR-11	Franche Comte	23.44	18.91
49	FR-12	Pays de la Loire	32.01	24.55
50	FR-13	Bretagne	30.50	26.40
51	FR-14	Poitou-Charentes	24.53	18.75
52	FR-15	Aquitaine	25.89	23.01
53	FR-16	Midi-Pyrenees	21.69	20.08
54	FR-17	Limousin	22.54	18.95
55	FR-18	Rhone-Alpes	33.71	25.59
56	FR-19	Auvergne	19.40	18.00
57	FR-20	Languedoc-Roussillon	24.28	21.39
58	FR-21	Provence-Alpes-Cote d'Azur	19.87	18.47
	ITALY			
59	IT- 1	Piemonte	30.59	19.86
60	IT- 2	Valle d'Aosta	24.93	12.04
61	IT- 3	Liguria	45.05	30.12
62	IT- 4	Lombardia	33.31	24.53
63	IT- 5	Trentino-Alto Adige	18.53	11.23
64	IT- 6	Veneto	35.01	26.28
65	IT- 7	Friuli-Venezia Giulia	23.95	17.86
66	IT- 8	Emilia-Romagna	34.52	25.61
67	IT- 9	Toscana	27.29	17.38
68	IT-10	Umbria	23.35	16.57
69	IT-11	Marche	30.39	19.29
70	IT-12	Lazio	36.96	23.61
71	IT-13	Campania	34.85	23.58
72	IT-14	Abruzzi	29.99	18.76
73	IT-15	Molise	14.05	9.85
74	IT-16	Puglia	30.90	19.30
75	IT-17	Basilicata	14.40	8.91
76	IT-18	Calabria	28.72	13.82
77	IT-19	Sicilia	21.35	14.14
78	IT-20	Sardegna	17.99	9.88

Table 10 continued

			INDA01	INDA02
	NETHERLANDS			
79	NL- 2	Friesland	48.04	49.99
80	NL- 3	Drente	28.60	30.62
81	NL- 4	Overijssel	48.93	45.09
82	NL- 5	Gelderland	37.59	36.88
83	NL- 6	Utrecht	88.33	90.76
84	NL- 7	Noord-Holland	100.00	100.00
85	NL- 8	Zuid-Holland	96.28	86.98
86	NL- 9	Zeeland	40.19	45.16
87	NL-10	Noord-Brabant	52.03	59.70
88	NL-11	Limburg	69.96	57.08
	BELGIUM			
89	BE- 1	Antwerpen	89.82	63.33
90	BE- 2	Brabant	6.53	10.84
91	BE- 3	Hainaut	17.13	16.95
92	BE- 4	Liege	20.51	18.41
93	BE- 5	Limburg	42.36	33.62
94	BE- 6	Luxemburg	.00	39.87
95	BE- 7	Namur	16.19	10.43
96	BE- 8	Oost-Vlaanderen	40.34	31.27
97	BE- 9	West-Vlaanderen	23.98	28.18
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	29.57	48.58
	UNITED KINGDOM			
99	UK- 1	North	26.05	29.73
100	UK- 2	Yorkshire/Humberside	37.22	36.96
101	UK- 3	East Midlands	34.12	32.78
102	UK- 4	East Anglia	30.22	31.15
103	UK- 5	South East	42.37	58.98
104	UK- 6	South West	35.45	31.81
105	UK- 7	West Midlands	36.80	43.19
106	UK- 8	North West	63.88	88.74
107	UK- 9	Wales	31.92	26.56
108	UK-10	Scotland	13.58	13.34
109	UK-11	Northern Ireland	30.20	23.95

Table 10 continued

			INDA01	INDA02
	IRELAND			
110	IR- 1	East	29.02	17.18
111	IR- 2	South West	21.77	11.33
112	IR- 3	South East	2.63	2.67
113	IR- 4	North East	2.14	2.17
114	IR- 5	Mid West	55.18	26.76
115	IR- 6	Donegal	.00	.57
116	IR- 7	Midlands	4.47	4.53
117	IR- 8	West	2.03	2.29
118	IR- 9	North West	1.86	1.04
	DENMARK			
119	DK- 1	Copenhagen Region	.00	64.24
120	DK- 2	Vestsjaellands Amt	.00	19.18
121	DK- 3	Storstroems Amt	.00	17.61
122	DK- 4	Bornholms Amt	.00	.00
123	DK- 5	Fyns Amt	.00	13.71
124	DK- 6	Soenderjyllands Amt	.00	11.71
125	DK- 7	Ribe Amt	.00	11.84
126	DK- 8	Vejle Amt	.00	22.95
127	DK- 9	Ringkoebing Amt	.00	11.72
128	DK-10	Arhus Amt	.00	16.79
129	DK-11	Viborg Amt	.00	4.65
130	DK-12	Nordjyllands Amt	.00	8.85
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	7.36	6.36
132	GR- 2	Central/Western Macedonia	14.69	8.59
133	GR- 3	Peloponese	15.85	12.84
134	GR- 4	Thessaly	25.15	5.99
135	GR- 5	Eastern Macedonia	8.01	6.24
136	GR- 6	Crete	47.39	26.96
137	GR- 7	Epirus	42.69	28.68
138	GR- 8	Thrace	13.15	18.81
139	GR- 9	Isl. of Eastern Aegean Sea	74.97	75.38

Table 10 continued

			INDB01	INDB02
	GERMANY			
1	GE- 1	Schleswig	64.61	56.91
2	GE- 2	Mittelholstein-Dithmarschen	50.29	57.57
3	GE- 3	Hamburg	99.15	69.69
4	GE- 4	Lueneburger Heide	47.47	51.37
5	GE- 5	Bremen	52.32	52.99
6	GE- 6	Osnabrueck	39.31	45.87
7	GE- 7	Ems	32.68	41.49
8	GE- 8	Muenster	32.58	43.06
9	GE- 9	Bielefeld	37.55	44.05
10	GE-10	Hannover	53.85	55.10
11	GE-11	Braunschweig	42.49	55.45
12	GE-12	Goettingen	41.43	48.07
13	GE-13	Kassel	34.24	48.89
14	GE-14	Dortmund-Siegen	41.44	53.54
15	GE-15	Essen	41.10	56.15
16	GE-16	Duesseldorf	68.69	63.93
17	GE-17	Aachen	37.13	47.68
18	GE-18	Koeln	61.49	61.56
19	GE-19	Trier	39.42	46.01
20	GE-20	Koblenz	35.32	44.05
21	GE-21	Mittel-Osthessen	35.88	33.68
22	GE-22	Bamberg-Hof	29.49	40.69
23	GE-23	Aschaffenburg-Schweinfurt	35.77	40.73
24	GE-24	Frankfurt-Darmstadt	60.31	56.79
25	GE-25	Mainz-Wiesbaden	60.13	60.83
26	GE-26	Saarland	38.39	46.73
27	GE-27	Westpfalz	35.39	48.54
28	GE-28	Rhein-Neckar-Suedpfalz	42.54	58.30
29	GE-29	Oberrhein-Nordschwarzwald	42.27	53.93
30	GE-30	Neckar-Franken	44.26	53.02
31	GE-31	Ansbach-Nuernberg	46.22	51.00
32	GE-32	Regensburg-Weiden	26.87	36.31
33	GE-33	Landshut-Passau	27.56	35.86
34	GE-34	Muenchen-Rosenheim	67.29	60.14
35	GE-35	Kempten-Ingolstadt	33.53	42.12
36	GE-36	Alb-Oberschwaben	38.94	51.53
37	GE-37	Oberrhein-Suedschwarzwald	36.43	47.18

Table 10 continued

			INDB01	INDB02
	FRANCE			
38	FR- 1	Ile de France	100.00	100.00
39	FR- 2	Champagne-Ardennes	36.47	48.28
40	FR- 3	Picardie	31.78	45.23
41	FR- 4	Haute Normandie	41.36	54.44
42	FR- 5	Centre	40.24	56.71
43	FR- 6	Basse Normandie	33.88	49.37
44	FR- 7	Bourgogne	37.73	53.93
45	FR- 8	Nord-Pas de Calais	28.04	37.01
46	FR- 9	Lorraine	33.19	44.45
47	FR-10	Alsace	41.73	56.13
48	FR-11	Franche Comte	33.21	44.85
49	FR-12	Pays de La Loire	31.24	47.65
50	FR-13	Bretagne	29.71	49.20
51	FR-14	Poitou-Charentes	32.12	47.61
52	FR-15	Aquitaine	41.90	54.64
53	FR-16	Midi-Pyrenees	37.04	53.14
54	FR-17	Limousin	34.69	52.05
55	FR-18	Rhone-Alpes	50.08	63.28
56	FR-19	Auvergne	37.73	51.24
57	FR-20	Languedoc-Roussillon	36.37	56.75
58	FR-21	Provence-Alpes-Cote d'Azur	58.61	69.93
	ITALY			
59	IT- 1	Piemonte	48.53	38.60
60	IT- 2	Valle d'Aosta	40.21	40.13
61	IT- 3	Liguria	68.45	50.11
62	IT- 4	Lombardia	48.51	36.66
63	IT- 5	Trentino-Alto Adige	32.47	28.34
64	IT- 6	Veneto	27.68	25.63
65	IT- 7	Friuli-Venezia Giulia	40.00	33.35
66	IT- 8	Emilia-Romagna	38.61	34.77
67	IT- 9	Toscana	40.40	36.86
68	IT-10	Umbria	26.16	25.07
69	IT-11	Marche	24.56	23.39
70	IT-12	Lazio	60.25	41.85
71	IT-13	Campania	27.32	25.23
72	IT-14	Abruzzi	19.39	20.83
73	IT-15	Molise	13.33	16.00
74	IT-16	Puglia	19.91	20.24
75	IT-17	Basilicata	15.05	16.17
76	IT-18	Calabria	16.43	17.01
77	IT-19	Sicilia	26.52	25.91
78	IT-20	Sardegna	21.14	20.97

Table 10 continued

			INDB01	INDB02
	NETHERLANDS			
79	NL- 2	Friesland	50.65	51.94
80	NL- 3	Drente	51.04	52.99
81	NL- 4	Overijssel	51.26	54.02
82	NL- 5	Gelderland	50.52	48.49
83	NL- 6	Utrecht	50.48	50.05
84	NL- 7	Noord-Holland	65.75	59.99
85	NL- 8	Zuid-Holland	69.42	59.52
86	NL- 9	Zeeland	45.16	49.20
87	NL-10	Noord-Brabant	45.64	49.03
88	NL-11	Limburg	40.58	43.27
	BELGIUM			
89	BE- 1	Antwerpen	.00	43.09
90	BE- 2	Brabant	.00	51.80
91	BE- 3	Hainaut	.00	34.19
92	BE- 4	Liege	.00	41.42
93	BE- 5	Limburg	.00	26.31
94	BE- 6	Luxemburg	.00	39.04
95	BE- 7	Namur	.00	42.99
96	BE- 8	Oost-Vlaanderen	.00	34.61
97	BE- 9	West-Vlaanderen	.00	37.25
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	95.87	76.78
	UNITED KINGDOM			
99	UK- 1	North	63.58	69.91
100	UK- 2	Yorkshire/Humberside	28.01	29.38
101	UK- 3	East Midlands	63.44	60.65
102	UK- 4	East Anglia	66.24	59.99
103	UK- 5	South East	62.60	50.42
104	UK- 6	South West	60.20	51.27
105	UK- 7	West Midlands	35.64	38.03
106	UK- 8	North West	27.35	28.15
107	UK- 9	Wales	41.33	41.69
108	UK-10	Scotland	49.28	46.11
109	UK-11	Northern Ireland	29.77	30.52

Table 10 continued

			INDB01	INDB02
	IRELAND			
110	IR- 1	East	.00	.00
111	IR- 2	South West	.00	.00
112	IR- 3	South East	.00	.00
113	IR- 4	North East	.00	.00
114	IR- 5	Mid West	.00	.00
115	IR- 6	Donegal	.00	.00
116	IR- 7	Midlands	.00	.00
117	IR- 8	West	.00	.00
118	IR- 9	North West	.00	.00
	DENMARK			
119	DK- 1	Copenhagen Region	.00	.00
120	DK- 2	Vestsjaellands Amt	.00	.00
121	DK- 3	Storstroems Amt	.00	.00
122	DK- 4	Bornholms Amt	.00	.00
123	DK- 5	Fyns Amt	.00	.00
124	DK- 6	Soenderjyllands Amt	.00	.00
125	DK- 7	Ribe Amt	.00	.00
126	DK- 8	Vejle Amt	.00	.00
127	DK- 9	Ringkoebing Amt	.00	.00
128	DK-10	Arhus Amt	.00	.00
129	DK-11	Viborg Amt	.00	.00
130	DK-12	Nordjyllands Amt	.00	.00
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	61.11	49.28
132	GR- 2	Central/Western Macedonia	25.29	29.96
133	GR- 3	Peloponese	18.82	24.93
134	GR- 4	Thessaly	16.20	21.51
135	GR- 5	Eastern Macedonia	17.07	20.71
136	GR- 6	Crete	20.07	23.39
137	GR- 7	Epirus	15.06	21.72
138	GR- 8	Thrace	12.20	12.45
139	GR- 9	Isl. of Eastern Aegean Sea	20.84	25.59

Table 10 continued

			INDCO1	INDCO2
	GERMANY			
1	GE- 1	Schleswig	2.35	3.49
2	GE- 2	Mittelholstein-Dithmarschen	18.89	23.62
3	GE- 3	Hamburg	22.88	24.46
4	GE- 4	Lueneburger Heide	5.91	4.48
5	GE- 5	Bremen	9.54	17.32
6	GE- 6	Osnabrueck	2.62	3.50
7	GE- 7	Ems	31.19	45.55
8	GE- 8	Muenster	11.20	13.33
9	GE- 9	Bielefeld	9.13	10.63
10	GE-10	Hannover	19.73	25.48
11	GE-11	Braunschweig	25.08	21.21
12	GE-12	Goettingen	4.85	5.22
13	GE-13	Kassel	6.92	8.96
14	GE-14	Dortmund-Siegen	13.67	16.25
15	GE-15	Essen	50.58	53.26
16	GE-16	Duesseldorf	54.46	45.67
17	GE-17	Aachen	7.43	16.45
18	GE-18	Koeln	40.02	47.76
19	GE-19	Trier	3.26	3.60
20	GE-20	Koblenz	9.35	8.41
21	GE-21	Mittel-Osthessen	2.58	3.07
22	GE-22	Bamberg-Hof	3.96	4.77
23	GE-23	Aschaffenburg-Schweinfurt	5.20	6.29
24	GE-24	Frankfurt-Darmstadt	16.08	20.41
25	GE-25	Mainz-Wiesbaden	11.72	11.48
26	GE-26	Saarland	18.55	17.98
27	GE-27	Westpfalz	5.57	5.29
28	GE-28	Rhein-Neckar-Suedpfalz	29.26	31.75
29	GE-29	Oberrhein-Nordschwarzwald	27.37	25.97
30	GE-30	Neckar-Franken	17.28	16.15
31	GE-31	Ansbach-Nuernberg	8.64	10.45
32	GE-32	Regensburg-Weiden	7.59	11.33
33	GE-33	Landshut-Passau	5.47	8.00
34	GE-34	Muenchen-Rosenheim	13.53	14.94
35	GE-35	Kempten-Ingolstadt	24.36	22.07
36	GE-36	Alb-Oberschwaben	10.33	8.06
37	GE-37	Oberrhein-Suedschwarzwald	7.16	10.78

Table 10 continued

			INDC01	INDC02
	FRANCE			
38	FR- 1	Ile de France	77.50	53.52
39	FR- 2	Champagne-Ardennes	9.26	9.15
40	FR- 3	Picardie	12.65	9.21
41	FR- 4	Haute Normandie	100.00	76.54
42	FR- 5	Centre	22.43	14.95
43	FR- 6	Basse Normandie	26.84	17.12
44	FR- 7	Bourgogne	12.97	9.01
45	FR- 8	Nord-Pas de Calais	36.46	26.59
46	FR- 9	Lorraine	21.88	17.55
47	FR-10	Alsace	51.70	46.89
48	FR-11	Franche Comte	21.26	19.24
49	FR-12	Pays de la Loire	35.51	26.74
50	FR-13	Bretagne	32.25	21.22
51	FR-14	Poitou-Charentes	13.00	9.91
52	FR-15	Aquitaine	33.76	24.01
53	FR-16	Midi-Pyrenees	27.78	19.81
54	FR-17	Limousin	24.31	16.55
55	FR-18	Rhone-Alpes	40.65	34.50
56	FR-19	Auvergne	19.20	12.36
57	FR-20	Languedoc-Roussillon	16.14	16.68
58	FR-21	Provence-Alpes-Cote d'Azur	36.28	33.15
	ITALY			
59	IT- 1	Piemonte	16.11	18.83
60	IT- 2	Valle d'Aosta	84.15	57.14
61	IT- 3	Liguria	42.34	64.11
62	IT- 4	Lombardia	14.91	34.61
63	IT- 5	Trentino-Alto Adige	38.24	18.49
64	IT- 6	Veneto	9.35	15.05
65	IT- 7	Friuli-Venezia Giulia	14.61	17.03
66	IT- 8	Emilia-Romagna	11.21	11.75
67	IT- 9	Toscana	8.31	9.21
68	IT-10	Umbria	12.26	5.73
69	IT-11	Marche	8.60	5.56
70	IT-12	Lazio	8.23	11.24
71	IT-13	Campania	6.28	3.38
72	IT-14	Abruzzi	7.87	4.12
73	IT-15	Molise	2.23	1.62
74	IT-16	Puglia	10.73	7.67
75	IT-17	Basilicata	4.74	2.85
76	IT-18	Calabria	2.21	5.40
77	IT-19	Sicilia	30.03	23.73
78	IT-20	Sardegna	51.16	27.36

Table 10 continued

			INDCO1	INDCO2
	NETHERLANDS			
79	NL- 2	Friesland	20.96	34.89
80	NL- 3	Drente	25.52	35.34
81	NL- 4	Overijssel	31.08	44.07
82	NL- 5	Gelderland	26.77	34.74
83	NL- 6	Utrecht	51.36	52.02
84	NL- 7	Noord-Holland	58.23	58.89
85	NL- 8	Zuid-Holland	54.62	62.49
86	NL- 9	Zeeland	20.32	28.51
87	NL-10	Noord-Brabant	35.37	44.87
88	NL-11	Limburg	58.01	69.25
	BELGIUM			
89	BE- 1	Antwerpen	72.85	100.00
90	BE- 2	Brabant	43.01	47.07
91	BE- 3	Hainaut	35.78	39.65
92	BE- 4	Liege	31.57	29.18
93	BE- 5	Limburg	28.33	35.64
94	BE- 6	Luxemburg	11.94	8.99
95	BE- 7	Namur	17.51	15.12
96	BE- 8	Oost-Vlaanderen	58.04	58.98
97	BE- 9	West-Vlaanderen	41.90	33.16
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	79.25	68.21
	UNITED KINGDOM			
99	UK- 1	North	21.63	26.64
100	UK- 2	Yorkshire/Humberside	28.71	29.35
101	UK- 3	East Midlands	31.43	36.28
102	UK- 4	East Anglia	21.95	13.48
103	UK- 5	South East	41.70	40.47
104	UK- 6	South West	17.21	16.55
105	UK- 7	West Midlands	28.53	27.19
106	UK- 8	North West	49.35	66.10
107	UK- 9	Wales	26.06	35.39
108	UK-10	Scotland	14.71	17.43
109	UK-11	Northern Ireland	6.97	7.36

Table 10 continued

			INDC01	INDC02
	IRELAND			
110	IR- 1	East	.00	8.65
111	IR- 2	South West	.00	3.17
112	IR- 3	South East	.00	3.06
113	IR- 4	North East	.00	2.51
114	IR- 5	Mid West	.00	2.20
115	IR- 6	Donegal	.00	1.23
116	IR- 7	Midlands	.00	2.73
117	IR- 8	West	.00	1.30
118	IR- 9	North West	.00	1.27
	DENMARK			
119	DK- 1	Copenhagen Region	4.34	4.70
120	DK- 2	Vestsjaellands Amt	59.37	48.94
121	DK- 3	Storstroems Amt	3.41	2.93
122	DK- 4	Bornholms Amt	1.02	.73
123	DK- 5	Fyns Amt	1.52	1.63
124	DK- 6	Soenderjyllands Amt	1.90	1.47
125	DK- 7	Ribe Amt	2.17	2.03
126	DK- 8	Vejle Amt	19.21	16.43
127	DK- 9	Ringkoebing Amt	1.40	1.32
128	DK-10	Arhus Amt	1.74	1.40
129	DK-11	Viborg Amt	1.96	1.62
130	DK-12	Nordjyllands Amt	1.99	1.72
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	1.21	9.01
132	GR- 2	Central/Western Macedonia	.00	5.26
133	GR- 3	Peloponese	.00	12.72
134	GR- 4	Thessaly	.00	.00
135	GR- 5	Eastern Macedonia	.00	.00
136	GR- 6	Crete	.00	.00
137	GR- 7	Epirus	.00	.00
138	GR- 8	Thrace	.00	.00
139	GR- 9	Isl. of Eastern Aegean Sea	.00	.00

Table 10 continued

			INDE01	INDE02
		GERMANY		
1	GE- 1	Schleswig	50.45	53.54
2	GE- 2	Mittelholstein-Dithmarschen	54.82	52.22
3	GE- 3	Hamburg	64.83	60.80
4	GE- 4	Lueneburger Heide	53.38	58.78
5	GE- 5	Bremen	53.18	58.47
6	GE- 6	Osnabrueck	56.19	60.96
7	GE- 7	Ems	52.56	56.47
8	GE- 8	Muenster	55.43	61.89
9	GE- 9	Bielefeld	62.81	60.76
10	GE-10	Hannover	68.55	63.59
11	GE-11	Braunschweig	58.07	59.35
12	GE-12	Goettingen	48.60	62.65
13	GE-13	Kassel	56.90	62.75
14	GE-14	Dortmund-Siegen	81.74	69.63
15	GE-15	Essen	100.00	99.63
16	GE-16	Duesseldorf	76.69	70.02
17	GE-17	Aachen	63.28	59.45
18	GE-18	Koeln	71.06	64.08
19	GE-19	Trier	36.59	48.92
20	GE-20	Koblenz	45.08	52.65
21	GE-21	Mittel-Osthessen	53.22	58.18
22	GE-22	Bamberg-Hof	54.94	58.23
23	GE-23	Aschaffenburg-Schweinfurt	47.12	50.84
24	GE-24	Frankfurt-Darmstadt	71.33	63.77
25	GE-25	Mainz-Wiesbaden	62.73	59.80
26	GE-26	Saarland	59.72	57.18
27	GE-27	Westpfalz	67.86	61.87
28	GE-28	Rhein-Neckar-Suedpfalz	66.01	62.67
29	GE-29	Oberrhein-Nordschwarzwald	71.06	65.93
30	GE-30	Neckar-Franken	67.56	68.08
31	GE-31	Ansbach-Nuernberg	67.20	63.12
32	GE-32	Regensburg-Weiden	40.14	46.55
33	GE-33	Landshut-Passau	35.64	46.55
34	GE-34	Muenchen-Rosenheim	68.54	60.95
35	GE-35	Kempten-Ingolstadt	60.95	55.81
36	GE-36	Alb-Oberschwaben	55.33	65.49
37	GE-37	Oberrhein-Suedschwarzwald	56.86	63.38

Table 10 continued

			INDE01	INDE02
	FRANCE			
38	FR- 1	Ile de France	60.56	44.51
39	FR- 2	Champagne-Ardennes	9.96	21.82
40	FR- 3	Picardie	38.30	27.55
41	FR- 4	Haute Normandie	52.02	38.76
42	FR- 5	Centre	52.11	53.81
43	FR- 6	Basse Normandie	3.47	31.74
44	FR- 7	Bourgogne	7.29	29.36
45	FR- 8	Nord-Pas de Calais	13.24	39.40
46	FR- 9	Lorraine	31.23	23.05
47	FR-10	Alsace	.00	22.58
48	FR-11	Franche Comte	15.71	45.65
49	FR-12	Pays de la Loire	.34	25.85
50	FR-13	Bretagne	18.44	25.45
51	FR-14	Poitou-Charentes	.00	20.93
52	FR-15	Aquitaine	6.12	16.57
53	FR-16	Midi-Pyrenees	20.74	20.91
54	FR-17	Limousin	.00	12.46
55	FR-18	Rhone-Alpes	30.46	33.46
56	FR-19	Auvergne	2.32	6.79
57	FR-20	Languedoc-Roussillon	24.31	40.50
58	FR-21	Provence-Alpes-Cote d'Azur	18.91	42.76
	ITALY			
59	IT- 1	Piemonte	.00	6.03
60	IT- 2	Valle d'Aosta	.00	13.82
61	IT- 3	Liguria	.00	32.35
62	IT- 4	Lombardia	.00	26.51
63	IT- 5	Trentino-Alto Adige	.00	7.46
64	IT- 6	Veneto	.00	19.56
65	IT- 7	Friuli-Venezia Giulia	.00	52.13
66	IT- 8	Emilia-Romagna	.00	31.28
67	IT- 9	Toscana	.00	28.03
68	IT-10	Umbria	.00	11.36
69	IT-11	Marche	.00	9.31
70	IT-12	Lazio	.00	3.21
71	IT-13	Campania	.00	1.13
72	IT-14	Abruzzi	.00	20.53
73	IT-15	Molise	.00	10.99
74	IT-16	Puglia	.00	4.92
75	IT-17	Basilicata	.00	.00
76	IT-18	Calabria	.00	4.43
77	IT-19	Sicilia	.00	2.71
78	IT-20	Sardegna	.00	3.07

Table 10 continued

			INDE01	INDE02
	NETHERLANDS			
79	NL- 2	Friesland	13.33	26.61
80	NL- 3	Drente	25.70	18.60
81	NL- 4	Overijssel	23.55	20.23
82	NL- 5	Gelderland	20.01	27.55
83	NL- 6	Utrecht	28.21	16.94
84	NL- 7	Noord-Holland	62.44	33.58
85	NL- 8	Zuid-Holland	58.27	56.43
86	NL- 9	Zeeland	7.46	7.15
87	NL-10	Noord-Brabant	29.29	19.11
88	NL-11	Limburg	12.55	15.15
	BELGIUM			
89	BE- 1	Antwerpen	2.78	22.31
90	BE- 2	Brabant	1.04	5.30
91	BE- 3	Hainaut	12.37	19.36
92	BE- 4	Liege	2.53	.60
93	BE- 5	Limburg	3.07	23.30
94	BE- 6	Luxemburg	4.39	32.07
95	BE- 7	Namur	1.48	10.78
96	BE- 8	Oost-Vlaanderen	4.06	33.50
97	BE- 9	West-Vlaanderen	3.47	39.10
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	.00	95.00
	UNITED KINGDOM			
99	UK- 1	North	.00	.00
100	UK- 2	Yorkshire/Humberside	.00	.00
101	UK- 3	East Midlands	.00	.00
102	UK- 4	East Anglia	.00	.00
103	UK- 5	South East	.00	.00
104	UK- 6	South West	.00	.00
105	UK- 7	West Midlands	.00	.00
106	UK- 8	North West	.00	.00
107	UK- 9	Wales	.00	.00
108	UK-10	Scotland	.00	.00
109	UK-11	Northern Ireland	.00	.00

Table 10 continued

			INDE01	INDE02
	IRELAND			
110	IR- 1	East	.00	.00
111	IR- 2	South West	.00	.00
112	IR- 3	South East	.00	.00
113	IR- 4	North East	.00	.00
114	IR- 5	Mid West	.00	.00
115	IR- 6	Donegal	.00	.00
116	IR- 7	Midlands	.00	.00
117	IR- 8	West	.00	.00
118	IR- 9	North West	.00	.00
	DENMARK			
119	DK- 1	Copenhagen Region	.00	21.38
120	DK- 2	Vestsjaellands Amt	.00	60.15
121	DK- 3	Storstroems Amt	.00	100.00
122	DK- 4	Bornholms Amt	.00	15.63
123	DK- 5	Fyns Amt	.00	39.22
124	DK- 6	Soenderjyllands Amt	.00	35.71
125	DK- 7	Ribe Amt	.00	17.75
126	DK- 8	Vejle Amt	.00	36.22
127	DK- 9	Ringkoebing Amt	.00	45.98
128	DK-10	Arhus Amt	.00	44.76
129	DK-11	Viborg Amt	.00	42.08
130	DK-12	Nordjyllands Amt	.00	27.86
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	.00	95.30
132	GR- 2	Central/Western Macedonia	.00	66.00
133	GR- 3	Peloponese	.00	33.60
134	GR- 4	Thessaly	.00	48.70
135	GR- 5	Eastern Macedonia	.00	39.30
136	GR- 6	Crete	.00	38.50
137	GR- 7	Epirus	.00	34.50
138	GR- 8	Thrace	.00	39.20
139	GR- 9	Isl. of Eastern Aegean Sea	.00	40.30

Table 10 continued

			INDF01	INDF02
	GERMANY			
1	GE- 1	Schleswig	42.71	31.31
2	GE- 2	Mittelholstein-Dithmarschen	61.44	56.49
3	GE- 3	Hamburg	66.78	59.70
4	GE- 4	Lueneburger Heide	40.12	33.60
5	GE- 5	Bremen	41.81	41.36
6	GE- 6	Osnabrueck	48.71	47.24
7	GE- 7	Ems	35.93	30.31
8	GE- 8	Muenster	82.35	78.78
9	GE- 9	Bielefeld	50.35	54.71
10	GE-10	Hannover	54.07	55.29
11	GE-11	Braunschweig	56.15	52.99
12	GE-12	Goettingen	100.00	100.00
13	GE-13	Kassel	40.55	43.80
14	GE-14	Dortmund-Siegen	44.88	45.02
15	GE-15	Essen	49.78	52.24
16	GE-16	Duesseldorf	44.28	48.39
17	GE-17	Aachen	66.21	72.96
18	GE-18	Koeln	82.39	75.47
19	GE-19	Trier	45.79	46.73
20	GE-20	Koblenz	42.17	31.17
21	GE-21	Mittel-Osthessen	80.07	66.31
22	GE-22	Bamberg-Hof	37.34	42.82
23	GE-23	Aschaffenburg-Schweinfurt	49.07	50.62
24	GE-24	Frankfurt-Darmstadt	59.71	55.94
25	GE-25	Mainz-Wiesbaden	69.63	68.34
26	GE-26	Saarland	64.01	52.45
27	GE-27	Westpfalz	38.98	40.95
28	GE-28	Rhein-Neckar-Suedpfalz	66.92	60.59
29	GE-29	Oberrhein-Nordschwarzwald	54.68	51.12
30	GE-30	Neckar-Franken	47.01	44.85
31	GE-31	Ansbach-Nuernberg	52.49	59.69
32	GE-32	Regensburg-Weiden	41.84	47.31
33	GE-33	Landshut-Passau	31.16	36.09
34	GE-34	Muenchen-Rosenheim	60.59	70.67
35	GE-35	Kempten-Ingolstadt	31.42	36.57
36	GE-36	Alb-Oberschwaben	67.81	59.45
37	GE-37	Oberrhein-Suedschwarzwald	61.83	55.24

Table 10 continued

			INDF01	INDF02
	FRANCE			
38	FR- 1	Ile de France	74.03	79.33
39	FR- 2	Champagne-Ardennes	34.38	34.45
40	FR- 3	Picardie	25.09	28.73
41	FR- 4	Haute Normandie	32.39	32.10
42	FR- 5	Centre	34.17	32.73
43	FR- 6	Basse Normandie	42.10	33.79
44	FR- 7	Bourgogne	40.33	35.46
45	FR- 8	Nord-Pas de Calais	39.16	39.20
46	FR- 9	Lorraine	60.76	40.19
47	FR-10	Alsace	63.91	48.34
48	FR-11	Franche Comte	45.16	38.95
49	FR-12	Pays de la Loire	32.29	34.17
50	FR-13	Bretagne	45.81	43.46
51	FR-14	Poitou-Charentes	37.70	32.74
52	FR-15	Aquitaine	57.55	50.64
53	FR-16	Midi-Pyrenees	69.04	59.49
54	FR-17	Limousin	41.70	41.48
55	FR-18	Rhone-Alpes	54.01	44.61
56	FR-19	Auvergne	46.70	40.32
57	FR-20	Languedoc-Roussillon	63.38	56.60
58	FR-21	Provence-Alpes-Cote d'Azur	62.04	53.53
	ITALY			
59	IT- 1	Piemonte	42.51	49.68
60	IT- 2	Valle d'Aosta	14.91	21.61
61	IT- 3	Liguria	65.99	70.92
62	IT- 4	Lombardia	42.49	51.16
63	IT- 5	Trentino-Alto Adige	26.26	26.03
64	IT- 6	Veneto	44.04	47.44
65	IT- 7	Friuli-Venezia Giulia	46.02	46.51
66	IT- 8	Emilia-Romagna	69.01	76.52
67	IT- 9	Toscana	68.16	79.16
68	IT-10	Umbria	83.92	81.70
69	IT-11	Marche	53.10	59.65
70	IT-12	Lazio	76.94	83.51
71	IT-13	Campania	58.64	58.30
72	IT-14	Abruzzi	59.31	56.26
73	IT-15	Molise	23.67	23.18
74	IT-16	Puglia	47.07	40.56
75	IT-17	Basilicata	21.09	23.79
76	IT-18	Calabria	21.97	30.59
77	IT-19	Sicilia	61.87	54.47
78	IT-20	Sardegna	48.06	45.80

Table 10 continued

			INDF01	INDF02
	NETHERLANDS			
79	NL- 2	Friesland	11.28	14.59
80	NL- 3	Drente	10.19	13.84
81	NL- 4	Overijssel	14.58	18.97
82	NL- 5	Gelderland	27.46	31.53
83	NL- 6	Utrecht	47.32	52.38
84	NL- 7	Noord-Holland	34.88	32.46
85	NL- 8	Zuid-Holland	29.98	32.54
86	NL- 9	Zeeland	9.79	13.10
87	NL-10	Noord-Brabant	18.04	20.82
88	NL-11	Limburg	10.14	14.38
	BELGIUM			
89	BE- 1	Antwerpen	34.21	34.38
90	BE- 2	Brabant	87.93	84.46
91	BE- 3	Hainaut	26.07	30.22
92	BE- 4	Liege	49.98	51.48
93	BE- 5	Limburg	21.90	28.01
94	BE- 6	Luxemburg	21.76	25.88
95	BE- 7	Namur	33.49	43.24
96	BE- 8	Oost-Vlaanderen	50.20	50.74
97	BE- 9	West-Vlaanderen	23.71	27.81
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	4.10	2.49
	UNITED KINGDOM			
99	UK- 1	North	.00	.00
100	UK- 2	Yorkshire/Humberside	.00	.00
101	UK- 3	East Midlands	.00	.00
102	UK- 4	East Anglia	.00	.00
103	UK- 5	South East	.00	.00
104	UK- 6	South West	.00	.00
105	UK- 7	West Midlands	.00	.00
106	UK- 8	North West	.00	.00
107	UK- 9	Wales	.00	.00
108	UK-10	Scotland	.00	.00
109	UK-11	Northern Ireland	.00	.00

Table 10 continued

			INDF01	INDF02
		IRELAND		
110	IR- 1	East	.00	.00
111	IR- 2	South West	.00	.00
112	IR- 3	South East	.00	.00
113	IR- 4	North East	.00	.00
114	IR- 5	Mid West	.00	.00
115	IR- 6	Donegal	.00	.00
116	IR- 7	Midlands	.00	.00
117	IR- 8	West	.00	.00
118	IR- 9	North West	.00	.00
		DENMARK		
119	DK- 1	Copenhagen Region	82.71	83.63
120	DK- 2	Vestsjaellands Amt	14.97	28.86
121	DK- 3	Storstroems Amt	5.72	26.42
122	DK- 4	Bornholms Amt	.00	15.53
123	DK- 5	Fyns Amt	25.30	45.78
124	DK- 6	Soenderjyllands Amt	11.75	31.71
125	DK- 7	Ribe Amt	16.59	31.86
126	DK- 8	Vejle Amt	18.32	33.23
127	DK- 9	Ringkoebing Amt	10.90	36.34
128	DK-10	Arhus Amt	78.87	90.66
129	DK-11	Viborg Amt	4.71	28.70
130	DK-12	Nordjyllands Amt	16.42	39.53
		GREECE		
131	GR- 1	Eastern Cont. Greece/Isl.	56.45	41.42
132	GR- 2	Central/Western Macedonia	59.62	47.65
133	GR- 3	Peloponese	26.28	27.43
134	GR- 4	Thessaly	20.67	23.70
135	GR- 5	Eastern Macedonia	15.79	20.61
136	GR- 6	Crete	23.47	25.43
137	GR- 7	Epirus	28.83	30.28
138	GR- 8	Thrace	11.41	20.89
139	GR- 9	Isl. of Eastern Aegean Sea	16.73	17.05

Table 10 continued

			INDG01	INDG02
	GERMANY			
1	GE- 1	Schleswig	43.07	40.17
2	GE- 2	Mittelholstein-Dithmarschen	48.79	50.12
3	GE- 3	Hamburg	60.27	54.14
4	GE- 4	Lueneburger Heide	55.87	55.99
5	GE- 5	Bremen	61.92	57.88
6	GE- 6	Osnabrueck	63.59	65.68
7	GE- 7	Ems	58.17	56.37
8	GE- 8	Muenster	77.99	74.63
9	GE- 9	Bielefeld	58.44	56.81
10	GE-10	Hannover	52.02	54.60
11	GE-11	Braunschweig	46.28	50.81
12	GE-12	Goettingen	65.57	62.09
13	GE-13	Kassel	54.44	59.09
14	GE-14	Dortmund-Siegen	66.81	65.32
15	GE-15	Essen	71.44	71.90
16	GE-16	Duesseldorf	57.67	58.35
17	GE-17	Aachen	51.48	51.83
18	GE-18	Koeln	60.68	59.47
19	GE-19	Trier	60.20	66.60
20	GE-20	Koblenz	61.96	60.62
21	GE-21	Mittel-Osthessen	49.35	55.20
22	GE-22	Bamberg-Hof	49.26	52.56
23	GE-23	Aschaffenburg-Schweinfurt	49.83	50.47
24	GE-24	Frankfurt-Darmstadt	51.58	47.98
25	GE-25	Mainz-Wiesbaden	58.10	54.54
26	GE-26	Saarland	71.75	70.72
27	GE-27	Westpfalz	42.45	46.73
28	GE-28	Rhein-Neckar-Suedpfalz	62.12	63.37
29	GE-29	Oberrhein-Nordschwarzwald	55.34	48.69
30	GE-30	Neckar-Franken	48.24	50.16
31	GE-31	Ansbach-Nuernberg	51.67	53.69
32	GE-32	Regensburg-Weiden	57.84	62.00
33	GE-33	Landshut-Passau	55.88	61.62
34	GE-34	Muenchen-Rosenheim	66.27	63.11
35	GE-35	Kempten-Ingolstadt	57.85	57.72
36	GE-36	Alb-Oberschwaben	52.64	53.50
37	GE-37	Oberrhein-Suedschwarzwald	62.20	58.54

Table 10 continued

			INDG01	INDG02
	FRANCE			
38	FR- 1	Ile de France	65.55	64.08
39	FR- 2	Champagne-Ardennes	58.41	59.83
40	FR- 3	Picardie	47.52	47.73
41	FR- 4	Haute Normandie	53.41	54.58
42	FR- 5	Centre	54.29	59.88
43	FR- 6	Basse Normandie	58.29	61.87
44	FR- 7	Bourgogne	57.49	60.69
45	FR- 8	Nord-Pas de Calais	43.00	46.42
46	FR- 9	Lorraine	62.41	66.03
47	FR-10	Alsace	83.60	79.42
48	FR-11	Franche Comte	52.73	55.17
49	FR-12	Pays de la Loire	53.79	58.92
50	FR-13	Bretagne	57.05	61.94
51	FR-14	Poitou-Charentes	45.55	57.32
52	FR-15	Aquitaine	64.89	69.16
53	FR-16	Midi-Pyrenees	61.81	69.01
54	FR-17	Limousin	48.44	57.35
55	FR-18	Rhone-Alpes	69.80	69.16
56	FR-19	Auvergne	55.21	61.98
57	FR-20	Languedoc-Roussillon	81.07	84.20
58	FR-21	Provence-Alpes-Cote d'Azur	89.91	81.24
	ITALY			
59	IT- 1	Piemonte	61.61	69.39
60	IT- 2	Valle d'Aosta	38.77	45.29
61	IT- 3	Liguria	83.20	83.89
62	IT- 4	Lombardia	69.49	68.54
63	IT- 5	Trentino-Alto Adige	71.31	73.73
64	IT- 6	Veneto	94.91	96.02
65	IT- 7	Friuli-Venezia Giulia	86.56	90.37
66	IT- 8	Emilia-Romagna	77.73	78.03
67	IT- 9	Toscana	70.10	74.36
68	IT-10	Umbria	68.06	66.73
69	IT-11	Marche	84.13	96.89
70	IT-12	Lazio	66.85	71.06
71	IT-13	Campania	47.29	50.63
72	IT-14	Abruzzi	56.65	73.25
73	IT-15	Molise	25.57	38.23
74	IT-16	Puglia	61.46	73.99
75	IT-17	Basilicata	52.99	58.93
76	IT-18	Calabria	31.82	46.05
77	IT-19	Sicilia	43.46	52.22
78	IT-20	Sardegna	40.17	49.94

Table 10 continued

			INDG01	INDG02
	NETHERLANDS			
79	NL- 2	Friesland	45.36	42.67
80	NL- 3	Drente	75.69	66.75
81	NL- 4	Overijssel	49.80	48.21
82	NL- 5	Gelderland	56.96	51.68
83	NL- 6	Utrecht	70.80	70.62
84	NL- 7	Noord-Holland	63.78	61.62
85	NL- 8	Zuid-Holland	61.02	56.37
86	NL- 9	Zeeland	43.19	38.67
87	NL-10	Noord-Brabant	61.64	54.51
88	NL-11	Limburg	67.44	58.37
	BELGIUM			
89	BE- 1	Antwerpen	46.15	48.35
90	BE- 2	Brabant	40.88	50.28
91	BE- 3	Hainaut	46.71	58.06
92	BE- 4	Liege	45.18	51.67
93	BE- 5	Limburg	43.47	45.36
94	BE- 6	Luxemburg	28.52	34.99
95	BE- 7	Namur	27.14	39.07
96	BE- 8	Oost-Vlaanderen	47.00	50.99
97	BE- 9	West-Vlaanderen	56.81	65.31
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	100.00	100.00
	UNITED KINGDOM			
99	UK- 1	North	69.51	65.59
100	UK- 2	Yorkshire/Humberside	70.15	49.25
101	UK- 3	East Midlands	61.52	66.78
102	UK- 4	East Anglia	64.36	71.24
103	UK- 5	South East	77.60	62.02
104	UK- 6	South West	79.53	72.46
105	UK- 7	West Midlands	64.76	56.24
106	UK- 8	North West	72.58	65.21
107	UK- 9	Wales	75.53	67.38
108	UK-10	Scotland	95.95	88.84
109	UK-11	Northern Ireland	90.15	86.46

Table 10 continued

			INDG01	INDG02
	IRELAND			
110	IR- 1	East	.00	.00
111	IR- 2	South West	.00	.00
112	IR- 3	South East	.00	.00
113	IR- 4	North East	.00	.00
114	IR- 5	Mid West	.00	.00
115	IR- 6	Donegal	.00	.00
116	IR- 7	Midlands	.00	.00
117	IR- 8	West	.00	.00
118	IR- 9	North West	.00	.00
	DENMARK			
119	DK- 1	Copenhagen Region	54.59	55.54
120	DK- 2	Vestsjaellands Amt	44.61	69.13
121	DK- 3	Storstroems Amt	44.82	43.63
122	DK- 4	Bornholms Amt	46.80	43.46
123	DK- 5	Fyns Amt	48.97	50.69
124	DK- 6	Soenderjyllands Amt	36.38	38.50
125	DK- 7	Ribe Amt	38.35	43.90
126	DK- 8	Vejle Amt	50.08	51.10
127	DK- 9	Ringkoebing Amt	36.80	41.19
128	DK-10	Arhus Amt	51.13	48.47
129	DK-11	Viborg Amt	43.88	44.45
130	DK-12	Nordjyllands Amt	40.82	42.48
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	.00	62.70
132	GR- 2	Central/Western Macedonia	.00	49.19
133	GR- 3	Peloponese	.00	26.76
134	GR- 4	Thessaly	.00	29.49
135	GR- 5	Eastern Macedonia	.00	44.28
136	GR- 6	Crete	.00	44.73
137	GR- 7	Epirus	.00	33.88
138	GR- 8	Thrace	.00	25.15
139	GR- 9	Isl. of Eastern Aegean Sea	.00	75.75

Table 10 continued

			INDJ01	INDJ02
	GERMANY			
1	GE- 1	Schleswig	62.80	14.01
2	GE- 2	Mittelholstein-Dithmarschen	34.65	15.00
3	GE- 3	Hamburg	42.64	24.19
4	GE- 4	Lueneburger Heide	22.78	11.75
5	GE- 5	Bremen	26.94	22.37
6	GE- 6	Osnabrueck	29.20	20.77
7	GE- 7	Ems	17.40	12.45
8	GE- 8	Muenster	31.47	29.07
9	GE- 9	Bielefeld	29.94	26.89
10	GE-10	Hannover	29.69	23.24
11	GE-11	Braunschweig	29.36	22.50
12	GE-12	Goettingen	19.10	21.04
13	GE-13	Kassel	24.99	14.06
14	GE-14	Dortmund-Siegen	39.17	32.04
15	GE-15	Essen	44.58	36.63
16	GE-16	Duesseldorf	44.13	36.12
17	GE-17	Aachen	29.62	29.65
18	GE-18	Koeln	48.34	35.33
19	GE-19	Trier	18.26	11.22
20	GE-20	Koblenz	27.53	10.36
21	GE-21	Mittel-Osthessen	18.96	15.45
22	GE-22	Bamberg-Hof	25.41	11.71
23	GE-23	Aschaffenburg-Schweinfurt	25.88	13.28
24	GE-24	Frankfurt-Darmstadt	37.36	31.22
25	GE-25	Mainz-Wiesbaden	42.29	26.32
26	GE-26	Saarland	26.33	26.11
27	GE-27	Westpfalz	26.04	15.41
28	GE-28	Rhein-Neckar-Suedpfalz	35.88	23.47
29	GE-29	Oberrhein-Nordschwarzwald	37.70	25.73
30	GE-30	Neckar-Franken	37.57	29.67
31	GE-31	Ansbach-Nuernberg	37.87	22.38
32	GE-32	Regensburg-Weiden	23.24	11.88
33	GE-33	Landshut-Passau	22.81	8.62
34	GE-34	Muenchen-Rosenheim	44.27	18.28
35	GE-35	Kempten-Ingolstadt	31.63	12.86
36	GE-36	Alb-Oberschwaben	28.10	22.02
37	GE-37	Oberrhein-Suedschwarzwald	31.57	20.26

Table 10 continued

			INDJ01	INDJ02
	FRANCE			
38	FR- 1	Ile de France	7.25	16.29
39	FR- 2	Champagne-Ardennes	3.03	33.87
40	FR- 3	Picardie	2.58	36.22
41	FR- 4	Haute Normandie	1.46	36.00
42	FR- 5	Centre	3.28	36.27
43	FR- 6	Basse Normandie	2.16	38.78
44	FR- 7	Bourgogne	2.62	39.73
45	FR- 8	Nord-Pas de Calais	1.27	23.88
46	FR- 9	Lorraine	4.81	29.17
47	FR-10	Alsace	7.13	30.27
48	FR-11	Franche Comte	3.41	54.22
49	FR-12	Pays de la Loire	2.22	34.47
50	FR-13	Bretagne	1.99	34.00
51	FR-14	Poitou-Charentes	1.86	30.92
52	FR-15	Aquitaine	2.99	37.24
53	FR-16	Midi-Pyrenees	2.12	42.74
54	FR-17	Limousin	1.35	44.69
55	FR-18	Rhone-Alpes	3.10	33.52
56	FR-19	Auvergne	1.98	38.86
57	FR-20	Languedoc-Roussillon	3.94	39.63
58	FR-21	Provence-Alpes-Cote d'Azur	5.00	23.05
	ITALY			
59	IT- 1	Piemonte	59.94	21.91
60	IT- 2	Valle d'Aosta	10.55	12.87
61	IT- 3	Liguria	15.76	11.89
62	IT- 4	Lombardia	23.16	18.23
63	IT- 5	Trentino-Alto Adige	28.12	25.52
64	IT- 6	Veneto	22.16	17.08
65	IT- 7	Friuli-Venezia Giulia	18.73	19.17
66	IT- 8	Emilia-Romagna	20.58	13.88
67	IT- 9	Toscana	18.78	10.69
68	IT-10	Umbria	30.08	8.46
69	IT-11	Marche	19.10	10.08
70	IT-12	Lazio	11.27	4.08
71	IT-13	Campania	9.12	3.61
72	IT-14	Abruzzi	8.32	5.38
73	IT-15	Molise	2.30	.90
74	IT-16	Puglia	9.65	4.56
75	IT-17	Basilicata	3.89	2.48
76	IT-18	Calabria	4.52	2.66
77	IT-19	Sicilia	8.08	3.96
78	IT-20	Sardegna	11.67	4.65

Table 10 continued

			INDJ01	INDJ02
	NETHERLANDS			
79	NL- 2	Friesland	91.54	100.00
80	NL- 3	Drente	70.21	73.52
81	NL- 4	Overijssel	69.42	76.63
82	NL- 5	Gelderland	82.53	80.74
83	NL- 6	Utrecht	93.37	97.13
84	NL- 7	Noord-Holland	87.75	97.53
85	NL- 8	Zuid-Holland	60.61	72.13
86	NL- 9	Zeeland	100.00	99.90
87	NL-10	Noord-Brabant	66.34	65.26
88	NL-11	Limburg	62.36	62.05
	BELGIUM			
89	BE- 1	Antwerpen	38.98	37.79
90	BE- 2	Brabant	48.09	42.61
91	BE- 3	Hainaut	39.93	43.14
92	BE- 4	Liege	40.45	31.33
93	BE- 5	Limburg	20.27	31.67
94	BE- 6	Luxemburg	29.55	36.85
95	BE- 7	Namur	35.02	56.07
96	BE- 8	Oost-Vlaanderen	51.56	44.23
97	BE- 9	West-Vlaanderen	55.64	49.10
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	.00	.00
	UNITED KINGDOM			
99	UK- 1	North	2.23	23.11
100	UK- 2	Yorkshire/Humberside	2.61	21.05
101	UK- 3	East Midlands	3.04	17.26
102	UK- 4	East Anglia	3.02	12.26
103	UK- 5	South East	6.74	19.26
104	UK- 6	South West	6.94	13.17
105	UK- 7	West Midlands	2.58	19.37
106	UK- 8	North West	4.00	21.98
107	UK- 9	Wales	2.05	17.20
108	UK-10	Scotland	8.70	22.71
109	UK-11	Northern Ireland	.00	.00

Table 10 continued

			INDJ01	INDJ02
	IRELAND			
110	IR- 1	East	.00	.00
111	IR- 2	South West	.00	.00
112	IR- 3	South East	.00	.00
113	IR- 4	North East	.00	.00
114	IR- 5	Mid West	.00	.00
115	IR- 6	Donegal	.00	.00
116	IR- 7	Midlands	.00	.00
117	IR- 8	West	.00	.00
118	IR- 9	North West	.00	.00
	DENMARK			
119	DK- 1	Copenhagen Region	38.76	80.20
120	DK- 2	Vestsjaellands Amt	40.98	68.98
121	DK- 3	Storstroems Amt	54.58	67.90
122	DK- 4	Bornholms Amt	36.68	57.68
123	DK- 5	Fyns Amt	32.94	60.81
124	DK- 6	Soenderjyllands Amt	28.33	59.30
125	DK- 7	Ribe Amt	34.64	53.14
126	DK- 8	Vejle Amt	37.09	59.93
127	DK- 9	Ringkoebing Amt	46.07	57.73
128	DK-10	Arhus Amt	39.24	67.30
129	DK-11	Viborg Amt	46.11	54.83
130	DK-12	Nordjyllands Amt	31.48	49.21
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	.00	13.78
132	GR- 2	Central/Western Macedonia	.00	5.30
133	GR- 3	Peloponese	.00	4.86
134	GR- 4	Thessaly	.00	4.38
135	GR- 5	Eastern Macedonia	.00	4.96
136	GR- 6	Crete	.00	13.14
137	GR- 7	Epirus	.00	4.05
138	GR- 8	Thrace	.00	2.21
139	GR- 9	Isl. of Eastern Aegean Sea	.00	17.13

Table 10 continued

			INDK01	INDK02
	GERMANY			
1	GE- 1	Schleswig	22.74	14.58
2	GE- 2	Mittelholstein-Dithmarschen	12.41	15.59
3	GE- 3	Hamburg	5.17	6.50
4	GE- 4	Lueneburger Heide	8.15	12.02
5	GE- 5	Bremen	8.39	11.25
6	GE- 6	Osnabrueck	6.74	11.49
7	GE- 7	Ems	3.32	6.51
8	GE- 8	Muenster	8.94	12.70
9	GE- 9	Bielefeld	12.30	15.44
10	GE-10	Hannover	7.52	12.58
11	GE-11	Braunschweig	17.56	19.93
12	GE-12	Goettingen	13.25	22.68
13	GE-13	Kassel	44.16	49.52
14	GE-14	Dortmund-Siegen	12.16	16.67
15	GE-15	Essen	7.21	9.95
16	GE-16	Duesseldorf	9.92	12.16
17	GE-17	Aachen	8.75	14.08
18	GE-18	Koeln	12.53	14.61
19	GE-19	Trier	10.62	11.45
20	GE-20	Koblenz	31.28	36.17
21	GE-21	Mittel-Osthessen	53.78	61.68
22	GE-22	Bamberg-Hof	22.69	26.83
23	GE-23	Aschaffenburg-Schweinfurt	12.43	13.56
24	GE-24	Frankfurt-Darmstadt	22.95	27.53
25	GE-25	Mainz-Wiesbaden	36.26	38.77
26	GE-26	Saarland	11.84	16.62
27	GE-27	Westpfalz	42.99	50.85
28	GE-28	Rhein-Neckar-Suedpfalz	13.59	17.65
29	GE-29	Oberrhein-Nordschwarzwald	21.41	26.84
30	GE-30	Neckar-Franken	15.34	20.70
31	GE-31	Ansbach-Nuernberg	6.92	9.36
32	GE-32	Regensburg-Weiden	7.34	12.48
33	GE-33	Landshut-Passau	6.33	6.44
34	GE-34	Muenchen-Rosenheim	10.61	11.65
35	GE-35	Kempten-Ingolstadt	8.90	10.87
36	GE-36	Alb-Oberschwaben	21.62	26.51
37	GE-37	Oberrhein-Suedschwarzwald	24.18	28.69

Table 10 continued

			INDK01	INDK02
	FRANCE			
38	FR- 1	Ile de France	.00	8.97
39	FR- 2	Champagne-Ardennes	.00	17.11
40	FR- 3	Picardie	.00	14.22
41	FR- 4	Haute Normandie	.00	14.59
42	FR- 5	Centre	.00	17.31
43	FR- 6	Basse Normandie	.00	20.20
44	FR- 7	Bourgogne	.00	25.55
45	FR- 8	Nord-Pas de Calais	.00	9.11
46	FR- 9	Lorraine	.00	20.58
47	FR-10	Alsace	.00	19.28
48	FR-11	Franche Comte	.00	17.97
49	FR-12	Pays de la Loire	.00	11.57
50	FR-13	Bretagne	.00	7.51
51	FR-14	Poitou-Charentes	.00	14.54
52	FR-15	Aquitaine	.00	11.68
53	FR-16	Midi-Pyrenees	.00	20.10
54	FR-17	Limousin	.00	9.08
55	FR-18	Rhone-Alpes	.00	15.23
56	FR-19	Auvergne	.00	10.82
57	FR-20	Languedoc-Roussillon	.00	19.35
58	FR-21	Provence-Alpes-Cote d'Azur	.00	17.00
	ITALY			
59	IT- 1	Piemonte	.00	14.23
60	IT- 2	Valle d'Aosta	.00	13.02
61	IT- 3	Liguria	.00	27.09
62	IT- 4	Lombardia	.00	11.43
63	IT- 5	Trentino-Alto Adige	.00	23.15
64	IT- 6	Veneto	.00	11.95
65	IT- 7	Friuli-Venezia Giulia	.00	22.87
66	IT- 8	Emilia-Romagna	.00	25.79
67	IT- 9	Toscana	.00	30.93
68	IT-10	Umbria	.00	35.23
69	IT-11	Marche	.00	17.57
70	IT-12	Lazio	.00	25.18
71	IT-13	Campania	.00	11.77
72	IT-14	Abruzzi	.00	28.22
73	IT-15	Molise	.00	16.02
74	IT-16	Puglia	.00	18.30
75	IT-17	Basilicata	.00	26.43
76	IT-18	Calabria	.00	9.81
77	IT-19	Sicilia	.00	17.22
78	IT-20	Sardegna	.00	24.85

Table 10 continued

			INDK01	INDK02
	NETHERLANDS			
79	NL- 2	Friesland	48.43	56.29
80	NL- 3	Drente	25.03	36.64
81	NL- 4	Overijssel	22.18	30.96
82	NL- 5	Gelderland	18.90	24.24
83	NL- 6	Utrecht	13.91	19.33
84	NL- 7	Noord-Holland	20.86	29.25
85	NL- 8	Zuid-Holland	16.79	21.12
86	NL- 9	Zeeland	29.80	35.88
87	NL-10	Noord-Brabant	14.16	20.03
88	NL-11	Limburg	21.15	28.11
	BELGIUM			
89	BE- 1	Antwerpen	34.59	41.43
90	BE- 2	Brabant	28.52	38.64
91	BE- 3	Hainaut	47.51	34.50
92	BE- 4	Liege	63.40	46.31
93	BE- 5	Limburg	49.03	40.73
94	BE- 6	Luxemburg	100.00	74.68
95	BE- 7	Namur	55.36	55.56
96	BE- 8	Oost-Vlaanderen	40.14	33.33
97	BE- 9	West-Vlaanderen	42.84	48.49
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	.00	29.61
	UNITED KINGDOM			
99	UK- 1	North	1.00	15.74
100	UK- 2	Yorkshire/Humberside	2.79	15.08
101	UK- 3	East Midlands	2.33	13.55
102	UK- 4	East Anglia	7.01	16.12
103	UK- 5	South East	4.35	11.58
104	UK- 6	South West	4.45	15.86
105	UK- 7	West Midlands	1.40	10.20
106	UK- 8	North West	2.96	10.56
107	UK- 9	Wales	4.49	17.63
108	UK-10	Scotland	1.61	11.90
109	UK-11	Northern Ireland	.73	7.02

Table 10 continued

			INDK01	INDK02
	IRELAND			
110	IR- 1	East	17.79	13.07
111	IR- 2	South West	15.22	11.82
112	IR- 3	South East	21.56	14.93
113	IR- 4	North East	.00	7.82
114	IR- 5	Mid West	26.26	26.16
115	IR- 6	Donegal	21.80	21.79
116	IR- 7	Midlands	35.57	27.21
117	IR- 8	West	18.26	17.98
118	IR- 9	North West	15.02	32.10
	DENMARK			
119	DK- 1	Copenhagen Region	39.61	56.39
120	DK- 2	Vestsjaellands Amt	59.17	70.15
121	DK- 3	Storstroems Amt	74.75	84.43
122	DK- 4	Bornholms Amt	100.00	57.53
123	DK- 5	Fyns Amt	73.51	100.00
124	DK- 6	Soenderjyllands Amt	39.61	60.71
125	DK- 7	Ribe Amt	83.44	98.02
126	DK- 8	Vejle Amt	26.95	51.06
127	DK- 9	Ringkoebing Amt	53.68	79.34
128	DK-10	Arhus Amt	53.05	52.79
129	DK-11	Viborg Amt	69.47	83.40
130	DK-12	Nordjyllands Amt	59.42	80.15
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	7.67	9.74
132	GR- 2	Central/Western Macedonia	2.40	2.49
133	GR- 3	Peloponese	12.89	8.98
134	GR- 4	Thessaly	3.58	3.40
135	GR- 5	Eastern Macedonia	5.68	5.84
136	GR- 6	Crete	10.35	5.79
137	GR- 7	Epirus	8.28	6.50
138	GR- 8	Thrace	3.58	6.96
139	GR- 9	Isl. of Eastern Aegean Sea	24.94	14.35

Table 10 continued

			INDL01	INDL02
	GERMANY			
1	GE- 1	Schleswig	7.95	19.88
2	GE- 2	Mittelholstein-Dithmarschen	14.96	17.81
3	GE- 3	Hamburg	26.91	30.17
4	GE- 4	Lueneburger Heide	69.41	67.74
5	GE- 5	Bremen	15.04	19.03
6	GE- 6	Osnabrueck	27.52	29.09
7	GE- 7	Ems	19.69	24.04
8	GE- 8	Muenster	26.89	29.34
9	GE- 9	Bielefeld	39.67	43.62
10	GE-10	Hannover	43.93	64.74
11	GE-11	Braunschweig	53.45	54.68
12	GE-12	Goettingen	73.63	95.41
13	GE-13	Kassel	78.04	88.09
14	GE-14	Dortmund-Siegen	81.27	87.36
15	GE-15	Essen	26.99	31.47
16	GE-16	Duesseldorf	23.76	31.78
17	GE-17	Aachen	44.18	47.42
18	GE-18	Koeln	49.24	62.40
19	GE-19	Trier	75.07	83.76
20	GE-20	Koblenz	78.71	87.83
21	GE-21	Mittel-Osthessen	73.25	84.16
22	GE-22	Bamberg-Hof	71.94	81.73
23	GE-23	Aschaffenburg-Schweinfurt	72.58	81.17
24	GE-24	Frankfurt-Darmstadt	72.91	82.05
25	GE-25	Mainz-Wiesbaden	61.00	64.97
26	GE-26	Saarland	61.30	67.38
27	GE-27	Westpfalz	79.90	87.91
28	GE-28	Rhein-Neckar-Suedpfalz	68.90	82.33
29	GE-29	Oberrhein-Nordschwarzwald	91.74	100.00
30	GE-30	Neckar-Franken	58.96	65.89
31	GE-31	Ansbach-Nuernberg	62.67	70.06
32	GE-32	Regensburg-Weiden	75.44	83.18
33	GE-33	Landshut-Passau	57.50	64.57
34	GE-34	Muenchen-Rosenheim	59.67	66.56
35	GE-35	Kempten-Ingolstadt	49.92	56.26
36	GE-36	Alb-Oberschwaben	59.05	65.61
37	GE-37	Oberrhein-Suedschwarzwald	83.08	94.74

Table 10 continued

			INDL01	INDL02
	FRANCE			
38	FR- 1	Ile de France	20.91	23.48
39	FR- 2	Champagne-Ardennes	29.54	31.02
40	FR- 3	Picardie	13.65	16.05
41	FR- 4	Haute Normandie	18.44	22.44
42	FR- 5	Centre	20.56	23.36
43	FR- 6	Basse Normandie	9.52	13.03
44	FR- 7	Bourgogne	80.25	37.47
45	FR- 8	Nord-Pas de Calais	13.91	8.23
46	FR- 9	Lorraine	33.26	46.24
47	FR-10	Alsace	34.00	43.42
48	FR-11	Franche Comte	41.15	47.97
49	FR-12	Pays de la Loire	20.42	12.22
50	FR-13	Bretagne	30.69	13.29
51	FR-14	Poitou-Charentes	14.24	18.12
52	FR-15	Aquitaine	85.27	50.11
53	FR-16	Midi-Pyrenees	22.46	28.31
54	FR-17	Limousin	30.11	37.92
55	FR-18	Rhone-Alpes	57.93	37.61
56	FR-19	Auvergne	24.63	35.21
57	FR-20	Languedoc-Roussillon	25.61	32.39
58	FR-21	Provence-Alpes-Cote d'Azur	53.46	44.42
	ITALY			
59	IT- 1	Piemonte	45.23	36.26
60	IT- 2	Valle d'Aosta	42.63	81.35
61	IT- 3	Liguria	100.00	56.37
62	IT- 4	Lombardia	39.31	47.93
63	IT- 5	Trentino-Alto Adige	84.35	64.95
64	IT- 6	Veneto	27.30	15.38
65	IT- 7	Friuli-Venezia Giulia	40.67	23.49
66	IT- 8	Emilia-Romagna	31.15	18.38
67	IT- 9	Toscana	72.93	40.60
68	IT-10	Umbria	57.39	33.10
69	IT-11	Marche	29.27	17.35
70	IT-12	Lazio	40.61	27.61
71	IT-13	Campania	39.41	21.90
72	IT-14	Abruzzi	35.79	41.13
73	IT-15	Molise	28.47	16.83
74	IT-16	Puglia	9.11	5.29
75	IT-17	Basilicata	32.78	19.79
76	IT-18	Calabria	51.16	35.95
77	IT-19	Sicilia	14.04	8.71
78	IT-20	Sardegna	26.21	17.42

Table 10 continued

			INDL01	INDL02
	NETHERLANDS			
79	NL- 2	Friesland	.00	.00
80	NL- 3	Drente	.00	.00
81	NL- 4	Overijssel	.00	.00
82	NL- 5	Gelderland	.00	.00
83	NL- 6	Utrecht	.00	.00
84	NL- 7	Noord-Holland	.00	.00
85	NL- 8	Zuid-Holland	.00	.00
86	NL- 9	Zeeland	.00	.00
87	NL-10	Noord-Brabant	.00	.00
88	NL-11	Limburg	.00	.00
	BELGIUM			
89	BE- 1	Antwerpen	22.36	18.38
90	BE- 2	Brabant	18.26	14.05
91	BE- 3	Hainaut	23.98	13.82
92	BE- 4	Liege	53.47	37.73
93	BE- 5	Limburg	27.09	21.96
94	BE- 6	Luxemburg	90.77	52.27
95	BE- 7	Namur	59.75	37.27
96	BE- 8	Oost-Vlaanderen	8.35	5.89
97	BE- 9	West-Vlaanderen	4.17	4.21
	GD LUXEMBURG			
98	LU- 1	GD Luxemburg	61.90	68.42
	UNITED KINGDOM			
99	UK- 1	North	14.60	12.63
100	UK- 2	Yorkshire/Humberside	33.86	6.56
101	UK- 3	East Midlands	4.43	3.88
102	UK- 4	East Anglia	5.73	6.41
103	UK- 5	South East	17.42	12.43
104	UK- 6	South West	33.10	9.75
105	UK- 7	West Midlands	11.04	6.55
106	UK- 8	North West	38.44	7.32
107	UK- 9	Wales	31.36	14.58
108	UK-10	Scotland	13.85	16.53
109	UK-11	Northern Ireland	1.02	6.18

Table 10 continued

			INDL01	INDL02
	IRELAND			
110	IR- 1	East	.00	5.62
111	IR- 2	South West	1.50	5.18
112	IR- 3	South East	.00	5.89
113	IR- 4	North East	.00	2.20
114	IR- 5	Mid West	.00	4.51
115	IR- 6	Donegal	.00	6.33
116	IR- 7	Midlands	.00	3.67
117	IR- 8	West	.00	5.17
118	IR- 9	North West	.00	6.02
	DENMARK			
119	DK- 1	Copenhagen Region	21.51	32.88
120	DK- 2	Vestsjaellands Amt	19.54	24.05
121	DK- 3	Storstroems Amt	23.87	23.41
122	DK- 4	Bornholms Amt	36.11	39.21
123	DK- 5	Fyns Amt	16.78	18.53
124	DK- 6	Soenderjyllands Amt	14.32	19.14
125	DK- 7	Ribe Amt	20.63	25.47
126	DK- 8	Vejle Amt	24.80	30.14
127	DK- 9	Ringkoebing Amt	21.19	25.14
128	DK-10	Arhus Amt	25.71	31.24
129	DK-11	Viborg Amt	26.64	25.25
130	DK-12	Nordjyllands Amt	18.20	21.01
	GREECE			
131	GR- 1	Eastern Cont. Greece/Isl.	39.38	.11
132	GR- 2	Central/Western Macedonia	42.27	.11
133	GR- 3	Peloponese	31.48	.03
134	GR- 4	Thessaly	37.55	.11
135	GR- 5	Eastern Macedonia	38.11	.07
136	GR- 6	Crete	1.94	.07
137	GR- 7	Epirus	27.01	.17
138	GR- 8	Thrace	57.47	.00
139	GR- 9	Isl. of Eastern Aegean Sea	29.59	.00

Legend for Table 10:

IGES Aggregate Infrastructure Indicator (Geometric mean of INDA-INDL)

INDA-INDL Indicators for the main infrastructure categories A to L with best equipped region=100.

Sources: Annex Tables

These figures must still be interpreted with some caution due to the statistical problems already mentioned. Since definitions can differ between member countries, as it had not been possible to always obtain information on the same subcategories and/or the same years, comparability problems remain. The most important deficiencies as to comparability have been tried to take care of by reducing the number of subindicators retained for the Community analysis as already explained [cf. VIII.3.]. In order to cover as many member countries as possible, the comparability requirements have sometimes been relaxed. When only a fully comparable indicator was available for a small number of countries, but a less comparable set for a larger number, the latter data set was chosen, because the first solution would in general amount to consider only the relatively higher developed parts of the Community.

Fortunately, as already explained, the comparability problems do not affect all infrastructure categories at the same degree. For example, in most countries subindicators for transportation infrastructure (like road kilometers, kilometers of waterways, railway track kilometers, size of runway surfaces) do not differ as much as indicators for socio-cultural facilities. In the latter cases, also the national characteristics of organization influence the results. Also, the number of hospital beds as an indicator for health infrastructure does not vary much. By contrast, environmental infrastructure may show stronger deviations depending, among others, on the intensity of antipollution policies and regulations. The measurement problems arising in the cultural fields where only a number of facilities are available, have already been mentioned.

Since the Community Analysis compares regions that belong to countries having significantly different levels of development, it can be expected that the total range of infrastructure disparities increases. Only the best equipped regions across all Community regions are now set equal to 100. Even if inside an individual member country, a policy would have been followed to avoid too strong an infrastructure disparity, the Community data set will show larger disparities because national "average" or "target" infrastructure equipments may differ.

According to TABLE 10, the best equipped regions equal to the maximum indicator value for IGES of 100 are those of TABLE 11.

TABLE 11.: Infrastructure Equipment of 139 EC-Regions - Best Equipped Regions -

INFRASTRUCTURE CATEGORIES	1st YEAR	2nd YEAR
A. Transportation	Noord-Holland	Noord-Holland
B. Communication	Ile de France	Ile de France
C. Energy Supply	Haute Normandie	Antwerpen
E. Environmental	Essen	Storstroems Amt
F. Education	Goettingen	Goettingen
G. Health	GD Luxembourg	GD Luxembourg
J. Social	Zeeland	Friesland
K. Cultural	Luxembourg/BE Bornholms Amt	Fyns Amt
L. Natural	Liguria	Oberrhein-Nord-schwarzwald
IGES	Noord-Holland	Noord-Holland
Source: Table 10		

The least equipped regions at the other extreme would be those having an indicator value equal to zero which means that no equipment in terms of the selected indicators exists. But due to the data problems already discussed, zero can also have a different meaning. If all regions of one member country show zeros, the reason is that the respective information is not available at all or was not considered to be sufficiently comparable. A full series of zeros can only appear for one or several of the main infrastructure categories, but not for total infrastructure indicator IGES. As to IGES, there is always a positive value for each region because if no information is available for a main infrastructure category, these zeros are disregarded.

The least equipped regions according to TABLE 10 are listed in TABLE 12.

TABLE 12.: Infrastructure Equipment of 139 EC-Regions
- Least Equipped Regions -

INFRASTRUCTURE CATEGORIES	1st YEAR	2nd YEAR
A. Transportation	Luxembourg/BE 0 Donegal 0	Bornholms Amt 0
B. Communication	Thrace 12.2	Thrace 12.5
C. Energy Supply	Several Greek Regions 0	Several Greek Regions 0
E. Environmental	Alsace 0 Poitou-Charentes 0 Limousin 0	Basilicata 0
F. Education	Bornholms Amt 0	G.D. Luxembourg 2.5
G. Health	Molise 25.6	Thrace 25.2
J. Social	Northern Ireland 0	Northern Ireland 0
K. Cultural	North East (Ireland) 0	Central/Western Macedonia 2.5
L. Natural	Several Irish Regions 0	Islands of Eastern Aegean Sea 0 Thrace 0
IGES	North East (Ireland) 2.3	North East (Ireland) 5.8
Source: Table 10		

TABLE 13 informs about maximum-minimum-ratios and coefficients of variation for all main infrastructure categories and for IGES on the basis of the Community Analysis. The first two columns of TABLE 13 show MMR-figures which take into account whether a single or several regions of one country do not have an infrastructure equipment according to the indicator definition selected. In these cases, MMR formally would amount to infinity. Instead, the sign ">1000" is used. Whenever this sign appears, at least one region really does have no equipment according to the definition. In order to inform about the disparities between those regions that have positive endowments, the third and fourth columns show figures for MMR*. For the calculation of this measure, the indicator value for that region having the lowest equipment close to zero has been used. The sign ">1000" corresponds with the sign ">100" in the preceding Tables presenting the results of the National Reports.

TABLE 13.: Maximum-Minimum-Ratios (MMR) and Coefficients of Variation (VC) for Main Infrastructure Category Indicators for up to 139 EC-Regions

Category	MMR		MMR*		VC		NN	
	01	02	01	02	01	02	01	02
A.	>1000	>1000	53.8	175.4	56.6	66.0	127	139
B.	8.2	8.0	8.2	8.0	40.9	32.0	109	118
C.	>1000	>1000	98.0	137.0	92.6	94.9	130	139
D.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	--	--
E.	>1000	>1000	294.1	166.7	68.3	58.8	77	119
F.	>1000	40.2	24.4	40.2	49.9	42.1	119	119
G.	3.9	4.0	3.9	4.0	24.8	23.5	121	130
H.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	--	--
I.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	--	--
J.	>1000	>1000	78.7	111.1	83.2	75.0	120	129
K.	>1000	40.2	137.0	40.2	93.2	78.8	97	139
L.	>1000	>1000	98.0	333.3	67.9	80.8	129	129
IGES	43.5	17.2	43.5	17.2	44.3	40.5	139	139

Legend:

MMR: Maximum-Minimum-Ratio
If minimum is equal to zero, >1000 is used.

MMR*: If a single region has no infrastructure equipment, the minimum region for calculating MMR* is the one with the lowest value close to zero.

VC: Unweighted coefficient of variation.

NN: Number of regions for which information is available.

Source: Table 10

TABLE 14.: Ranking of 139 EC-Regions According to Infrastructure Indicator IGES 1st and 2nd Cross Section Years

Regions		IGES01	Regions		IGES02
113	IR- 4	2.30	113	IR- 4	5.81
115	IR- 6	4.98	115	IR- 6	5.84
118	IR- 9	5.41	118	IR- 9	7.46
117	IR- 8	5.95	117	IR- 8	7.62
112	IR- 3	6.86	112	IR- 3	9.66
116	IR- 7	9.66	134	GR- 4	10.75
109	UK-11	11.36	116	IR- 7	11.07
111	IR- 2	14.14	135	GR- 5	11.11
110	IR- 1	14.31	111	IR- 2	12.78
138	GR- 8	15.16	138	GR- 8	13.99
136	GR- 6	15.61	137	GR- 7	14.45
135	GR- 5	15.72	133	GR- 3	15.00
134	GR- 4	18.21	136	GR- 6	15.19
73	IT-15	19.18	132	GR- 2	16.37
114	IR- 5	20.19	114	IR- 5	17.05
132	GR- 2	20.42	73	IT-15	17.66
51	FR-14	21.63	75	IT-17	18.08
133	GR- 3	21.64	110	IR- 1	19.09
137	GR- 7	22.61	109	UK-11	20.64
49	FR-12	23.62	71	IT-13	22.88
99	UK- 1	24.06	76	IT-18	24.14
122	DK- 4	24.25	131	GR- 1	24.27
105	UK- 7	24.68	122	DK- 4	24.90
54	FR-17	25.14	74	IT-16	25.98
101	UK- 3	25.77	139	GR- 9	26.66
131	GR- 1	25.87	77	IT-19	28.11
75	IT-17	26.17	78	IT-20	30.39
76	IT-18	26.71	69	IT-11	36.48
108	UK-10	27.04	70	IT-12	38.01
124	DK- 6	27.37	72	IT-14	39.51
56	FR-19	28.38	129	DK-11	40.25
43	FR- 6	28.48	102	UK- 4	40.53
139	GR- 9	29.22	124	DK- 6	40.77
102	UK- 4	29.56	1	GE- 1	41.18
94	BE- 6	31.19	130	DK-12	41.46
127	DK- 9	31.34	68	IT-10	41.94
100	UK- 2	31.34	105	UK- 7	42.66
129	DK-11	32.19	100	UK- 2	42.70
107	UK- 9	33.08	125	DK- 7	43.01
39	FR- 2	33.47	92	BE- 4	43.29
130	DK-12	33.70	104	UK- 6	43.91
45	FR- 8	35.13	108	UK-10	44.33
40	FR- 3	35.35	101	UK- 3	44.50
90	BE- 2	35.79	51	FR-14	45.16
123	DK- 5	36.76	64	IT- 6	45.17
74	IT-16	37.09	33	GE-33	45.20

Table 14 continued

Regions		IGES01	Regions		IGES02
125	DK- 7	37.21	56	FR-19	45.22
121	DK- 3	37.42	127	DK- 9	45.41
95	BE- 7	38.21	63	IT- 5	45.83
97	BE- 9	38.47	59	IT- 1	46.08
44	FR- 7	38.68	40	FR- 3	46.13
106	UK- 8	40.01	60	IT- 2	48.20
104	UK- 6	40.28	45	FR- 8	48.52
50	FR-13	41.53	123	DK- 5	49.10
48	FR-11	41.57	4	GE- 4	49.23
33	GE-33	41.88	50	FR-13	49.45
53	FR-16	42.00	6	GE- 6	49.55
93	BE- 5	42.01	39	FR- 2	49.60
103	UK- 5	42.55	54	FR-17	50.27
72	IT-14	42.81	19	GE-19	50.58
6	GE- 6	43.34	49	FR-12	50.63
77	IT-19	43.58	107	UK- 9	51.21
42	FR- 5	44.01	7	GE- 7	52.47
71	IT-13	44.45	43	FR- 6	52.60
1	GE- 1	44.62	66	IT- 8	53.42
7	GE- 7	44.70	67	IT- 9	53.52
47	FR-10	44.70	90	BE- 2	53.84
57	FR-20	45.53	99	UK- 1	53.89
52	FR-15	46.53	95	BE- 7	54.08
19	GE-19	46.54	128	DK-10	54.33
32	GE-32	46.95	23	GE-23	54.44
128	DK-10	47.94	106	UK- 8	54.60
5	GE- 5	48.63	32	GE-32	54.64
78	IT-20	48.83	91	BE- 3	54.76
126	DK- 8	49.15	22	GE-22	55.09
86	NL- 9	49.42	103	UK- 5	55.57
4	GE- 4	49.80	35	GE-35	55.95
96	BE- 8	50.11	5	GE- 5	56.20
91	BE- 3	50.63	42	FR- 5	56.41
69	IT-11	51.21	65	IT- 7	56.97
22	GE-22	51.48	121	DK- 3	57.40
46	FR- 9	51.66	97	BE- 9	57.46
92	BE- 4	51.82	86	NL- 9	57.63
41	FR- 4	52.00	44	FR- 7	57.66
23	GE-23	52.08	93	BE- 5	57.88
119	DK- 1	52.48	62	IT- 4	58.46
60	IT- 2	53.55	2	GE- 2	59.24
64	IT- 6	53.88	46	FR- 9	59.75
17	GE-17	54.03	52	FR-15	60.30
89	BE- 1	55.42	27	GE-27	61.06
35	GE-35	56.33	53	FR-16	61.27
12	GE-12	56.43	21	GE-21	61.54
8	GE- 8	57.08	96	BE- 8	61.86

Table 14 continued

Regions		IGES01	Regions		IGES02
9	GE- 9	57.16	20	GE-20	61.95
58	FR-21	57.67	31	GE-31	62.11
2	GE- 2	57.86	9	GE- 9	63.20
31	GE-31	58.05	94	BE- 6	63.22
21	GE-21	58.08	3	GE- 3	64.47
80	NL- 3	58.29	126	DK- 8	64.93
27	GE-27	58.50	48	FR-11	64.98
65	IT- 7	58.85	8	GE- 8	65.35
55	FR-18	58.92	36	GE-36	65.67
70	IT-12	58.98	34	GE-34	66.33
79	NL- 2	59.56	80	NL- 3	66.70
66	IT- 8	60.47	57	FR-20	66.88
88	NL-11	60.99	17	GE-17	67.27
13	GE-13	61.42	12	GE-12	67.57
81	NL- 4	61.73	13	GE-13	67.79
67	IT- 9	61.82	55	FR-18	67.87
62	IT- 4	62.51	41	FR- 4	69.25
120	DK- 2	62.68	58	FR-21	69.58
36	GE-36	62.84	87	NL-10	69.59
10	GE-10	62.86	88	NL-11	69.75
82	NL- 5	63.22	11	GE-11	69.87
87	NL-10	63.49	119	DK- 1	71.18
68	IT-10	63.69	30	GE-30	71.61
20	GE-20	64.36	81	NL- 4	71.67
11	GE-11	66.01	10	GE-10	72.07
37	GE-37	66.21	82	NL- 5	73.00
63	IT- 5	66.72	37	GE-37	73.02
30	GE-30	66.72	38	FR- 1	73.60
3	GE- 3	67.48	26	GE-26	74.00
26	GE-26	68.65	47	FR-10	74.95
34	GE-34	69.52	89	BE- 1	75.57
14	GE-14	70.41	14	GE-14	76.53
59	IT- 1	71.73	61	IT- 3	76.83
98	LU- 1	75.40	79	NL- 2	77.09
15	GE-15	76.84	25	GE-25	79.11
28	GE-28	77.34	98	LU- 1	80.73
16	GE-16	79.11	120	DK- 2	81.45
25	GE-25	79.61	29	GE-29	81.98
29	GE-29	79.74	16	GE-16	82.72
24	GE-24	79.77	24	GE-24	83.30
38	FR- 1	84.33	28	GE-28	83.67
83	NL- 6	85.62	15	GE-15	86.81
18	GE-18	88.03	83	NL- 6	89.47
85	NL- 8	89.36	18	GE-18	91.81
61	IT- 3	94.04	85	NL- 8	96.53
84	NL- 7	100.00	84	NL- 7	100.00

Source: Table 10

The main findings based on TABLES 10 to 14 can be summarized as follows:

(1) On the basis of a Community-wide analysis, the best equipped region in both cross section years is Noord-Holland with the maximum IGES-value of 100. The opposite end of the ranking scale is occupied by North East of Ireland with an aggregate infrastructure equipment of 2.3% of Noord-Holland in the 1st and of 5.8% in the 2nd year. These IGES-values give a MMR of 43.5 in the 1st and 17.2 in the 2nd year. Compared with the maximum national MMR for Italy of 3.5, this is more than 12 times respectively 5 times as much. As the VC-figures demonstrate, the reduction of the Community MMR between the 1st and the 2nd year is larger than the reduction of VC from 44.3 to 40.5 . This indicates that the improvement of North East from 2.3 to 5.8 does not correspond with the average improvement of all other regions inside the Community. Obviously, regions must exist which experienced lower increase of infrastructure capacities than the least equipped Irish region.

(2) There are seven main categories in the 1st and still five in the 2nd year for which the indicator values range from zero to 100 as is indicated by a MMR of >1000. If the non-equipped regions are excluded, the MMR* reduces to values of 333 at maximum (Natural Infrastructure) in the 2nd cross section year and 3.9 (Health) in the 1st at minimum. The value for Natural Infrastructure is, however, affected by serious comparability problems between the 1st and the 2nd cross section year.

(3) The general tendency of reduced disparities from the beginning to the end of the seventies shows up also in Communication, Environmental and Cultural Infrastructure. In Communication, the in-between distribution has become significantly more equal compared with the span of the extreme values according to MMR*. Environmental and Cultural Infrastructure show clear reductions according to both measures. Education, Health and Social Infrastructure increased their distribution span according to MMR*, whereas according to VC, disparities have become smaller. Apparently, regions in-between

the extreme equipment values have relatively improved their situation. A strong increase in disparities is to be observed in Transportation and in Natural Infrastructure, a smaller one also in Energy Supply. Further insight into changes in relative position of individual regions can be obtained with the aid of a cluster analysis whose results are presented below.

(4) The lowest disparities show up for Health and for Communication. In case of Health, a MMR of about 4 and a VC of 24.8/23.5 is very low compared with national disparities measured in MMR which e.g. inside Greece amount to MMR of 9.06 and 8.2 [cf. TABLE 9]. This lends support to the view that Health Infrastructure, measured here with the aid of number of hospital beds per 1000 population, may belong to those basic public services that any government tends to supply according to reasonably equitable standards in relation to population. A MMR of about 8.0 and a VC of 40.9/32.0 in case of Communication points to the second lowest disparities. This indicator, based mainly on existing telephones or telephone connections, is only a partial indicator as far as the broad fields of telecommunication, especially new media, satelite systems and computer networks are concerned. Unfortunately no data were available for these more modern types of communication. Again, Greece comes very close to the MMR for the Community (GR: 7.05, 4.87). But even compared with the lowest national disparities in Ireland (1.45 for 2nd year only), the Community disparities are still very low. A third category with relatively low disparities, at least on the VC basis, is Education Infrastructure. Here also a certain trend towards a more equitable provision of educational facilities throughout the member countries can be responsible for the already mentioned clear decrease in disparities and the low level of VC (42.1) reached in the 2nd year.

IX.3. A SIMPLE CLUSTER ANALYSIS

A simple cluster or grouping analysis can be undertaken by distributing all 139 regions into five classes of very low (0-<20), low (20-<40), medium (40-<60), high (60-<80) and very high (80-100) infrastructure endowment on the basis of the aggregate infrastructure indicator values for IGES. The results of this analysis are presented in TABLE 15, in FIGURE 4 and in the two MAPS 1 and 2. The additional insights gained with the aid of this analysis can be summarized in the following way:

(1) In general, the regions of those member countries which according to intuitive knowledge are considered to be relatively well developed are to be found in the higher classes, whereas the regions of the less well developed member countries are to be found in the lower classes. In addition, inside the groups of national regions, the relatively highly agglomerated, urbanized and centrally located regions are to be found in higher groups compared with the sparsely populated, rural and more peripherally ones. If a simple deviation analysis compared with the medium class (40-<60 IGES) is undertaken, all or at least the majority of regions in Belgium, France, Germany and The Netherlands in both years are found in the higher classes. For Denmark and the United Kingdom, this is only true for the 2nd cross section year, whereas in the 1st year, the majority of British and Danish regions is to be found in the low category. The Irish regions - with only one exception in the 1st year - are always concentrated in the very low group, whereas the Greek regions are split up between the very low and the low category. Italy presents a somewhat special case, because it is the only country that covers all five classes from very low to very high in the first year and still has its regions allocated to four classes in the second year from very low to high. Denmark also covers four of the five quintiles in the 2nd year, although the majority of regions is clearly in the medium group. As to Italy, this stresses the often mentioned "dual" nature of the country with highly developed regions in the North and less developed regions in the South.

TABLE 15.: Clustering of 139 EC-Regions According to Aggregate Infrastructure Indicator IGES for 1st and 2nd Cross Section Years.

	Very Low 0-<20	Low 20-<40	Medium 40-<60	High 60-<80	Very High 80-100
GE			1,2,4,5, 6, 7, 8, 9,12,17, 19,21,22, 23,27,31, 32,33,35	3,10,11, 13,14,15, 16,20,24, 25,26,28, 29,30,34, 36,37	18
FR		39,40,43, 44,45,49, 51,54,56	41,42,46, 47,48,50, 52,53,55, 57,58		38
IT	73	74,75,76	60,64,65, 69,70,71, 72,77,78	59,62,63, 66,67,68	61
NL			79,80,86,	81,82,87, 88	83,84,85
BE		90,94,95, 97	89,91,92, 93,96		
LU				98	
UK	109	99,100, 101,102, 105,107, 108	103,104, 106		
IR	110,111, 112,113, 115,116, 117,118	114			
DK		121,122, 123,124, 125,127, 129,130	119,126, 128	120	
GR	134,135, 136,138	131,132, 133,137, 139			

Table 15 continued: Second Cross-Section Year

	Very Low 0-<20	Low 20-<40	Medium 40-<60	High 60-<80	Very High 80-100
GE			1, 2, 4, 5, 6, 7, 19,22,23, 32,33,35	3, 8, 9, 10,11,12, 13,14,17, 20,21,25, 26,27,30, 31,34,36, 37	15,16,18, 24,28,29
FR			39,40,42, 43,44,45, 46,49,50, 51,54,56	38,41,47, 48,52,53, 55,57,58	
IT	73,75	69,70,71, 72,74,76, 77,78	59,60,62, 63,64,65, 66,67,68	61	
NL			86	79,80,81, 82,87,88	83,84,85
BE			90,91,92, 93,95,97,	89,94,96	
LU					98
UK		109	99,100, 101,102, 103,104, 105,106, 107,108		
IR	110,111, 112,113, 114,115, 116,117, 118				
DK		122	121,123, 124,125, 127,128, 129,130	119,126	120
GR	132,133 134,135, 136,137, 138	131,139			

Source: Table 10. Numbers represent regions.

FIGURE 4.: Frequency Distribution of Infrastructure Indicators IGES, 1st and 2nd Cross Section Years, 139 EC-Regions

```
IGES01

                 *
              ****
              ****
              ****
        *     ****
     ****     ****
     ****     ****     *
     ****     ****  ****
     ****     ****  ****
     ****     ****  ****
   **  ****     ****  ****
  ****  ****  ****  ****
  ****  ****  ****  ****    **
  ****  ****  ****  ****  ****
--++++--++++--++++--++++--++++--
  14    37    53    29    6
--++++--++++--++++--++++--++++--

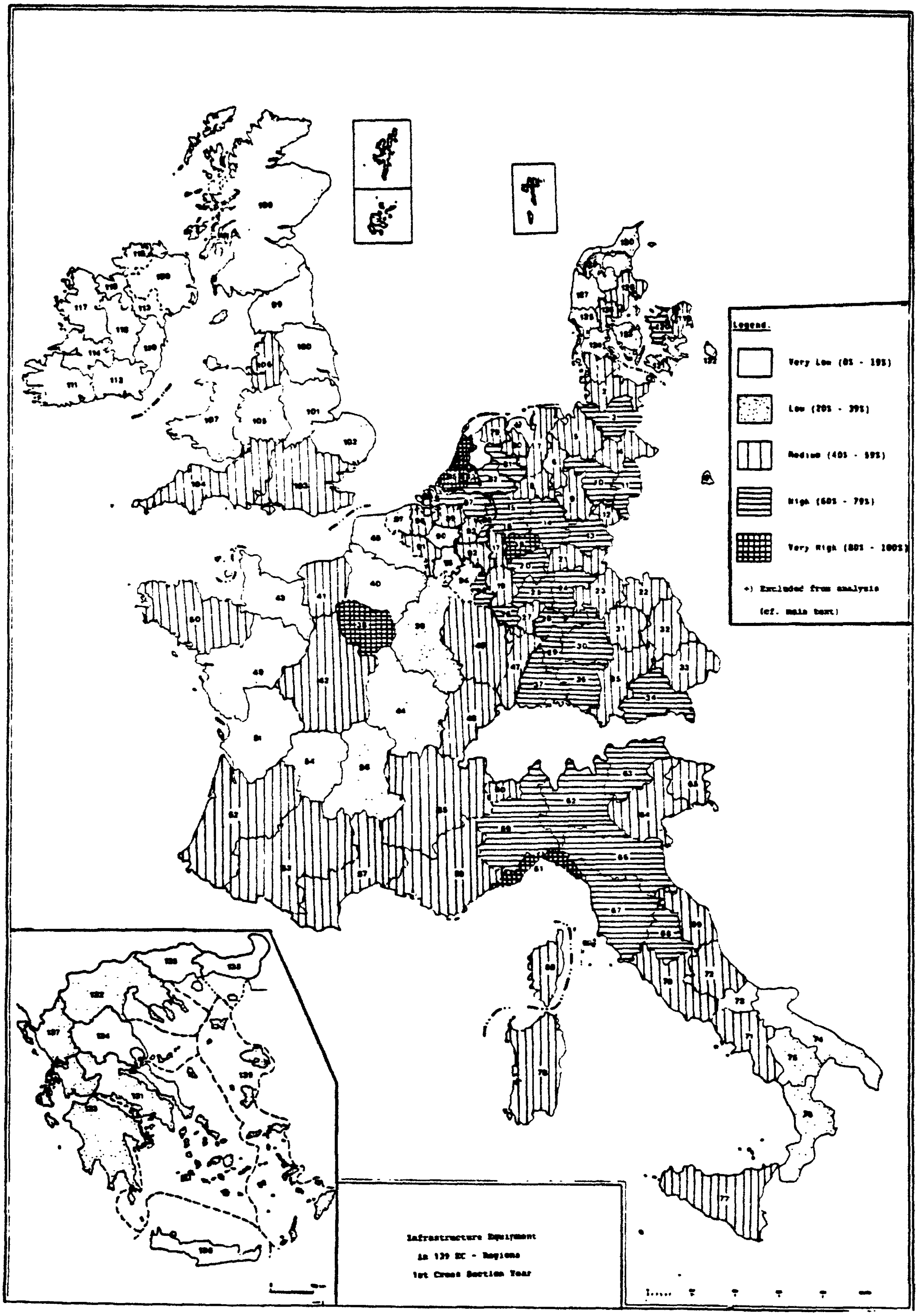
---------------------------------------------

IGES02

                **
              ****
              ****
              ****
              ****
              ****  ****
              ****  ****
              ****  ****
              ****  ****
              ****  ****
    **        ****  ****
  ****        ****  ****
  ****  ****  ****  ****   ***
  ****  ****  ****  ****  ****
  ****  ****  ****  ****  ****
--++++--++++--++++--++++--++++--
  18    12    58    40    11
--++++--++++--++++--++++--++++--
```

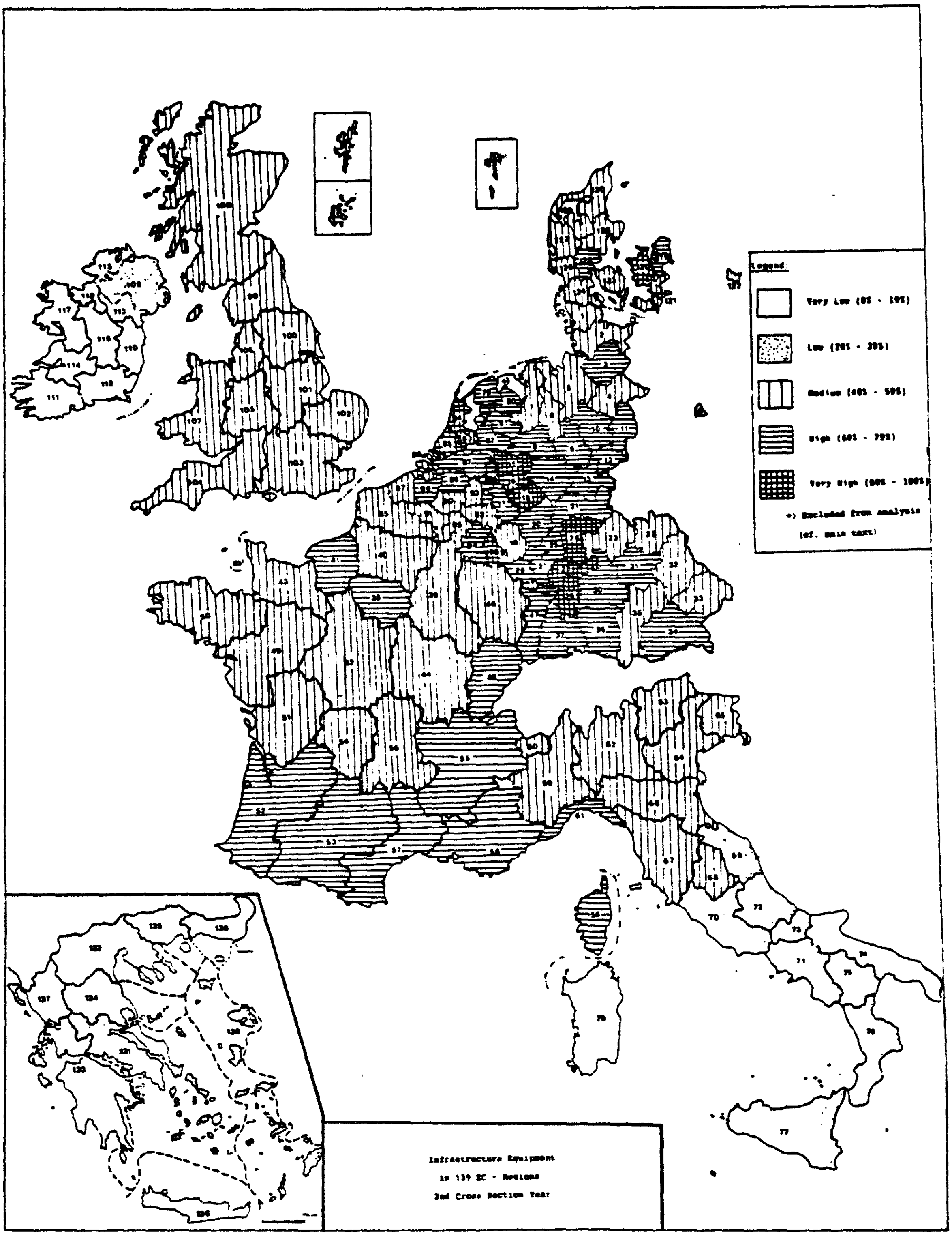
MAP 1

Infrastructure Equipment in 139 EC-Regions, 1st Cross Section Year



MAP 2

Infrastructure Equipment in 139 EC-Regions, 2nd Cross Section Year



(2) As FIGURE 4 demonstrates, the frequency distribution has changed considerably between the beginning and the end of the 70s. In the 1st year, there is a rough approximation to normal distribution, whereas IGES02 shows a clear deviation. Due to the fact that in the 2nd year, many regions improved their positions from low to medium in one group of member countries, whereas others fell back from low to very low in other countries, the low class only has 12 regions compared with 18 in the very low and 58 in the medium range. This change can clearly be seen in the French case on the one hand and the Greek case on the other. In France with the exception of Ile de France in the 1st year, all regions have been concentrated in the low and medium class and moved up into the medium and high class in the 2nd year. This demonstrates a clear improvement in relative position, given the fact that for each cross section year, the best equipped region has been set equal to 100. On the basis of that measurement procedure, a region which only experiences an average increase in infrastructure equipment will remain in the same class in both cross section years, whereas regions improving more than proportionately will move up to a higher class and regions which cannot reach the same average improvement will fall back into a lower class. If TABLE 15 is interpreted from this relative point of view, a faster than average increase in equipment seems to have been the case in France, Belgium, the United Kingdom and Denmark. In Germany, the situation remained roughly constant as far as the positions of German regions in relation to the three higher classes are concerned, although now six instead of one region are to be found in the very high group in the 2nd year.

(3) Long-term regional development is always connected with dynamic changes. It is possible, therefore, that in periods of faster growth interregional disparities may increase, but that in the following phase, a certain "catching-up" effect may take place. This can occur due to the fact that innovations introduced in the centrally located or more agglomerated regions may begin to spread on other regions and may help them to gain comparative advantages, such that they are able to overtake the innovators. [This is sometimes referred to as the "Law of Williamson", but it is not always empirically verified. It does not seem to apply in the Italian case, for example.] This appears to be at least a part of the explanation for the relative decline of many of the "old", but highly developed

industrialized regions on the one hand, and for the fast development of many of the "Southern" regions compared with the "Northern" on the other. A more detailed investigation of the causes of these dynamic and structural changes is needed in order to identify the role of infrastructure in this more long-term dynamic context. In this Report only the basis for such an extended analysis can be provided.

In summing up the findings of the Community Analysis obtained up to now, the basic trends as far as infrastructure equipment is concerned seems to be that overall disparities decrease both in terms of in size of the distribution and the in-between changes of relative positions. But at the same time, a majority of regions considerably improves their relative positions, whereas a minority of regions, unfortunately belonging to the less well developed member countries, could not keep pace with the general development. In order to gain a more detailed insight into the reasons and the elements of this process, region-specific analyses are needed. A general analysis like the present one can show the general trends and allow a classification of problems, but it needs to be supplemented by region-specific analyses. These analyses should also be the base for regional development programs, in order to avoid increasing gaps between the already well developed and the still less developed regions of the Community.

A final point needs to be mentioned already at this stage of our analysis. When describing the income and employment disparities in section II.3. of this Report, it was noted that both types of disparities increased from the begin to the end of the seventies. These results like the ones summarized here as to infrastructure equipment are based on measures of dispersion like MMR and VC. It remains to be seen how these countercurrent developments in income and employment ont the one hand and infrastructure dotation on the other influence the regression analysis with the aid of quasi-production functions to be undertaken later [cf. X.1.].

IX.4. ANALYSIS OF THE CORRELATION BETWEEN INFRASTRUCTURE AND REGIONAL DEVELOPMENT INDICATORS

TABLE 16 presents a summary of the findings of the National Reports regarding the correlation (Pearson r) coefficients between the infrastructure and development indicators. Income per capita (BEPO), the indicators for the main infrastructure categories A-L and IGES have been selected for this analysis. The correlation coefficients give a first impression as to the existing statistical associations between these variables. It has to be noted that r is only a measure for linear relationships whereas those are characteristic for production functions are non-linear (e.g. logarithmic). The results of the correlation analysis can be summarized as follows:

(1) As far as the aggregate infrastructure indicator IGES is concerned, relatively high correlations are reported for all countries which calculated this indicator with the exception of IR, where the correlation is very low and negative. This may be due to the fact that for IR, mainly numbers of infrastructure facilities have been used which do not give an appropriate measure as to infrastructure capacities of the facilities concerned.

(2) High coefficients also exist in general for Transportation (except UK in both years and IT, BE and GR in the 2nd year), Communication (except BE and UK in both years, FR in the 1st and IR in the 2nd year), Energy (except DK and UK in both years, IR in the 1st and IT in the 2nd year) and partly also for Water Supply and Environmental Infrastructure where network type indicators have been used. This first group, therefore, represents basic network types of infrastructure having a high degree of publicness and contributing directly to income generation. It may be considered to represent what may be called directly productive infrastructure.

(3) As to Education, Health, Sport and Tourism, Social and Cultural Infrastructure, the correlation results vary: Partly correlation is very high, but also very low. Given the fact that these point type infrastructure categories are less comparable than the first group of

network type infrastructure, the large variation in correlation may also be due to data problems. This is especially the case for Culture. These categories are point infrastructures with a lower degree of publicness; they are more income utilization or consumption oriented infrastructures which may also be grouped together under the heading of socio-cultural infrastructure.

(4) Special Urban Infrastructure and Natural Endowment appear to represent a special group, the latter perhaps in combination with Water Infrastructure, at least as measured as for most countries on the basis of surface water and dams. Correlations for this last group appear to be generally lower than for the other groups.

As has already been explained in Part One, the second group of socio-cultural infrastructure may perhaps be considered to be more dependent on income and less determinant of it. It will certainly depend upon the type of social and cultural policy pursued in a particular country as to whether or not there is a relatively strong or weak relationship with income. When compared with the directly productive network infrastructure group, more cases appear with negative signs, altough this could be due to definitional and measurement problems or to the lack of weighting possibilities.

Test calculations and estimations show that weighting plays an important role in this context. This can be readily appreciated in relation to the possible variation in quality levels of say a highway compared with a small local road, or when a place in a primary school is compared with one in a university. If road kilometers are implicitly weighted by a factor of one by simply adding up the road kilometer figures for the different categories, it is obvious that a region with the same road kilometer total as another region, but with a higher share of motorways, would be set equal to the latter region with a significantly lower service quality level. A simple weighting procedure, such as on the basis of differences in road width, or, better still, with the aid of specific information regarding standard speeds and potential numbers of cars travelling per hour, can improve the explanatory power of the infrastructure variable considerably. Accordingly, in those cases where suitable information has been available, both in the national and the Community Analyses infrastructure indicators have been weighted on the basis of factors such as road kilometers by width, waterways by maximum ship capacity, electricity networks by voltage etc. Examples are given in some National Reports, e.g. for the Federal Republic of Germany, France and Italy. In the French National Report, a weighting system based on monetary capital stock values has been successfully tried, too.

As already noted, production relationships are usually not linear. The correlation coefficients presented in TABLE 16 will, therefore, underestimate the importance of infrastructure. This will subsequently become clear, when the results of the estimation of production functions based on a double logarithmic type are presented.

Statistical representativity is further weakened by the fact that the reported correlations in some countries, are based on a very low number of observations according to the number of regions for which data are available.

Instead of calculating simple coefficients of correlation and comparing them with the results of the National Reports presented above, it seems to be reasonable to estimate singular regression functions for the different infrastructure indicators, to continue by estimating modified Cobb-Douglas production functions containing infrastructure as a capital element and finally, to estimate quasi-production functions based on the full set of potentiality factors. The results of these analyses are presented in the following chapter.

However, in order to give a first visual impression of the relationship between infrastructure and the development indicator income per capita (BEPO) for all Community regions taken together, FIGURES 5 to 12 show scattergrams for selected infrastructure categories and for IGES.

TABLE 16.: Correlation Coefficients for Linear Relationships Between
Income per Capita and infrastructure Categories for Both Cross Section Years According to National Reports.

Infrastructure Categories	BELGIUM		DENMARK		FRANCE	
	01	02	01	02	01	02
A.Transportation	0.71	0.27	0.52	0.59	0.66	0.65
B.Communication	0.26	0.23	0.71	0.68	-0.05	0.50
C.Energy Supply	0.59	0.71	0.18	0.35	0.72	0.76
D.Water Supply	n.a.	n.a.	n.a.	n.a.	0.15	0.13
E.Environmental	-0.43	-0.23	n.a.	n.a.	0.57	0.29
F.Education	0.34	0.18	0.88	0.75	-0.29	-0.54
G.Health	0.75	0.37	0.81	0.61	0.16	-0.12
H.Special Urban	-0.37	-0.37	0.81	0.63	0.27	0.10
I.Sport, Tourism	-0.51	-0.56	-0.60	-0.63	-0.57	-0.57
J.Social	0.84	0.13	0.76	0.78	0.03	0.05
K.Cultural	-0.44	0.02	0.89	0.83	-0.31	-0.31
L.Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IGES	n.a.	n.a.	0.92	0.86	0.38	0.41

Table 16 continued

Infrastructure Categories	GERMANY Variant A +		GERMANY Variant B *	
	01	02	01	02
A.Transportation	0.69	0.69	0.65	0.63
B.Communication	0.68	0.76	0.68	0.62
C.Energy Supply	0.69	0.60	0.69	0.61
D.Water Supply	0.15	-0.17	0.22	0.07
E.Environmental	0.66	0.42	0.54	0.49
F.Education	0.16	0.16	0.62	0.55
G.Health	0.20	0.17	0.56	0.52
H.Special Urban	n.a.	n.a.	n.a.	n.a.
I.Sport, Tourism	0.61	0.38	0.56	0.52
J.Social	0.72	0.62	0.56	0.54
K.Cultural	-0.27	-0.36	-0.66	-0.65
L.Natural	-0.23	-0.27	-0.28	-0.31
IGES	0.82	0.71	0.68	0.62

+) Same calculations as for other countries
*) All indicators related to area

Table 16 continued

Infrastructure Category	GREECE		IRELAND		ITALY	
	01	02	01	02	01	02
A.Transportation	0.67	0.32	n.a.	0.61	0.40	0.23
B.Communication	0.90	0.87	n.a.	0.33	0.69	0.83
C.Energy Supply	0.91	0.91	n.a.	-0.08	0.29	0.74
D.Water Supply	n.a.	n.a.	n.a.	n.a.	0.87	0.89
E.Environmental	n.a.	n.a.	n.a.	-0.22	n.a.	0.57
F.Education	0.84	0.82	n.a.	0.39	0.11	0.31
G.Health	0.36	0.17	n.a.	0.75	0.74	0.64
H.Special Urban	-0.72	-0.52	n.a.	-0.36	n.a.	n.a.
I.Sport, Tourism	-0.71	-0.80	n.a.	0.03	0.34	0.50
J.Social	n.a.	n.a.	n.a.	0.24	0.75	0.84
K.Cultural	-0.13	-0.27	n.a.	-0.53	0.56	0.54
L.Natural	0.29	0.45	n.a.	n.a.	0.04	0.17
IGES	0.59	0.43	n.a.	-0.14	0.79	0.85

Table 16 continued

Infrastructure Category	NETHERLANDS		UNITED KINGDOM	
	01	02	01	02
A.Transportation	0.85	0.51	0.03	-0.13
B.Communication	0.93	0.67	-0.12	-0.07
C.Energy Supply	0.86	0.56	0.01	0.38
D.Water Supply	0.78	0.51	-0.28	-0.13
E.Environmental	0.04	0.36	0.05	0.14
F.Education	-0.51	-0.36	-0.32	-0.81
G.Health	-0.05	0.02	0.30	-0.22
H.Special Urban	0.39	0.79	-0.24	-0.10
I.Sport, Tourism	-0.36	-0.44	n.a.	-0.18
J.Social	-0.05	0.17	0.54	0.79
K.Cultural	0.10	-0.20	0.04	0.34
L.Natural	-0.44	-0.51	-0.04	-0.10
IGES	0.81	0.64	n.a.	n.a.

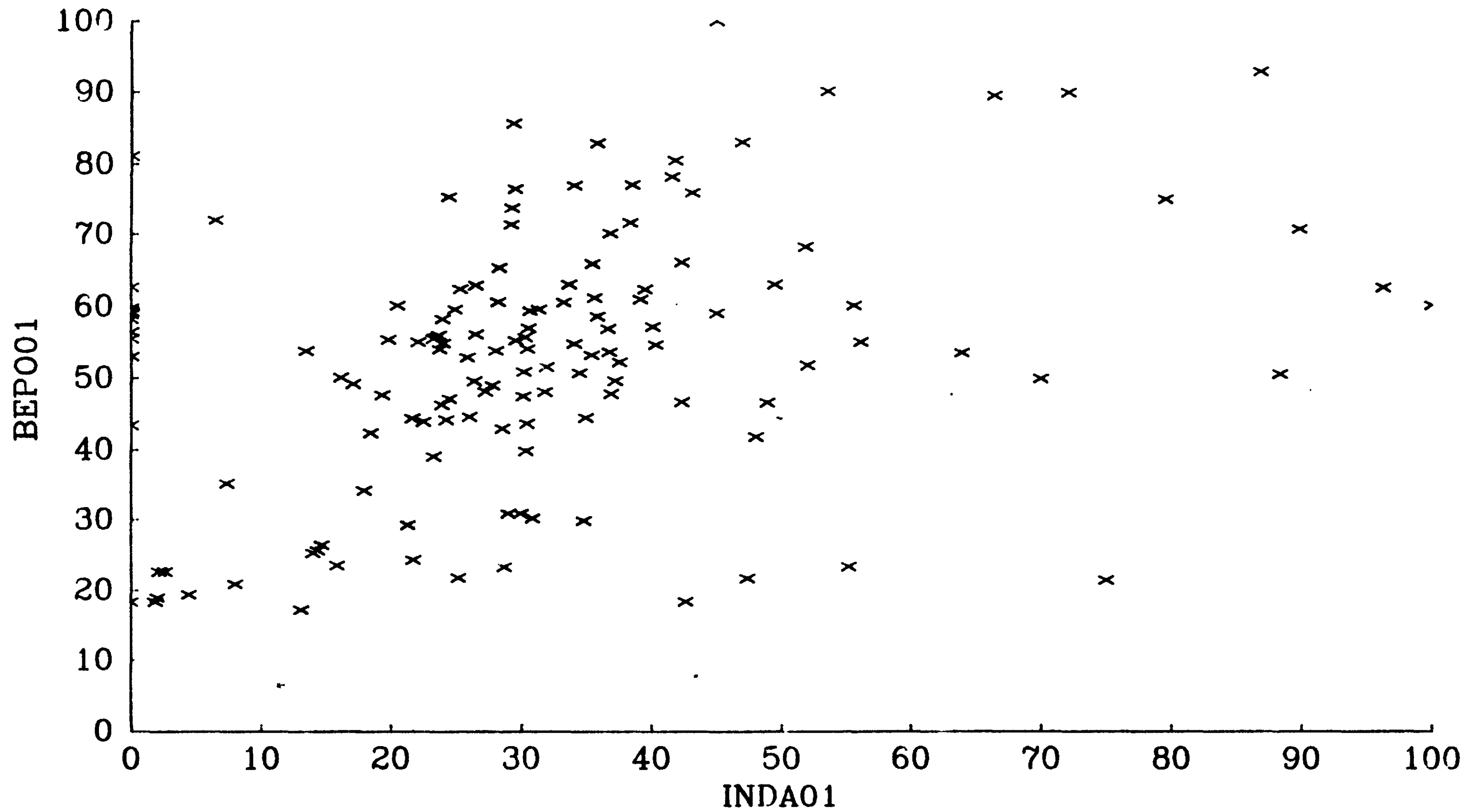


FIGURE 5.: Scattergram of Correlation for BEPO01 and INDA01

The Income Values BEPO are normalized: Maximum Region is set equal to 100

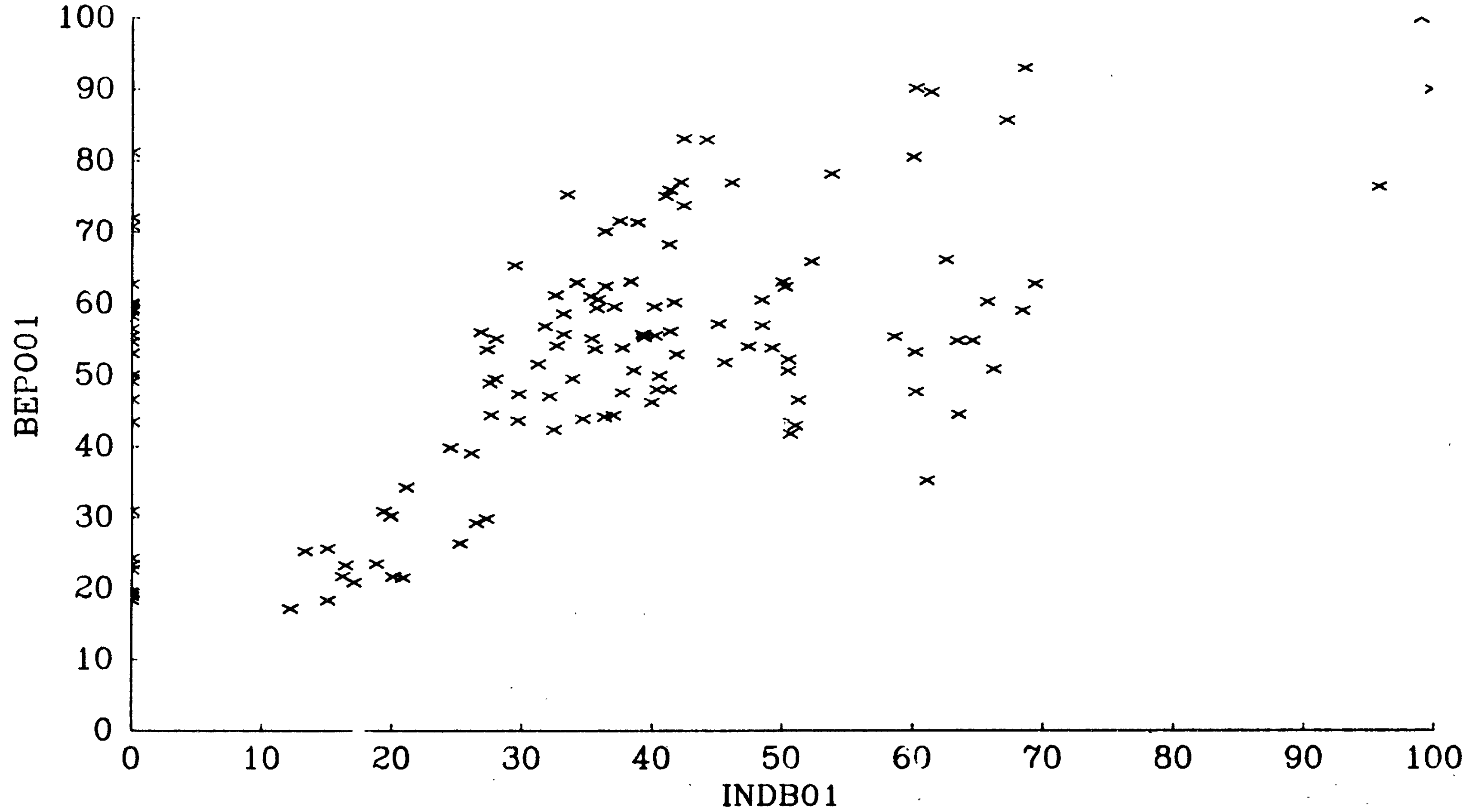


FIGURE 6 Scattergram of Correlation for BEPO01 and INDB01

The Income Values BEPO are normalized: Maximum Region is set equal to 100

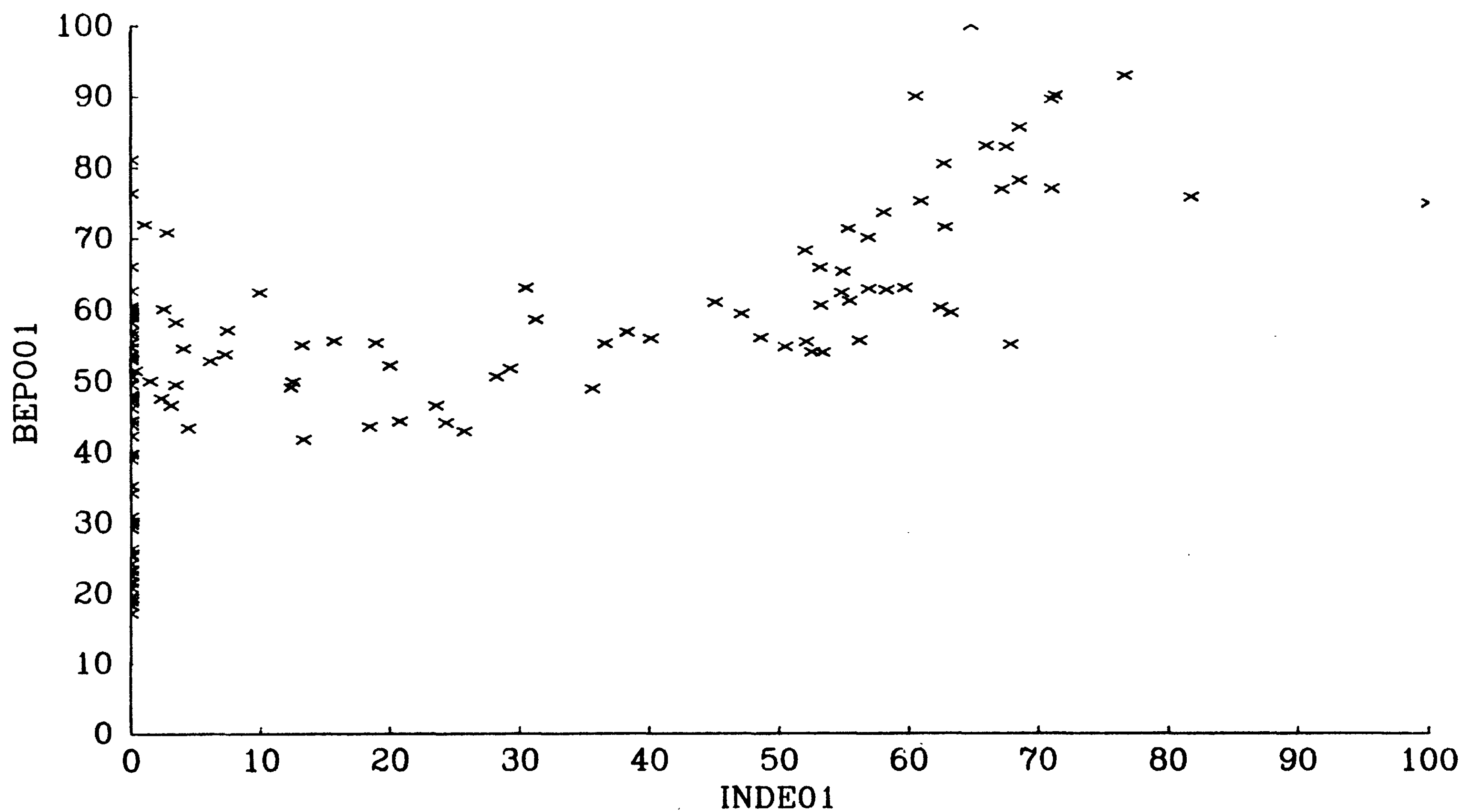


FIGURE 7. Scattergram of Correlation for BEPOO1 and INDE01

The Income Values BEPO are normalized: Maximum Region is set equal to 100.

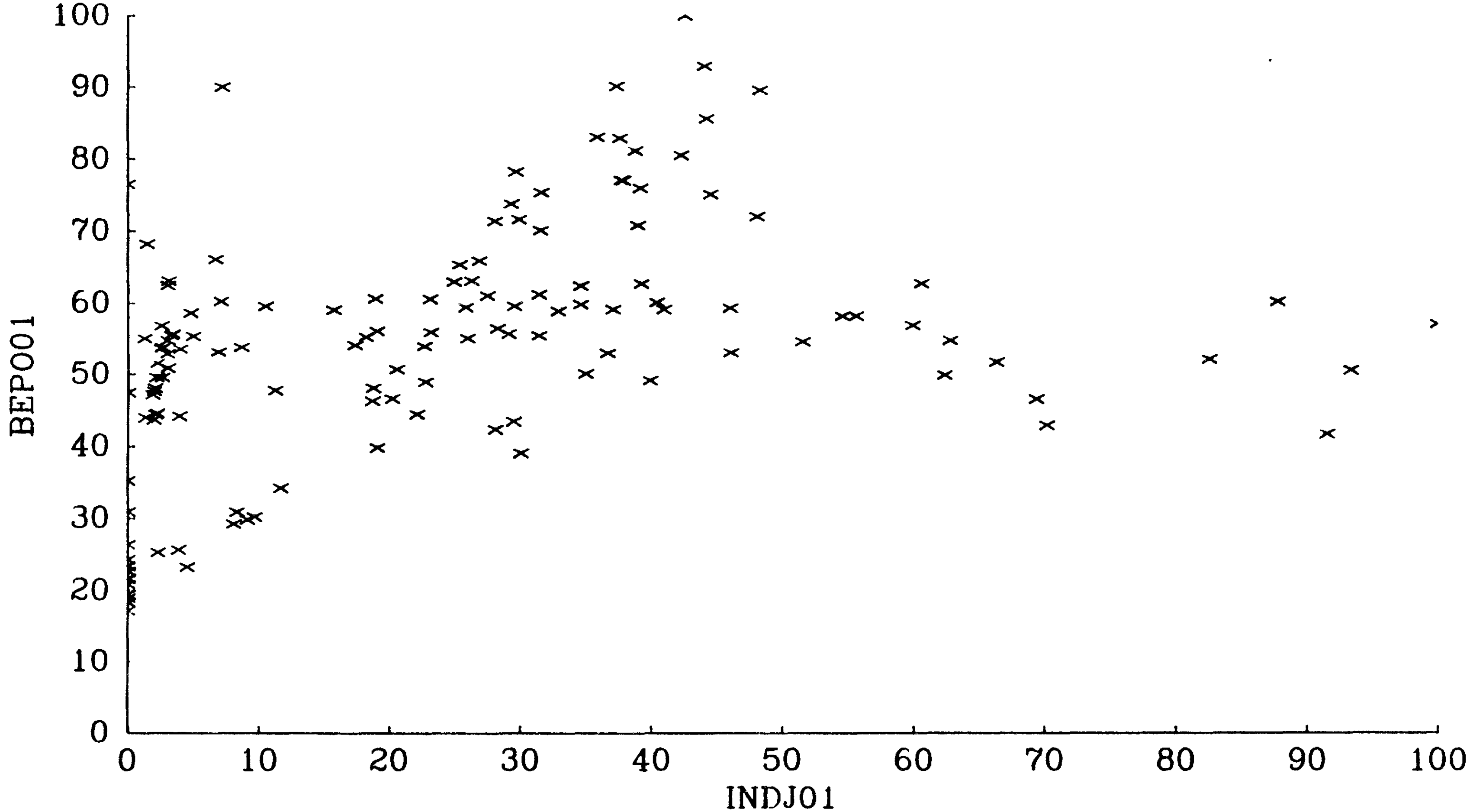


FIGURE 8. Scattergram of Correlation for BEPO01 and INDJ01

The Income Values BEPO are normalized: Maximum Region is set equal to 100

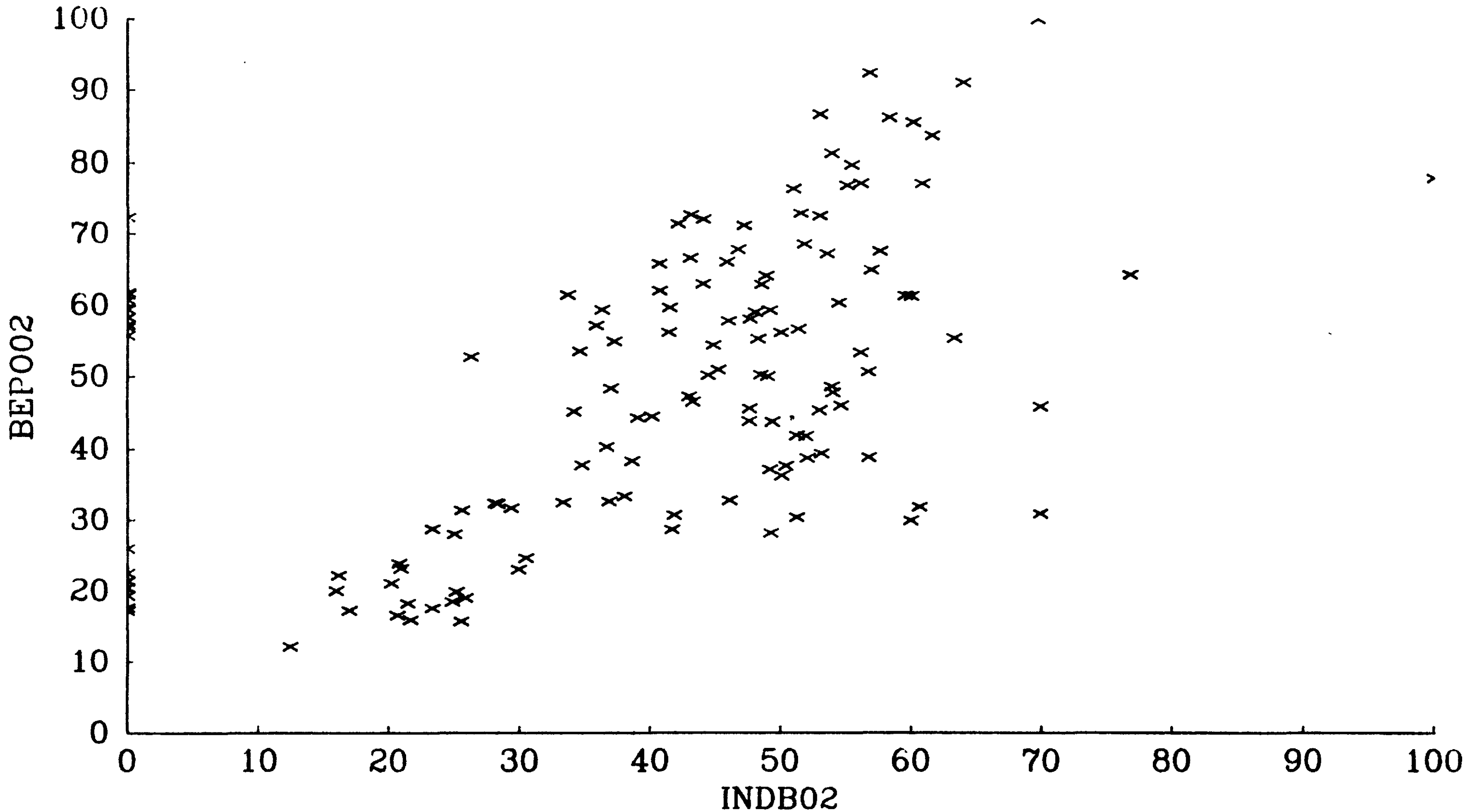


FIGURE 9.: Scattergram of Correlation for BEPO02 and INDB02

The Income Values BEPO are normalized: Maximum Region is set equal to 100

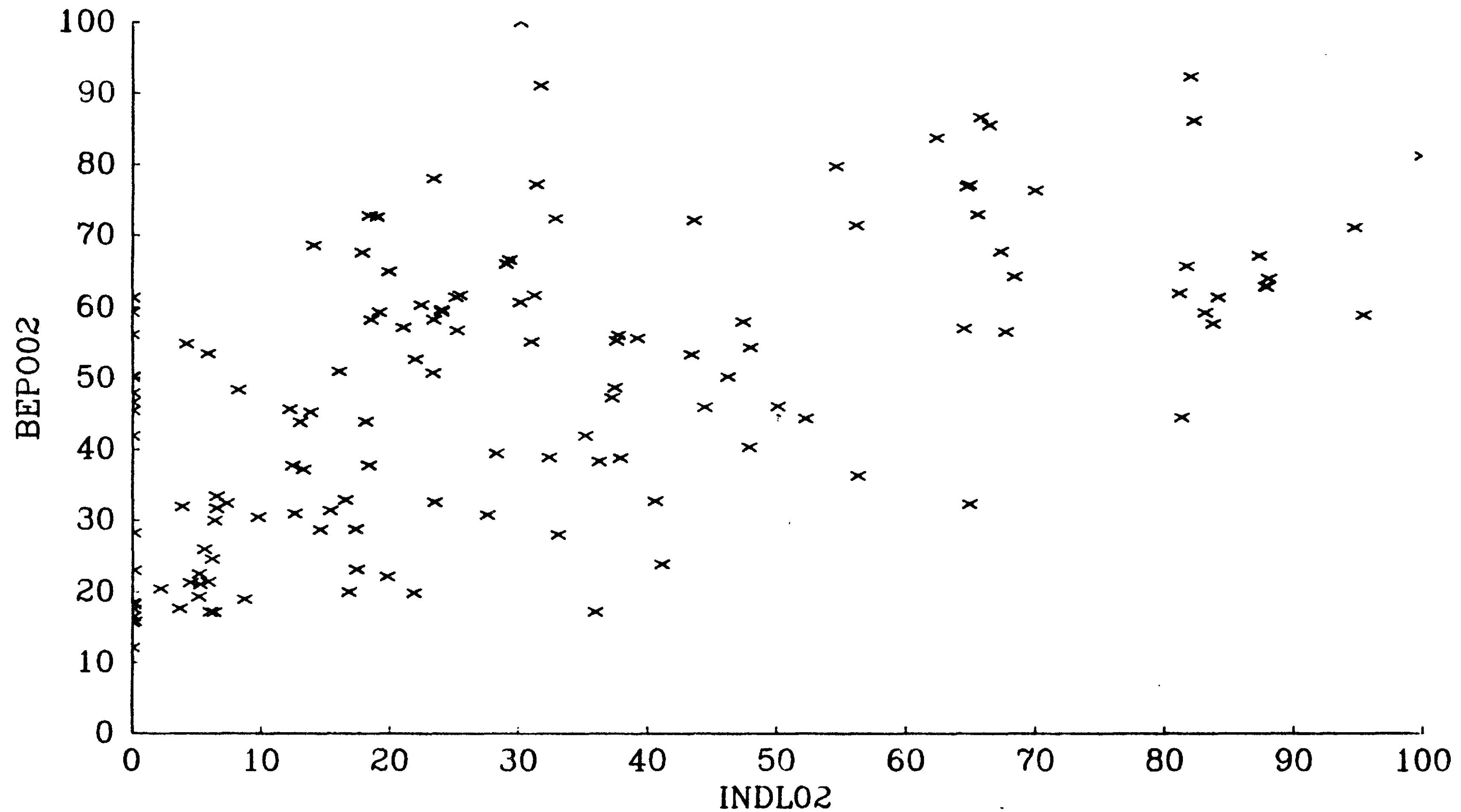


FIGURE 10. Scattergram of Correlation for BEPOO2 and INDL02

The Income Values BEPO are normalized: Maximum Region is set equal to 100

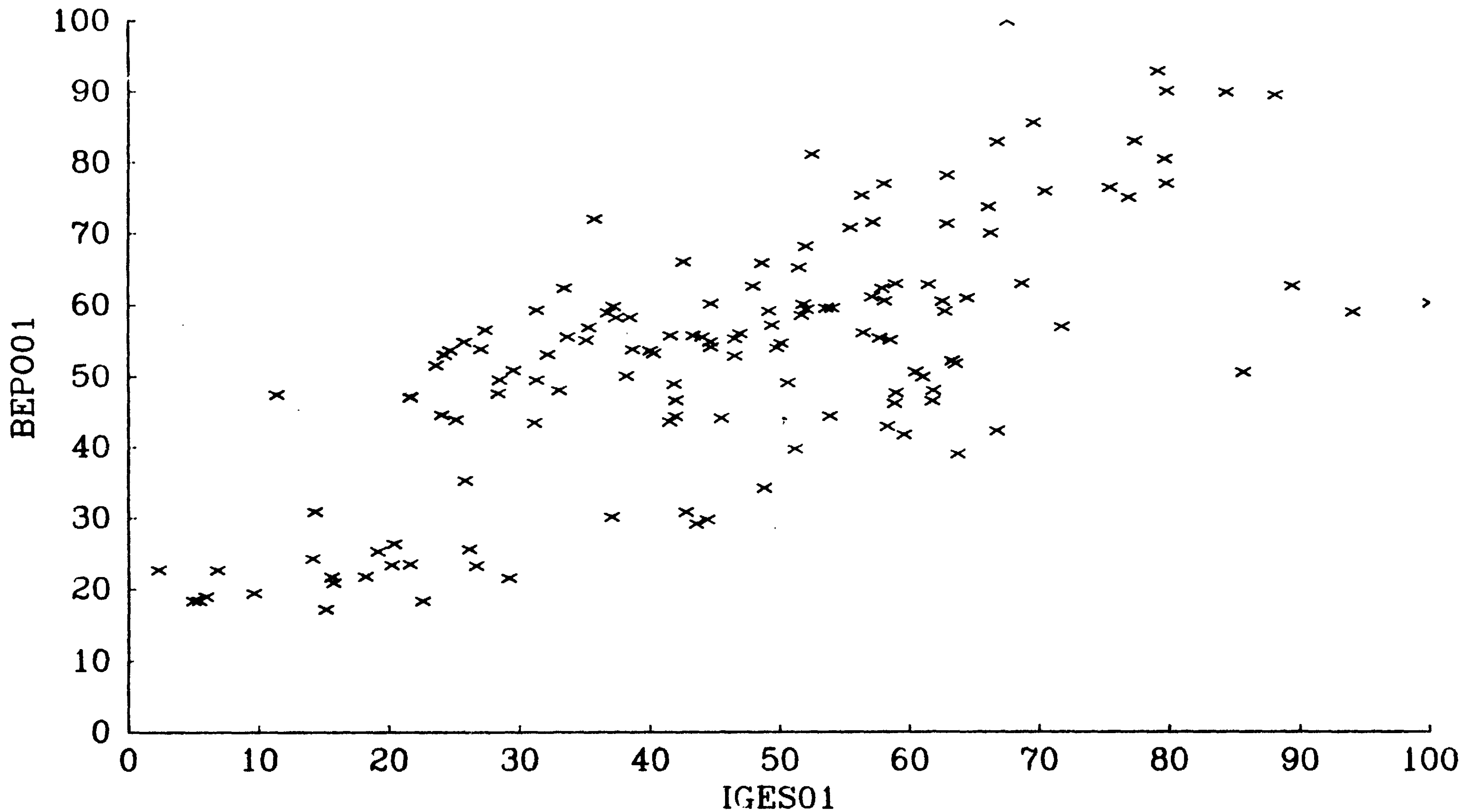


FIGURE 11.: Scattergram of Correlation for BEPO01 and IGES01

The Income Values BEPO are normalized: Maximum Region is set equal to 100

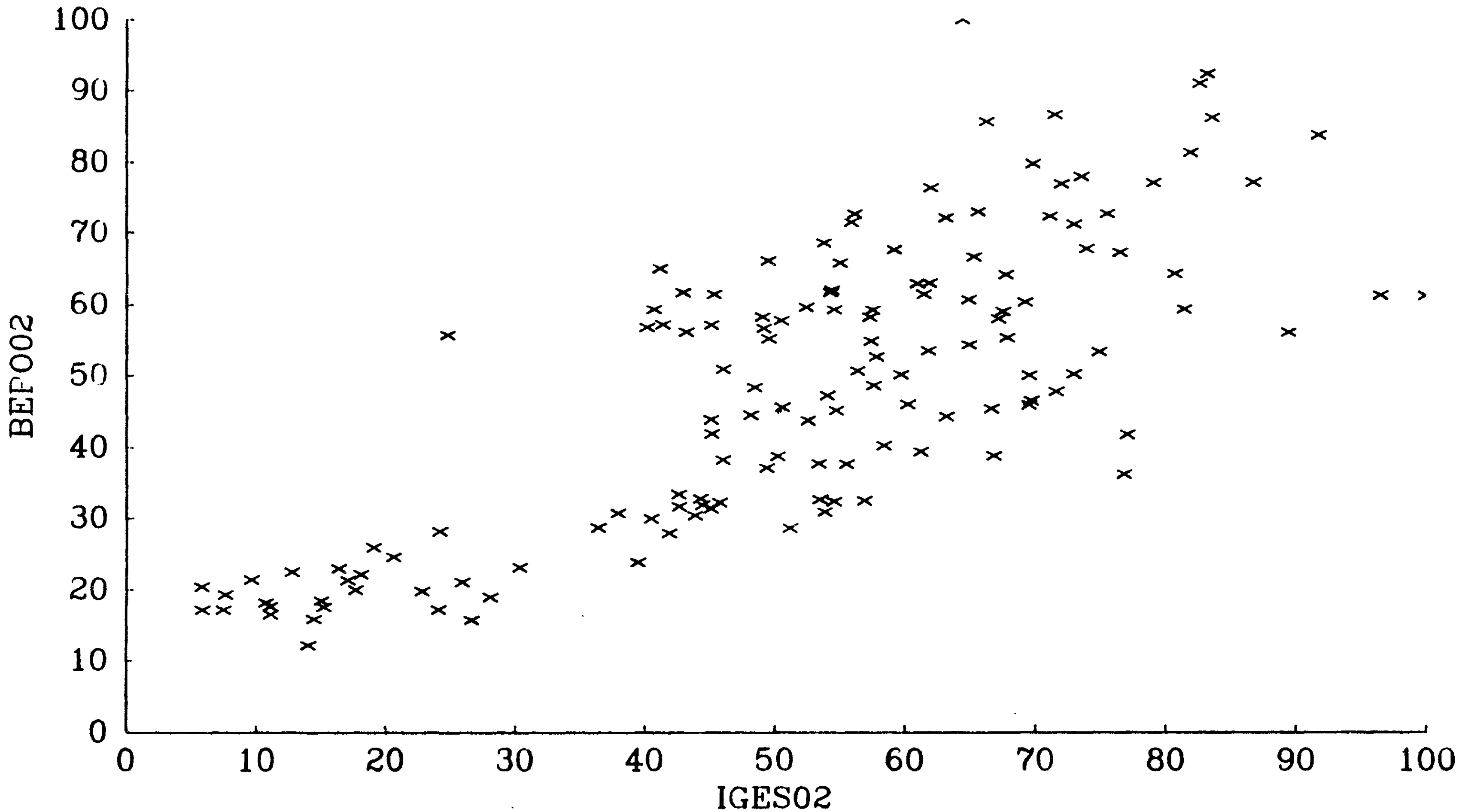


FIGURE 12.: Scattergram of Correlation for BEPOO2 and IGES02

The Income Values BEPO are normalized: Maximum Region is set equal to 100

X. INFRASTRUCTURE AS A CAPITAL INPUT IN A REGIONAL PRODUCTION FUNCTION

X.1. A SIMPLE INFRASTRUCTURE PRODUCTION FUNCTION

The first proposition of the potentiality factor approach to be tested is the assertion that the infrastructure equipment of a region determines regional income and employment. Given the fact that infrastructure is but one of the full potentiality factors set, it can be expected that the influence of infrastructure is exaggerated if infrastructure is tested in isolation. It may attract a part of the explanatory power due to other potentiality factors. However, this test is important, first in order to see if the regression coefficients have the expected sign and really are significant and not only the function as such, and second, to investigate how the contribution of infrastructure changes when other variables are introduced in a fully specified production function.

TABLE 17 presents the results for a number of singular quasi-production functions with infrastructure indicators as exogenous and selected development indicators as endogenous variables. In conformity with the usual production function approach, they are double-logarithmic functions of the type

$$\log DI=f(\log INFRA),$$

where 'DI' means development indicator and 'INFRA' means infrastructure indicator. The Table shows for each cross section year singular quasi-production functions for 10 selected income variables and 6 employment variables. Each function is characterized by its number of observations NN (number of regions for which the respective data are available), the adjusted coefficient of determination RSQA, and by an asterisk (*) preceding the positive (or sometimes negative) sign in case a regression coefficient is significant at the 95 percent level for one of the main infrastructure categories A - L and for IGES.

TABLE 17.: Adjusted Coefficients of Determination RSQA and Significance of Regression Coefficients for Singular Infrastructure Quasi-Production Functions with Selected Development Indicators, 1st and 2nd Cross Section Years

1st Cross section Year				2nd Cross section Year			
DI	NN	RSQA	IN	DI	NN	RSQA	IN
BEP001	125	.2874	INDA01**+	BEP002	138	.2669	INDA02**+
BEP001	109	.5776	INDB01**+	BEP002	118	.5730	INDB02**+
BEP001	122	.0406	INDC01**+	BEP002	133	.0828	INDC02**+
BEP001	74	.2169	INDE01**+	BEP002	118	.1916	INDE02**+
BEP001	118	.0639	INDF01**+	BEP002	119	.0413	INDF02**+
BEP001	121	.0171	INDG01**+	BEP002	130	-.0033	INDG02 +
BEP001	119	.1237	INDJ01**+	BEP002	128	.3791	INDJ02**+
BEP001	96	.0004	INDK01 +	BEP002	139	.0931	INDK02**+
BEP001	121	.0372	INDL01**+	BEP002	127	.4383	INDL02**+
BEP001	139	.5706	IGES01**+	BEP002	139	.6699	IGES02**+
BKP001	116	.4156	INDA01**+	BKP002	129	.3658	INDA02**+
BKP001	100	.5522	INDB01**+	BKP002	109	.4609	INDB02**+
BKP001	121	.0740	INDC01**+	BKP002	130	.1434	INDC02**+
BKP001	74	.1931	INDE01**+	BKP002	109	.4335	INDE02**+
BKP001	109	.0150	INDF01 +	BKP002	110	.0336	INDF02**+
BKP001	121	.0556	INDG01**+	BKP002	121	-.0033	INDG02 -
BKP001	119	.1502	INDJ01**+	BKP002	119	.1302	INDJ02**+
BKP001	87	.0047	INDK01 -	BKP002	130	-.0076	INDK02 -
BKP001	112	.0415	INDL01**+	BKP002	120	.3905	INDL02**+
BKP001	130	.5762	IGES01**+	BKP002	130	.6024	IGES02**+
BEEM01	125	.3061	INDA01**+	BEEM02	129	.2421	INDA02**+
BEEM01	109	.5975	INDB01**+	BEEM02	118	.5184	INDB02**+
BEEM01	122	.0977	INDC01**+	BEEM02	124	.0649	INDC02**+
BEEM01	74	.1243	INDE01**+	BEEM02	118	.1182	INDE02**+
BEEM01	118	.0455	INDF01**+	BEEM02	119	.0153	INDF02**+
BEEM01	121	.0040	INDG01 +	BEEM02	130	-.0026	INDG02 +
BEEM01	119	.3003	INDJ01**+	BEEM02	128	.3895	INDJ02**+
BEEM01	96	.0202	INDK01**+	BEEM02	130	.0856	INDK02**+
BEEM01	121	.0386	INDL01**+	BEEM02	118	.4275	INDL02**+
BEEM01	139	.6408	IGES01**+	BEEM02	130	.6971	IGES02**+
BKEM01	116	.4707	INDA01**+	BKEM02	120	.3849	INDA02**+
BKEM01	100	.5468	INDB01**+	BKEM02	109	.4277	INDB02**+
BKEM01	121	.1654	INDC01**+	BKEM02	121	.1954	INDC02**+
BKEM01	74	.0588	INDE01**+	BKEM02	109	.2320	INDE02**+
BKEM01	109	-.0056	INDF01 +	BKEM02	110	-.0035	INDF02 +
BKEM01	121	.0347	INDG01**+	BKEM02	121	-.0054	INDG02 -
BKEM01	119	.3470	INDJ01**+	BKEM02	119	.1440	INDJ02**+
BKEM01	87	-.0103	INDK01 -	BKEM02	121	.0065	INDK02 -
BKEM01	112	.0424	INDL01**+	BKEM02	111	.2370	INDL02**+
BKEM01	130	.6676	IGES01**+	BKEM02	121	.5993	IGES02**+

Table 17 continued

1st Cross section Year				2nd Cross section Year			
DI	NN	RSQA	IN	DI	NN	RSQA	IN
BGEGE1	117	.1563	INDA01**+	BGEGE2	118	.2428	INDA02**+
BGEGE1	109	.4731	INDB01**+	BGEGE2	118	.4629	INDB02**+
BGEGE1	122	.0326	INDC01**+	BGEGE2	112	.0532	INDC02**+
BGEGE1	74	.1839	INDE01**+	BGEGE2	106	.1700	INDE02**+
BGEGE1	118	.0310	INDF01**+	BGEGE2	107	.0166	INDF02**+
BGEGE1	121	-.0080	INDG01 +	BGEGE2	118	-.0086	INDG02 +
BGEGE1	119	.3827	INDJ01**+	BGEGE2	116	.3637	INDJ02**+
BGEGE1	88	.0981	INDK01**+	BGEGE2	118	.0901	INDK02**+
BGEGE1	120	.0394	INDL01**+	BGEGE2	106	.3670	INDL02**+
BGEGE1	130	.5408	IGES01**+	BGEGE2	118	.6217	IGES02**+
BGEGK1	108	.2202	INDA01**+	BGEGK2	109	.2431	INDA02**+
BGEGK1	100	.3884	INDB01**+	BGEGK2	109	.3776	INDB02**+
BGEGK1	121	.0796	INDC01**+	BGEGK2	109	.0660	INDC02**+
BGEGK1	74	.1008	INDE01**+	BGEGK2	97	.3975	INDE02**+
BGEGK1	109	-.0085	INDF01 +	BGEGK2	98	.0020	INDF02 +
BGEGK1	121	.0090	INDG01 +	BGEGK2	109	.0316	INDG02*-
BGEGK1	119	.4720	INDJ01**+	BGEGK2	107	.1990	INDJ02**+
BGEGK1	79	-.0022	INDK01 +	BGEGK2	109	-.0089	INDK02 +
BGEGK1	111	.0381	INDL01**+	BGEGK2	99	.2764	INDL02**+
BGEGK1	121	.4690	IGES01**+	BGEGK2	109	.5460	IGES02**+
BEFL01	125	.4180	INDA01**+	BEFL02	138	.5193	INDA02**+
BEFL01	109	.4327	INDB01**+	BEFL02	118	.3216	INDB02**+
BEFL01	122	.1358	INDC01**+	BEFL02	133	.3149	INDC02**+
BEFL01	74	.0906	INDE01**+	BEFL02	118	.0433	INDE02**+
BEFL01	118	.1339	INDF01**+	BEFL02	119	.1090	INDF02**+
BEFL01	121	.0560	INDG01**+	BEFL02	130	.0384	INDG02**+
BEFL01	119	.1670	INDJ01**+	BEFL02	128	.1758	INDJ02**+
BEFL01	96	-.0088	INDK01 -	BEFL02	139	.0167	INDK02**+
BEFL01	121	.0078	INDL01 +	BEFL02	127	.2308	INDL02**+
BEFL01	139	.5524	IGES01**+	BEFL02	139	.6211	IGES02**+
BKFL01	116	.5068	INDA01**+	BKFL02	129	.6113	INDA02**+
BKFL01	100	.2767	INDB01**+	BKFL02	109	.1223	INDB02**+
BKFL01	121	.1471	INDC01**+	BKFL02	130	.3532	INDC02**+
BKFL01	74	.0808	INDE01**+	BKFL02	109	.0674	INDE02**+
BKFL01	109	.0882	INDF01**+	BKFL02	110	.0774	INDF02**+
BKFL01	121	.0652	INDG01**+	BKFL02	121	-.0028	INDG02 +
BKFL01	119	.1637	INDJ01**+	BKFL02	119	.0247	INDJ02**+
BKFL01	87	.0321	INDK01 -	BKFL02	130	.0005	INDK02 -
BKFL01	112	.0031	INDL01 +	BKFL02	120	.0935	INDL02**+
BKFL01	130	.4950	IGES01**+	BKFL02	130	.4852	IGES02**+

Table 17 continued

1st Cross section Year				2nd Cross section Year			
DI	NN	RSQA	IN	DI	NN	RSQA	IN
BGFLE1	117	.3236	INDA01*+	BGFLE2	118	.4498	INDA02*+
BGFLE1	109	.4518	INDB01*+	BGFLE2	118	.3394	INDB02*+
BGFLE1	122	.1354	INDC01*+	BGFLE2	112	.2273	INDC02*+
BGFLE1	74	.0952	INDE01*+	BGFLE2	106	.0484	INDE02*+
BGFLE1	118	.1390	INDF01*+	BGFLE2	107	.0992	INDF02*+
BGFLE1	121	.0595	INDG01*+	BGFLE2	118	.0410	INDG02*+
BGFLE1	119	.1635	INDJ01*+	BGFLE2	116	.2421	INDJ02*+
BGFLE1	88	-.0114	INDK01 +	BGFLE2	118	.0784	INDK02*+
BGFLE1	120	-.0025	INDL01 +	BGFLE2	106	.2318	INDL02*+
BGFLE1	130	.4707	IGES01*+	BGFLE2	118	.5882	IGES02*+
BGFLK1	108	.4268	INDA01*+	BGFLK2	109	.5385	INDA02*+
BGFLK1	100	.2847	INDB01*+	BGFLK2	109	.1280	INDB02*+
BGFLK1	121	.1468	INDC01*+	BGFLK2	109	.2308	INDC02*+
BGFLK1	74	.0858	INDE01*+	BGFLK2	97	.1033	INDE02*+
BGFLK1	109	.0918	INDF01*+	BGFLK2	98	.0546	INDF02*+
BGFLK1	121	.0686	INDG01*+	BGFLK2	109	-.0089	INDG02 -
BGFLK1	119	.1605	INDJ01*+	BGFLK2	107	.0742	INDJ02*+
BGFLK1	79	.0453	INDK01*-	BGFLK2	109	-.0093	INDK02 -
BGFLK1	111	-.0071	INDL01 +	BGFLK2	99	-.0076	INDL02 +
BGFLK1	121	.3209	IGES01*+	BGFLK2	109	.3247	IGES02*+
EMP001	125	.0158	INDA01*+	EMP002	129	.0974	INDA02*-
EMP001	109	.0503	INDB01*+	EMP002	118	-.0025	INDB02 +
EMP001	122	-.0007	INDC01 -	EMP002	124	.1718	INDC02*-
EMP001	74	.1083	INDE01*+	EMP002	118	.0730	INDE02*+
EMP001	118	.0298	INDF01*+	EMP002	119	.0374	INDF02*+
EMP001	121	.0134	INDG01 +	EMP002	130	-.0076	INDG02 -
EMP001	119	.0225	INDJ01*-	EMP002	128	-.0065	INDJ02 -
EMP001	96	.0216	INDK01*-	EMP002	130	.0059	INDK02 +
EMP001	121	-.0010	INDL01 +	EMP002	118	-.0076	INDL02 +
EMP001	139	.0218	IGES01*+	EMP002	130	.0010	IGES02 -
EISP01	125	.1828	INDA01*+	EISP02	129	.0280	INDA02*+
EISP01	109	.4974	INDB01*+	EISP02	118	.4174	INDB02*+
EISP01	122	.0362	INDC01*+	EISP02	124	-.0039	INDC02 -
EISP01	74	.1446	INDE01*+	EISP02	118	.0582	INDE02*+
EISP01	118	.1170	INDF01*+	EISP02	119	.0980	INDF02*+
EISP01	121	.0827	INDG01*+	EISP02	130	.0959	INDG02*+
EISP01	119	-.0083	INDJ01 +	EISP02	128	.2228	INDJ02*+
EISP01	96	-.0101	INDK01 -	EISP02	130	.1598	INDK02*+
EISP01	121	.0042	INDL01 +	EISP02	118	.3325	INDL02*+
EISP01	139	.3283	IGES01*+	EISP02	130	.4049	IGES02*+

Table 17 continued

1st Cross section Year				2nd Cross section Year			
DI	NN	RSQA	IN	DI	NN	RSQA	IN
EMT001	125	.1827	INDA01*+	EMT002	129	.0663	INDA02*+
EMT001	109	.1121	INDB01*+	EMT002	118	.0540	INDB02*+
EMT001	122	.1304	INDC01*+	EMT002	124	.1463	INDC02*+
EMT001	74	.0417	INDE01*+	EMT002	118	-.0070	INDE02 -
EMT001	118	.4274	INDF01*+	EMT002	119	.3054	INDF02*+
EMT001	121	.2476	INDG01*+	EMT002	130	.1977	INDG02*+
EMT001	119	.1121	INDJ01*-	EMT002	128	.0072	INDJ02 -
EMT001	96	.3020	INDK01*-	EMT002	130	.1429	INDK02*-
EMT001	121	-.0084	INDL01 -	EMT002	118	-.0083	INDL02 -
EMT001	139	.1974	IGES01*+	EMT002	130	.0334	IGES02*+
EMIS01	125	.2214	INDA01*+	EMIS02	129	.1105	INDA02*+
EMIS01	109	.2160	INDB01*+	EMIS02	118	.1262	INDB02*+
EMIS01	122	.1548	INDC01*+	EMIS02	124	.1853	INDC02*+
EMIS01	74	.0472	INDE01*+	EMIS02	118	-.0082	INDE02 -
EMIS01	118	.4354	INDF01*+	EMIS02	119	.3161	INDF02*+
EMIS01	121	.2612	INDG01*+	EMIS02	130	.2402	INDG02*+
EMIS01	119	.0858	INDJ01*-	EMIS02	128	-.0079	INDJ02 -
EMIS01	96	.2169	INDK01*-	EMIS02	130	.0771	INDK02*-
EMIS01	121	-.0081	INDL01 +	EMIS02	118	.0017	INDL02 +
EMIS01	139	.2671	IGES01*+	EMIS02	130	.1106	IGES02*+
EOFL01	125	.3910	INDA01*+	EOFL02	129	.3951	INDA02*+
EOFL01	109	.2874	INDB01*+	EOFL02	118	.1264	INDB02*+
EOFL01	122	.1171	INDC01*+	EOFL02	124	.1755	INDC02*+
EOFL01	74	.0782	INDE01*+	EOFL02	118	.0053	INDE02 +
EOFL01	118	.1476	INDF01*+	EOFL02	119	.1458	INDF02*+
EOFL01	121	.0618	INDG01*+	EOFL02	130	.0552	INDG02*+
EOFL01	119	.1080	INDJ01*+	EOFL02	128	.0436	INDJ02*+
EOFL01	96	.0056	INDK01 -	EOFL02	130	-.0039	INDK02 +
EOFL01	121	-.0021	INDL01 +	EOFL02	118	.0448	INDL02*+
EOFL01	139	.4266	IGES01*+	EOFL02	130	.2780	IGES02*+
EGFL01	125	.3902	INDA01*+	EGFL02	129	.4056	INDA02*+
EGFL01	109	.3899	INDB01*+	EGFL02	118	.1968	INDB02*+
EGFL01	122	.1372	INDC01*+	EGFL02	124	.1947	INDC02*+
EGFL01	74	.0766	INDE01*+	EGFL02	118	.0054	INDE02 +
EGFL01	118	.1565	INDF01*+	EGFL02	119	.1372	INDF02*+
EGFL01	121	.0730	INDG01*+	EGFL02	130	.0802	INDG02*+
EGFL01	119	.1076	INDJ01*+	EGFL02	128	.0928	INDJ02*+
EGFL01	96	-.0022	INDK01 -	EGFL02	130	.0103	INDK02 +
EGFL01	121	-.0005	INDL01 +	EGFL02	118	.1041	INDL02*+
EGFL01	139	.4690	IGES01*+	EGFL02	130	.3899	IGES02*+

A negative RSQA indicates a very low unadjusted figure which becomes negative after adjustment. For an explanation of Codes used cf. "Key to Tables" below.

KEY TO TABLES 17 - 34

DI Development Indicators

BEPO	GDP per capita in ECU (nominal income)
BKPO	GDP per capita in purchasing power parity terms (PPPT)
BEEM	GDP per active person in ECU
BKEM	GDP per active person in PPPT
BGEGE	GDP in industry and services per active person in the corresponding sectors in ECU
BGEGK	GDP in industry and services per active person in the corresponding sectors in PPPT
BEFL	GDP in ECU per square kilometer (nominal income density)
BKFL	GDP in PPPT per square kilometer (real income density)
BGFLE	GDP in ECU in industry and services per square kilometer (specific nominal income density)
BGFLK	GDP in PPPT in industry and services per square kilometer (specific real income density)

EV Explanatory Variables

EMPO	Overall activity rate
EISP	Activity rate in industry and services
EMTO	Total active population
EMIS	Active persons in industry and services
EOFL	Total active population per square kilometer (employment density)
EGFL	Active persons in industry and services per square kilometer (specific employment density)
IGES	Aggregate infrastructure indicator
ENTGKM	Sum of distances in km between the region considered and all other regions (Location indicator)
BPG%	Share of industry and services in regional GDP (indicator for sectoral structure)
E%IS	Share of persons employed in industries and services in total employment (indicator for sectoral structure)
POFL	Population density (agglomeration indicator)
+ or -	The regression coefficient of the respective variable is positive or negative
*	The regression coefficient of the respective variable is significant at least at the 95% level
RSQA	Adjusted Coefficient of Determination
NN	Number of Observations (Regions)
DUMY..	Dummy variables for the respective countries.

The results can be summarized as follows:

(1) In the vast majority of cases, significant positive relationships show up. Among the 320 functions, only 12 have a significant negative regression coefficient for infrastructure. With the exception of INDC02, the categories affected are social and cultural indicators like INDG, INDJ and INDK. The RSQA increases up to .697 [BEEM02 = f(IGES02)]. Of all 32 functions for IGES, only one for EMPO is insignificant.

(2) In general, the goodness of fit of the singular infrastructure production functions is better than the results in the National Reports. However, when comparing the results of the Community Analysis with those of the National Reports, it has to be noted as already mentioned that the adjusted coefficients of determination RSQA correspond with the square of the correlation coefficient r and are already adjusted for degrees of freedom. In addition, the r-values apply to linear relationships, whereas the RSQA values are derived from double log functions. Despite the fact that in some member countries such as UK and IR, the r-values are relatively low in some cases, it is comforting to see that these countries did not distort the general picture too much. This may also be due to the fact that different definitions and weighting procedures have sometimes been applied to the national data sets in order to make them more comparable.

(3) As far as the production oriented infrastructure categories Transportation, Communication and Energy Supply are concerned, Transportation and Communication are again highly correlated with GDP per capita measured in terms of ECU (BEPO) and in PPPT (BKPO). The same is true for the two parallel indicators for income per employed person (BEEM, BKEM). Replacing the general income variables by incomes in the non-agricultural sector (BGEGE, BGEGK) in order to exclude possible distortions arising in the agricultural sector due to relative price effects and the high degree of protectionism, weakens especially the results for Transport infrastructure.

(4) In order to test whether and to what extent infrastructure also explains spatial income density, i. e. GDP measured in ECU or PPPT in relation to area, four additional income variables have been calculated (BEFL, BKFL, BGFLE, and BGFLK). A comparison between the results obtained for the income per capita and for the income density variables shows that Transportation improves considerably and Energy slightly and that Communication remains largely unaffected.

(5) Education is a weak explanatory variable in relation to income per capita or per employed person. It gains in importance, however, for income density.

(6) The Socio-cultural infrastructure categories are generally less influential on the income variables compared with the first group of production oriented infrastructure. Frequently Social infrastructure exhibits a stronger influence in those cases where e. g. Transportation has less influence and vice versa. Thus Social infrastructure has relatively high RSQ values for the two measures of GDP per employed person in the non-agricultural sector. But here again, this could also mean that this type of infrastructure is more dependent on income than the other way round if the arguments presented in Part One are considered.

(7) If the question is whether and to what extent infrastructure contributes to employment, the results are generally not as good as those for income. Infrastructure appears to have less influence if the activity rate (EMPO) and the absolute number of employed persons in the economy as a whole (EMTO) or in the non-agricultural sector (EMIS) are considered. In addition, the results differ strongly between the first and second cross section years so that one must be still careful as far as generalizations are concerned. As far as the non-agricultural activity rate (EISP) is concerned, productive infrastructure exerts a relatively strong influence, above all Communication. Communication also ranks very high in the second cross section year, whereas the other productive infrastructure categories Transportation, Energy and Environmental infrastructure perform less well. Although the influence of the Socio-cultural infrastructure categories is almost negligible in 1970, it increases in 1978. If the absolute employment indicators EMTO and EMIS are considered,

Education infrastructure appears to be the most important determinant in both years, followed by Transportation, Health and Cultural infrastructure. If the employment density variables, total spatial concentration of employment (EOFL) and non-agricultural employment density (EGFL) are reviewed, the strongest influence can be attributed to productive infrastructure, especially to Transportation and Communication, but also Education in the first and Energy in the second year. Aggregate infrastructure IGES appears to have a relatively strong influence on employment density.

(8) Aggregate infrastructure IGES is almost always better than any other single infrastructure category as long as income indicators are considered. This supports the view that there is some degree, even if it is low, of substitutability between the different infrastructure categories so that an aggregate infrastructure indicator like IGES makes sense. In case of the exogenous employment indicators, however, Communication and Education sometimes show better results. To what extent the definition of employment in the agricultural sector (high percentage of part-time family aids) distorts the results, can be seen from a comparison between total employment EMTO and total activity rate EMPO on the one hand and employment in the non-agricultural sectors EMIS and EISP on the other. For EMIS and EISP, the RSQA are significantly higher. Employment density, EOFL and EGFL, like income density, show results almost as good as most personal income variables.

(9) Natural endowment shows a diffused picture in both years. It seems to be relatively strong as far as the contribution to income variables in both years is concerned, but whereas it shows the third highest RSQA in 1978 for explaining EISP, it is practically negligible for the first year. It also seems to have a notable influence on income density in the second but almost no influence in the first year. Here again, these changes of the results may be due to changes in the composition of the indicator data available for the two cross section years. But in general, Natural infrastructure appears to contribute more to income and employment on the basis of the Community Analysis than was suggested by the National Reports. In particular, the negative signs disappeared in the significant functions in the Community Analysis, whereas they dominate in the National Reports. -

(10) In general, the adjusted coefficients of determination (RSQA) for IGES are higher for the second compared with the first year. This is expectially true for income per capita (BEPO) and productivity per employed person (BEEM), two important endogenous variables. It seems to indicate that the countercurrent findings of the disparity analyses in section II.3. above did not only not negative influence the regression results but even contributed to improve them. The findings that income disparities have risen from the begin towards the end of the seventies whereas infrastructure equipment shows a reduced dispersion could have implied that the statistical association between the two variables had weakened. The results of the regression analysis point in the opposite direction: Interregional income distribution has come more in line with interregional infrastructure endowment. It has to be noted, however, that the number of indicators available for the second year is considerably higher than for the first one and that this fact could also have contributed to the improved results.

All in all, the large number of significant positive coefficients indicate that the basic hypothesis according to which infrastructure contributes to regional development and employment can be considered as well supported, given the deficiencies of the data base available. It remains to be seen whether infrastructure will still be significant or perform even better if other potentiality factors are introduced into an extended regional production function.

X.2. INFRASTRUCTURE AS THE CAPITAL ELEMENT IN A MODIFIED COBB-DOUGLAS PRODUCTION FUNCTION

The idea behind a macroeconomic production function is that labour and capital available in a region, sector or national economy, can be considered to represent the basic inputs required in order to produce output, measured e.g. in terms of income. The basic structure of such a production function, frequently called Cobb-Douglas production function according to the two authors who have developed it, is as follows:

$$\log \text{output} = f(a + b*\log L + c*\log K)$$

where a is a constant, L means labour input and K capital services. The coefficients b and c represent the partial elasticities of output in relation to each input. For example, if the K input is increased by one percent, the output increases by c percent. Such a production function can be estimated with the aid of ordinary least squares. If capital is represented by the available regional infrastructure indicator, and if labour is represented by the already used indicators for absolute number of employed persons, activity rates or employment density, it can be expected that the overall explanation of regional output is improved given that labour is now explicitly introduced in the production function.

TABLES 18 - 20 present a summary of the results obtained with a number of Cobb-Douglas production functions modified along the lines explained. The variants differ in relation to the definition of the dependent income variable and in relation to the selected exogenous labour variable. TABLE 20 also contains dummy variables. These additional variables were included in order to incorporate the influence of those factors which are specific to all regions of a member country, such as its exchange rate, its general national economic framework condition, and systematic differences in the size of its regions compared with those of another country, but differ between countries. In principle, it is possible to introduce one dummy per country less one. However, whether or not always n-1 dummies or a special combination of less dummies are really 'needed' in order to obtain unbiased estimates, cannot be said a priori. Only as far as individual countries are concerned, it is possible to formulate a conjecture as to the direction of the influence, i. e. whether or not a positive or negative sign seems to be plausible. Thus, it can be argued that for the first cross section year, the Italian Lire and the Greek Drachme tended to be overvalued or that the general framework conditions are less favourable in these two countries.

TABLES 18 and 19 show a number of significant modified Cobb-Douglas production functions for both cross section years. In general, these results are better than those obtained for IGES alone. The RSQA range from 0.3430 to 0.8968 for the first and from 0.4005 to 0.9775 for the second cross section year. The often very strong increase in RSQA is naturally also due to the country dummies.

TABLE 18.: Modified Cobb-Douglas Production Functions with Labour and Infrastructure Capital for EC-Regions, 1st Cross Section Year

NN	Endogenous Variable		Coefficients and Exogenous Variables		RSQA
139	BEP001	.4389	1.3431 EMP001 (9.07*)	.4444 IGES01 (15.34*)	.7304
139	BEP001	1.4163	1.0048 EISP01 (20.84*)	.2290 IGES01 (10.59*)	.8968
130	BKP001	1.0559	1.0656 EMP001 (9.92*)	.3445 IGES01 (15.77*)	.7594
130	BKP001	1.5782	.9230 EISP01 (18.95*)	.2047 IGES01 (11.80*)	.8884
139	BEEM01	2.4389	.3431 EMP001 (2.32*)	.4444 IGES01 (15.34*)	.6519
139	BEEM01	2.2360	.6712 EISP01 (12.25*)	.2821 IGES01 (11.48*)	.8279
130	BKEM01	2.7005	.3750 EISP01 (5.91*)	.2755 IGES01 (12.20*)	.7373
130	BKEM01	3.1318	.0941 EOFL01 (5.58*)	.2596 IGES01 (10.46*)	.7311
130	BGEGE1	-.3130	.3065 EMP001 (3.11*)	.3555 IGES01 (12.67*)	.5699
130	BGEGE1	-.1370	.3129 EISP01 (6.58*)	.2585 IGES01 (8.81*)	.6549
121	BGEGK1	-.3149	.0539 EOFL01 (4.01*)	.2149 IGES01 (7.43*)	.5288
121	BGEGK1	.3294	.0540 EGFL01 (4.40*)	.2083 IGES01 (7.24*)	.5401
139	BEFL01	-2.0415	1.4287 EMP001 (2.59*)	1.3723 IGES01 (12.72*)	.5703
139	BEFL01	-1.9855	1.9699 EISP01 (8.05*)	.9100 IGES01 (8.29*)	.6946
130	BKFL01	-1.3537	1.1526 EMP001 (2.08*)	1.2328 IGES01 (10.94*)	.5078

Table 18 continued

NN	Endogenous Variable	Coefficients and Exogenous Variables		RSQA
130	BKFL01 -2.0676	2.0485 EISP01 (6.24*)	.8823 IGES01 (7.55*)	.6106
130	BGFLE1 -6.1408	1.6447 EMP001 (2.85*)	1.8006 IGES01 (10.95*)	.4985
130	BGFLE1 -5.6296	2.1170 EISP01 (8.14*)	1.1403 IGES01 (7.10*)	.6495
121	BGFLK1 -5.0521	1.2980 EMP001 (2.24*)	1.4915 IGES01 (7.74*)	.3430
121	BGFLK1 -5.9625	2.2374 EISP01 (6.27*)	1.2212 IGES01 (6.96*)	.4865

TABLE 19.: Modified Cobb-Douglas Production Functions with Labour and Infrastructure Capital for EC-Regions, 2nd Cross Section Year

NN	Endogenous Variable	Coefficients and Exogenous Variables		RSQA
130	BEP002 1.1577	.7090 EMP002 (4.72*)	.8289 IGES02 (17.19*)	.7015
130	BEP002 1.7576	.5706 EISP02 (4.51*)	.6261 IGES02 (9.95*)	.6975
121	BKP002 1.6993	.6161 EMP002 (6.46*)	.5900 IGES02 (13.57*)	.6290
121	BKP002 1.8961	.6666 EISP02 (7.33*)	.4480 IGES02 (10.22*)	.6550
130	BEEM02 2.6744	.0145 EOFL02 (.45)	.8239 IGES02 (14.32*)	.6952
130	BEEM02 2.6862	.0194 EGFL02 (.64)	.8125 IGES02 (13.00*)	.6957
121	BKEM02 3.0389	.0500 EOFL02 (2.37*)	.5652 IGES02 (11.44*)	.6143
121	BKEM02 3.0609	.0528 EGFL02 (2.65*)	.5510 IGES02 (10.89*)	.6186

Table 19 continued

NN	Endogenous Variable		Coefficients and Exogenous Variables		RSQA
109	BGEGK2	.3131	.0227 EOFL02 (1.18)	.4534 IGES02 (10.01*)	.5476
109	BGEGK2	.3221	.0186 EGFL02 (1.02)	.4531 IGES02 (9.69*)	.5461
130	BEFL02	-.3256	1.0145 EOFL02 (31.39*)	.8239 IGES02 (14.32*)	.9475
130	BEFL02	.3081	.9490 EGFL02 (30.49*)	.5557 IGES02 (8.66*)	.9447
121	BKFL02	.0389	1.0500 EOFL02 (49.79*)	.5652 IGES02 (11.44*)	.9689
121	BKFL02	.4688	.9978 EGFL02 (51.02*)	.3992 IGES02 (8.03*)	.9704
118	BGFLE2	-5.0163	1.5890 EISP02 (3.59*)	1.4526 IGES02 (7.06*)	.6266
118	BGFLE2	-3.7049	1.0477 EOFL02 (31.33*)	.9909 IGES02 (16.87*)	.9564
109	BGFLK2	-5.4450	2.0729 EISP02 (3.81*)	1.2622 IGES02 (5.32*)	.4005
109	BGFLK2	-3.1388	1.0714 EOFL02 (53.20*)	.6356 IGES02 (13.41*)	.9775

TABLE 20 presents basically the same selection of modified CD-functions with dummies. Given the larger number of variants due to the dummies, an extremely large number of significant functions could have been presented. This demonstrates that there are not only a few accidentally well performing functions, but that the tested relationships hold in general. For comparable variants, e. g. for personal income or income density variables, the dummies show typical combinations. In many cases, IT, GR, IR, and UK appear with negative signs, sometimes BR and DK with positive ones. Functions for which without dummies relatively low RSQAs have been obtained, improve considerably; a large number reaches now values beyond 0.80 in the first and beyond 0.90 in the second year. The best results present a combination of employment and infrastructure as exogenous and income density (BEFL, BKFL) as endogenous variables.

RSQAs go up to 0.99 which means that almost 99% of total dispersion of income density is explained. But what is more important is that a number of combinations of the two exogenous variables labour and infrastructure have now significant regression coefficients that were not possible without the dummies. This implies that differences between member countries as far as these nation specific framework conditions are concerned play an important role and should not be neglected.

Evaluated in terms of the t-values printed in parentheses below each regression coefficient, the highest contribution of IGES is to be found in functions with personal income indicators as endogenous variables and the lowest contribution in some income density functions. The t-values for IGES are normally lower if dummies are introduced. This shadows the results to be presented later on the basis of the fully specified potentiality factor functions.

TABLE 20.: Modified Cobb-Douglas Production Functions with Labour, Infrastructure Capital and Dummies for EC-Regions, Both Cross Section Years

	BETA	T-VALUE		BETA	T-VALUE
BEP001	1.255	7.481	BEP002	1.285	6.784
EMP001	.985	9.905*	EMP002	1.129	10.097*
IGES01	.324	11.137*	IGES02	.353	8.694*
DUMYFR	-.027	1.873*	DUMYBR	.154	11.424*
DUMYIT	-.145	9.738*	DUMYIT	-.153	9.110*
DUMYIR	-.130	4.157*	DUMYNL	.159	5.420*
DUMYGR	-.278	11.968*	DUMYBE	.110	5.081*
			DUMYUK	-.175	9.637*
			DUMYGR	-.223	7.668*
RSQ=.898450	RSQA =.893834		RSQ=.938247	RSQA =.934164	
NN = 139	F = 194.64		NN = 130	F = 229.80	

	BETA	T-VALUE		BETA	T-VALUE
BEP001	1.106	6.258	BEP002	1.451	8.851
EMP001	1.055	10.142*	EMP002	1.111	11.499*
IGES01	.340	11.993*	IGES02	.358	8.606*
DUMYIT	-.132	8.847*	DUMYFR	-.146	10.318*
DUMYBE	.051	2.443*	DUMYIT	-.297	17.323*
DUMYIR	-.104	3.368*	DUMYUK	-.319	16.054*
DUMYGR	-.260	11.398*	DUMYDK	-.145	6.371*
			DUMYGR	-.366	11.353*
RSQ=.900259	RSQA =.895725		RSQ=.933512	RSQA =.929697	
NN = 139	F = 198.57		NN = 130	F = 244.70	

	BETA	T-VALUE		BETA	T-VALUE
BEP001	1.477	29.452	BEP002	2.067	22.276
EISP01	1.118	24.398*	EISP02	.902	13.945*
IGES01	.107	4.003*	IGES02	.155	4.079*
DUMYFR	-.036	3.404*	DUMYBR	.121	11.514*
DUMYIT	-.077	7.159*	DUMYIT	-.182	13.545*
DUMYUK	-.126	7.505*	DUMYNL	.055	3.031*
DUMYIR	-.135	6.099*	DUMYBE	.047	2.880*
			DUMYUK	-.244	15.515*
			DUMYGR	-.138	5.344*
RSQ=.947360	RSQA =.944967		RSQ=.956357	RSQA =.953472	
NN = 139	F = 395.93		NN = 130	F = 331.44	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEP001	1.683	23.540	BEP002	2.195	23.197
EISP01	1.002	18.935*	EISP02	.778	13.114*
IGES01	.094	3.677*	IGES02	.208	5.946*
DUMYFR	-.043	4.142*	DUMYBR	.091	8.589*
DUMYIT	-.093	8.437*	DUMYFR	-.030	2.380*
DUMYUK	-.125	7.837*	DUMYIT	-.208	14.537*
DUMYIR	-.173	7.450*	DUMYUK	-.260	15.740*
DUMYGR	-.079	3.867*	DUMYGR	-.168	6.211*
RSQ=.952754	RSQA =.950229		RSQ=.953570	RSQA =.950906	
NN = 139	F = 377.38		NN = 130	F = 357.94	

	BETA	T-VALUE		BETA	T-VALUE
BEP001	2.739	52.108	BEP002	3.038	36.119
EOFL01	.097	5.465*	EOFL02	.079	4.166*
IGES01	.286	8.009*	IGES02	.312	5.892*
DUMYIT	-.189	12.380*	DUMYBR	.124	8.994*
DUMYNL	-.141	6.762*	DUMYIT	-.190	9.603*
DUMYBE	-.049	2.290*	DUMYUK	-.182	7.974*
DUMYIR	-.157	4.888*	DUMYDK	.112	5.579*
DUMYGR	-.282	11.700*	DUMYGR	-.233	6.474*
RSQ=.886664	RSQA =.880608		RSQ=.915678	RSQA =.910840	
NN = 139	F = 146.41		NN = 130	F = 188.73	

	BETA	T-VALUE		BETA	T-VALUE
BEP001	2.715	51.000	BEP002	3.116	38.370
EOFL01	.102	5.755*	EOFL02	.083	4.165*
IGES01	.291	8.243*	IGES02	.332	6.347*
DUMYIT	-.183	11.908*	DUMYFR	-.114	7.028*
DUMYNL	-.137	6.630*	DUMYIT	-.305	16.760*
DUMYBE	-.044	2.064*	DUMYNL	-.159	7.714*
DUMYIR	-.144	4.427*	DUMYBE	-.097	4.598*
DUMYDK	.039	2.048*	DUMYUK	-.299	14.143*
DUMYGR	-.272	11.178*	DUMYGR	-.338	9.932*
RSQ=.890207	RSQA =.883451		RSQ=.919569	RSQA =.914252	
NN = 139	F = 131.76		NN = 130	F = 172.93	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEP001	2.440	28.242	BEP002	2.807	27.527
EMIS01	.088	6.498*	EMIS02	.051	3.171*
IGES01	.237	6.776*	IGES02	.356	6.955*
DUMYBR	.072	4.907*	DUMYBR	.137	9.898*
DUMYIT	-.146	8.788*	DUMYIT	-.186	9.112*
DUMYIR	-.127	3.664*	DUMYUK	-.185	7.446*
DUMYDK	.119	5.360*	DUMYDK	.138	6.413*
DUMYGR	-.241	9.245*	DUMYGR	-.211	5.844*
RSQ=.879054	RSQA =.872591		RSQ=.911019	RSQA =.905914	
NN = 139	F = 136.02		NN = 130	F = 178.44	

	BETA	T-VALUE		BETA	T-VALUE
BEP001	2.403	27.557	BEP002	2.910	32.340
EMIS01	.095	6.864*	EMIS02	.065	4.088*
IGES01	.233	6.703*	IGES02	.333	6.349*
DUMYBR	.081	5.350*	DUMYFR	-.159	9.933*
DUMYIT	-.137	8.071*	DUMYIT	-.330	16.376*
DUMYBE	.047	2.038*	DUMYNL	-.148	7.088*
DUMYIR	-.116	3.344*	DUMYBE	-.085	4.011*
DUMYDK	.132	5.773*	DUMYUK	-.334	13.379*
DUMYGR	-.230	8.737*	DUMYGR	-.356	10.163*
RSQ=.882799	RSQA =.875587		RSQ=.919196	RSQA =.913853	
NN = 139	F = 122.40		NN = 130	F = 172.06	

	BETA	T-VALUE		BETA	T-VALUE
BKP001	.972	4.787	BKP002	1.277	5.934
EMP001	1.112	8.273*	EMP002	1.083	7.624*
IGES01	.348	16.341*	IGES02	.369	9.037*
DUMYIT	-.063	4.052*	DUMYBR	.139	9.816*
DUMYNL	.063	2.541*	DUMYFR	.033	2.275*
DUMYBE	.070	3.365*	DUMYNL	.137	4.265*
DUMYUK	.051	2.811*	DUMYBE	.083	3.960*
			DUMYDK	-.045	2.038*
RSQ=.846653	RSQA =.839173		RSQ=.830400	RSQA =.819894	
NN = 130	F = 113.18		NN = 121	F = 79.04	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKP001	1.214	7.011	BKP002	1.259	5.559
EMP001	1.040	10.000*	EMP002	1.122	7.607*
IGES01	.307	10.594*	IGES02	.363	8.698*
DUMYBR	-.044	3.023*	DUMYBR	.106	8.226*
DUMYFR	-.072	4.664*	DUMYIT	-.029	1.798*
DUMYIT	-.124	8.245*	DUMYNL	.110	3.617*
DUMYIR	-.106	3.601*	DUMYBE	.051	2.532*
DUMYDK	-.061	3.158*	DUMYUK	-.047	2.492*
			DUMYDK	-.083	3.455*
RSQ=.855044	RSQA =.846727		RSQ=.832768	RSQA =.820823	
NN = 130	F = 102.80		NN = 121	F = 69.72	

	BETA	T-VALUE		BETA	T-VALUE
BKP001	1.378	20.747	BKP002	1.786	16.572
EISP01	1.129	20.142*	EISP02	1.073	12.722*
IGES01	.136	7.031*	IGES02	.157	4.199*
DUMYFR	-.027	2.808*	DUMYBR	.063	6.564*
DUMYNL	.074	5.087*	DUMYIT	-.058	4.493*
DUMYUK	-.056	3.668*	DUMYUK	-.134	7.580*
			DUMYDK	-.115	6.046*
RSQ=.916560	RSQA =.913196		RSQ=.885053	RSQA =.879003	
NN = 130	F = 272.42		NN = 121	F = 146.29	

	BETA	T-VALUE		BETA	T-VALUE
BKP001	1.554	18.579	BKP002	1.639	14.483
EISP01	1.079	16.045*	EISP02	1.162	11.972*
IGES01	.083	2.962*	IGES02	.130	3.070*
DUMYFR	-.041	4.157*	DUMYBR	.120	9.507*
DUMYIT	-.021	1.714*	DUMYFR	.060	4.492*
DUMYNL	.068	4.366*	DUMYNL	.081	3.964*
DUMYUK	-.073	4.570*	DUMYBE	.042	2.596*
DUMYIR	-.086	3.827*	DUMYUK	-.085	5.063*
			DUMYDK	-.069	3.714*
RSQ=.926366	RSQA =.922141		RSQ=.888136	RSQA =.880146	
NN = 130	F = 219.26		NN = 121	F = 111.15	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKP001	2.781	52.587	BKP002	2.850	40.131
EOFL01	.105	5.978*	EOFL02	.064	3.339*
IGES01	.236	6.597*	IGES02	.398	8.093*
DUMYIT	-.124	8.228*	DUMYBR	.119	8.086*
DUMYNL	-.072	3.453*	DUMYFR	.046	2.553*
DUMYIR	-.112	3.475*	DUMYNL	-.046	2.068*
			DUMYDK	.078	4.148*
RSQ=.802323	RSQA =.794353		RSQ=.765391	RSQA =.753043	
NN = 130	F = 100.66		NN = 121	F = 61.99	
	BETA	T-VALUE		BETA	T-VALUE
BKP001	2.768	48.513	BKP002	3.029	35.147
EOFL01	.104	5.656*	EOFL02	.068	3.524*
IGES01	.263	6.597*	IGES02	.359	6.700*
DUMYBR	-.034	1.893*	DUMYFR	-.072	4.358*
DUMYFR	-.035	1.867*	DUMYIT	-.135	7.051*
DUMYIT	-.154	8.053*	DUMYNL	-.161	8.042*
DUMYNL	-.104	4.248*	DUMYBE	-.109	5.214*
DUMYBE	-.067	2.894*	DUMYUK	-.122	5.742*
DUMYIR	-.121	3.683*	DUMYDK	-.043	2.211*
RSQ=.816623	RSQA =.804499		RSQ=.768630	RSQA =.752103	
NN = 130	F = 67.36		NN = 121	F = 46.51	
	BETA	T-VALUE		BETA	T-VALUE
BKP001	2.455	27.928	BKP002	2.768	27.477
EMIS01	.085	6.120*	EMIS02	.027	1.827*
IGES01	.256	7.690*	IGES02	.436	8.961*
DUMYFR	-.048	3.009*	DUMYBR	.104	7.698*
DUMYIT	-.138	8.844*	DUMYIT	-.029	1.722*
DUMYIR	-.091	2.577*	DUMYNL	-.057	2.552*
DUMYDK	.062	2.904*	DUMYDK	.067	3.157*
RSQ=.796667	RSQA =.786749		RSQ=.752966	RSQA =.739964	
NN = 130	F = 80.32		NN = 121	F = 57.91	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKP001	2.474	28.413	BKP002	2.829	29.847
EMIS01	.077	5.448*	EMIS02	.043	2.474*
IGES01	.275	8.097*	IGES02	.388	7.210*
DUMYFR	-.052	3.264*	DUMYBR	.035	1.715*
DUMYIT	-.145	9.222*	DUMYFR	-.070	3.047*
DUMYNL	-.047	2.159*	DUMYIT	-.111	4.356*
DUMYIR	-.090	2.580*	DUMYNL	-.120	4.738*
DUMYDK	.053	2.433*	DUMYBE	-.062	2.470*
			DUMYUK	-.104	3.333*
RSQ=.804153	RSQA	=.792916	RSQ=.759406	RSQA	=.742221
NN = 130	F	= 71.56	NN = 121	F	= 44.19

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	2.471	11.215	BEEM02	2.217	11.336
EMP001	.524	3.939*	EMP002	.710	5.535*
IGES01	.236	6.361*	IGES02	.370	7.695*
DUMYBR	.071	4.771*	DUMYBR	.263	14.681*
DUMYNL	.109	4.039*	DUMYFR	.105	5.741*
DUMYBE	.129	5.322*	DUMYNL	.352	9.585*
DUMYIR	-.105	2.951*	DUMYBE	.247	9.463*
DUMYGR	-.231	9.011*	DUMYUK	-.079	3.893*
			DUMYGR	-.103	3.512*
RSQ=.834893	RSQA	=.826071	RSQ=.913738	RSQA	=.913365
NN = 139	F	= 94.63	NN = 130	F	= 171.00

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	2.500	11.524	BEEM02	2.097	10.415
EMP001	.497	3.782*	EMP002	.668	5.001*
IGES01	.237	6.512*	IGES02	.479	12.488*
DUMYBR	.084	5.373*	DUMYBR	.254	13.704*
DUMYFR	.040	2.358*	DUMYFR	.102	5.329*
DUMYNL	.119	4.422*	DUMYNL	.329	8.707*
DUMYBE	.140	5.768*	DUMYBE	.242	8.865*
DUMYIR	-.093	2.621*	DUMYUK	-.069	3.262*
DUMYGR	-.219	8.490*			
RSQ=.841665	RSQA	=.831921	RSQ=.910452	RSQA	=.905314
NN = 139	F	= 86.38	NN = 130	F	= 177.20

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	2.731	31.321	BEEM02	3.211	29.754
EISP01	.478	7.414*	EISP02	.394	4.925*
IGES01	.187	6.020*	IGES02	.251	5.670*
DUMYFR	-.047	3.784*	DUMYFR	-.139	11.094*
DUMYIT	-.105	7.784*	DUMYIT	-.301	19.291*
DUMYUK	-.100	5.123*	DUMYUK	-.354	18.339*
DUMYIR	-.152	5.341*	DUMYDK	-.184	9.364*
DUMYGR	-.186	7.472*	DUMYGR	-.332	11.120*
RSQ=.909346	RSQA	=.904502	RSQ=.944322	RSQA	=.941127
NN = 139	F	= 187.72	NN = 130	F	= 295.59

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	2.738	32.794	BEEM02	3.114	30.606
EISP01	.533	8.377*	EISP02	.340	4.788*
IGES01	.140	4.301*	IGES02	.267	6.381*
DUMYFR	-.063	4.959*	DUMYBR	.156	13.501*
DUMYIT	-.111	8.544*	DUMYIT	-.149	10.109*
DUMYUK	-.127	6.310*	DUMYNL	.178	8.914*
DUMYIR	-.190	6.512*	DUMYBE	.114	6.357*
DUMYDK	-.057	3.594*	DUMYUK	-.197	11.443*
DUMYGR	-.199	8.250*	DUMYGR	-.184	6.516*
RSQ=.917541	RSQA	=.912466	RSQ=.947870	RSQA	=.944423
NN = 139	F	= 180.82	NN = 130	F	= 275.02

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	3.192	69.594	BEEM02	3.533	48.993
EOFL01	.065	4.141*	EOFL02	.080	4.799*
IGES01	.273	8.805*	IGES02	.267	5.819*
DUMYIT	-.129	9.613*	DUMYBR	.113	9.266*
DUMYIR	-.116	4.092*	DUMYIT	-.200	12.334*
DUMYGR	-.257	11.934*	DUMYNL	.103	5.411*
			DUMYUK	-.230	11.938*
			DUMYGR	-.269	9.031*
RSQ=.880701	RSQA	=.876216	RSQ=.936519	RSQA	=.932876
NN = 139	F	= 196.37	NN = 130	F	= 257.12

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	3.255	66.120	BEEM02	3.519	51.727
EOFL01	.085	5.106*	EOFL02	.060	3.638*
IGES01	.217	6.147*	IGES02	.285	6.559*
DUMYIT	-.132	10.098*	DUMYBR	.133	10.635*
DUMYUK	-.060	2.999*	DUMYIT	-.179	11.161*
DUMYIR	-.152	5.054*	DUMYNL	.122	6.591*
DUMYGR	-.274	12.645*	DUMYBE	.077	4.052*
			DUMYUK	-.206	10.788*
			DUMYGR	-.250	8.788*
RSQ=.888313	RSQA	=.883236	RSQ=.944105	RSQA	=.940409
NN = 139	F	= 174.98	NN = 130	F	= 255.47

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	3.072	48.290	BEEM02	3.449	41.290
EMIS01	.073	5.318*	EMIS02	.054	3.913*
IGES01	.187	5.161*	IGES02	.287	6.575*
DUMYFR	-.074	4.791*	DUMYFR	-.158	11.647*
DUMYIT	-.168	12.352*	DUMYIT	-.320	18.432*
DUMYUK	-.116	4.772*	DUMYUK	-.357	16.807*
DUMYIR	-.193	6.103*	DUMYDK	-.111	6.516*
DUMYGR	-.308	13.761*	DUMYGR	-.381	12.425*
RSQ=.894155	RSQA	=.888500	RSQ=.940698	RSQA	=.937295
NN = 139	F	= 158.09	NN = 130	F	= 276.47

	BETA	T-VALUE		BETA	T-VALUE
BEEM01	3.031	39.820	BEEM02	3.398	43.786
EMIS01	.039	3.262*	EMIS02	.033	2.551*
IGES01	.293	9.655*	IGES02	.305	6.826*
DUMYBR	.037	2.826*	DUMYBR	.148	12.163*
DUMYIT	-.115	7.734*	DUMYIT	-.174	10.520*
DUMYBE	.074	3.651*	DUMYNL	.143	7.466*
DUMYIR	-.088	2.890*	DUMYBE	.102	5.452*
DUMYDK	.041	2.056*	DUMYUK	-.202	9.884*
DUMYGR	-.235	10.264*	DUMYGR	-.241	8.322*
RSQ=.884715	RSQA	=.877620	RSQ=.941155	RSQA	=.937265
NN = 139	F	= 124.70	NN = 130	F	= 241.91

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	2.661	14.635	BKEM02	3.170	14.430
EMP001	.344	2.896*	EMP002	.242	1.665*
IGES01	.293	13.430*	IGES02	.358	8.143*
DUMYBR	.040	3.229*	DUMYFR	-.096	7.150*
DUMYNL	.124	5.396*	DUMYIT	-.124	7.499*
DUMYBE	.112	5.464*	DUMYNL	.034	1.230
DUMYUK	.061	3.255*	DUMYUK	-.145	7.471*
			DUMYDK	-.191	7.500*
RSQ=.777551	RSQA =.766700		RSQ=.821798	RSQA =.810759	
NN = 130	F = 71.66		NN = 121	F = 74.44	

	BETA	T-VALUE			
BKEM01	2.648	13.725			
EMP001	.422	3.601*			
IGES01	.230	7.037*			
DUMYBR	.038	2.970*			
DUMYNL	.134	5.689*			
DUMYBE	.106	5.051*			
DUMYIR	-.065	2.095*			
RSQ=.766718	RSQA =.755339				
NN = 130	F = 67.38				

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	2.575	36.817	BKEM02	2.918	22.441
EISP01	.524	9.692*	EISP02	.526	4.766*
IGES01	.198	9.698*	IGES02	.219	4.459*
DUMYBR	.027	2.698*	DUMYBR	.078	6.985*
DUMYNL	.138	8.014*	DUMYIT	-.055	3.770*
DUMYBE	.088	5.485*	DUMYNL	.123	6.417*
			DUMYUK	-.116	5.665*
			DUMYDK	-.159	7.159*
RSQ=.845140	RSQA =.838896		RSQ=.858973	RSQA =.850237	
NN = 130	F = 135.34		NN = 121	F = 98.32	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	2.773	29.307	BKEM02	2.916	22.894
EISP01	.500	6.592*	EISP02	.515	4.760*
IGES01	.171	5.157*	IGES02	.223	4.641*
DUMYBR	-.085	6.227*	DUMYBR	.091	7.490*
DUMYFR	-.123	7.683*	DUMYIT	-.043	2.809*
DUMYIT	-.114	7.951*	DUMYNL	.134	6.937*
DUMYUK	-.121	5.061*	DUMYBE	.041	2.418*
DUMYIR	-.156	5.223*	DUMYUK	-.103	4.932*
DUMYDK	-.118	6.335*	DUMYDK	-.145	6.465*
RSQ=.852902	RSQA =.843176		RSQ=.865968	RSQA =.856394	
NN = 130	F = 87.70		NN = 121	F = 90.45	

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	3.233	74.389	BKEM02	3.422	56.656
EOFL01	.074	5.077*	EOFL02	.051	3.298*
IGES01	.225	7.601*	IGES02	.300	7.319*
DUMYIT	-.068	5.441*	DUMYBR	.153	12.512*
DUMYNL	.049	2.851*	DUMYFR	.064	4.438*
DUMYBE	.038	2.157*	DUMYNL	.142	7.635*
DUMYIR	-.072	2.721*	DUMYBE	.087	4.982*
RSQ=.817084	RSQA =.808162		RSQ=.844866	RSQA =.836701	
NN = 130	F = 91.57		NN = 121	F = 103.47	

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	3.296	61.473	BKEM02	3.490	50.740
EOFL01	.066	4.056*	EOFL02	.058	3.875*
IGES01	.224	6.497*	IGES02	.295	6.832*
DUMYBR	-.045	3.276*	DUMYBR	.081	6.971*
DUMYFR	-.061	3.689*	DUMYIT	-.061	3.908*
DUMYIT	-.117	7.375*	DUMYNL	.070	4.093*
DUMYUK	-.042	2.017*	DUMYUK	-.082	4.592*
DUMYIR	-.126	3.908*	DUMYDK	-.088	5.568*
DUMYDK	-.054	2.877*			
RSQ=.824007	RSQA =.812371		RSQ=.845050	RSQA =.841235	
NN = 130	F = 70.82		NN = 121	F = 91.83	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	3.098	48.303	BKEM02	3.440	40.882
EMIS01	.042	3.948*	EMIS02	.037	2.670*
IGES01	.249	8.866*	IGES02	.312	7.231*
DUMYFR	-.045	3.449*	DUMYFR	-.112	8.524*
DUMYIT	-.087	6.781*	DUMYIT	-.149	8.774*
DUMYNL	.058	3.229*	DUMYBE	-.053	3.110*
DUMYBE	.049	2.733*	DUMYUK	-.175	8.503*
DUMYIR	-.076	2.745*	DUMYDK	-.158	9.550*
RSQ=.813445	RSQA =.802741		RSQ=.841390	RSQA =.832457	
NN = 130	F = 75.99		NN = 121	F = 86.18	

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	3.132	44.122	BKEM02	3.390	41.266
EMIS01	.056	3.794*	EMIS02	.033	2.309*
IGES01	.220	6.119*	IGES02	.321	7.266*
DUMYBR	-.059	4.228*	DUMYBR	.058	3.435*
DUMYFR	-.112	6.134*	DUMYFR	-.055	2.930*
DUMYIT	-.149	9.112*	DUMYIT	-.091	4.279*
DUMYUK	-.086	3.228*	DUMYNL	.053	2.524*
DUMYIR	-.149	4.491*	DUMYUK	-.116	4.638*
DUMYDK	-.056	2.953*	DUMYDK	-.104	5.111*
RSQ=.821328	RSQA =.809515		RSQ=.845434	RSQA =.834393	
NN = 130	F = 69.53		NN = 121	F = 76.58	

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.163	1.335	BGEGE2	.272	1.841
EMP001	.185	2.489*	EMP002	.372	4.330*
IGES01	.211	7.913*	IGES02	.232	5.862*
DUMYFR	-.052	4.778*	DUMYFR	-.116	9.183*
DUMYIT	-.104	9.632*	DUMYIT	-.282	18.094*
DUMYUK	-.077	4.915*	DUMYUK	-.339	19.050*
DUMYGR	-.162	8.734*	DUMYGR	-.312	10.437*
RSQ=.805161	RSQA =.795657		RSQ=.932490	RSQA =.928841	
NN = 130	F = 84.72		NN = 118	F = 255.53	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.122	.984	BGEGE2	.329	2.250
EMP001	.238	2.979*	EMP002	.356	4.237*
IGES01	.188	6.377*	IGES02	.217	5.554*
DUMYFR	-.061	5.098*	DUMYFR	-.122	9.709*
DUMYIT	-.108	9.859*	DUMYIT	-.292	18.542*
DUMYUK	-.090	5.209*	DUMYBE	-.042	2.483*
DUMYDK	-.026	1.721*	DUMYUK	-.347	19.609*
DUMYGR	-.175	8.786*	DUMYGR	-.327	10.939*
RSQ=.809777 RSQA =.798863			RSQ=.936074 RSQA =.932006		
NN = 130 F = 74.19			NN = 118 F = 230.11		

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.158	2.114	BGEGE2	.587	5.861
EISP01	.266	4.721*	EISP02	.190	2.397*
IGES01	.147	5.007*	IGES02	.194	4.403*
DUMYFR	-.057	5.512*	DUMYBR	.058	4.422*
DUMYIT	-.087	7.814*	DUMYFR	-.061	4.345*
DUMYUK	-.108	6.452*	DUMYIT	-.236	13.518*
DUMYGR	-.108	5.152*	DUMYUK	-.296	13.660*
			DUMYGR	-.238	8.211*
RSQ=.826740 RSQA =.818289			RSQ=.942118 RSQA =.938434		
NN = 130 F = 97.82			NN = 118 F = 255.77		

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.163	2.217	BGEGE2	.502	4.890
EISP01	.303	5.208*	EISP02	.212	2.444*
IGES01	.114	3.492*	IGES02	.191	3.921*
DUMYFR	-.067	5.986*	DUMYBR	.117	9.784*
DUMYIT	-.090	8.127*	DUMYIT	-.176	11.318*
DUMYUK	-.125	6.831*	DUMYNL	.066	3.498*
DUMYDK	-.029	2.148*	DUMYBE	.059	3.440*
DUMYGR	-.115	5.514*	DUMYUK	-.238	11.983*
			DUMYGR	-.176	6.394*
RSQ=.833057 RSQA =.823478			RSQ=.942394 RSQA =.938166		
NN = 130 F = 86.97			NN = 118 F = 222.90		

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.478	10.428	BGEGE2	.781	11.889
EOFL01	.045	3.200*	EOFL02	.056	3.751*
IGES01	.145	4.439*	IGES02	.186	4.651*
DUMYBR	.021	2.069*	DUMYBR	.070	6.043*
DUMYFR	-.032	2.706*	DUMYFR	-.036	2.551*
DUMYIT	-.094	8.159*	DUMYIT	-.228	14.205*
DUMYUK	-.081	4.917*	DUMYUK	-.280	16.034*
DUMYGR	-.157	8.645*	DUMYGR	-.248	8.842*
RSQ=.817116 RSQA =.806623			RSQ=.946000 RSQA =.942564		
NN = 130 F = 77.87			NN = 118 F = 275.29		

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.442	9.744	BGEGE2	.737	11.144
EOFL01	.043	3.103*	EOFL02	.055	3.632*
IGES01	.177	5.507*	IGES02	.192	4.595*
DUMYFR	-.045	4.140*	DUMYBR	.105	8.438*
DUMYIT	-.110	10.546*	DUMYIT	-.192	11.879*
DUMYNL	-.038	2.758*	DUMYNL	.033	1.940*
DUMYUK	-.089	5.558*	DUMYBE	.037	2.072*
DUMYGR	-.161	9.045*	DUMYUK	-.244	13.210*
			DUMYGR	-.211	7.571*
RSQ=.821808 RSQA =.811584			RSQ=.945796 RSQA =.941818		
NN = 130 F = 80.38			NN = 118 F = 237.74		

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.348	6.620	BGEGE2	.652	8.431
EMIS01	.040	3.573*	EMIS02	.037	2.847*
IGES01	.148	4.519*	IGES02	.207	5.164*
DUMYFR	-.072	5.765*	DUMYBR	.061	4.986*
DUMYIT	-.122	11.395*	DUMYFR	-.071	4.782*
DUMYUK	-.117	5.768*	DUMYIT	-.246	13.473*
DUMYGR	-.175	9.509*	DUMYUK	-.302	14.018*
			DUMYGR	-.258	8.786*
RSQ=.814593 RSQA =.805548			RSQ=.943346 RSQA =.939741		
NN = 130 F = 90.07			NN = 118 F = 261.66		

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	.345	6.654	BGEGE2	.584	7.315
EMIS01	.035	3.039*	EMIS02	.031	2.475*
IGES01	.170	5.016*	IGES02	.225	5.457*
DUMYFR	-.071	5.810*	DUMYBR	.128	10.675*
DUMYIT	-.124	11.719*	DUMYIT	-.175	11.319*
DUMYNL	-.030	2.136*	DUMYNL	.061	3.382*
DUMYUK	-.111	5.512*	DUMYBE	.071	4.002*
DUMYGR	-.173	9.477*	DUMYUK	-.230	12.632*
			DUMYGR	-.184	6.705*
RSQ=.821276	RSQA	=.811022	RSQ=.942469	RSQA	=.938247
NN = 130	F	= 80.09	NN = 118	F	= 223.20

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.064	.430	BGEGK2	.108	.731
EMP001	.221	2.450*	EMP002	.396	4.649*
IGES01	.199	6.948*	IGES02	.263	6.466*
DUMYBR	.036	3.501*	DUMYFR	-.065	5.296*
DUMYNL	.089	4.834*	DUMYIT	-.105	6.744*
DUMYBE	.058	3.621*	DUMYUK	-.159	9.094*
RSQ=.590882	RSQA	=.573094	RSQ=.768441	RSQA	=.757201
NN = 121	F	= 33.22	NN = 109	F	= 68.36

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.044	.304	BGEGK2	.184	1.274
EMP001	.240	2.698*	EMP002	.376	4.598*
IGES01	.197	7.021*	IGES02	.243	6.149*
DUMYBR	.027	2.564*	DUMYFR	-.074	6.089*
DUMYFR	-.026	2.326*	DUMYIT	-.117	7.615*
DUMYNL	.083	4.538*	DUMYBE	-.051	3.179*
DUMYBE	.051	3.174*	DUMYUK	-.170	9.920*
RSQ=.609415	RSQA	=.588858	RSQ=.789313	RSQA	=.776919
NN = 121	F	= 29.64	NN = 109	F	= 63.69

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	-.004	.051	BGEGK2	.411	3.526
EISP01	.428	6.397*	EISP02	.210	2.282*
IGES01	.079	2.091*	IGES02	.235	5.419*
DUMYFR	-.064	5.610*	DUMYBR	.065	6.260*
DUMYNL	.083	5.507*	DUMYIT	-.050	3.490*
DUMYUK	-.079	3.939*	DUMYUK	-.109	5.670*
DUMYDK	-.031	2.206*			
RSQ=.666246	RSQA =.648680		RSQ=.808178	RSQA =.798866	
NN = 121	F = 37.93		NN = 109	F = 86.79	

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.124	1.443	BGEGK2	.292	2.371
EISP01	.389	4.707*	EISP02	.283	2.607*
IGES01	.088	2.165*	IGES02	.210	4.180*
DUMYBR	-.082	4.905*	DUMYBR	.114	8.183*
DUMYFR	-.144	7.110*	DUMYFR	.048	3.252*
DUMYIT	-.094	6.370*	DUMYNL	.069	2.993*
DUMYBE	-.070	3.433*	DUMYBE	.048	2.692*
DUMYUK	-.155	5.081*	DUMYUK	-.067	3.674*
DUMYDK	-.111	4.939*			
RSQ=.694268	RSQA =.672430		RSQ=.810661	RSQA =.797539	
NN = 121	F = 31.79		NN = 109	F = 61.78	

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.419	8.979	BGEGK2	.671	10.348
EOFL01	.041	2.911*	EOFL02	.046	3.345*
IGES01	.176	5.314*	IGES02	.222	5.471*
DUMYFR	-.043	3.929*	DUMYBR	.067	7.123*
DUMYIT	-.045	4.329*	DUMYIT	-.056	3.970*
DUMYNL	.028	1.987*	DUMYUK	-.103	6.435*
DUMYUK	-.029	1.774*			
RSQ=.648353	RSQA =.629845		RSQ=.818228	RSQA =.809404	
NN = 121	F = 35.03		NN = 109	F = 92.73	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.474	8.357	BGEGK2	.589	10.143
EOFL01	.042	2.906*	EOFL02	.050	3.382*
IGES01	.164	4.503*	IGES02	.235	5.784*
DUMYBR	-.035	2.584*	DUMYBR	.117	8.550*
DUMYFR	-.079	4.844*	DUMYFR	.059	3.886*
DUMYIT	-.081	5.236*	DUMYNL	.043	2.292*
DUMYBE	-.034	1.789*	DUMYBE	.040	2.330*
DUMYUK	-.067	3.076*	DUMYUK	-.051	3.288*
DUMYDK	-.043	2.377*			
RSQ=.659449	RSQA =.635124		RSQ=.818476	RSQA =.805896	
NN = 121	F = 27.11		NN = 109	F = 65.06	

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.341	5.468	BGEGK2	.475	6.026
EMIS01	.027	2.098*	EMIS02	.025	1.953*
IGES01	.196	5.707*	IGES02	.271	6.740*
DUMYBR	-.028	2.456*	DUMYBR	.120	8.228*
DUMYFR	-.087	5.660*	DUMYFR	.041	2.821*
DUMYIT	-.082	6.032*	DUMYNL	.050	2.414*
DUMYUK	-.063	2.708*	DUMYBE	.053	2.799*
DUMYDK	-.026	1.704*	DUMYUK	-.053	3.164*
RSQ=.643483	RSQA =.621398		RSQ=.805274	RSQA =.791778	
NN = 121	F = 29.14		NN = 109	F = 59.67	

	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.370	5.792	BGEGK2	.592	6.648
EMIS01	.033	2.510*	EMIS02	.049	3.470*
IGES01	.169	4.556*	IGES02	.192	4.318*
DUMYBR	-.045	3.047*	DUMYFR	-.073	5.723*
DUMYFR	-.109	5.559*	DUMYIT	-.129	7.605*
DUMYIT	-.100	5.891*	DUMYBE	-.053	3.173*
DUMYBE	-.035	1.778*	DUMYUK	-.185	9.094*
DUMYUK	-.091	3.260*			
DUMYDK	-.044	2.408*			
RSQ=.653273	RSQA =.628507		RSQ=.772499	RSQA =.759117	
NN = 121	F = 26.38		NN = 109	F = 57.73	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-2.638	2.855	BEFL02	-1.489	1.622
EMP001	1.909	3.168*	EMP002	1.233	2.087*
IGES01	1.157	10.639*	IGES02	1.298	8.391*
DUMYBR	.257	3.989*	DUMYBR	.399	5.756*
DUMYNL	.435	3.679*	DUMYNL	.521	3.407*
DUMYBE	.559	5.320*	DUMYBE	.493	4.329*
DUMYUK	.493	5.140*	DUMYUK	.237	2.537*
RSQ=.715133	RSQA =.702185		RSQ=.659960	RSQA =.643372	
NN = 139	F = 55.23		NN = 130	F = 39.79	

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-3.204	3.411	BEFL02	-2.426	2.519
EMP001	2.008	3.382*	EMP002	1.771	2.896*
IGES01	1.401	9.420*	IGES02	1.298	8.597*
DUMYBR	.228	3.525*	DUMYBR	.478	6.464*
DUMYNL	.404	3.461*	DUMYIT	.213	2.652*
DUMYBE	.572	5.536*	DUMYNL	.679	4.223*
DUMYUK	.541	5.611*	DUMYBE	.597	5.062*
DUMYIR	.336	2.361*	DUMYUK	.300	3.182*
RSQ=.726759	RSQA =.712158		RSQ=.678495	RSQA =.660048	
NN = 139	F = 49.78		NN = 130	F = 36.78	

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-2.379	8.873	BEFL02	-1.477	3.385
EISP01	2.471	10.950*	EISP02	1.838	4.133*
IGES01	.702	6.912*	IGES02	.875	3.469*
DUMYFR	-.290	4.828*	DUMYBR	.246	3.117*
DUMYNL	.280	3.228*	DUMYFR	-.189	2.185*
DUMYBE	.239	2.801*	DUMYNL	.383	2.868*
DUMYDK	-.233	3.058*	DUMYBE	.327	3.007*
			DUMYDK	-.247	2.466*
RSQ=.786611	RSQA =.776911		RSQ=.707280	RSQA =.690485	
NN = 139	F = 81.10		NN = 130	F = 42.11	

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-2.838	8.251	BEFL02	-2.102	3.643
EISP01	2.798	10.274*	EISP02	1.880	4.674*
IGES01	.668	6.577*	IGES02	1.076	4.539*
DUMYFR	-.284	4.770*	DUMYBR	.440	6.726*
DUMYNL	.323	3.662*	DUMYIT	.235	2.821*
DUMYBE	.255	3.010*	DUMYNL	.567	4.989*
DUMYDK	-.230	3.057*	DUMYBE	.533	5.259*
DUMYGR	.226	2.092*	DUMYUK	.203	2.077*
			DUMYGR	.397	2.482*
RSQ=.793509	RSQA	=.782475	RSQ=.709982	RSQA	=.690807
NN = 139	F	= 71.92	NN = 130	F	= 37.03

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	.255	5.177	BEFL02	.633	8.687
EOFL01	1.085	65.204*	EOFL02	1.058	61.374*
IGES01	.217	6.147*	IGES02	.291	6.441*
DUMYIT	-.132	10.098*	DUMYFR	-.123	8.617*
DUMYUK	-.060	2.999*	DUMYIT	-.299	18.288*
DUMYIR	-.152	5.054*	DUMYUK	-.325	17.561*
DUMYGR	-.274	12.645*	DUMYDK	-.122	7.204*
			DUMYGR	-.368	11.984*
RSQ=.990060	RSQA	=.989608	RSQ=.989477	RSQA	=.988873
NN = 139	F	=2191.31	NN = 130	F	=1638.74

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	.210	4.415	BEFL02	.519	7.629
EOFL01	1.057	67.305*	EOFL02	1.060	64.533*
IGES01	.263	8.154*	IGES02	.285	6.559*
DUMYBR	.022	1.764*	DUMYBR	.133	10.635*
DUMYIT	-.118	8.349*	DUMYIT	-.179	11.161*
DUMYBE	.044	2.284*	DUMYNL	.122	6.591*
DUMYIR	-.117	4.137*	DUMYBE	.077	4.052*
DUMYGR	-.253	11.887*	DUMYUK	-.206	10.788*
			DUMYGR	-.250	8.788*
RSQ=.989904	RSQA	=.989365	RSQ=.990373	RSQA	=.989737
NN = 139	F	=1834.92	NN = 130	F	=1556.01

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-1.537	6.068	BEFL02	-1.680	5.489
EMIS01	.641	11.785*	EMIS02	.631	11.805*
IGES01	.410	2.836*	IGES02	.744	4.299*
DUMYFR	-.590	9.642*	DUMYFR	-.649	12.112*
DUMYIT	-.465	8.594*	DUMYIT	-.494	7.271*
DUMYUK	-.378	3.888*	DUMYUK	-.583	6.882*
DUMYIR	-.371	2.944*	DUMYGR	-.433	3.660*
DUMYGR	-.551	6.174*			
RSQ=.850598	RSQA	=.842615	RSQ=.834689	RSQA	=.826625
NN = 139	F	= 106.55	NN = 130	F	= 103.51

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-1.608	6.389	BEFL02	-1.734	5.685
EMIS01	.628	11.668*	EMIS02	.631	11.895*
IGES01	.477	3.277*	IGES02	.766	4.456*
DUMYFR	-.555	8.918*	DUMYFR	-.632	11.694*
DUMYIT	-.438	8.022*	DUMYIT	-.473	6.904*
DUMYBE	.163	2.213*	DUMYBE	.124	1.755*
DUMYUK	-.329	3.346*	DUMYUK	-.563	6.640*
DUMYIR	-.302	2.360*	DUMYGR	-.404	3.412*
DUMYGR	-.506	5.604*			
RSQ=.356023	RSQA	=.847163	RSQ=.838760	RSQA	=.829509
NN = 139	F	= 96.62	NN = 130	F	= 90.66

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-2.207	2.349	BKFL02	-1.127	1.283
EMP001	1.744	2.844*	EMP002	.834	1.670*
IGES01	1.069	9.477*	IGES02	1.641	9.015*
DUMYBR	.219	3.390*	DUMYFR	-.447	6.368*
DUMYNL	.452	3.791*	DUMYDK	-.386	3.516*
DUMYBE	.514	4.864*			
DUMYUK	.493	5.081*			
RSQ=.671070	RSQA	=.655024	RSQ=.518261	RSQA	=.501649
NN = 130	F	= 41.82	NN = 121	F	= 31.20

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-2.752	2.819	BKFL02	-2.336	2.167
EMP001	1.823	2.995*	EMP002	1.356	2.143*
IGES01	1.315	7.556*	IGES02	1.599	6.793*
DUMYBR	.198	3.043*	DUMYBR	.439	5.844*
DUMYNL	.427	3.599*	DUMYIT	.409	4.362*
DUMYBE	.535	5.080*	DUMYNL	.558	3.399*
DUMYUK	.550	5.449*	DUMYBE	.542	4.500*
DUMYIR	.301	1.843*	DUMYUK	.498	4.956*
RSQ=.679979	RSQA	=.661617	RSQ=.536612	RSQA	=.507906
NN =	130 F	= 37.03	NN =	121 F	= 18.69

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-2.856	7.694	BKFL02	-2.543	3.511
EISP01	2.881	9.783*	EISP02	2.940	5.230*
IGES01	.604	5.767*	IGES02	.482	1.904*
DUMYFR	-.316	5.246*	DUMYBR	.230	3.385*
DUMYNL	.375	4.168*	DUMYNL	.497	4.009*
DUMYBE	.238	2.779*	DUMYBE	.319	3.037*
DUMYDK	-.268	3.506*	DUMYDK	-.439	3.924*
RSQ=.753511	RSQA	=.741487	RSQ=.521638	RSQA	=.496462
NN =	130 F	= 62.67	NN =	121 F	= 20.72

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-3.457	6.170	BKFL02	-2.153	3.140
EISP01	3.144	6.970*	EISP02	1.672	3.495*
IGES01	.542	2.741*	IGES02	1.265	5.014*
DUMYBR	.279	4.296*	DUMYBR	.408	6.063*
DUMYIT	.371	4.095*	DUMYIT	.402	4.610*
DUMYNL	.706	6.043*	DUMYNL	.504	4.201*
DUMYBE	.541	5.801*	DUMYBE	.492	4.710*
DUMYUK	.267	2.627*	DUMYUK	.385	3.812*
DUMYIR	.288	2.013*			
RSQ=.755081	RSQA	=.738888	RSQ=.564822	RSQA	=.537864
NN =	130 F	= 46.63	NN =	121 F	= 20.95

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	.233	5.360	BKFL02	.422	6.986
EOFL01	1.074	73.374*	EOFL02	1.051	68.283*
IGES01	.225	7.601*	IGES02	.300	7.319*
DUMYIT	-.068	5.441*	DUMYBR	.153	12.512*
DUMYNL	.049	2.851*	DUMYFR	.064	4.438*
DUMYBE	.038	2.157*	DUMYNL	.142	7.635*
DUMYIR	-.072	2.721*	DUMYBE	.087	4.982*
RSQ=.989871	RSQA	=.989377	RSQ=.987503	RSQA	=.986846
NN =	130 F	=2003.35	NN =	121 F	=1501.40

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	.296	5.525	BKFL02	.490	7.123
EOFL01	1.066	65.169*	EOFL02	1.058	70.802*
IGES01	.224	6.497*	IGES02	.295	6.832*
DUMYBR	-.045	3.276*	DUMYBR	.081	6.971*
DUMYFR	-.061	3.689*	DUMYIT	-.061	3.908*
DUMYIT	-.117	7.375*	DUMYNL	.070	4.093*
DUMYUK	-.042	2.017*	DUMYUK	-.082	4.592*
DUMYIR	-.126	3.908*	DUMYDK	-.088	5.568*
DUMYDK	-.054	2.877*			
RSQ=.990254	RSQA	=.989610	RSQ=.987957	RSQA	=.987211
NN =	130 F	=1536.82	NN =	121 F	=1324.28

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-1.911	7.127	BKFL02	-2.009	6.155
EMIS01	.717	12.087*	EMIS02	.651	11.300*
IGES01	.435	2.991*	IGES02	.816	4.428*
DUMYBR	-.207	3.916*	DUMYFR	-.581	10.439*
DUMYFR	-.730	10.400*	DUMYIT	-.291	4.060*
DUMYIT	-.534	8.574*	DUMYBE	.123	1.698*
DUMYUK	-.486	4.567*	DUMYUK	-.388	4.372*
DUMYIR	-.331	2.622*			
RSQ=.832868	RSQA	=.823279	RSQ=.758886	RSQA	=.746196
NN =	130 F	= 86.85	NN =	121 F	= 59.80

Table 20 continued

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-2.137	8.616	BKFL02	-1.802	5.064
EMIS01	.678	11.275*	EMIS02	.672	10.909*
IGES01	.569	5.732*	IGES02	.696	3.719*
DUMYFR	-.490	8.561*	DUMYBR	-.124	2.150*
DUMYIT	-.313	5.712*	DUMYFR	-.699	10.009*
DUMYNL	.237	3.179*	DUMYIT	-.428	4.989*
DUMYBE	.256	3.469*	DUMYUK	-.527	5.156*
DUMYUK	-.212	2.417*	DUMYDK	-.138	1.788*
DUMYDK	.143	2.021*			
RSQ=.832260	RSQA	=.821169	RSQ=.764294	RSQA	=.749693
NN = 130	F	= 75.04	NN = 121	F	= 52.34

Notes:

For an explanation of codes, cf. 'Key to Tables' below TABLE 17

BETA Regression coefficient

T-Value Value of t-distribution at 95%-level

RSQ Unadjusted coefficient of determination

RSQA Adjusted coefficient of determination

NN Number of observations (regions)

F F-test

X.3. FULLY SPECIFIED POTENTIALITY FACTOR QUASI-PRODUCTION FUNCTIONS

According to the potentiality factor approach, infrastructure is only one of the determinants of regional development potential. It is necessary, therefore, to examine the income and employment effects of infrastructure in combination with the other potentiality factors. In order to do this, the production function used upto now has to be extended in order to be able to include the other potentiality factors.

The general form of the fully specified quasi-production function to be tested can be written as follows:

DI=f (LOC, AGG, STR, INFRA, SIZE)

where LOC = Location variable (ENTGKM), AGG = Agglomeration indicators, STR = Structure indicators, INFRA = Infrastructure indicators, and SIZE = Size indicator.

Given the fact that the size of the European regions differs considerably between member states, it may sometimes be necessary to include a special SIZE variable, e. g. in terms of absolute number of inhabitants, absolute number of employed persons or total surface. Where necessary, this variable will catch economies of scale effects.

INFRASTRUCTURE will again be represented by the aggregate infrastructure indicator IGES, whereas the other potentiality factors have to be represented by the best available simple proxy indicator. To find such a definition is an empirical problem which involves a number of tests on competing and alternative indicators. The same is also true for the development indicators, for which several definitions are again possible depending upon research interest and in particular what aspect of income or employment is to be explained. As has already been mentioned, one must also take into account the fact that the agricultural sector can produce distortions. For example, agricultural activity rates may be exaggerated because too many family helps are counted as employed, or because agricultural prices do not always reflect the same index of real productivity as in other sectors given the high rate of protection.

In the estimated quasi-production functions, LOCATION is defined as sum of all distances of one region to all others (ENTGKM). As has already been shown [BIEHL/MUENZER (1980)], a much more simplified location indicator such as the distance of a region from an assumed core area of the Community, for example Wiesbaden or Koeln/Duesseldorf, is already an useful proxy. The basic economic assumption behind this indicator is the idea that communication cost increase with the location distance of a region compared with the dominant centers of world economic activity. A fully specified location approach would necessitate relying on a gravitation model or a fully developed central place model a la Christaller/Loesch. As can be seen from the scattergram for the location variable (ENTGKM) in FIGURE 13, the basic relationship between income per capita and increasing sum of distances represents already a reasonable approximation to those more differentiated models. It clearly shows that income per capita decreases with increasing distance, so that a negative sign for this variable in the quasi-production function can be expected. The complete ranking list of the sum of distances used as the proxy variable for location, ENTGKM, is to be found in the Annex. .p As to AGGLOMERATION, a similar crude indicator is again used as a proxy, namely population density (POFL) or employment density (EOFL, EGFL). SECTORAL STRUCTURE is represented mainly by the share of the non-agricultural sectors industry and services in GDP (BPG%), sometimes by the share of non-agricultural employment in total employment (E%IS). The last variable, SIZE, only has the function of correcting for possible distortions arising due to differences between regions in absolute size which may conceal economies of scale. It is measured by FLGS or EMTO.

Finally, some dummy variables will be introduced as in the case of the modified Cobb-Douglas production functions.

The test to which the potentiality factor approach is submitted here is a very severe one:

- It is done on a cross-section basis, thereby ensuring that the normal growth relationships which characterize time series, and which normally provide high correlations due to the time trend involved, are completely absent.

- With a few exceptions, all the variables used are in per capita or per unit area terms thus excluding the possibility of obtaining high fits with the aid of absolute figures, which always will show a high correlation if the regions differ sufficiently in size. On the other hand, where size seems to be a reasonable proxy for economies of scale, appropriate variables have been introduced in order to measure this influence explicitly.

- With the exception of the weights used for aggregating the infrastructure subcategories of education, no monetary values have been used. This also reduces the chance of obtaining high correlations due to the underlying general price system.

- By increasing the number of exogenous variables, the risk that relevant variables become insignificant simply because there are too many of them, also increases. This risk is particularly high if one of the variables chosen to represent a potentiality factor is a 'dominant' variable in the statistical sense, i. e. that it accounts for such a large part of the total explanation of the dispersion of the development indicator that any other theoretically well justified variable will show up as insignificant. To avoid this risk, a multivariate factor analysis could be used in order to reduce the number of variables to those that are most significant. Some National Reports (e. g. the one for Italy) record findings with that technique.

This difference between the theoretical concept, and the statistical possibilities or impossibilities of adequately testing a theoretical proposition, should always be borne in mind when evaluating the results. Therefore, in order to obtain significant combinations of explanatory variables and unbiased estimates of regression coefficients, it has been necessary to reduce the number of variables and to look for the best fully significant abridged version of a quasi-production function.

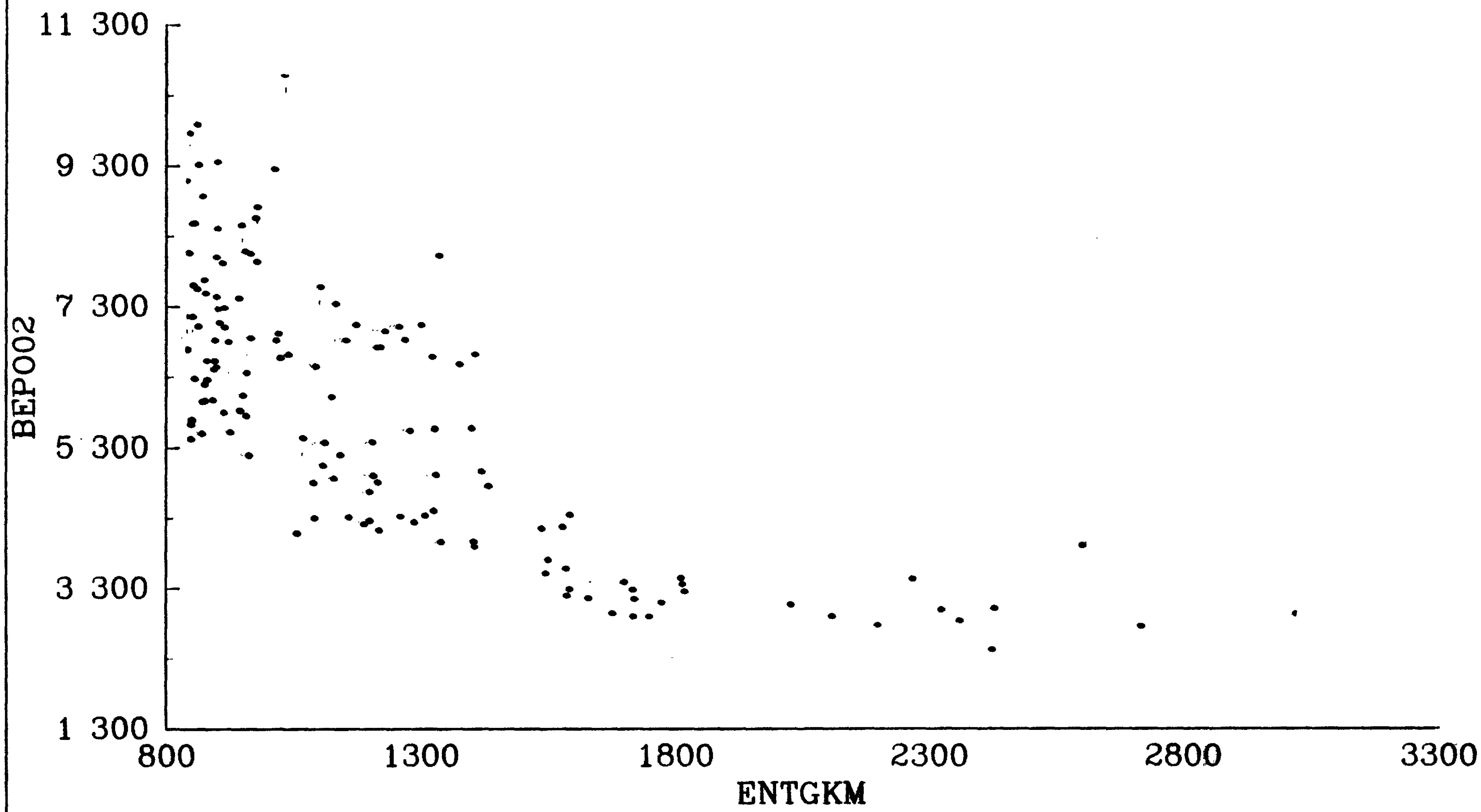


FIGURE 13.: Scattergram of Correlation for BEPO02 and ENTGKM

The ENTGKM–Values are ranked in descending order

Again, a large number of significant quasi-production functions were obtained. Some of the best-fit ones are presented in TABLE 21. The results of the estimations can be summarized as follows:

(1) In general, the RSQAs for the fully specified functions are as good as the modified Cobb-Douglas functions with a similar number of dummies, in some cases even better. Only for BEFLO2 as endogenous variable, no fully specified function with significant parameters could be obtained. The RSQAs range between .6237 and .9940 for the first respectively .6969 and .9928 for the second year. The lowest figures refer to the functions explaining real GDP in the non-agricultural sectors per employed person in these sectors (BGEGK). If these functions are disregarded because they clearly deviate strongly from all other results, the other functions explain between 81 respectively 86 and 99 per cent of total variation. This demonstrates that the fully specified potentiality factor quasi-production functions, although they include only exogenous variables with a high "publicness" character, perform as well as modified Cobb-Douglas functions which include labour as a "private" factor of production. It is, therefore, possible to maintain the thesis that these factors can be considered to determine regional development potential, if regional potential is defined in terms of the "normal" or "average" income or employment which can be obtained through a given regional production capacity.

(2) As has been expected, the regression coefficients and their t-values for the aggregate infrastructure indicator IGES are lower compared with both the singular infrastructure functions and the modified Cobb-Douglas functions. Since the regression coefficients can be interpreted as production elasticities, this implies that the contribution of infrastructure is reduced if the full set of potentiality factors is considered.

(3) Evaluated on the basis of the t-figures, infrastructure is a strong explanatory variable in the case of the personal income and productivity indicators BEPO, BEEM and BKEM. In case of the two nominal income density variables BEFL

and BGFLE t-values are lower, but increase again for the two real income density variables BKFL and BGFL, although the agglomeration variable POFL occupies a prominent place and seems to determine the largest part of the endogenous variables. A possible explanation is that the agglomeration variable already captures a part of those effects of infrastructure which are linked with population density.

(4) The role of infrastructure remains significant in case of the two functions for the absolute number of employed persons in non-agricultural sectors (EMIS) and the activity rate in these sectors (EISP). Understandably in the first function, the absolute size of a region measured in terms of area has the strongest influence followed by agglomeration. But it is interesting to note that infrastructure contributes even to the explanation of EISP, a variable for which it is not easy to find fully significant explanatory functions.

In summarizing, the fully specified quasi-production functions forcefully support the basic thesis of the potentiality factor approach for the EC-regions. Given the fact that the proxy indicators used for the potentiality factors are not measured in monetary terms, that the time trend factor which often improves regressions in form of time series is totally absent and that there are not a few problems as to comparability of statistical data used, the results are unexpectedly good.

The following analyses are limited to the two endogenous indicators BEPO and BEEM. The first indicator seems to be the best available general income indicator because it relates GDP to population. Population is considered to represent potential labour force. It can be expected that BEPO increases whenever productivity and/or employment rise. BEEM links GDP with the number of employed persons and, therefore, is a productivity indicator. The high values obtained for BEEM as to goodness of fit imply that a better resource endowment is very frequently reflected in increased productivity. The BEPO and BEEM quasi-production functions will be used for an additional type of analysis in the following section.

TABLE 21.: Selected Fully Specified Potentiality Factors Quasi-Production Functions (Income Per Capita, Income per Employed Person, Labour Force Participation), 1st and 2nd Cross Section Years

	BETA	T-VALUE		BETA	T-VALUE
BEP001	1.737	3.046	BEP002	2.682	4.528
IGES01	.222	4.526*	IGES02	.191	3.282*
ENTGKM	-.353	5.177*	ENTGKM	-.444	5.484*
BPG%01	1.119	4.826*	BPG%02	.986	4.021*
POFL01	.036	1.830*	POFL02	.037	1.834*
DUMYBR	.048	2.636*	DUMYBR	.132	8.945*
DUMYDK	.119	5.477*	DUMYFR	.040	2.148*
DUMYFR	.067	3.584*	DUMYIT	-.114	6.137*
DUMYIT	-.063	3.183*	DUMYUK	-.142	5.838*
DUMYNL	-.069	2.922*			
DUMYUK	.040	1.493			
RSQ=.894479	RSQA =.885612		RSQ=.936198	RSQA =.931515	
NN =130	F = 100.87		NN =118	F = 199.93	
	BETA	T-VALUE		BETA	T-VALUE
BEEM01	2.541	5.955	BEEM02	3.340	6.541
IGES01	.121	3.535*	IGES02	.185	3.469*
ENTGKM	-.412	7.214*	ENTGKM	-.294	3.441*
BPG%01	1.094	6.726*	BPG%02	.659	2.905*
POFL01	.032	1.844*	POFL02	.043	2.493*
DUMYBR	.034	2.596*	DUMYBR	.073	4.404*
DUMYDK	.069	4.347*	DUMYFR	-.039	1.915*
DUMYFR	.044	3.137*	DUMYIT	-.197	8.222*
DUMYNL	.037	1.853*	DUMYNL	.069	3.139*
			DUMYUK	-.247	9.989*
			DUMYGR	-.165	3.852*
RSQ=.884209	RSQA =.876554		RSQ=.956145	RSQA =.952047	
NN =130	F = 115.50		NN =118	F = 233.29	

Table 21 continued

	BETA	T-VALUE		BETA	T-VALUE
BKEM01	2.248	7.006	BKEM02	3.668	8.698
IGES01	.082	2.930*	IGES02	.125	2.606*
ENTGKM	-.153	2.946*	ENTGKM	-.320	4.711*
E%IS01	.911	8.087*	E%IS02	.541	3.299*
POFL01	.025	1.891*	POFL02	.041	2.824*
DUMYNL	.058	4.326*	DUMYBR	.112	9.562*
DUMYUK	-.042	2.409*	DUMYFR	.062	4.382*
DUMYIR	-.057	2.578*	DUMYNL	.075	4.457*
RSQ=.893319	RSQA =.887198		RSQ=.872268	RSQA =.864355	
NN =130	F = 145.94		NN =121	F = 110.24	
	BETA	**T-VALUE**		**BETA**	**T-VALUE**
EMIS01	-3.964	10.360	EMIS02	-3.049	7.499
IGES01	.134	3.706*	IGES02	.102	2.425*
ENTGKM	-.103	1.964*	ENTGKM	-.104	1.715*
BPG%01	1.827	12.000*	BPG%02	1.288	7.576*
POFL01	.988	72.629*	POFL02	1.008	72.831*
FLGS01	1.008	63.197*	FLGS02	1.043	60.454*
DUMYBR	-.017	1.403	DUMYBR	.007	.517
DUMYFR	.030	1.824*	DUMYFR	-.026	1.462
DUMYIT	-.064	4.825*	DUMYIT	-.006	.405
DUMYNL	-.094	5.773*	DUMYNL	-.067	4.052*
DUMYUK	.058	2.836*	DUMYUK	.039	2.073*
RSQ=.994455	RSQA =.993989		RSQ=.993400	RSQA =.992784	
NN = 130	F =2134.31		NN = 118	F =1610.63	
	BETA	**T-VALUE**		**BETA**	**T-VALUE**
EISP01	-1.395	3.759	EISP02	-.835	2.036
IGES01	.057	1.669*	IGES02	.086	2.055*
ENTGKM	-.162	3.770*	ENTGKM	-.114	1.916*
BPG%01	1.652	10.570*	BPG%02	1.185	6.868*
EOFL01	.027	1.894*	EGFL02	.027	2.038*
DUMYFR	.076	7.265*	FLGS02	.046	2.755*
DUMYUK	.087	4.752*	DUMYBR	.008	.603
DUMYDK	.079	6.037*	DUMYFR	-.020	1.143
			DUMYIT	-.005	.330
			DUMYNL	-.066	4.053*
			DUMYUK	.037	2.005*
RSQ=.891033	RSQA =.884781		RSQ=.872244	RSQA =.860305	
NN = 130	F = 142.51		NN =118	F = 73.05	

TABLE 22.: Selected Fully Specified Potentiality Factors Quasi-Production Functions (Income Density, Sectoral Income per Employed Person), 1st and 2nd Cross Section Year

	BETA	T-VALUE		BETA	T-VALUE
BEFL01	-1.354	2.317			
IGES01	.097	1.986*			
ENTGKM	-.535	6.861*			
BPG%01	1.557	6.786*			
POFL01	.962	37.344*			
EMT001	.032	1.745*			
RSQ=.977609	RSQA	=.976706			
NN = 130	F	=1082.78			

	BETA	T-VALUE		BETA	T-VALUE
BKFL01	-3.341	5.038	BKFL02	-.035	.032
IGES01	.131	3.269*	IGES02	.233	3.215*
ENTGKM	-.368	5.236*	ENTGKM	-.673	5.526*
BPG%01	2.294	7.680*	BPG%02	1.045	2.094*
POFL01	.961	42.495*	POFL02	.953	37.504*
EMT001	.026	1.754*	EMT002	.072	3.074*
RSQ=.981874	RSQA	=.981085	RSQ=.973673	RSQA	=.972395
NN = 121	F	=1245.86	NN = 109	F	= 761.86

	BETA	T-VALUE		BETA	T-VALUE
BGFLE1	-6.590	11.499	BGFLE2	-1.440	1.839
IGES01	.097	1.983*	IGES02	.364	3.928*
ENTGKM	-.488	6.615*	ENTGKM	-.920	7.352*
BPG%01	2.675	12.094*	BPG%02	.638	1.989*
POFL01	.982	41.925*	POFL02	1.014	34.082*
RSQ=.980105	RSQA	=.979469	RSQ=.969812	RSQA	=.968743
NN = 130	F	=1539.54	NN = 118	F	= 907.55

Table 22 continued

	BETA	T-VALUE		BETA	T-VALUE
BGFLK1	-8.593	13.156	BGFLK2	-6.482	6.267
IGES01	.132	3.286*	IGES02	.276	3.735*
ENTGKM	-.323	4.894*	ENTGKM	-.464	4.417*
BPG%01	3.409	11.597*	BPG%02	2.597	5.366*
POFL01	.977	46.531*	POFL02	.981	39.658*
RSQ=.982905	RSQA	=.982315	RSQ=.973019	RSQA	=.971981
NN = 121	F	=1667.38	NN = 109	F	= 937.63
	BETA	T-VALUE		BETA	T-VALUE
BGEGE1	-.226	.552	BGEGE2	.960	2.076
IGES01	.109	3.139*	IGES02	.152	3.314*
ENTGKM	-.207	4.057*	ENTGKM	-.404	6.253*
BPG%01	.714	4.467*	BPG%02	.558	2.909*
POFL01	.026	1.885*	POFL02	.032	2.265*
DUMYIT	-.050	4.214*	DUMYBR	.082	8.063*
DUMYUK	-.079	4.323*	DUMYIT	-.141	10.337*
DUMYDK	.030	2.256*	DUMYUK	-.221	12.024*
RSQ=.823531	RSQA	=.813405	RSQ=.942410	RSQA	=.938745
NN = 130	F	= 81.33	NN = 118	F	= 257.15
	BETA	T-VALUE		BETA	T-VALUE
BGEGK1	.128	.314	BGEGK2	3.264	6.702
IGES01	.119	3.342*	IGES02	.257	4.354*
ENTGKM	-.107	1.760*	ENTGKM	-.585	6.932*
E%IS01	.357	2.431*	E%IS02	-.459	2.558*
POFL01	.035	2.371*	POFL02	.050	2.777*
DUMYNL	.037	2.566*	DUMYNL	-.036	1.837*
DUMYUK	-.031	1.542	DUMYBE	-.064	3.274*
RSQ=.642532	RSQA	=.623718	RSQ=.715162	RSQA	=.698407
NN = 121	F	= 34.15	NN = 109	F	= 42.68

X.4. INFRASTRUCTURE BOTTLENECKS AND EXCESS CAPACITIES

According to the potentiality factor approach, the hypothetical values estimated with the aid of one of the quasi-production functions for e.g. income per capita can be interpreted as representing that regional product per inhabitant that could be expected if a given regional production capacity is utilized in a "normal" or "average" intensity. This implies that the appropriate quantities and qualities of "private" factors of production are available in order to be combined with the "public" production capacity in terms of the potentiality factors. Whenever entrepreneurial capabilities, other private human and material capital and labour force are too small compared with "normal" utilization, the existing capacity will not be fully utilized and the resulting actual income will be lower than potential income. If, on the other hand, private resources exceed this normal rate of utilization, actual income - to a certain extent at least - will be larger than potential income. As in all regions for which data have been collected, both types of resources exist, and since nobody knows exactly their "optimal" combination, it can also be expected that there exists a large range of differences between actual and potential income. But potential income is unknown, and we need a methodology in order to approximate it by estimation.

Such estimation can be based on a quasi-production function. The regression function allows to obtain an estimate of that income per capita that will "normally" or "on average" be associated with a given infrastructure or potentiality factor capacity. If this hypothetical income is taken as a proxy for the unknown potential income under optimal utilization, the difference between actual and hypothetical income can be interpreted as an indicator for relative under- or overutilization of regional development potential. On the basis of the implicit "normal" utilization hypothesis, it is possible to identify regions where actual income is higher and those where it is lower than the proxy value for potential income. Whenever actual income is higher than potential, the conclusion is that the respective region was capable to obtain a higher return than can normally be expected from the same capacity, and if actual income is lower, the capacity is not sufficiently used.

One could be tempted to argue that such an interpretation of the differences is not permissible because the deviations between actually observed and estimated figures are only due to measurement errors or stochastic influences. However, this argument is invalid because it presupposes that the respective regression function is completely specified and that no relevant variables have been omitted. But exactly this is the case with the quasi-production functions estimated here: All explanatory variables of the usual "private" goods type like private labour and capital, energy, raw materials etc. have been explicitly excluded. Their influence, therefore, must also be reflected in the deviations between the hypothetical income estimated with the aid of the regression function (BPYO) and the actually observed income (BEPO). And since these omitted variables represent those factors which determine the rate of utilization of a regional capacity measured in terms of "public" resources only, it is justified to interprete BEPO minus BPYO = BPDO as an indicator for absolute over- or underutilization. Here, BEPO is the actually observed income, BPYO the estimated "potential" income and BPDO the difference in terms of ECU. If this difference is related to the predicted income BPYO, the resulting ratio BPRO = BPDO/BPYO, is an indicator for relative overutilization or the existence of a relative "excess" capacity in case it is negative.

This interpretation can be applied both to the singular infrastructure production functions with IGES and dummies and to the fully specified potentiality factor functions with location, agglomeration and sectoral structure besides Infrastructure as exogenous variables. Although the singular infrastructure functions allocate a larger part of the total observed income or employment dispersion to infrastructure than would be the case if infrastructure was only one among the many other potentiality factor variables in a fully specified quasi-production function, the result is nevertheless meaningful. If infrastructure is considered to be a limiting factor for regional development, it may be worthwhile to know what maximum income level could be attained in a region if its infrastructure equipment is used as the only productive input.

It is obvious that in this case, the other determinants of regional development potential are not explicity considered and that the results will over-estimate the effects of infrastructure. Infrastructure may possibly incorporate a part of the explanation due to other factors which are linked more or less with infrastructure. The figures obtained can, however, be interpreted as showing the influence of infrastructure in an extended sense so that we have a sort of "upper" limit for the contribution of infrastructure. The influence of infrastructure may on the other hand be under-estimated if all other relevant influences are taken account of. This is possible if e.g. another determinant of regional development potential is a "dominant" variable in the statistical sense, i.e. monopolizing too high an explanation of the endogenous variable and reducing the true influence of infrastructure, sometimes even making infrastructure an insignificant exogenous variable. This could be the case e.g. for a powerful agglomeration or sectoral structure variable. We may then have a sort of "lower" limit for the true contribution of infrastructure to regional development.

TABLES 23, 24 and 25 present results obtained for 1st and 2nd cross section years with the aid of one of the best fit singular infrastructure quasi-production functions with dummies. TABLES 23 and 24 in the first column show the actually observed income per capita figures (BEPO) in ECU and current prices. The second columns give the "potential" income per capita (BPYO) obtained with the aid of the selected quasi-production function. BPDO in the third column is the difference between column one and two according to the formula given above in ECU. BPRO in TABLE 25 represents the same difference in per cent of the potential income BPYO. To give an example: The first line for the region of Schleswig in TABLE 23 means that actual income per capita is 2209.54 ECU in first cross section year and that potential income which can be obtained with the given infrastructure equipment of Schleswig is equal to 2385.98 ECU. Since potential income is higher compared to actual income, the difference must have a negative sign. In absolute ECU terms, the difference is 176.44 and in per cent of the potential income [cf. TABLE 25], it is 7.40. On the basis of the interpretation given above, this means that Schleswig has a relatively underutilized infrastructure capacity which can be quantified as representing about 7% of its total income creating capacity.

TABLE 23.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEPO with the Aid of Singular QPF for Infrastructure (IGES) and Country Dummies, 1st Cross Section Year

			BEP001	BPY011	BPD011
		GERMANY			
1	GE- 1	Schleswig	2209.54	2385.98	-176.44
2	GE- 2	Mittelh.-Dithmarschen	2512.12	2692.72	-180.60
3	GE- 3	Hamburg	4029.90	2892.83	1137.07
4	GE- 4	Lueneburger Heide	2176.79	2511.17	-334.38
5	GE- 5	Bremen	2653.19	2483.40	169.79
6	GE- 6	Osnabrueck	2244.90	2353.82	-108.92
7	GE- 7	Ems	2179.61	2387.81	-208.20
8	GE- 8	Muenster	2465.34	2675.73	-210.40
9	GE- 9	Bielefeld	2884.21	2677.60	206.61
10	GE-10	Hannover	3151.28	2798.71	352.57
11	GE-11	Braunschweig	2972.80	2863.30	109.50
12	GE-12	Goettingen	2261.04	2661.50	-400.45
13	GE-13	Kassel	2533.46	2768.75	-235.29
14	GE-14	Dortmund-Siegen	3060.38	2950.61	109.77
15	GE-15	Essen	3026.05	3073.23	-47.17
16	GE-16	Duesseldorf	3745.70	3115.10	630.60
17	GE-17	Aachen	2401.25	2608.24	-206.99
18	GE-18	Koeln	3609.10	3273.99	335.11
19	GE-19	Trier	2227.83	2433.02	-205.19
20	GE-20	Koblenz	2457.65	2829.63	-371.98
21	GE-21	Mittel-Osthessen	2441.18	2697.61	-256.43
22	GE-22	Bamberg-Hof	2630.21	2550.28	79.93
23	GE-23	Aschaffenb.-Schweinf.	2393.75	2563.90	-170.14
24	GE-24	Frankfurt-Darmstadt	3630.35	3127.24	503.11
25	GE-25	Mainz-Wiesbaden	3243.39	3124.24	119.14
26	GE-26	Saarland	2539.48	2915.97	-376.49
27	GE-27	Westpfalz	2220.92	2706.72	-485.81
28	GE-28	Rhein-Neckar-Suedpf.	3345.13	3082.42	262.70
29	GE-29	Oberrhein-Nordschw.	3104.83	3126.68	-21.85
30	GE-30	Neckar-Franken	3339.14	2877.55	461.59
31	GE-31	Ansbach-Nuernberg	3102.72	2696.94	405.78
32	GE-32	Regensburg-Weiden	2256.47	2443.16	-186.69
33	GE-33	Landshut-Passau	1971.09	2316.58	-345.49
34	GE-34	Muenchen-Rosenheim	3449.43	2933.25	516.19
35	GE-35	Kempten-Ingolstadt	3036.67	2659.38	377.29
36	GE-36	Alb-Oberschwaben	2876.20	2798.27	77.93
37	GE-37	Oberrhein-Suedschw.	2822.97	2867.22	-44.25

Table 23 continued

			BEP001	BPY011	BPD011
	FRANCE				
38	FR- 1	Ile de France	3625.22	3109.42	515.80
39	FR- 2	Champagne-Ardennes	2514.53	2022.10	492.43
40	FR- 3	Picardie	2290.93	2074.18	216.76
41	FR- 4	Haute Normandie	2746.90	2482.41	264.48
42	FR- 5	Centre	2237.04	2297.04	-60.00
43	FR- 6	Basse Normandie	1995.78	1875.52	120.26
44	FR- 7	Bourgogne	2166.43	2162.94	3.49
45	FR- 8	Nord-Pas de Calais	2220.03	2067.93	152.10
46	FR- 9	Lorraine	2361.26	2475.01	-113.75
47	FR-10	Alsace	2426.00	2313.69	112.31
48	FR-11	Franche Comte	2244.60	2236.73	7.87
49	FR-12	Pays de la Loire	2076.29	1718.96	357.33
50	FR-13	Bretagne	1757.03	2235.78	-478.75
51	FR-14	Poitou-Charentes	1896.12	1649.82	246.30
52	FR-15	Aquitaine	2128.64	2357.17	-228.54
53	FR-16	Midi-Pyrenees	1786.48	2247.41	-460.93
54	FR-17	Limousin	1767.49	1769.78	-2.28
55	FR-18	Rhone-Alpes	2538.13	2631.18	-93.05
56	FR-19	Auvergne	1918.49	1872.41	46.08
57	FR-20	Languedoc-Roussillon	1777.79	2333.62	-555.83
58	FR-21	Prov.-Alp./Cote d'Az.	2231.78	2605.13	-373.35
	ITALY				
59	IT- 1	Piemonte	2295.88	1889.67	406.21
60	IT- 2	Valle d'Aosta	2400.81	1649.12	751.69
61	IT- 3	Liguria	2379.98	2143.65	236.33
62	IT- 4	Lombardia	2439.92	1772.33	667.59
63	IT- 5	Trentino-Alto Adige	1705.84	1826.92	-121.08
64	IT- 6	Veneto	1789.33	1653.86	135.48
65	IT- 7	Friuli-Venezia Giulia	1862.22	1723.27	138.95
66	IT- 8	Emilia-Romagna	2041.85	1745.20	296.65
67	IT- 9	Toscana	1935.58	1763.20	172.37
68	IT-10	Umbria	1572.92	1787.84	-214.92
69	IT-11	Marche	1603.64	1615.12	-11.49
70	IT-12	Lazio	1922.59	1724.98	197.60
71	IT-13	Campania	1200.05	1512.18	-312.13
72	IT-14	Abruzzi	1243.45	1485.86	-242.41
73	IT-15	Molise	1017.34	1022.20	-4.86
74	IT-16	Puglia	1214.84	1389.90	-175.06
75	IT-17	Basilicata	1031.04	1181.51	-150.47
76	IT-18	Calabria	936.22	1192.84	-256.62
77	IT-19	Sicilia	1175.37	1498.28	-322.91
78	IT-20	Sardegna	1379.06	1579.74	-200.68

Table 23 continued

	BEP001	BPY011	BPD011
NETHERLANDS			
79 NL- 2 Friesland	1683.91	1944.54	-260.64
80 NL- 3 Drente	1730.25	1925.09	-194.84
81 NL- 4 Overijssel	1875.14	1977.16	-102.02
82 NL- 5 Gelderland	2101.91	1999.22	102.69
83 NL- 6 Utrecht	2039.70	2302.59	-262.88
84 NL- 7 Noord-Holland	2429.59	2475.27	-45.68
85 NL- 8 Zuid-Holland	2527.33	2348.97	178.36
86 NL- 9 Zeeland	2303.92	1782.65	521.27
87 NL-10 Noord-Brabant	2086.13	2003.22	82.91
88 NL-11 Limburg	2012.10	1966.13	45.97
BELGIUM			
89 BE- 1 Antwerpen	2854.49	2363.01	491.48
90 BE- 2 Brabant	2903.14	1927.71	975.44
91 BE- 3 Hainaut	1979.57	2265.49	-285.92
92 BE- 4 Liege	2422.89	2290.31	132.58
93 BE- 5 Limburg	1877.39	2077.02	-199.63
94 BE- 6 Luxemburg	1749.30	1807.95	-58.65
95 BE- 7 Namur	2016.62	1987.25	29.37
96 BE- 8 Oost-Vlaanderen	2202.50	2254.73	-52.23
97 BE- 9 West-Vlaanderen	2347.43	1993.50	353.93
GD LUXEMBURG			
98 LU- 1 GD Luxemburg	3082.74	2727.40	355.34
UNITED KINGDOM			
99 UK- 1 North	1794.35	1939.80	-145.46
100 UK- 2 Yorkshire/Humberside	1996.26	2194.20	-197.94
101 UK- 3 East Midlands	2208.44	2003.14	205.31
102 UK- 4 East Anglia	2049.01	2135.23	-86.21
103 UK- 5 South East	2661.47	2529.97	131.50
104 UK- 6 South West	2142.67	2466.11	-323.44
105 UK- 7 West Midlands	2159.91	1963.03	196.88
106 UK- 8 North West	2158.64	2458.43	-299.79
107 UK- 9 Wales	1935.99	2249.86	-313.87
108 UK-10 Scotland	2167.92	2048.33	119.59
109 UK-11 Northern Ireland	1910.10	1367.71	542.39

Table 23 continued

			BEP001	BPY011	BPD011
		IRELAND			
110	IR- 1	East	1244.42	1257.89	-13.46
111	IR- 2	South West	976.76	1250.91	-274.16
112	IR- 3	South East	911.01	892.90	18.11
113	IR- 4	North East	911.01	536.78	374.23
114	IR- 5	Mid West	939.19	1476.52	-537.33
115	IR- 6	Donegal	739.61	769.62	-30.01
116	IR- 7	Midlands	781.87	1047.61	-265.74
117	IR- 8	West	763.09	835.73	-72.64
118	IR- 9	North West	739.61	799.66	-60.05
		DENMARK			
119	DK- 1	Copenhagen Region	3268.82	2780.31	488.52
120	DK- 2	Vestsjaellands Amt	2382.61	3019.96	-637.34
121	DK- 3	Storstroems Amt	2346.22	2375.02	-28.81
122	DK- 4	Bornholms Amt	2134.25	1940.61	193.65
123	DK- 5	Fyns Amt	2373.41	2355.41	18.00
124	DK- 6	Soenderjyllands Amt	2275.03	2053.07	221.96
125	DK- 7	Ribe Amt	2410.48	2368.76	41.72
126	DK- 8	Vejle Amt	2382.41	2696.66	-314.26
127	DK- 9	Ringkoebing Amt	2390.31	2186.79	203.51
128	DK-10	Arhus Amt	2525.01	2665.48	-140.48
129	DK-11	Viborg Amt	2137.07	2214.29	-77.22
130	DK-12	Nordjyllands Amt	2237.38	2261.92	-24.54
		GREECE			
131	GR- 1	Eastern Cont. Greece	1419.90	1019.31	400.60
132	GR- 2	Central/W. Macedonia	1061.01	913.04	147.97
133	GR- 3	Peloponese	945.58	937.97	7.61
134	GR- 4	Thessaly	874.60	865.64	8.96
135	GR- 5	Eastern Macedonia	839.73	808.26	31.47
136	GR- 6	Crete	871.19	805.74	65.45
137	GR- 7	Epirus	739.28	957.43	-218.16
138	GR- 8	Thrace	692.57	794.82	-102.25
139	GR- 9	I. of East. Aeg. Sea	865.73	1078.81	-213.09

TABLE 24.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEPO with the Aid of Singular QPF for Infrastructure (IGES) and Country Dummies, 2nd Cross Section Year

			BEP002	BPY012	BPD012
		GERMANY			
1	GE- 1	Schleswig	6989.80	6072.41	917.40
2	GE- 2	Mittelh.-Dithmarschen	7267.09	7283.89	-16.81
3	GE- 3	Hamburg	10759.52	7598.93	3160.59
4	GE- 4	Lueneburger Heide	6098.61	6639.88	-541.27
5	GE- 5	Bremen	7810.55	7094.63	715.92
6	GE- 6	Osnabrueck	7103.56	6661.36	442.20
7	GE- 7	Ems	6420.89	6854.87	-433.97
8	GE- 8	Muenster	7161.53	7650.84	-489.31
9	GE- 9	Bielefeld	7754.02	7523.68	230.34
10	GE-10	Hannover	8279.11	8035.20	243.91
11	GE-11	Braunschweig	8582.49	7911.59	670.90
12	GE-12	Goettingen	6355.20	7780.01	-1424.81
13	GE-13	Kassel	6900.08	7792.33	-892.25
14	GE-14	Dortmund-Siegen	7229.65	8280.00	-1050.35
15	GE-15	Essen	8308.33	8819.13	-510.79
16	GE-16	Duesseldorf	9793.44	8608.85	1184.59
17	GE-17	Aachen	6245.91	7762.54	-1516.63
18	GE-18	Koeln	9011.64	9069.89	-58.25
19	GE-19	Trier	6219.60	6730.45	-510.85
20	GE-20	Koblenz	6777.15	7448.77	-671.62
21	GE-21	Mittel-Osthessen	6610.82	7424.31	-813.49
22	GE-22	Bamberg-Hof	7076.06	7024.42	51.64
23	GE-23	Aschaffenb.-Schweinf.	6674.99	6982.45	-307.46
24	GE-24	Frankfurt-Darmstadt	9938.49	8639.06	1299.43
25	GE-25	Mainz-Wiesbaden	8305.35	8418.53	-113.19
26	GE-26	Saarland	7289.62	8142.15	-852.54
27	GE-27	Westpfalz	6770.96	7395.09	-624.13
28	GE-28	Rhein-Neckar-Suedpf.	9275.28	8658.29	616.99
29	GE-29	Oberrhein-Nordschw.	8753.03	8570.12	182.92
30	GE-30	Neckar-Franken	9323.40	8009.38	1314.03
31	GE-31	Ansbach-Nuernberg	8224.07	7458.63	765.44
32	GE-32	Regensburg-Weiden	6387.50	6995.11	-607.61
33	GE-33	Landshut-Passau	6147.88	6361.75	-213.87
34	GE-34	Muenchen-Rosenheim	9205.60	7708.25	1497.35
35	GE-35	Kempten-Ingolstadt	7682.92	7079.06	603.85
36	GE-36	Alb-Oberschwaben	7848.72	7669.66	179.06
37	GE-37	Oberrhein-Suedschw.	7655.04	8087.67	-432.62

Table 24 continued

			BEP002	BPY012	BPD012
	FRANCE				
38	FR- 1	Ile de France	8394.34	5873.21	2521.13
39	FR- 2	Champagne-Ardennes	5944.86	4820.43	1124.43
40	FR- 3	Picardie	5481.44	4648.84	832.60
41	FR- 4	Haute Normandie	6496.91	5696.96	799.95
42	FR- 5	Centre	5455.21	5141.14	314.07
43	FR- 6	Basse Normandie	4709.70	4964.35	-254.64
44	FR- 7	Bourgogne	5234.81	5197.91	36.90
45	FR- 8	Nord-Pas de Calais	5202.20	4767.82	434.37
46	FR- 9	Lorraine	5398.97	5291.15	107.82
47	FR-10	Alsace	5741.22	5926.88	-185.66
48	FR-11	Franche Comte	5850.75	5518.05	332.70
49	FR-12	Pays de la Loire	4906.51	4870.42	36.09
50	FR-13	Bretagne	3999.24	4813.02	-813.78
51	FR-14	Poitou-Charentes	4719.14	4599.45	119.69
52	FR-15	Aquitaine	4950.86	5315.39	-364.53
53	FR-16	Midi-Pyrenees	4241.97	5358.33	-1116.36
54	FR-17	Limousin	4172.32	4853.14	-680.82
55	FR-18	Rhone-Alpes	5956.95	5639.73	317.22
56	FR-19	Auvergne	4509.82	4602.26	-92.44
57	FR-20	Languedoc-Roussillon	4180.86	5598.41	-1417.54
58	FR-21	Prov.-Alp./Cote d'Az.	4938.37	5710.41	-772.03
	ITALY				
59	IT- 1	Piemonte	4120.46	3329.58	790.88
60	IT- 2	Valle d'Aosta	4786.53	3405.50	1381.03
61	IT- 3	Liguria	3905.13	4300.43	-395.30
62	IT- 4	Lombardia	4336.35	3750.62	585.73
63	IT- 5	Trentino-Alto Adige	3472.32	3320.61	151.71
64	IT- 6	Veneto	3373.77	3296.49	77.28
65	IT- 7	Friuli-Venezia Giulia	3498.85	3702.50	-203.65
66	IT- 8	Emilia-Romagna	4061.20	3585.33	475.87
67	IT- 9	Toscana	3514.92	3588.67	-73.75
68	IT-10	Umbria	3003.31	3176.26	-172.95
69	IT-11	Marche	3088.26	2962.13	126.13
70	IT-12	Lazio	3303.17	3023.57	279.61
71	IT-13	Campania	2135.66	2345.47	-209.81
72	IT-14	Abruzzi	2561.18	3082.71	-521.54
73	IT-15	Molise	2149.31	2060.18	89.13
74	IT-16	Puglia	2261.33	2499.20	-237.86
75	IT-17	Basilicata	2380.69	2084.50	296.19
76	IT-18	Calabria	1852.44	2409.39	-556.95
77	IT-19	Sicilia	2043.89	2599.99	-556.10
78	IT-20	Sardegna	2485.28	2703.43	-218.15

Table 24 continued

		BEP002	BPY012	BPD012
	NETHERLANDS			
79	NL- 2 Friesland	4501.77	5586.60	-1084.83
80	NL- 3 Drente	4883.05	5196.24	-313.18
81	NL- 4 Overijssel	5147.03	5386.39	-239.36
82	NL- 5 Gelderland	5406.97	5436.06	-29.09
83	NL- 6 Utrecht	6044.62	6018.95	25.67
84	NL- 7 Noord-Holland	6595.04	6363.53	231.52
85	NL- 8 Zuid-Holland	6602.95	6251.93	351.02
86	NL- 9 Zeeland	6383.93	4829.41	1554.51
87	NL-10 Noord-Brabant	5387.24	5307.37	79.88
88	NL-11 Limburg	5005.68	5313.77	-308.09
	BELGIUM			
89	BE- 1 Antwerpen	7820.79	6365.54	1455.26
90	BE- 2 Brabant	7374.21	5371.95	2002.26
91	BE- 3 Hainaut	4859.64	5418.16	-558.52
92	BE- 4 Liege	6043.56	4816.76	1226.80
93	BE- 5 Limburg	5666.19	5570.44	95.74
94	BE- 6 Luxemburg	4769.23	5821.69	-1052.46
95	BE- 7 Namur	5082.50	5383.99	-301.49
96	BE- 8 Oost-Vlaanderen	5756.41	5758.59	-2.18
97	BE- 9 West-Vlaanderen	5907.91	5550.18	357.73
	GD LUXEMBURG			
98	LU- 1 GD Luxemburg	6919.25	6579.74	339.51
	UNITED KINGDOM			
99	UK- 1 North	3326.38	3721.83	-395.45
100	UK- 2 Yorkshire/Humberside	3406.89	3312.50	94.39
101	UK- 3 East Midlands	3431.28	3381.76	49.51
102	UK- 4 East Anglia	3220.58	3227.33	-6.75
103	UK- 5 South East	4053.82	3779.50	274.32
104	UK- 6 South West	3270.62	3359.38	-88.76
105	UK- 7 West Midlands	3591.39	3310.95	280.43
106	UK- 8 North West	3486.58	3746.37	-259.79
107	UK- 9 Wales	3080.92	3627.92	-547.00
108	UK-10 Scotland	3529.06	3375.35	153.71
109	UK-11 Northern Ireland	2642.81	2302.23	340.58

Table 24 continued

			BEP002	BPY012	BPD012
		IRELAND			
110	IR- 1	East	2785.68	3197.13	-411.45
111	IR- 2	South West	2418.54	2615.96	-197.42
112	IR- 3	South East	2300.75	2274.04	26.71
113	IR- 4	North East	2196.73	1762.50	434.23
114	IR- 5	Mid West	2288.51	3021.31	-732.80
115	IR- 6	Donegal	1849.47	1767.37	82.11
116	IR- 7	Midlands	1899.95	2434.09	-534.13
117	IR- 8	West	2077.41	2018.62	58.79
118	IR- 9	North West	1849.47	1998.42	-148.95
		DENMARK			
119	DK- 1	Copenhagen Region	7782.16	7799.32	-17.17
120	DK- 2	Vestsjaellands Amt	6392.60	8343.56	-1950.96
121	DK- 3	Storstroems Amt	6270.08	7003.26	-733.18
122	DK- 4	Bornholms Amt	5994.37	4611.05	1383.32
123	DK- 5	Fyns Amt	6274.07	6476.44	-202.37
124	DK- 6	Soenderjyllands Amt	6387.79	5901.12	486.67
125	DK- 7	Ribe Amt	6638.19	6061.28	576.91
126	DK- 8	Vejle Amt	6532.76	7449.02	-916.26
127	DK- 9	Ringkoebing Amt	6612.03	6228.04	383.99
128	DK-10	Arhus Amt	6640.30	6813.23	-172.93
129	DK-11	Viborg Amt	6113.13	5863.39	249.73
130	DK-12	Nordjyllands Amt	6155.14	5950.71	204.43
		GREECE			
131	GR- 1	Eastern Cont. Greece	3029.33	2396.69	632.64
132	GR- 2	Central/W. Macedonia	2470.62	1967.68	502.94
133	GR- 3	Peloponese	1984.26	1883.80	100.46
134	GR- 4	Thessaly	1960.45	1594.56	365.89
135	GR- 5	Eastern Macedonia	1779.78	1620.86	158.92
136	GR- 6	Crete	1889.89	1895.36	-5.47
137	GR- 7	Epirus	1707.24	1848.74	-141.50
138	GR- 8	Thrace	1301.98	1818.93	-516.95
139	GR- 9	I. of East. Aeg. Sea	1688.85	2512.06	-823.21

Notes to TABLES 23 and 24:

The results of TABLE 23 are based on the following quasi-production function with country dummies:

```
BEP001=2.561+0.466*IGES01-0.149*DUMYIT-0.211*DUMYGR+
             (15.84)      (6.03)       (7.66)
        +0.082*DUMYDK+0.048*DUMYBR+0.083*DUMYUK-
             (3.08)       (2.00)       (3.17)
        -0.099*DUMYNL+0.034*DUMYFR
             (3.21)       (1.47)

     RSQA  = 0.8477          F-VALUE= 97.01
```

All variables except DUMYFR are significant at the 95% level. t-values in brackets, critical t: 1.66.

The results of TABLE 24 are based on the following quasi-production function with country dummies:

```
BEP002=2.864+0.500*IGES02-0.174*DUMYIT-0.177*DUMYGR+
             (17.38)      (8.43)       (6.82)
        +0.101*DUMYDK+0.112*DUMYBR-0.160*DUMYUK-
             (4.13)       (5.27)       (6.47)
        -0.061*DUMYNL-0.029*DUMYFR
             (2.18)       (1.31)

        RSQA  = 0.9125          F-VALUE= 180.94
```

All variables except DUMYFR are significant at the 95% level. t-values in brackets, critical t: 1.66.

TABLE 25.: Ranking List of Regions with Relative Underutilization and Overutilization of Infrastructure (Singular BEPO-Functions) 1st and 2nd Cross Section Years

Regions		BPRO11	Regions		BPRO12
114	IR- 5	-36.39	139	GR- 9	-32.77
116	IR- 7	-25.37	138	GR- 8	-28.42
57	FR-20	-23.82	57	FR-20	-25.32
137	GR- 7	-22.79	114	IR- 5	-24.25
111	IR- 2	-21.92	120	DK- 2	-23.38
77	IT-19	-21.55	76	IT-18	-23.12
76	IT-18	-21.51	116	IR- 7	-21.94
50	FR-13	-21.41	77	IT-19	-21.39
120	DK- 2	-21.10	53	FR-16	-20.83
71	IT-13	-20.64	17	GE-17	-19.54
53	FR-16	-20.51	79	NL- 2	-19.42
139	GR- 9	-19.75	12	GE-12	-18.31
27	GE-27	-17.95	94	BE- 6	-18.08
72	IT-14	-16.31	72	IT-14	-16.92
12	GE-12	-15.05	50	FR-13	-16.91
33	GE-33	-14.91	107	UK- 9	-15.08
58	FR-21	-14.33	54	FR-17	-14.03
107	UK- 9	-13.95	58	FR-21	-13.52
79	NL- 2	-13.40	110	IR- 1	-12.87
4	GE- 4	-13.32	14	GE-14	-12.69
20	GE-20	-13.15	126	DK- 8	-12.30
104	UK- 6	-13.12	13	GE-13	-11.45
26	GE-26	-12.91	21	GE-21	-10.96
138	GR- 8	-12.86	99	UK- 1	-10.63
75	IT-17	-12.74	26	GE-26	-10.47
78	IT-20	-12.70	121	DK- 3	-10.47
91	BE- 3	-12.62	91	BE- 3	-10.31
74	IT-16	-12.60	74	IT-16	-9.52
106	UK- 8	-12.19	61	IT- 3	-9.19
68	IT-10	-12.02	20	GE-20	-9.02
126	DK- 8	-11.65	71	IT-13	-8.95
83	NL- 6	-11.42	32	GE-32	-8.69
80	NL- 3	-10.12	27	GE-27	-8.44
52	FR-15	-9.70	4	GE- 4	-8.15
93	BE- 5	-9.61	78	IT-20	-8.07
21	GE-21	-9.51	137	GR- 7	-7.65
100	UK- 2	-9.02	19	GE-19	-7.59
7	GE- 7	-8.72	111	IR- 2	-7.55
117	IR- 8	-8.69	118	IR- 9	-7.45
13	GE-13	-8.50	106	UK- 8	-6.93
19	GE-19	-8.43	52	FR-15	-6.86
17	GE-17	-7.94	8	GE- 8	-6.40
8	GE- 8	-7.86	7	GE- 7	-6.33
32	GE-32	-7.64	80	NL- 3	-6.03
118	IR- 9	-7.51	88	NL-11	-5.80
99	UK- 1	-7.50	15	GE-15	-5.79

Table 25 continued

Regions		BPRO11	Regions		BPRO12
1	GE- 1	-7.40	95	BE- 7	-5.60
2	GE- 2	-6.71	65	IT- 7	-5.50
23	GE-23	-6.64	68	IT-10	-5.45
63	IT- 5	-6.63	37	GE-37	-5.35
128	DK-10	-5.27	43	FR- 6	-5.13
81	NL- 4	-5.16	81	NL- 4	-4.44
6	GE- 6	-4.63	23	GE-23	-4.40
46	FR- 9	-4.60	33	GE-33	-3.36
102	UK- 4	-4.04	47	FR-10	-3.13
115	IR- 6	-3.90	123	DK- 5	-3.12
55	FR-18	-3.54	104	UK- 6	-2.64
129	DK-11	-3.49	128	DK-10	-2.54
94	BE- 6	-3.24	67	IT- 9	-2.05
42	FR- 5	-2.61	56	FR-19	-2.01
96	BE- 8	-2.32	25	GE-25	-1.34
84	NL- 7	-1.85	18	GE-18	-.64
37	GE-37	-1.54	82	NL- 5	-.54
15	GE-15	-1.53	136	GR- 6	-.29
121	DK- 3	-1.21	2	GE- 2	-.23
130	DK-12	-1.09	119	DK- 1	-.22
110	IR- 1	-1.07	102	UK- 4	-.21
69	IT-11	-.71	96	BE- 8	-.04
29	GE-29	-.70	83	NL- 6	.43
73	IT-15	-.48	44	FR- 7	.71
54	FR-17	-.13	22	GE-22	.74
44	FR- 7	.16	49	FR-12	.74
48	FR-11	.35	112	IR- 3	1.17
123	DK- 5	.76	101	UK- 3	1.46
133	GR- 3	.81	87	NL-10	1.51
134	GR- 4	1.04	93	BE- 5	1.72
95	BE- 7	1.48	46	FR- 9	2.04
125	DK- 7	1.76	29	GE-29	2.13
112	IR- 3	2.03	36	GE-36	2.33
88	NL-11	2.34	64	IT- 6	2.34
56	FR-19	2.46	51	FR-14	2.60
36	GE-36	2.78	100	UK- 2	2.85
22	GE-22	3.13	117	IR- 8	2.91
14	GE-14	3.72	10	GE-10	3.04
25	GE-25	3.81	9	GE- 9	3.06
11	GE-11	3.82	130	DK-12	3.44
135	GR- 5	3.89	84	NL- 7	3.64
87	NL-10	4.14	69	IT-11	4.26
47	FR-10	4.85	129	DK-11	4.26
82	NL- 5	5.14	73	IT-15	4.33
103	UK- 5	5.20	108	UK-10	4.55
92	BE- 4	5.79	63	IT- 5	4.57
108	UK-10	5.84	115	IR- 6	4.65
43	FR- 6	6.41	98	LU- 1	5.16
5	GE- 5	6.84	133	GR- 3	5.33

Table 25 continued

Regions		BPR011	Regions		BPR012
45	FR- 8	7.36	85	NL- 8	5.61
85	NL- 8	7.59	55	FR-18	5.62
9	GE- 9	7.72	48	FR-11	6.03
65	IT- 7	8.06	42	FR- 5	6.11
136	GR- 6	8.12	127	DK- 9	6.17
64	IT- 6	8.19	97	BE- 9	6.45
28	GE-28	8.52	6	GE- 6	6.64
127	DK- 9	9.31	28	GE-28	7.13
67	IT- 9	9.78	103	UK- 5	7.26
122	DK- 4	9.98	124	DK- 6	8.25
105	UK- 7	10.03	105	UK- 7	8.47
18	GE-18	10.24	11	GE-11	8.48
101	UK- 3	10.25	35	GE-35	8.53
40	FR- 3	10.45	45	FR- 8	9.11
41	FR- 4	10.65	70	IT-12	9.25
124	DK- 6	10.81	125	DK- 7	9.52
61	IT- 3	11.02	135	GR- 5	9.80
70	IT-12	11.46	5	GE- 5	10.09
10	GE-10	12.60	31	GE-31	10.26
98	LU- 1	13.03	66	IT- 8	13.27
35	GE-35	14.19	16	GE-16	13.76
51	FR-14	14.93	41	FR- 4	14.04
31	GE-31	15.05	75	IT-17	14.21
30	GE-30	16.04	109	UK-11	14.79
24	GE-24	16.09	24	GE-24	15.04
132	GR- 2	16.21	1	GE- 1	15.11
38	FR- 1	16.59	62	IT- 4	15.62
66	IT- 8	17.00	30	GE-30	16.41
119	DK- 1	17.57	40	FR- 3	17.91
34	GE-34	17.60	34	GE-34	19.43
97	BE- 9	17.75	89	BE- 1	22.86
16	GE-16	20.24	134	GR- 4	22.95
49	FR-12	20.79	39	FR- 2	23.33
89	BE- 1	20.80	59	IT- 1	23.75
59	IT- 1	21.50	113	IR- 4	24.64
39	FR- 2	24.35	92	BE- 4	25.47
86	NL- 9	29.24	132	GR- 2	25.56
62	IT- 4	37.67	131	GR- 1	26.40
131	GR- 1	39.30	122	DK- 4	30.00
3	GE- 3	39.31	86	NL- 9	32.19
109	UK-11	39.66	90	BE- 2	37.27
60	IT- 2	45.58	60	IT- 2	40.55
90	BE- 2	50.60	3	GE- 3	41.59
113	IR- 4	69.72	38	FR- 1	42.93

Whereas TABLES 23 and 24 present the results according to the usual geographical order, TABLE 25 gives a ranking list of regions with relative underutilization and overutilization of infrastructure on the basis of the relative utilization measure BPRO based on data of TABLES 23 and 24.

On the basis of this approach and its interpretation and taking into account that also the results of these estimations are affected by the data problems mentioned, the following tentative conclusions can be drawn:

(1) The preceding analysis has shown that better developed regions typically dispose of a higher infrastructure equipment compared with less well developed areas. The question can now be answered whether and to what extent there is a typical relationship between level of infrastructure equipment or level of development on the one hand and rates of under- or overutilization of infrastructure on the other. TABLES 23 - 25 allow the conclusion that in general, richer regions tend to utilize their infrastructure capacities more than normal, whereas poorer regions show a relative underutilization. One would, therefore, expect that the total dispersion of potential income is smaller compared with the total dispersion of actual income per capita. However, this conclusion only seems to be compatible with the results obtained if the Irish regions are disregarded. There is some evidence that they should be excluded from such an analysis because their data coverage is very small and because they show no typical relations between actual and potential incomes. If Irish region are excluded, the maximum actual income per capita around 1970 of 4030 ECU in Hamburg related to the minimum actual income of 693 in Thrace yields a MMR of 5.8. In terms of potential income, disparities are lower: 3274 ECU for Koeln compared to 795 ECU for Thrace give a MMR of 4.1. If Irish regions are included, potential income disparity increases up to 6.1 since minimum region is now North East with 537 ECU, whereas actual income disparity remains at 5.8. The difference between actual and potential income for North East is the largest one; with only 537 ECU potential income and 911 ECU actual income, the relative overutilization amounts to 70%.

The hypothesis that potential income disparities should be expected to be smaller than actual ones is also supported by another consideration. The difference in aggregate infrastructure equipment measured in terms of IGES is characterized by the best equipped region Noord-Holland with IGES = 100 and 2.30 for North East yielding a MMR of 43.5. If Irish regions are excluded, the minimum region is now again Thrace with an IGES of 15.17 and a MMR equal to 6.6. This allows the conclusion that infrastructure seems to be characterized by decreasing returns to scale.

(2) Relative underutilization or overutilization in the 1st cross section year ranges from -36% to +70% Irish regions included, or from -24% to +51% without them. This asymmetrical distribution of underutilization and overutilization rates seems to be a special characteristic. Similar results will be obtained also with the aid of other quasi-production functions, as will be shown below. This would imply that relative excess capacities of infrastructure in less developed regions are smaller compared with bottlenecks in the better developed ones. It is also interesting to note that the asymmetrical distribution of bottlenecks and excess capacities disappears if the measure for relative under- and overutilization are expressed in per cent of actual instead of potential income. In the latter case, both relative under- and overutilization rates would be roughly at 30% at maximum. However, according to the logic of the potentiality factors approach, it seems to be more reasonable to measure excess capacities and bottlenecks in per cent of potential income, because in the better developed regions actual income is higher than potential, whereas in less developed regions actual income is generally lower than potential. If the latter measure for bottlenecks and excess capacities is applied, and if also the additional information obtained with other quasi-production functions is considered, relative underutilization is still about 30% at maximum, but relative overutilization is between 40 and 50%.

(3) In 2nd cross section year, maximum actual income per capita is 10760 ECU again in Hamburg and minimum income 1302 ECU in Thrace. The Irish regions with the lowest income per capita are Donegal and North West both with 1849 ECU. MMR is equal to 8.3/5.8. If Groningen would not have been excluded, MMR would amount to 11 (14294 ECU). In terms of

potential income, the corresponding figures are 9070 ECU for Koeln and 1595 ECU for Thessaly, yielding a MMR of 5.7. Again, Noord-Holland has maximum infrastructure equipment equal to 100. Thessaly with an IGES of 10.75 is now the minimum region if Irish regions are excluded. If they are considered, they have some of the lowest IGES-values: North East is the absolute minimum region with an IGES of 5.81, followed by Donegal (5.84), North West (7.46) and West (7.62). The resulting MMR is 9.3 without and 17.2 with Irish regions. As far as total dispersion of income disparities measured by MMR is concerned, disparities increased from 1st to 2nd year, whereas infrastructure equipment disparities decreased. However, as already explained when interpreting the results of the MMR-, VC- and cluster analysis above, this increased span between the extreme values does not necessarily mean a deterioration in the in-between distribution of all other regions. The cluster analysis has shown a majority of regions could improve their situation, but they belong to the already well developed.

(4) Relative rates of underutilization and overutilization in the 2nd cross section year have also become smaller. The range is now from -33 to +43%. Isles of Eastern Aegean Sea are now the region with maximum excess capacity and Ile de France the region having the most serious bottleneck. In the 2nd year, Irish regions need not to be disregarded, because they no longer belong to the extreme cases. This may be partly due to the fact that the information on infrastructure equipment for the 2nd in Ireland is better. That relative rates of utilization differ between the 1st and the 2nd year, can also be seen by comparing the two quasi-production functions used in order to estimate potential income. The QPF for the first year allows only an explanation of total dispersion of actual income per capita (BEPO) of 85%, whereas the 2nd year function increases up to 91%. On the one hand, like in the case of Ireland, this could be a result of the improved data situation for the 2nd compared with the 1st cross section year. On the other hand, however, it may also be due to the fact that general economic activity in the 1st cross section year has been more pronounced and closer to full employment conditions than in the 2nd year. This may involve that rates of utilization show larger differences in a boom year compared with where economic activity was less strong as was the case at the end of the seventies.-

A similar picture is obtained if income per employed person or the productivity indicator BEEM is examined in the same manner for income per capita. The results for BEEM are presented in TABLES 26 to 28. Again, the first two Tables give information for actual and potential income and on the absolute and relative differences between them. TABLE 28 shows the ranking of all 139 regions according to relative rates of utilization. When comparing these figures, it has to be noted that income per employed person is always considerably higher than income per capita.

(1) In both years, Hamburg again shows the highest actual productivity figures of 8649 ECU and 26165 ECU compared with the lowest figures for Thrace with 1783 in the 1st and 3331 in the 2nd year. The corresponding MMR are 4.9 and 7.9. If Groningen would have been included, the gap in the 2nd year would have increased to a MMR of 16.3 (BEEM Groningen: 54378 ECU). The potential productivity gap is characterized by the maximum value of 7326 ECU for Koeln and 7174 ECU for Noord-Holland on the one hand, compared with 2175 ECU for Thrace on the other hand as a minimum, yielding a MMR of 3.4. Irish regions included, the minimum region becomes North East with 1675 ECU and MMR of 4.4 in the 1st year. The same situation prevails in the 2nd year: Again, Koeln with 21785 is closely followed by Noord-Holland with 21714 at the top and Thessaly with 4281 at the bottom (MMR: 5.1). These figures also point to an increase in disparity span in the seventies.

(2) As to BEEM, relative utilization rates show a similar picture compared with BEPO, although the deviations are smaller. The region with the lowest rate of utilization is now Epirus (-23%) in the 1st and again Thrace (-29%) in the 2nd year. The bottleneck regions are Eastern Continental Greece (+59%) and Zeeland (+36%). Irish regions need not be excluded because they do not belong to the extreme regions in the 1st year and are no longer present in the 2nd year. Utilization rates tend to decrease during the period if the total band from under- to overutilization is considered.

TABLE 26.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEEM with the Aid of Singular QPF for Infrastructure (IGES) and Country Dummies, 1st Cross Section Year

			BEEM01	BEY011	BED011
		GERMANY			
1	GE- 1	Schleswig	6016.65	5916.20	100.45
2	GE- 2	Mittelh.-Dithmarschen	6502.63	6419.70	82.92
3	GE- 3	Hamburg	8649.43	6738.13	1911.29
4	GE- 4	Lueneburger Heide	5690.15	6124.10	-433.95
5	GE- 5	Bremen	6330.42	6078.27	252.16
6	GE- 6	Osnabrueck	5510.02	5862.22	-352.20
7	GE- 7	Ems	5792.17	5919.27	-127.10
8	GE- 8	Muenster	6546.33	6392.33	153.99
9	GE- 9	Bielefeld	6976.07	6395.34	580.74
10	GE-10	Hannover	6861.72	6589.29	272.44
11	GE-11	Braunschweig	6851.99	6691.61	160.39
12	GE-12	Goettingen	5513.02	6369.34	-856.31
13	GE-13	Kassel	6029.38	6541.57	-512.19
14	GE-14	Dortmund-Siegen	7490.85	6828.74	662.11
15	GE-15	Essen	8022.34	7019.12	1003.23
16	GE-16	Duesseldorf	7815.49	7083.57	731.92
17	GE-17	Aachen	6626.05	6282.98	343.07
18	GE-18	Koeln	8271.53	7325.60	945.93
19	GE-19	Trier	5837.63	5994.72	-157.09
20	GE-20	Koblenz	6484.87	6638.37	-153.50
21	GE-21	Mittel-Osthessen	5901.81	6427.58	-525.77
22	GE-22	Bamberg-Hof	5712.86	6188.35	-475.49
23	GE-23	Aschaffenb.-Schweinf.	5807.19	6210.64	-403.45
24	GE-24	Frankfurt-Darmstadt	7612.85	7102.19	510.66
25	GE-25	Mainz-Wiesbaden	7481.24	7097.60	383.64
26	GE-26	Saarland	6499.36	6774.49	-275.13
27	GE-27	Westpfalz	6103.40	6442.23	-338.83
28	GE-28	Rhein-Neckar-Suedpf.	7428.23	7033.30	394.94
29	GE-29	Oberrhein-Nordschw.	6686.35	7101.33	-414.99
30	GE-30	Neckar-Franken	6784.42	6714.08	70.33
31	GE-31	Ansbach-Nuernberg	6221.57	6426.50	-204.93
32	GE-32	Regensburg-Weiden	5500.14	6011.58	-511.45
33	GE-33	Landshut-Passau	4641.43	5799.43	-1158.00
34	GE-34	Muenchen-Rosenheim	7363.22	6801.58	561.64
35	GE-35	Kempten-Ingolstadt	6707.77	6365.92	341.85
36	GE-36	Alb-Oberschwaben	6119.02	6588.59	-469.58
37	GE-37	Oberrhein-Suedschw.	6222.42	6697.79	-475.38

Table 26 continued

			BEEM01	BEY011	BED011
	FRANCE				
38	FR- 1	Ile de France	7503.08	6799.86	703.22
39	FR- 2	Champagne-Ardennes	6008.40	5085.02	923.38
40	FR- 3	Picardie	5506.62	5173.10	333.53
41	FR- 4	Haute Normandie	6366.79	5840.46	526.33
42	FR- 5	Centre	5149.57	5542.23	-392.65
43	FR- 6	Basse Normandie	4591.19	4833.06	-241.86
44	FR- 7	Bourgogne	5075.15	5321.59	-246.44
45	FR- 8	Nord-Pas de Calais	5995.24	5162.57	832.66
46	FR- 9	Lorraine	5904.67	5828.68	75.98
47	FR-10	Alsace	5548.88	5569.33	-20.45
48	FR-11	Franche Comte	5358.82	5443.52	-84.71
49	FR-12	Pays de la Loire	4860.53	4556.76	303.77
50	FR-13	Bretagne	4209.92	5441.97	-1232.05
51	FR-14	Poitou-Charentes	4735.87	4432.16	303.72
52	FR-15	Aquitaine	5181.63	5639.80	-458.17
53	FR-16	Midi-Pyrenees	4516.09	5461.06	-944.97
54	FR-17	Limousin	4147.35	4647.30	-499.95
55	FR-18	Rhone-Alpes	5824.35	6074.59	-250.24
56	FR-19	Auvergne	4626.87	4827.63	-200.77
57	FR-20	Languedoc-Roussillon	5016.22	5601.67	-585.46
58	FR-21	Prov.-Alp./Cote d'Az.	5886.46	6033.92	-147.47
	ITALY				
59	IT- 1	Piemonte	5491.77	4863.45	628.32
60	IT- 2	Valle d'Aosta	5945.95	4436.16	1509.79
61	IT- 3	Liguria	6347.79	5295.79	1052.00
62	IT- 4	Lombardia	5935.92	4657.37	1278.54
63	IT- 5	Trentino-Alto Adige	4537.15	4753.78	-216.63
64	IT- 6	Veneto	4724.87	4444.77	280.11
65	IT- 7	Friuli-Venezia Giulia	4744.68	4569.91	174.77
66	IT- 8	Emilia-Romagna	4745.53	4609.10	136.42
67	IT- 9	Toscana	4940.58	4641.16	299.42
68	IT-10	Umbria	4150.37	4684.86	-534.49
69	IT-11	Marche	3853.58	4374.20	-520.62
70	IT-12	Lazio	5421.31	4572.98	848.34
71	IT-13	Campania	3777.82	4183.90	-406.08
72	IT-14	Abruzzi	3487.39	4134.59	-647.19
73	IT-15	Molise	2715.55	3211.64	-496.09
74	IT-16	Puglia	3664.90	3952.31	-287.41
75	IT-17	Basilicata	2833.11	3541.67	-708.55
76	IT-18	Calabria	2985.21	3564.57	-579.35
77	IT-19	Sicilia	4042.69	4157.89	-115.21
78	IT-20	Sardegna	4485.60	4309.24	176.36

Table 26 continued

			BEEM01	BEY011	BED011
	NETHERLANDS				
79	NL- 2	Friesland	6020.55	6095.46	-74.91
80	NL- 3	Drente	5570.18	6054.20	-484.03
81	NL- 4	Overijssel	5834.46	6164.31	-329.85
82	NL- 5	Gelderland	6744.73	6210.68	534.04
83	NL- 6	Utrecht	6274.81	6832.44	-557.63
84	NL- 7	Noord-Holland	6584.54	7174.41	-589.87
85	NL- 8	Zuid-Holland	7636.09	6925.09	710.99
86	NL- 9	Zeeland	6911.76	5747.92	1163.84
87	NL-10	Noord-Brabant	6555.36	6219.08	336.28
88	NL-11	Limburg	5697.82	6141.07	-443.25
	BELGIUM				
89	BE- 1	Antwerpen	7707.32	6793.12	914.20
90	BE- 2	Brabant	7397.48	5920.41	1477.07
91	BE- 3	Hainaut	5851.13	6602.49	-751.36
92	BE- 4	Liege	6747.82	6651.25	96.57
93	BE- 5	Limburg	5528.50	6226.33	-697.82
94	BE- 6	Luxemburg	5327.99	5669.43	-341.45
95	BE- 7	Namur	6026.37	6043.29	-16.92
96	BE- 8	Oost-Vlaanderen	5834.67	6581.30	-746.63
97	BE- 9	West-Vlaanderen	6440.95	6056.12	384.83
	GD LUXEMBURG				
98	LU- 1	GD Luxemburg	8105.22	6564.81	1540.41
	UNITED KINGDOM				
99	UK- 1	North	4343.66	4583.12	-239.46
100	UK- 2	Yorkshire/Humberside	4398.35	4980.86	-582.51
101	UK- 3	East Midlands	4449.97	4683.65	-233.68
102	UK- 4	East Anglia	4747.92	4890.06	-142.13
103	UK- 5	South East	5740.66	5483.62	257.03
104	UK- 6	South West	4672.65	5389.75	-717.10
105	UK- 7	West Midlands	4600.58	4620.10	-19.53
106	UK- 8	North West	4811.23	5378.41	-567.18
107	UK- 9	Wales	4590.63	5065.84	-475.21
108	UK-10	Scotland	4891.93	4754.75	137.18
109	UK-11	Northern Ireland	5608.86	3619.66	1989.20

Table 26 continued

		BEEM01	BEY011	BED011
	IRELAND			
110	IR- 1 East	3360.92	2977.68	383.24
111	IR- 2 South West	2790.37	2966.53	-176.15
112	IR- 3 South East	2670.49	2362.44	308.05
113	IR- 4 North East	2447.36	1675.35	772.00
114	IR- 5 Mid West	2681.45	3318.03	-636.59
115	IR- 6 Donegal	2103.21	2136.89	-33.68
116	IR- 7 Midlands	2213.50	2631.65	-418.14
117	IR- 8 West	2091.61	2259.19	-167.58
118	IR- 9 North West	2019.42	2192.87	-173.45
	DENMARK			
119	DK- 1 Copenhagen Region	6944.51	5857.57	1086.94
120	DK- 2 Vestsjaellands Amt	5241.41	6193.95	-952.54
121	DK- 3 Storstroems Amt	5159.30	5266.31	-107.02
122	DK- 4 Bornholms Amt	4996.50	4594.71	401.79
123	DK- 5 Fyns Amt	5242.41	5236.91	5.50
124	DK- 6 Soenderjyllands Amt	5322.57	4772.89	549.69
125	DK- 7 Ribe Amt	5489.21	5256.94	232.28
126	DK- 8 Vejle Amt	5359.38	5737.97	-378.59
127	DK- 9 Ringkoebing Amt	5334.16	4980.68	353.48
128	DK-10 Arhus Amt	5694.44	5693.07	1.36
129	DK-11 Viborg Amt	4936.00	5022.88	-86.88
130	DK-12 Nordjyllands Amt	5189.11	5095.61	93.51
	GREECE			
131	GR- 1 Eastern Cont. Greece	4078.81	2573.10	1505.70
132	GR- 2 Central/W. Macedonia	2882.51	2388.72	493.79
133	GR- 3 Peloponese	2387.85	2432.58	-44.73
134	GR- 4 Thessaly	2336.71	2304.25	32.46
135	GR- 5 Eastern Macedonia	2064.55	2199.95	-135.40
136	GR- 6 Crete	2127.39	2195.32	-67.93
137	GR- 7 Epirus	1894.02	2466.55	-572.53
138	GR- 8 Thrace	1783.27	2175.18	-391.92
139	GR- 9 I. of East. Aeg. Sea	2452.59	2673.61	-221.02

TABLE 27.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEEM with the Aid of Singular QPF for Infrastructure (IGES) and Country Dummies, 2nd Cross Section Year

			BEEM02	BEY012	BED012
	GERMANY				
1	GE- 1	Schleswig	18540.05	16415.85	2124.20
2	GE- 2	Mittelh.-Dithm.	19280.20	18663.30	616.90
3	GE- 3	Hamburg	26165.32	19229.10	6936.22
4	GE- 4	Lueneburger Heide	15150.39	17483.60	-2333.20
5	GE- 5	Bremen	19033.67	18319.92	713.75
6	GE- 6	Osnabrueck	19324.54	17523.46	1801.08
7	GE- 7	Ems	18490.21	17881.01	609.20
8	GE- 8	Muenster	20999.25	19321.66	1677.59
9	GE- 9	Bielefeld	20938.65	19094.59	1844.06
10	GE-10	Hannover	20733.15	20001.37	731.77
11	GE-11	Braunschweig	22303.09	19783.84	2519.25
12	GE-12	Goettingen	15085.73	19551.19	-4465.46
13	GE-13	Kassel	18605.16	19573.03	-967.86
14	GE-14	Dortmund-Siegen	19509.39	20429.28	-919.89
15	GE-15	Essen	22379.02	21358.78	1020.24
16	GE-16	Duesseldorf	25667.61	20998.30	4669.31
17	GE-17	Aachen	16825.30	19520.21	-2694.92
18	GE-18	Koeln	24295.04	21785.37	2509.67
19	GE-19	Trier	15465.49	17651.47	-2185.98
20	GE-20	Koblenz	17789.83	18960.29	-1170.47
21	GE-21	Mittel-Osthessen	17185.72	18916.36	-1730.64
22	GE-22	Bamberg-Hof	16166.86	18191.85	-2024.99
23	GE-23	Aschaffenb.-Schw.	16285.88	18115.12	-1829.24
24	GE-24	Frankfurt-Darmstadt	25234.17	21050.25	4183.92
25	GE-25	Mainz-Wiesbaden	21117.61	20669.78	447.83
26	GE-26	Saarland	20656.47	20188.79	467.68
27	GE-27	Westpfalz	16887.12	18863.81	-1976.69
28	GE-28	Rhein-Neckar-Suedpf.	22814.93	21083.28	1731.65
29	GE-29	Oberrhein-Nordschw.	21349.33	20931.61	417.71
30	GE-30	Neckar-Franken	21428.54	19956.01	1472.53
31	GE-31	Ansbach-Nuernberg	18877.07	18977.99	-100.93
32	GE-32	Regensburg-Weiden	15381.16	18138.27	-2757.11
33	GE-33	Landshut-Passau	14522.16	16963.78	-2441.62
34	GE-34	Muenchen-Rosenheim	19999.81	19423.81	576.00
35	GE-35	Kempten-Ingolstadt	17687.73	18291.55	-603.83
36	GE-36	Alb-Oberschwaben	18220.19	19355.17	-1134.98
37	GE-37	Oberrhein-Suedschw.	19118.94	20093.40	-974.46

Table 27 continued

			BEEM02	BEY012	BED012
	FRANCE				
38	FR- 1	Ile de France	16941.68	14123.72	2817.96
39	FR- 2	Champagne-Ardennes	14374.77	12286.74	2088.03
40	FR- 3	Picardie	13679.41	11976.60	1702.81
41	FR- 4	Haute Normandie	16252.32	13823.42	2428.91
42	FR- 5	Centre	13016.36	12857.84	158.52
43	FR- 6	Basse Normandie	11353.59	12544.37	-1190.78
44	FR- 7	Bourgogne	13276.08	12957.84	318.25
45	FR- 8	Nord-Pas de Calais	13163.44	12192.02	971.42
46	FR- 9	Lorraine	13345.05	13121.35	223.70
47	FR-10	Alsace	15017.01	14214.64	802.37
48	FR-11	Franche Comte	14126.13	13515.78	610.35
49	FR-12	Pays de la Loire	11303.85	12376.48	-1072.63
50	FR-13	Bretagne	11295.26	12273.41	-978.16
51	FR-14	Poitou-Charentes	11902.80	11886.72	16.08
52	FR-15	Aquitaine	12706.71	13163.72	-457.01
53	FR-16	Midi-Pyrenees	10701.44	13238.64	-2537.20
54	FR-17	Limousin	10250.00	12345.50	-2095.50
55	FR-18	Rhone-Alpes	14303.17	13725.32	577.84
56	FR-19	Auvergne	11482.69	11891.84	-409.15
57	FR-20	Languedoc-Rouss.	12231.39	13654.31	-1422.92
58	FR-21	Prov.-Alp./Cote d'A.	13134.04	13846.43	-712.39
	ITALY				
59	IT- 1	Piemonte	9494.57	8399.52	1095.05
60	IT- 2	Valle d'Aosta	10642.02	8534.16	2107.86
61	IT- 3	Liguria	9593.08	10060.86	-467.78
62	IT- 4	Lombardia	10498.57	9135.46	1363.11
63	IT- 5	Trentino-Alto Adige	8563.75	8383.55	180.20
64	IT- 6	Veneto	9037.26	8340.55	696.70
65	IT- 7	Friuli-Venezia Giuli	8904.56	9052.63	-148.07
66	IT- 8	Emilia-Romagna	9344.54	8849.61	494.93
67	IT- 9	Toscana	8790.43	8855.42	-64.99
68	IT-10	Umbria	7749.20	8124.81	-375.61
69	IT-11	Marche	7618.63	7734.50	-115.87
70	IT-12	Lazio	8672.38	7847.32	825.06
71	IT-13	Campania	6454.33	6560.37	-106.04
72	IT-14	Abruzzi	6948.74	7955.28	-1006.54
73	IT-15	Molise	5309.01	5986.86	-677.85
74	IT-16	Puglia	6232.75	6860.80	-628.05
75	IT-17	Basilicata	6011.42	6036.63	-25.21
76	IT-18	Calabria	5549.57	6685.96	-1136.39
77	IT-19	Sicilia	6481.85	7054.84	-572.99
78	IT-20	Sardegna	7536.90	7251.67	285.23

Table 27 continued

			BEEM02	BEY012	BED012
	NETHERLANDS				
79	NL- 2	Friesland	18330.94	19808.83	-1477.89
80	NL- 3	Drente	18600.00	18822.15	-222.15
81	NL- 4	Overijssel	18188.61	19305.40	-1116.79
82	NL- 5	Gelderland	19686.02	19430.80	255.22
83	NL- 6	Utrecht	20319.23	20878.21	-558.98
84	NL- 7	Noord-Holland	21567.57	21714.34	-146.77
85	NL- 8	Zuid-Holland	21470.15	21445.05	25.10
86	NL- 9	Zeeland	24375.00	17874.87	6500.13
87	NL-10	Noord-Brabant	18118.24	19105.19	-986.95
88	NL-11	Limburg	17503.31	19121.45	-1618.14
	BELGIUM				
89	BE- 1	Antwerpen	21120.49	17891.35	3229.14
90	BE- 2	Brabant	19095.21	15872.91	3222.30
91	BE- 3	Hainaut	14736.44	15969.09	-1232.65
92	BE- 4	Liege	17125.43	14697.35	2428.08
93	BE- 5	Limburg	16574.14	16284.38	289.76
94	BE- 6	Luxemburg	14172.95	16799.08	-2626.13
95	BE- 7	Namur	14914.97	15897.99	-983.02
96	BE- 8	Oost-Vlaanderen	15486.40	16670.43	-1184.03
97	BE- 9	West-Vlaanderen	15964.99	16242.58	-277.59
	GD LUXEMBURG				
98	LU- 1	GD Luxemburg	16304.44	18313.93	-2009.49
	UNITED KINGDOM				
99	UK- 1	North	7834.47	8541.68	-707.22
100	UK- 2	Yorkshire/Humberside	7755.37	7867.78	-112.41
101	UK- 3	East Midlands	7970.86	7983.46	-12.60
102	UK- 4	East Anglia	7631.65	7724.53	-92.89
103	UK- 5	South East	9023.14	8634.83	388.31
104	UK- 6	South West	8006.29	7946.16	60.13
105	UK- 7	West Midlands	7947.62	7865.18	82.44
106	UK- 8	North West	8008.81	8581.37	-572.56
107	UK- 9	Wales	7540.23	8389.09	-848.86
108	UK-10	Scotland	8301.04	7972.79	328.25
109	UK-11	Northern Ireland	7345.39	6086.97	1258.42

Table 27 continued

			BEEM02	BEY012	BED012
		IRELAND			
110	IR- 1	East	.00	.00	.00
111	IR- 2	South West	.00	.00	.00
112	IR- 3	South East	.00	.00	.00
113	IR- 4	North East	.00	.00	.00
114	IR- 5	Mid West	.00	.00	.00
115	IR- 6	Donegal	.00	.00	.00
116	IR- 7	Midlands	.00	.00	.00
117	IR- 8	West	.00	.00	.00
118	IR- 9	North West	.00	.00	.00
		DENMARK			
119	DK- 1	Copenhagen Region	14356.73	14377.41	-20.68
120	DK- 2	Vestsjaellands Amt	12376.60	15078.00	-2701.40
121	DK- 3	Storstroems Amt	12372.20	13326.03	-953.83
122	DK- 4	Bornholms Amt	11748.58	9923.82	1824.76
123	DK- 5	Fyns Amt	12432.62	12610.84	-178.22
124	DK- 6	Soenderjyllands Amt	12664.77	11809.91	854.86
125	DK- 7	Ribe Amt	12821.51	12035.10	786.41
126	DK- 8	Vejle Amt	12695.76	13918.85	-1223.09
127	DK- 9	Ringkoebing Amt	12465.78	12267.72	198.07
128	DK-10	Arhus Amt	13243.64	13069.94	173.69
129	DK-11	Viborg Amt	12046.27	11756.60	289.67
130	DK-12	Nordjyllands Amt	12166.07	11879.82	286.25
		GREECE			
131	GR- 1	Eastern Cont. Greece	6439.06	5707.06	732.00
132	GR- 2	Central/W. Macedonia	6681.11	4965.86	1715.25
133	GR- 3	Peloponese	4963.35	4815.58	147.77
134	GR- 4	Thessaly	5308.45	4281.39	1027.06
135	GR- 5	Eastern Macedonia	4454.89	4331.08	123.80
136	GR- 6	Crete	4642.83	4836.41	-193.58
137	GR- 7	Epirus	4396.58	4752.19	-355.61
138	GR- 8	Thrace	3330.56	4698.01	-1367.45
139	GR- 9	I. of East. Aeg. Sea	4695.88	5899.49	-1203.61

Notes to TABLES 26 and 27:

The results of TABLE 26 are based on the following quasi-production function with country dummies:

```
BEEM01=3.227+0.315*IGES01+0.026*DUMYBR-0.123*DUMYIT+
             (10.36)      (2.06)       (8.40)
          +0.057*DUMYBE-0.116*DUMYIR-0.261*DUMYGR
             (2.85)       (3.92)       (11.79)

        RSQA  = 0.8693              F-VALUE= 153.97
```

All variables are significant at the 95% level.
t-values in brackets, critical t: 1.66.

The results of TABLE 27 are based on the following quasi-production function with country dummies:

```
BEEM02=3.590+0.353*IGES02-0.253*DUMYIT-0.322*DUMYGR-
             (8.58)      (11.79)      (9.64)
          -0.086*DUMYDK+0.056*DUMYBR-0.269*DUMYUK+
             (3.05)      (11.72)      (1.77)
          +0.041*DUMYNL-0.099*DUMYFR
             (3.87)      (5.03)

        RSQA  = 0.9339              F-VALUE= 229.12
```

All variables are significant at the 95% level.
t-values in brackets, critical t: 1.66.

TABLE 28.: Ranking List of Regions with Relative Underutilization and Overutilization of Infrastructure (Singular BEEM-Functions) 1st and 2nd Cross Section Years

Regions		BER011	Regions		BER012
137	GR- 7	-23.21	138	GR- 8	-29.11
50	FR-13	-22.64	12	GE-12	-22.84
75	IT-17	-20.01	139	GR- 9	-20.40
33	GE-33	-19.97	53	FR-16	-19.17
114	IR- 5	-19.19	120	DK- 2	-17.92
138	GR- 8	-18.02	76	IT-18	-17.00
53	FR-16	-17.30	54	FR-17	-16.97
76	IT-18	-16.25	94	BE- 6	-15.63
116	IR- 7	-15.89	32	GE-32	-15.20
72	IT-14	-15.65	33	GE-33	-14.39
73	IT-15	-15.45	17	GE-17	-13.81
120	DK- 2	-15.38	4	GE- 4	-13.35
12	GE-12	-13.44	72	IT-14	-12.65
104	UK- 6	-13.30	19	GE-19	-12.38
69	IT-11	-11.90	73	IT-15	-11.32
100	UK- 2	-11.70	22	GE-22	-11.13
68	IT-10	-11.41	98	LU- 1	-10.97
91	BE- 3	-11.38	27	GE-27	-10.48
96	BE- 8	-11.34	57	FR-20	-10.42
93	BE- 5	-11.21	107	UK- 9	-10.12
54	FR-17	-10.76	23	GE-23	-10.10
106	UK- 8	-10.55	43	FR- 6	-9.49
57	FR-20	-10.45	74	IT-16	-9.15
71	IT-13	-9.71	21	GE-21	-9.15
107	UK- 9	-9.38	126	DK- 8	-8.79
32	GE-32	-8.51	49	FR-12	-8.67
139	GR- 9	-8.27	88	NL-11	-8.46
84	NL- 7	-8.22	99	UK- 1	-8.28
21	GE-21	-8.18	77	IT-19	-8.12
83	NL- 6	-8.16	50	FR-13	-7.97
52	FR-15	-8.12	91	BE- 3	-7.72
80	NL- 3	-7.99	137	GR- 7	-7.48
118	IR- 9	-7.91	79	NL- 2	-7.46
13	GE-13	-7.83	121	DK- 3	-7.16
22	GE-22	-7.68	96	BE- 8	-7.10
117	IR- 8	-7.42	106	UK- 8	-6.67
74	IT-16	-7.27	95	BE- 7	-6.18
88	NL-11	-7.22	20	GE-20	-6.17
36	GE-36	-7.13	36	GE-36	-5.86
37	GE-37	-7.10	81	NL- 4	-5.78
4	GE- 4	-7.09	87	NL-10	-5.17
42	FR- 5	-7.08	58	FR-21	-5.14
126	DK- 8	-6.60	13	GE-13	-4.94
23	GE-23	-6.50	37	GE-37	-4.85
135	GR- 5	-6.15	61	IT- 3	-4.65
94	BE- 6	-6.02	68	IT-10	-4.62

Table 28 continued

Regions		BER011	Regions		BER012
6	GE- 6	-6.01	14	GE-14	-4.50
111	IR- 2	-5.94	136	GR- 6	-4.00
29	GE-29	-5.84	52	FR-15	-3.47
81	NL- 4	-5.35	56	FR-19	-3.44
27	GE-27	-5.26	35	GE-35	-3.30
99	UK- 1	-5.22	83	NL- 6	-2.68
43	FR- 6	-5.00	97	BE- 9	-1.71
101	UK- 3	-4.99	65	IT- 7	-1.64
44	FR- 7	-4.63	71	IT-13	-1.62
63	IT- 5	-4.56	69	IT-11	-1.50
56	FR-19	-4.16	100	UK- 2	-1.43
55	FR-18	-4.12	123	DK- 5	-1.41
26	GE-26	-4.06	102	UK- 4	-1.20
31	GE-31	-3.19	80	NL- 3	-1.18
136	GR- 6	-3.09	67	IT- 9	-.73
102	UK- 4	-2.91	84	NL- 7	-.68
77	IT-19	-2.77	31	GE-31	-.53
19	GE-19	-2.62	75	IT-17	-.42
58	FR-21	-2.44	101	UK- 3	-.16
20	GE-20	-2.31	119	DK- 1	-.14
7	GE- 7	-2.15	110	IR- 1	.00
121	DK- 3	-2.03	111	IR- 2	.00
133	GR- 3	-1.84	112	IR- 3	.00
129	DK-11	-1.73	113	IR- 4	.00
115	IR- 6	-1.58	114	IR- 5	.00
48	FR-11	-1.56	115	IR- 6	.00
79	NL- 2	-1.23	116	IR- 7	.00
105	UK- 7	-.42	117	IR- 8	.00
47	FR-10	-.37	118	IR- 9	.00
95	BE- 7	-.28	85	NL- 8	.12
128	DK-10	.02	51	FR-14	.14
123	DK- 5	.11	104	UK- 6	.76
30	GE-30	1.05	105	UK- 7	1.05
2	GE- 2	1.29	42	FR- 5	1.23
46	FR- 9	1.30	82	NL- 5	1.31
134	GR- 4	1.41	128	DK-10	1.33
92	BE- 4	1.45	127	DK- 9	1.61
1	GE- 1	1.70	46	FR- 9	1.70
130	DK-12	1.84	93	BE- 5	1.78
11	GE-11	2.40	29	GE-29	2.00
8	GE- 8	2.41	63	IT- 5	2.15
108	UK-10	2.89	25	GE-25	2.17
66	IT- 8	2.96	26	GE-26	2.32
65	IT- 7	3.82	130	DK-12	2.41
78	IT-20	4.09	44	FR- 7	2.46
10	GE-10	4.13	129	DK-11	2.46
5	GE- 5	4.15	135	GR- 5	2.86
125	DK- 7	4.42	34	GE-34	2.97

Table 28 continued

Regions		BER011	Regions		BER012
103	UK- 5	4.69	133	GR- 3	3.07
35	GE-35	5.37	2	GE- 2	3.31
25	GE-25	5.41	7	GE- 7	3.41
87	NL-10	5.41	10	GE-10	3.66
17	GE-17	5.46	5	GE- 5	3.90
28	GE-28	5.62	78	IT-20	3.93
64	IT- 6	6.30	108	UK-10	4.12
97	BE- 9	6.35	55	FR-18	4.21
40	FR- 3	6.45	103	UK- 5	4.50
67	IT- 9	6.45	48	FR-11	4.52
49	FR-12	6.67	15	GE-15	4.78
51	FR-14	6.85	66	IT- 8	5.59
127	DK- 9	7.10	47	FR-10	5.64
24	GE-24	7.19	125	DK- 7	6.53
34	GE-34	8.26	124	DK- 6	7.24
82	NL- 5	8.60	30	GE-30	7.38
122	DK- 4	8.74	45	FR- 8	7.97
41	FR- 4	9.01	28	GE-28	8.21
9	GE- 9	9.08	64	IT- 6	8.35
14	GE-14	9.70	8	GE- 8	8.68
85	NL- 8	10.27	9	GE- 9	9.66
16	GE-16	10.33	6	GE- 6	10.28
38	FR- 1	10.34	70	IT-12	10.51
124	DK- 6	11.52	18	GE-18	11.52
110	IR- 1	12.87	11	GE-11	12.73
18	GE-18	12.91	131	GR- 1	12.83
59	IT- 1	12.92	1	GE- 1	12.94
112	IR- 3	13.04	59	IT- 1	13.04
89	BE- 1	13.46	40	FR- 3	14.22
15	GE-15	14.29	62	IT- 4	14.92
45	FR- 8	16.13	92	BE- 4	16.52
39	FR- 2	18.16	39	FR- 2	16.99
70	IT-12	18.55	41	FR- 4	17.57
119	DK- 1	18.56	89	BE- 1	18.05
61	IT- 3	19.86	122	DK- 4	18.39
86	NL- 9	20.25	24	GE-24	19.88
132	GR- 2	20.67	38	FR- 1	19.95
98	LU- 1	23.46	90	BE- 2	20.30
90	BE- 2	24.95	109	UK-11	20.67
62	IT- 4	27.45	16	GE-16	22.24
3	GE- 3	28.37	134	GR- 4	23.99
60	IT- 2	34.03	60	IT- 2	24.70
113	IR- 4	46.08	132	GR- 2	34.54
109	UK-11	54.96	3	GE- 3	36.07
131	GR- 1	58.52	86	NL- 9	36.36

All those regions showing a significantly large negative figure as an indicator for relative underutilization of infrastructure capacity seem to suffer not so much from development restrictions in the form of insufficient infrastructure, but rather more from lacking attractivity and capability of paying market rates of remuneration for highly qualified labour and private investors. In addition other non-economic factors which increasingly play a role in determining attractivity of regions may be held responsible. Infrastructure does not appear to be the main factor limiting regional development in those regions. On the other hand, at first sight infrastructure bottlenecks in the more developed richer regions seem not to have a very strong negative influence. Presumably other advantages, and among them especially agglomeration economies, lower communication cost, better job opportunities, higher profits, wages and salaries are possibly compensating for the disadvantages linked with crowding of infrastructure capacities. As long as these factors prevail in the short run, even overcongested regions will continue to grow as long as these regions remain attractive for existing and newly to be created economic activities. However, in the long run, infrastructure bottlenecks will increasingly limit growth prospects in these regions. The reduced rates of overutilization in the seventies seem to indicate that these implications have been noticed and that governments are trying to reduce bottlenecks.

As has been explained, the distribution of regions according to relative underutilization and relative overutilization for once depends on the assumption of a "normal" rate of capacity utilization which is inherent in the regression line of the quasi-production function as a reference. This curve could also be shifted upwards until it passes through the points of maximum yield per infrastructure unit which are those of the well developed regions. This would make disappear the overutilization of those regions, but necessarily increase the idle capacities in regions which already under "normal" utilization show overcapacities. This is not done here, because it is certainly too ambitious to expect that regions having difficulties in retaining or attracting sufficiently large quantities and qualities of mobile factors of production, should be able to increase their rate of capacity utilization up to levels that are only possible in highly agglomerated, centrally located and well structured regions. On the contrary, less developed regions may even need additional infrastructure capacities in order to realize a certain "minimum capacity" and in order to compensate for non-available other potentiality factors.

At first sight, these findings seem to allow a simple straightforward policy conclusion: On the one hand, where infrastructure does not represent a bottleneck, it does also not restrict development. What seems to be lacking in the less developed regions is innovative entrepreneurs, private investment capital, qualified labour and other types of "private" factors of production. Regional policy should, therefore, concentrate on maintaining and on attracting these "private" factors of production. On the other hand, a strategy for regions having infrastructure bottlenecks would have to consist in increasing infrastructure capacities in order to remove the existing bottlenecks as growth restrictions.

However, this simple two-tier strategy has to be qualified in several aspects:

(1) The apparent underutilization of infrastructure and the lack of private capital and qualified labour may be due to other factors determining regional development. If, as has already been mentioned in the first part of the Study, a region has a peripheral location, a low degree of agglomeration and a bad sectoral structure, it may be that even a large relative excess capacity of infrastructure is not sufficient to compensate these deficits and to induce growth in that area. On the other hand, a centrally located, optimally agglomerated region with a good future oriented sectoral structure may need less infrastructure in order to sustain its high rate of growth due to its better endowment with these other potentiality factors.

(2) The relative need for infrastructure in relation to a certain level of development may differ between the different groups of regions such that less developed regions may have a higher need for infrastructure in terms of a "minimum capacity" when compared with the better developed ones. This is especially true in the case of infrastructure categories of the network type like roads, railways, communication networks, energy and water supply systems. As their capacities have to be planned and measured in relation to the areas of a region concerned, even with a small number of inhabitants a relative large capacity has to be provided if the service should be made available at all. As the estimates of potential income per capita under "normal" rates of utilization demonstrate, many of the less developed Community regions will still show very low income per capita or producitvity figures even if relative underutilization has been

removed. Clearly this involves a political decision as to what level of actual and potential income disparities are considered to be tolerable and politically acceptable. This argument again supports a strategy for less developed regions where both private factors of production and public infrastructure are subsidized.

(3) The particular characteristics of the individual region must also be taken into account. If a region is disadvantaged by topography, because it is for example a mountain region where it is difficult to construct roads, electricity and water supply etc. or a coastal region where there is no possibility of creating a harbour, or a region close to a political/economic border such as the Iron Curtain in Europe, similar infrastructure endowments may not produce the same growth and welfare effects.

Not all these propositions can be examined within the context of this Study. However, it is possible to utilize the fully specified set of potentiality factors in order to see whether and to what extent the influence of infrastructure represented by the singular quasi-production function is exaggerated such that both relative underutilization and overutilization are not correctly recorded. As far as the relationships between infrastructure overutilization or underutilization on the one hand and overutilization or underutilization of the other potentiality factors on the other hand are concerned, the four cases represented in TABLE 29 can be distinguished.

Cell I and Cell IV characterize the case where an infrastructure overutilization or underutilization is accompanied by a comparable overutilization or underutilization of the other potentiality factors. In these cases, the true potential income or productivity estimate and consequently also the relative size of overutilization or underutilization will not differ significantly. Thus, a region with an average infrastructure endowment and average degree of agglomeration, location and sectoral structure will generally have the same potential income independent of the function used. But if the endowment with the other factors deviate from this proportionate structure for a given region, this will no longer be true.

TABLE 29.: Infrastructure Over- or Underutilization and Potentiality Factor Bottlenecks or Excess Capacities

	Infrastructure	
	Overutilization Bottleneck	Underutilization Excess Capacity
Other Potentiality Factors Overutilization Bottleneck	+ I +	- II +
Underutilization Excess Capacity	+ III -	- IV -

Cell II represents the case where infrastructure underutilization and overutilization of the other potentiality factors exist simultaneously whereas Cell III stands for the opposite case: There exists an infrastructure bottleneck, but the other potentiality factor capacities are underutilized. Since relative overutilization or underutilization has been in a range upto 50%, it can be expected that the basic characterization of a region as having a bottleneck or excess capacity remains valid, but that the intensity or the degree of overutilization or underutilization changes. It may be that a region shows a relative overutilization of +30 on the basis of its infrastructure endowment, but that this overutilization is reduced say to +10 if the other potentiality factors are included.

This means that there is still a relative overutilization of the total regional development potential, but that this overutilization is less pronounced compared with the measured overutilization of infrastructure only. This change in the intensity of overutilization can then be interpreted by saying that a part of what appears to be overutilization of infrastructure on the basis of the singular infrastructure quasi-production function, is compensated by a relatively better endowment with other potentiality factors.

In the case of underutilization of infrastructure, the reverse would be true: If a region shows a high degree of underutilization based on the singular infrastructure function, and if this underutilization is reduced by including other potentiality factors, then this implies that the endowment with these factors is not as good as that of infrastructure. In that case, an excess capacity of infrastructure is (at least partially) needed in order to compensate a bad location, a low degree of agglomeration and/or a deteriorated sectoral structure.

To test these hypotheses, the following procedure is applied:

(1) New potential income figures are estimated with the aid of one of the fully specified potentiality factors quasi-production functions. Since the fully specified function besides infrastructure contains also indicators for location, agglomeration and sectoral structure, the influence of these other potentiality factors is explicitly taken account of.

(2) The new potential income figures are then compared with those potential income figures already derived from the singular quasi-production functions based on infrastructure alone. The difference is then interpreted along the lines presented above in relation to TABLE 29.

TABLES 30 to 32 present the estimated potential income figures with the aid of one of the best fit fully specified quasi-production functions including some dummy variables. Complete details for these functions are again given at the end of each pair of Tables.

TABLE 30.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEPO with the Aid of Fully Specified Potentiality Factors QPF Including Infrastructure (IGES) and Country Dummies, 1st Cross Section Year

			BEP001	BPY021	BPD021
		GERMANY			
1	GE- 1	Schleswig	2209.54	2105.06	104.48
2	GE- 2	Mittelh.-Dithmarschen	2512.12	2492.96	19.16
3	GE- 3	Hamburg	4029.90	2845.04	1184.86
4	GE- 4	Lueneburger Heide	2176.79	2361.15	-184.35
5	GE- 5	Bremen	2653.19	2500.12	153.06
6	GE- 6	Osnabrueck	2244.90	2348.40	-103.50
7	GE- 7	Ems	2179.61	2300.50	-120.89
8	GE- 8	Muenster	2465.34	2694.25	-228.92
9	GE- 9	Bielefeld	2884.21	2740.84	143.37
10	GE-10	Hannover	3151.28	2821.46	329.82
11	GE-11	Braunschweig	2972.80	2823.01	149.79
12	GE-12	Goettingen	2261.04	2658.47	-397.43
13	GE-13	Kassel	2533.46	2701.82	-168.37
14	GE-14	Dortmund-Siegen	3060.38	3079.05	-18.67
15	GE-15	Essen	3026.05	3260.39	-234.34
16	GE-16	Duesseldorf	3745.70	3343.95	401.75
17	GE-17	Aachen	2401.25	2833.04	-431.79
18	GE-18	Koeln	3609.10	3339.25	269.84
19	GE-19	Trier	2227.83	2470.15	-242.32
20	GE-20	Koblenz	2457.65	2874.70	-417.06
21	GE-21	Mittel-Osthessen	2441.18	2746.01	-304.83
22	GE-22	Bamberg-Hof	2630.21	2635.43	-5.22
23	GE-23	Aschaffenb.-Schweinf.	2393.75	2606.26	-212.50
24	GE-24	Frankfurt-Darmstadt	3630.35	3180.41	449.94
25	GE-25	Mainz-Wiesbaden	3243.39	3060.11	183.28
26	GE-26	Saarland	2539.48	3071.01	-531.54
27	GE-27	Westpfalz	2220.92	2778.59	-557.68
28	GE-28	Rhein-Neckar-Suedpf.	3345.13	3075.58	269.54
29	GE-29	Oberrhein-Nordschw.	3104.83	3084.87	19.96
30	GE-30	Neckar-Franken	3339.14	2942.82	396.32
31	GE-31	Ansbach-Nuernberg	3102.72	2774.15	328.57
32	GE-32	Regensburg-Weiden	2256.47	2407.60	-151.13
33	GE-33	Landshut-Passau	1971.09	2245.42	-274.32
34	GE-34	Muenchen-Rosenheim	3449.43	2814.36	635.07
35	GE-35	Kempten-Ingolstadt	3036.67	2581.43	455.24
36	GE-36	Alb-Oberschwaben	2876.20	2699.72	176.47
37	GE-37	Oberrhein-Suedschw.	2822.97	2826.31	-3.34

Table 30 continued

			BEP001	BPY021	BPD021
	FRANCE				
38	FR- 1	Ile de France	3625.22	3276.19	349.03
39	FR- 2	Champagne-Ardennes	2514.53	2133.83	380.70
40	FR- 3	Picardie	2290.93	2192.35	98.58
41	FR- 4	Haute Normandie	2746.90	2578.46	168.43
42	FR- 5	Centre	2237.04	2095.90	141.14
43	FR- 6	Basse Normandie	1995.78	1920.60	75.18
44	FR- 7	Bourgogne	2166.43	2241.76	-75.33
45	FR- 8	Nord-Pas de Calais	2220.03	2551.23	-331.19
46	FR- 9	Lorraine	2361.26	2716.73	-355.47
47	FR-10	Alsace	2426.00	2668.79	-242.79
48	FR-11	Franche Comte	2244.60	2382.61	-138.02
49	FR-12	Pays de la Loire	2076.29	1805.06	271.23
50	FR-13	Bretagne	1757.03	1842.49	-85.47
51	FR-14	Poitou-Charentes	1896.12	1661.34	234.79
52	FR-15	Aquitaine	2128.64	1980.87	147.77
53	FR-16	Midi-Pyrenees	1786.48	1948.89	-162.42
54	FR-17	Limousin	1767.49	1842.73	-75.24
55	FR-18	Rhone-Alpes	2538.13	2593.90	-55.77
56	FR-19	Auvergne	1918.49	1963.44	-44.95
57	FR-20	Languedoc-Roussillon	1777.79	1921.95	-144.16
58	FR-21	Prov.-Alp./Cote d'Az.	2231.78	2352.72	-120.94
	ITALY				
59	IT- 1	Piemonte	2295.88	2012.73	283.15
60	IT- 2	Valle d'Aosta	2400.81	1853.95	546.86
61	IT- 3	Liguria	2379.98	2164.19	215.78
62	IT- 4	Lombardia	2439.92	2047.19	392.72
63	IT- 5	Trentino-Alto Adige	1705.84	1857.89	-152.04
64	IT- 6	Veneto	1789.33	1764.93	24.41
65	IT- 7	Friuli-Venezia Giulia	1862.22	1834.11	28.11
66	IT- 8	Emilia-Romagna	2041.85	1731.50	310.35
67	IT- 9	Toscana	1935.58	1821.12	114.46
68	IT-10	Umbria	1572.92	1683.89	-110.97
69	IT-11	Marche	1603.64	1595.19	8.45
70	IT-12	Lazio	1922.59	1757.33	165.25
71	IT-13	Campania	1200.05	1472.75	-272.70
72	IT-14	Abruzzi	1243.45	1403.32	-159.88
73	IT-15	Molise	1017.34	1070.41	-53.07
74	IT-16	Puglia	1214.84	1274.96	-60.12
75	IT-17	Basilicata	1031.04	1140.48	-109.44
76	IT-18	Calabria	936.22	1163.15	-226.92
77	IT-19	Sicilia	1175.37	1317.16	-141.79
78	IT-20	Sardegna	1379.06	1379.53	-.47

Table 30 continued

			BEP001	BPY021	BPD021
		NETHERLANDS			
79	NL- 2	Friesland	1683.91	1762.09	-78.18
80	NL- 3	Drente	1730.25	1773.44	-43.19
81	NL- 4	Overijssel	1875.14	1925.59	-50.46
82	NL- 5	Gelderland	2101.91	2027.42	74.49
83	NL- 6	Utrecht	2039.70	2369.11	-329.41
84	NL- 7	Noord-Holland	2429.59	2467.35	-37.76
85	NL- 8	Zuid-Holland	2527.33	2411.48	115.85
86	NL- 9	Zeeland	2303.92	1756.13	547.79
87	NL-10	Noord-Brabant	2086.13	2132.98	-46.85
88	NL-11	Limburg	2012.10	2159.23	-147.12
		BELGIUM			
89	BE- 1	Antwerpen	2854.49	2620.26	234.23
90	BE- 2	Brabant	2903.14	2373.72	529.43
91	BE- 3	Hainaut	1979.57	2460.73	-481.16
92	BE- 4	Liege	2422.89	2433.37	-10.49
93	BE- 5	Limburg	1877.39	2280.59	-403.21
94	BE- 6	Luxemburg	1749.30	1835.38	-86.09
95	BE- 7	Namur	2016.62	2122.51	-105.89
96	BE- 8	Oost-Vlaanderen	2202.50	2591.04	-388.54
97	BE- 9	West-Vlaanderen	2347.43	2164.93	182.50
		GD LUXEMBURG			
98	LU- 1	GD Luxemburg	3082.74	2529.82	552.92
		UNITED KINGDOM			
99	UK- 1	North	1794.35	1882.24	-87.90
100	UK- 2	Yorkshire/Humberside	1996.26	2206.25	-209.99
101	UK- 3	East Midlands	2208.44	2141.23	67.22
102	UK- 4	East Anglia	2049.01	2103.67	-54.66
103	UK- 5	South East	2661.47	2595.83	65.64
104	UK- 6	South West	2142.67	2251.22	-108.56
105	UK- 7	West Midlands	2159.91	2098.78	61.13
106	UK- 8	North West	2158.64	2550.52	-391.88
107	UK- 9	Wales	1935.99	2094.25	-158.26
108	UK-10	Scotland	2167.92	1844.56	323.36
109	UK-11	Northern Ireland	1910.10	1528.50	381.60

Table 30 continued

	BEP001	BPY021	BPD021
IRELAND			
110 IR- 1 East	1244.42	.00	.00
111 IR- 2 South West	976.76	.00	.00
112 IR- 3 South East	911.01	.00	.00
113 IR- 4 North East	911.01	.00	.00
114 IR- 5 Mid West	939.19	.00	.00
115 IR- 6 Donegal	739.61	.00	.00
116 IR- 7 Midlands	781.87	.00	.00
117 IR- 8 West	763.09	.00	.00
118 IR- 9 North West	739.61	.00	.00
DENMARK			
119 DK- 1 Copenhagen Region	3268.82	2964.65	304.17
120 DK- 2 Vestsjaellands Amt	2382.61	2687.81	-305.20
121 DK- 3 Storstroems Amt	2346.22	2355.13	-8.91
122 DK- 4 Bornholms Amt	2134.25	2095.43	38.82
123 DK- 5 Fyns Amt	2373.41	2510.79	-137.38
124 DK- 6 Soenderjyllands Amt	2275.03	2185.56	89.47
125 DK- 7 Ribe Amt	2410.48	2360.09	50.39
126 DK- 8 Vejle Amt	2382.41	2632.15	-249.74
127 DK- 9 Ringkoebing Amt	2390.31	2151.87	238.44
128 DK-10 Arhus Amt	2525.01	2630.59	-105.58
129 DK-11 Viborg Amt	2137.07	2079.54	57.52
130 DK-12 Nordjyllands Amt	2237.38	2211.58	25.80
GREECE			
131 GR- 1 Eastern Cont. Greece	1419.90	1363.70	56.20
132 GR- 2 Central/W. Macedonia	1061.01	1028.52	32.49
133 GR- 3 Peloponese	945.58	862.58	83.00
134 GR- 4 Thessaly	874.60	807.33	67.27
135 GR- 5 Eastern Macedonia	839.73	752.66	87.08
136 GR- 6 Crete	871.19	765.41	105.79
137 GR- 7 Epirus	739.28	964.34	-225.06
138 GR- 8 Thrace	692.57	657.40	35.18
139 GR- 9 I. of East. Aeg. Sea	865.73	1011.99	-146.26

Table 31.: Infrastructure Bottlenecks and Excess Capacities Estimated for BEPO with the Aid of Fully Specified Potentiality Factors QPF Including Infrastructure (IGES) and Country Dummies, 2nd Cross Section Year

			BEP002	BPY022	BPD022
		GERMANY			
1	GE- 1	Schleswig	6989.80	5727.15	1262.65
2	GE- 2	Mittelh.-Dithmarschen	7267.09	6720.73	546.35
3	GE- 3	Hamburg	10759.52	7520.19	3239.33
4	GE- 4	Lueneburger Heide	6098.61	6449.87	-351.27
5	GE- 5	Bremen	7810.55	7029.51	781.04
6	GE- 6	Osnabrueck	7103.56	6962.04	141.51
7	GE- 7	Ems	6420.89	6601.91	-181.01
8	GE- 8	Muenster	7161.53	7627.31	-465.78
9	GE- 9	Bielefeld	7754.02	7749.28	4.74
10	GE-10	Hannover	8279.11	7777.74	501.37
11	GE-11	Braunschweig	8582.49	7570.99	1011.50
12	GE-12	Goettingen	6355.20	7481.88	-1126.67
13	GE-13	Kassel	6900.08	7596.09	-696.01
14	GE-14	Dortmund-Siegen	7229.65	8486.43	-1256.78
15	GE-15	Essen	8308.33	9068.01	-759.67
16	GE-16	Duesseldorf	9793.44	9085.85	707.59
17	GE-17	Aachen	6245.91	8194.26	-1948.35
18	GE-18	Koeln	9011.64	9109.82	-98.19
19	GE-19	Trier	6219.60	7063.13	-843.53
20	GE-20	Koblenz	6777.15	7885.75	-1108.59
21	GE-21	Mittel-Osthessen	6610.82	7716.79	-1105.96
22	GE-22	Bamberg-Hof	7076.06	7215.81	-139.75
23	GE-23	Aschaffenb.-Schweinf.	6674.99	7221.27	-546.28
24	GE-24	Frankfurt-Darmstadt	9938.49	8716.60	1221.89
25	GE-25	Mainz-Wiesbaden	8305.35	8315.48	-10.14
26	GE-26	Saarland	7289.62	8530.70	-1241.09
27	GE-27	Westpfalz	6770.96	7812.14	-1041.18
28	GE-28	Rhein-Neckar-Suedpf.	9275.28	8566.52	708.76
29	GE-29	Oberrhein-Nordschw.	8753.03	8478.57	274.46
30	GE-30	Neckar-Franken	9323.40	8094.96	1228.45
31	GE-31	Ansbach-Nuernberg	8224.07	7687.25	536.82
32	GE-32	Regensburg-Weiden	6387.50	6672.40	-284.90
33	GE-33	Landshut-Passau	6147.88	6175.97	-28.09
34	GE-34	Muenchen-Rosenheim	9205.60	7461.10	1744.49
35	GE-35	Kempten-Ingolstadt	7682.92	6969.77	713.14
36	GE-36	Alb-Oberschwaben	7848.72	7391.24	457.47
37	GE-37	Oberrhein-Suedschw.	7655.04	7856.29	-201.25

Table 31 continued

			BEP002	BPY022	BPD022
	FRANCE				
38	FR- 1	Ile de France	8394.34	6656.69	1737.65
39	FR- 2	Champagne-Ardennes	5944.86	5151.28	793.58
40	FR- 3	Picardie	5481.44	5164.12	317.32
41	FR- 4	Haute Normandie	6496.91	5850.55	646.36
42	FR- 5	Centre	5455.21	4903.71	551.50
43	FR- 6	Basse Normandie	4709.70	4916.49	-206.79
44	FR- 7	Bourgogne	5234.81	5350.47	-115.66
45	FR- 8	Nord-Pas de Calais	5202.20	5988.27	-786.07
46	FR- 9	Lorraine	5398.97	6016.99	-618.02
47	FR-10	Alsace	5741.22	6414.65	-673.42
48	FR-11	Franche Comte	5850.75	5734.52	116.23
49	FR-12	Pays de la Loire	4906.51	4667.48	239.03
50	FR-13	Bretagne	3999.24	4291.50	-292.26
51	FR-14	Poitou-Charentes	4719.14	4570.82	148.32
52	FR-15	Aquitaine	4950.86	4679.16	271.70
53	FR-16	Midi-Pyrenees	4241.97	4580.18	-338.21
54	FR-17	Limousin	4172.32	4610.33	-438.01
55	FR-18	Rhone-Alpes	5956.95	5678.56	278.39
56	FR-19	Auvergne	4509.82	4705.48	-195.67
57	FR-20	Languedoc-Roussillon	4180.86	4634.13	-453.26
58	FR-21	Prov.-Alp./Cote d'Az.	4938.37	5115.06	-176.69
	ITALY				
59	IT- 1	Piemonte	4120.46	3670.96	449.50
60	IT- 2	Valle d'Aosta	4786.53	3613.23	1173.31
61	IT- 3	Liguria	3905.13	4071.13	-166.00
62	IT- 4	Lombardia	4336.35	4025.53	310.82
63	IT- 5	Trentino-Alto Adige	3472.32	3455.97	16.35
64	IT- 6	Veneto	3373.77	3445.78	-72.01
65	IT- 7	Friuli-Venezia Giulia	3498.85	3590.68	-91.83
66	IT- 8	Emilia-Romagna	4061.20	3411.76	649.44
67	IT- 9	Toscana	3514.92	3509.51	5.41
68	IT-10	Umbria	3003.31	3099.47	-96.16
69	IT-11	Marche	3088.26	3010.91	77.35
70	IT-12	Lazio	3303.17	3137.03	166.14
71	IT-13	Campania	2135.66	2572.47	-436.80
72	IT-14	Abruzzi	2561.18	2788.70	-227.52
73	IT-15	Molise	2149.31	2287.71	-138.40
74	IT-16	Puglia	2261.33	2361.41	-100.08
75	IT-17	Basilicata	2380.69	2195.12	185.57
76	IT-18	Calabria	1852.44	2126.50	-274.06
77	IT-19	Sicilia	2043.89	2399.54	-355.65
78	IT-20	Sardegna	2485.28	2520.97	-35.69

Table 31 continued

	BEP002	BPY022	BPD022
NETHERLANDS			
79 NL- 2 Friesland	4501.77	5080.82	-579.05
80 NL- 3 Drente	4883.05	5238.49	-355.43
81 NL- 4 Overijssel	5147.03	5420.95	-273.92
82 NL- 5 Gelderland	5406.97	5850.67	-443.70
83 NL- 6 Utrecht	6044.62	6387.89	-343.27
84 NL- 7 Noord-Holland	6595.04	6470.70	124.34
85 NL- 8 Zuid-Holland	6602.95	6426.50	176.45
86 NL- 9 Zeeland	6383.93	4993.48	1390.45
87 NL-10 Noord-Brabant	5387.24	5967.98	-580.74
88 NL-11 Limburg	5005.68	6056.47	-1050.79
BELGIUM			
89 BE- 1 Antwerpen	7820.79	6387.24	1433.55
90 BE- 2 Brabant	7374.21	5954.67	1419.55
91 BE- 3 Hainaut	4859.64	5779.12	-919.49
92 BE- 4 Liege	6043.56	5444.79	598.77
93 BE- 5 Limburg	5666.19	5737.68	-71.49
94 BE- 6 Luxemburg	4769.23	5267.96	-498.72
95 BE- 7 Namur	5082.50	5448.50	-366.00
96 BE- 8 Oost-Vlaanderen	5756.41	5970.39	-213.98
97 BE- 9 West-Vlaanderen	5907.91	5556.32	351.59
GD LUXEMBURG			
98 LU- 1 GD Luxemburg	6919.25	5868.58	1050.66
UNITED KINGDOM			
99 UK- 1 North	3326.38	3188.67	137.71
100 UK- 2 Yorkshire/Humberside	3406.89	3394.97	11.92
101 UK- 3 East Midlands	3431.28	3465.58	-34.30
102 UK- 4 East Anglia	3220.58	3408.38	-187.80
103 UK- 5 South East	4053.82	4159.83	-106.01
104 UK- 6 South West	3270.62	3403.43	-132.81
105 UK- 7 West Midlands	3591.39	3415.21	176.18
106 UK- 8 North West	3486.58	3969.20	-482.62
107 UK- 9 Wales	3080.92	3285.73	-204.80
108 UK-10 Scotland	3529.06	2921.65	607.41
109 UK-11 Northern Ireland	2642.81	2535.94	106.87

Table 31 continued

			BEP002	BPY022	BPD022
		IRELAND			
110	IR- 1	East	2785.68	.00	.00
111	IR- 2	South West	2418.54	.00	.00
112	IR- 3	South East	2300.75	.00	.00
113	IR- 4	North East	2196.73	.00	.00
114	IR- 5	Mid West	2288.51	.00	.00
115	IR- 6	Donegal	1849.47	.00	.00
116	IR- 7	Midlands	1899.95	.00	.00
117	IR- 8	West	2077.41	.00	.00
118	IR- 9	North West	1849.47	.00	.00
		DENMARK			
119	DK- 1	Copenhagen Region	7782.16	.00	.00
120	DK- 2	Vestsjaellands Amt	6392.60	.00	.00
121	DK- 3	Storstroems Amt	6270.08	.00	.00
122	DK- 4	Bornholms Amt	5994.37	.00	.00
123	DK- 5	Fyns Amt	6274.07	.00	.00
124	DK- 6	Soenderjyllands Amt	6387.79	.00	.00
125	DK- 7	Ribe Amt	6638.19	.00	.00
126	DK- 8	Vejle Amt	6532.76	.00	.00
127	DK- 9	Ringkoebing Amt	6612.03	.00	.00
128	DK-10	Arhus Amt	6640.30	.00	.00
129	DK-11	Viborg Amt	6113.13	.00	.00
130	DK-12	Nordjyllands Amt	6155.14	.00	.00
		GREECE			
131	GR- 1	Eastern Cont. Greece	3029.33	2883.63	145.70
132	GR- 2	Central/W. Macedonia	2470.62	2423.66	46.96
133	GR- 3	Peloponese	1984.26	1711.05	273.21
134	GR- 4	Thessaly	1960.45	1754.46	205.99
135	GR- 5	Eastern Macedonia	1779.78	1569.41	210.37
136	GR- 6	Crete	1889.89	1521.63	368.26
137	GR- 7	Epirus	1707.24	1961.37	-254.13
138	GR- 8	Thrace	1301.98	1588.35	-286.37
139	GR- 9	I. of East. Aeg. Sea	1688.85	2301.63	-612.78

Notes to TABLES 30 and 31:

The results of TABLE 30 are based on the following quasi-production function with country dummies:

```
BEP001=1.737+0.222*IGES01-0.353*ENTGKM+1.119*BPG%01+
             (4.53)       (5.18)        (4.83)
        +0.036*POFL01+0.048*DUMYBR+0.119*DUMYDK+
             (1.83)       (2.64)        (5.48)
        +0.067*DUMYFR-0.063*DUMYIT-0.069*DUMYNL+
             (3.58)       (3.18)        (2.92)
        +0.040*DUMYUK
             (1.49)

             RSQA   = 0.8856       F-VALUE= 100.87
```

All variables except DUMYUK are significant at the 95% level. t-values in brackets, critical t: 1.66.

The results of TABLE 31 are based on the following quasi-production function with country dummies:

```
BEP002=2.682+0.191*IGES02-0.444*ENTGKM+0.986*BPG%02+
             (3.28)       (5.48)        (4.02)
        +0.037*POFL02+0.132*DUMYBR+0.040*DUMYFR-
             (1.83)       (8.95)        (2.15)
        -0.114*DUMYIT-0.142*DUMYUK
             (6.14)       (5.84)

             RSQA   = 0.9315       F-VALUE= 199.17
```

All variables are significant at the 95% level. t-values in brackets, critical t: 1.66.

TABLE 32.: Ranking List of Regions with Relative Underutilization and Overutilization of Regional Development Potential (Multiple BEPO-Functions) 1st and 2nd Cross Section Years

Regions		BPRO21	Regions		BPRO22
137	GR- 7	-23.34	139	GR- 9	-26.62
27	GE-27	-20.07	17	GE-17	-23.78
91	BE- 3	-19.55	138	GR- 8	-18.03
76	IT-18	-19.51	88	NL-11	-17.35
71	IT-13	-18.52	71	IT-13	-16.98
93	BE- 5	-17.68	91	BE- 3	-15.91
26	GE-26	-17.31	12	GE-12	-15.06
106	UK- 8	-15.36	77	IT-19	-14.82
17	GE-17	-15.24	14	GE-14	-14.81
96	BE- 8	-15.00	26	GE-26	-14.55
12	GE-12	-14.95	21	GE-21	-14.33
20	GE-20	-14.51	20	GE-20	-14.06
139	GR- 9	-14.45	27	GE-27	-13.33
83	NL- 6	-13.90	45	FR- 8	-13.13
46	FR- 9	-13.08	137	GR- 7	-12.96
45	FR- 8	-12.98	76	IT-18	-12.89
33	GE-33	-12.22	106	UK- 8	-12.16
72	IT-14	-11.39	19	GE-19	-11.94
120	DK- 2	-11.35	79	NL- 2	-11.40
21	GE-21	-11.10	47	FR-10	-10.50
77	IT-19	-10.76	46	FR- 9	-10.27
19	GE-19	-9.81	57	FR-20	-9.78
75	IT-17	-9.60	87	NL-10	-9.73
100	UK- 2	-9.52	54	FR-17	-9.50
126	DK- 8	-9.49	94	BE- 6	-9.47
47	FR-10	-9.10	13	GE-13	-9.16
8	GE- 8	-8.50	15	GE-15	-8.38
53	FR-16	-8.33	72	IT-14	-8.16
63	IT- 5	-8.18	82	NL- 5	-7.58
23	GE-23	-8.15	23	GE-23	-7.56
4	GE- 4	-7.81	53	FR-16	-7.38
107	UK- 9	-7.56	50	FR-13	-6.81
57	FR-20	-7.50	80	NL- 3	-6.79
15	GE-15	-7.19	95	BE- 7	-6.72
88	NL-11	-6.81	107	UK- 9	-6.23
68	IT-10	-6.59	8	GE- 8	-6.11
32	GE-32	-6.28	73	IT-15	-6.05
13	GE-13	-6.23	102	UK- 4	-5.51
48	FR-11	-5.79	4	GE- 4	-5.45
123	DK- 5	-5.47	83	NL- 6	-5.37
7	GE- 7	-5.25	81	NL- 4	-5.05
58	FR-21	-5.14	32	GE-32	-4.27
95	BE- 7	-4.99	74	IT-16	-4.24
73	IT-15	-4.96	43	FR- 6	-4.21
104	UK- 6	-4.82	56	FR-19	-4.16

Table 32 continued

Regions		BPR021	Regions		BPR022
74	IT-16	-4.72	61	IT- 3	-4.08
94	BE- 6	-4.69	104	UK- 6	-3.90
99	UK- 1	-4.67	96	BE- 8	-3.58
50	FR-13	-4.64	58	FR-21	-3.45
79	NL- 2	-4.44	68	IT-10	-3.10
6	GE- 6	-4.41	7	GE- 7	-2.74
54	FR-17	-4.08	37	GE-37	-2.56
128	DK-10	-4.01	65	IT- 7	-2.56
44	FR- 7	-3.36	103	UK- 5	-2.55
81	NL- 4	-2.62	44	FR- 7	-2.16
102	UK- 4	-2.60	64	IT- 6	-2.09
80	NL- 3	-2.44	22	GE-22	-1.94
56	FR-19	-2.29	78	IT-20	-1.42
87	NL-10	-2.20	93	BE- 5	-1.25
55	FR-18	-2.15	18	GE-18	-1.08
84	NL- 7	-1.53	101	UK- 3	-.99
14	GE-14	-.61	33	GE-33	-.45
92	BE- 4	-.43	25	GE-25	-.12
121	DK- 3	-.38	110	IR- 1	.00
22	GE-22	-.20	111	IR- 2	.00
37	GE-37	-.12	112	IR- 3	.00
78	IT-20	-.03	113	IR- 4	.00
110	IR- 1	.00	114	IR- 5	.00
111	IR- 2	.00	115	IR- 6	.00
112	IR- 3	.00	116	IR- 7	.00
113	IR- 4	.00	117	IR- 8	.00
114	IR- 5	.00	118	IR- 9	.00
115	IR- 6	.00	119	DK- 1	.00
116	IR- 7	.00	120	DK- 2	.00
117	IR- 8	.00	121	DK- 3	.00
118	IR- 9	.00	122	DK- 4	.00
69	IT-11	.53	123	DK- 5	.00
29	GE-29	.65	124	DK- 6	.00
2	GE- 2	.77	125	DK- 7	.00
130	DK-12	1.17	126	DK- 8	.00
64	IT- 6	1.38	127	DK- 9	.00
65	IT- 7	1.53	128	DK-10	.00
122	DK- 4	1.85	129	DK-11	.00
125	DK- 7	2.13	130	DK-12	.00
103	UK- 5	2.53	9	GE- 9	.06
129	DK-11	2.77	67	IT- 9	.15
105	UK- 7	2.91	100	UK- 2	.35
101	UK- 3	3.14	63	IT- 5	.47
132	GR- 2	3.16	84	NL- 7	1.92
82	NL- 5	3.67	132	GR- 2	1.94
43	FR- 6	3.91	48	FR-11	2.03
124	DK- 6	4.09	6	GE- 6	2.03
131	GR- 1	4.12	69	IT-11	2.57

Table 32 continued

Regions		BPR021	Regions		BPR022
40	FR- 3	4.50	85	NL- 8	2.75
85	NL- 8	4.80	29	GE-29	3.24
1	GE- 1	4.96	51	FR-14	3.24
9	GE- 9	5.23	109	UK-11	4.21
11	GE-11	5.31	99	UK- 1	4.32
138	GR- 8	5.35	55	FR-18	4.90
25	GE-25	5.99	131	GR- 1	5.05
5	GE- 5	6.12	49	FR-12	5.12
67	IT- 9	6.28	105	UK- 7	5.16
41	FR- 4	6.53	70	IT-12	5.30
36	GE-36	6.54	52	FR-15	5.81
42	FR- 5	6.73	40	FR- 3	6.14
52	FR-15	7.46	36	GE-36	6.19
18	GE-18	8.08	97	BE- 9	6.33
134	GR- 4	8.33	10	GE-10	6.45
97	BE- 9	8.43	31	GE-31	6.98
28	GE-28	8.76	62	IT- 4	7.72
89	BE- 1	8.94	16	GE-16	7.79
70	IT-12	9.40	2	GE- 2	8.13
133	GR- 3	9.62	28	GE-28	8.27
61	IT- 3	9.97	75	IT-17	8.45
119	DK- 1	10.26	35	GE-35	10.23
38	FR- 1	10.65	92	BE- 4	11.00
127	DK- 9	11.08	41	FR- 4	11.05
135	GR- 5	11.57	5	GE- 5	11.11
10	GE-10	11.69	42	FR- 5	11.25
31	GE-31	11.84	134	GR- 4	11.74
16	GE-16	12.01	59	IT- 1	12.24
30	GE-30	13.47	11	GE-11	13.36
136	GR- 6	13.82	135	GR- 5	13.40
59	IT- 1	14.07	24	GE-24	14.02
51	FR-14	14.13	30	GE-30	15.18
24	GE-24	14.15	39	FR- 2	15.41
49	FR-12	15.03	133	GR- 3	15.97
108	UK-10	17.53	98	LU- 1	17.90
35	GE-35	17.64	66	IT- 8	19.04
39	FR- 2	17.84	108	UK-10	20.79
66	IT- 8	17.92	1	GE- 1	22.05
62	IT- 4	19.18	89	BE- 1	22.44
98	LU- 1	21.86	34	GE-34	23.38
90	BE- 2	22.30	90	BE- 2	23.84
34	GE-34	22.57	136	GR- 6	24.20
109	UK-11	24.97	38	FR- 1	26.10
60	IT- 2	29.50	86	NL- 9	27.85
86	NL- 9	31.19	60	IT- 2	32.47
3	GE- 3	41.65	3	GE- 3	43.08

The main results which merit to be mentioned and the conclusions that can be drawn from these results can be summarized as follows:

(1) As far as potential income disparities are concerned, the estimates presented in TABLES 23 to 25 and TABLES 30 to 32 are roughly comparable. In terms of potential income per capita (BEPO), Duesseldorf with 3344 ECU and Koeln with 3339 ECU are the maximum regions and Thrace with 657 ECU is the minimum region in the 1st year with a MMR of 5.1. In the 2nd year, Koeln and Duesseldorf changed place; it is now Koeln with 9110 ECU which is at the top but again closely followed by Duesseldorf with 9086 ECU as maximum regions. The minimum regions are Crete with 1522 and Thrace with 1588 ECU. This yields MMR of 6.0 or 5.7. These results point again to an increase in MMR disparities.

(2) If the Irish regions are disregarded because for them no estimates could be obtained due to lack of appropriate data, relative underutilization or overutilization ranges between -23% and +42% in the 1st and -27% and +43% in the 2nd year. The asymmetrical distribution of overutilization and underutilization ratios apparently still exists, although, especially in the 1st year, it is less pronounced compared with the singular QPF.

(3) If the regions that show relative overutilization respectively underutilization on the base of the singular infrastructure functions are compared with the list obtained with the aid of the fully specified functions, most regions remain in their respective categories, i. e. there are only few changes from plus to minus or vice-versa.

(4) However, intensity of relative underutilization or overutilization changes significantly in many cases. It is, therefore, possible to apply the interpretation already explained as far as the relative influence of infrastructure compared with the other potentiality factors is concerned.

TABLE 33.: Infrastructure Bottlenecks and Excess Capacities Estimated with the Aid of Fully Specified Potentiality Factors QPF for BEEM Including Infrastructure (IGES) and Country Dummies, 1st Cross Section Year

			BEEM01	BEY021	BED021
		GERMANY			
1	GE- 1	Schleswig	6016.65	5106.82	909.83
2	GE- 2	Mittelh.-Dithmarschen	6502.63	5875.74	626.89
3	GE- 3	Hamburg	8649.43	6601.11	2048.32
4	GE- 4	Lueneburger Heide	5690.15	5696.65	-6.50
5	GE- 5	Bremen	6330.42	6045.66	284.76
6	GE- 6	Osnabrueck	5510.02	5780.71	-270.69
7	GE- 7	Ems	5792.17	5626.94	165.24
8	GE- 8	Muenster	6546.33	6440.21	106.12
9	GE- 9	Bielefeld	6976.07	6533.47	442.61
10	GE-10	Hannover	6861.72	6636.33	225.39
11	GE-11	Braunschweig	6851.99	6599.45	252.54
12	GE-12	Goettingen	5513.02	6347.49	-834.46
13	GE-13	Kassel	6029.38	6409.59	-380.21
14	GE-14	Dortmund-Siegen	7490.85	7186.48	304.37
15	GE-15	Essen	8022.34	7515.44	506.91
16	GE-16	Duesseldorf	7815.49	7682.66	132.83
17	GE-17	Aachen	6626.05	6812.01	-185.96
18	GE-18	Koeln	8271.53	7612.71	658.81
19	GE-19	Trier	5837.63	6066.30	-228.67
20	GE-20	Koblenz	6484.87	6807.55	-322.68
21	GE-21	Mittel-Osthessen	5901.81	6563.76	-661.95
22	GE-22	Bamberg-Hof	5712.86	6343.11	-630.25
23	GE-23	Aschaffenb.-Schweinf.	5807.19	6286.63	-479.44
24	GE-24	Frankfurt-Darmstadt	7612.85	7327.17	285.68
25	GE-25	Mainz-Wiesbaden	7481.24	7072.40	408.84
26	GE-26	Saarland	6499.36	7187.65	-688.29
27	GE-27	Westpfalz	6103.40	6639.79	-536.38
28	GE-28	Rhein-Neckar-Suedpf.	7428.23	7115.85	312.38
29	GE-29	Oberrhein-Nordschw.	6686.35	7114.87	-428.52
30	GE-30	Neckar-Franken	6784.42	6895.17	-110.75
31	GE-31	Ansbach-Nuernberg	6221.57	6606.81	-385.23
32	GE-32	Regensburg-Weiden	5500.14	5838.11	-337.98
33	GE-33	Landshut-Passau	4641.43	5505.06	-863.63
34	GE-34	Muenchen-Rosenheim	7363.22	6533.68	829.53
35	GE-35	Kempten-Ingolstadt	6707.77	6149.55	558.22
36	GE-36	Alb-Oberschwaben	6119.02	6364.60	-245.58
37	GE-37	Oberrhein-Suedschw.	6222.42	6640.70	-418.28

Table 33 continued

			BEEM01	BEY021	BED021
	FRANCE				
38	FR- 1	Ile de France	7503.08	7284.00	219.09
39	FR- 2	Champagne-Ardennes	6008.40	5311.72	696.69
40	FR- 3	Picardie	5506.62	5396.56	110.06
41	FR- 4	Haute Normandie	6366.79	6057.08	309.70
42	FR- 5	Centre	5149.57	5008.38	141.19
43	FR- 6	Basse Normandie	4591.19	4793.51	-202.31
44	FR- 7	Bourgogne	5075.15	5479.97	-404.81
45	FR- 8	Nord-Pas de Calais	5995.24	6251.84	-256.60
46	FR- 9	Lorraine	5904.67	6448.31	-543.64
47	FR-10	Alsace	5548.88	6411.01	-862.13
48	FR-11	Franche Comte	5358.82	5765.90	-407.08
49	FR-12	Pays de la Loire	4860.53	4548.85	311.68
50	FR-13	Bretagne	4209.92	4361.25	-151.33
51	FR-14	Poitou-Charentes	4735.87	4251.71	484.16
52	FR-15	Aquitaine	5181.63	4644.22	537.41
53	FR-16	Midi-Pyrenees	4516.09	4615.31	-99.21
54	FR-17	Limousin	4147.35	4641.53	-494.18
55	FR-18	Rhone-Alpes	5824.35	5996.07	-171.71
56	FR-19	Auvergne	4626.87	4896.73	-269.86
57	FR-20	Languedoc-Roussillon	5016.22	4533.21	483.01
58	FR-21	Prov.-Alp./Cote d'Az.	5886.46	5394.60	491.86
	ITALY				
59	IT- 1	Piemonte	5491.77	5526.65	-34.88
60	IT- 2	Valle d'Aosta	5945.95	5293.50	652.45
61	IT- 3	Liguria	6347.79	5744.42	603.37
62	IT- 4	Lombardia	5935.92	5687.87	248.05
63	IT- 5	Trentino-Alto Adige	4537.15	5175.80	-638.65
64	IT- 6	Veneto	4724.87	4974.97	-250.10
65	IT- 7	Friuli-Venezia Giulia	4744.68	5108.15	-363.48
66	IT- 8	Emilia-Romagna	4745.53	4825.65	-80.12
67	IT- 9	Toscana	4940.58	5036.86	-96.28
68	IT-10	Umbria	4150.37	4637.77	-487.40
69	IT-11	Marche	3853.58	4485.86	-632.28
70	IT-12	Lazio	5421.31	4824.79	596.52
71	IT-13	Campania	3777.82	4135.71	-357.89
72	IT-14	Abruzzi	3487.39	4003.85	-516.45
73	IT-15	Molise	2715.55	3311.71	-596.16
74	IT-16	Puglia	3664.90	3649.87	15.03
75	IT-17	Basilicata	2833.11	3397.73	-564.62
76	IT-18	Calabria	2985.21	3413.50	-428.29
77	IT-19	Sicilia	4042.69	3683.15	359.53
78	IT-20	Sardegna	4485.60	3854.83	630.77

Table 33 continued

		BEEM01	BEY021	BED021
	NETHERLANDS			
79	NL- 2 Friesland	6020.55	5508.91	511.64
80	NL- 3 Drente	5570.18	5569.49	.69
81	NL- 4 Overijssel	5834.46	5979.28	-144.82
82	NL- 5 Gelderland	6744.73	6302.35	442.37
83	NL- 6 Utrecht	6274.81	7106.24	-831.43
84	NL- 7 Noord-Holland	6584.54	7266.81	-682.27
85	NL- 8 Zuid-Holland	7636.09	7180.32	455.77
86	NL- 9 Zeeland	6911.76	5620.50	1291.27
87	NL-10 Noord-Brabant	6555.36	6622.22	-66.86
88	NL-11 Limburg	5697.82	6736.32	-1038.50
	BELGIUM			
89	BE- 1 Antwerpen	7707.32	6467.75	1239.57
90	BE- 2 Brabant	7397.48	6106.34	1291.14
91	BE- 3 Hainaut	5851.13	6132.91	-281.77
92	BE- 4 Liege	6747.82	6053.80	694.01
93	BE- 5 Limburg	5528.50	5799.09	-270.59
94	BE- 6 Luxemburg	5327.99	4863.33	464.66
95	BE- 7 Namur	6026.37	5483.20	543.17
96	BE- 8 Oost-Vlaanderen	5834.67	6458.99	-624.32
97	BE- 9 West-Vlaanderen	6440.95	5546.84	894.11
	GD LUXEMBURG			
98	LU- 1 GD Luxemburg	8105.22	6064.14	2041.08
	UNITED KINGDOM			
99	UK- 1 North	4343.66	4467.70	-124.04
100	UK- 2 Yorkshire/Humberside	4398.35	5145.32	-746.97
101	UK- 3 East Midlands	4449.97	5119.19	-669.22
102	UK- 4 East Anglia	4747.92	5019.30	-271.38
103	UK- 5 South East	5740.66	5909.91	-169.25
104	UK- 6 South West	4672.65	5154.39	-481.73
105	UK- 7 West Midlands	4600.58	5001.49	-400.91
106	UK- 8 North West	4811.23	5814.10	-1002.87
107	UK- 9 Wales	4590.63	4866.94	-276.31
108	UK-10 Scotland	4891.93	4342.59	549.34
109	UK-11 Northern Ireland	5608.86	3922.54	1686.32

Table 33 continued

	BEEM01	BEY021	BED021
IRELAND			
110 IR- 1 East	3360.92	.00	.00
111 IR- 2 South West	2790.37	.00	.00
112 IR- 3 South East	2670.49	.00	.00
113 IR- 4 North East	2447.36	.00	.00
114 IR- 5 Mid West	2681.45	.00	.00
115 IR- 6 Donegal	2103.21	.00	.00
116 IR- 7 Midlands	2213.50	.00	.00
117 IR- 8 West	2091.61	.00	.00
118 IR- 9 North West	2019.42	.00	.00
DENMARK			
119 DK- 1 Copenhagen Region	6944.51	6383.37	561.14
120 DK- 2 Vestsjaellands Amt	5241.41	5758.88	-517.47
121 DK- 3 Storstroems Amt	5159.30	5336.31	-177.01
122 DK- 4 Bornholms Amt	4996.50	4920.78	75.72
123 DK- 5 Fyns Amt	5242.41	5679.05	-436.64
124 DK- 6 Soenderjyllands Amt	5322.57	5132.73	189.85
125 DK- 7 Ribe Amt	5489.21	5365.25	123.96
126 DK- 8 Vejle Amt	5359.38	5784.32	-424.94
127 DK- 9 Ringkoebing Amt	5334.16	4964.55	369.61
128 DK-10 Arhus Amt	5694.44	5770.61	-76.18
129 DK-11 Viborg Amt	4936.00	4771.86	164.13
130 DK-12 Nordjyllands Amt	5189.11	5019.82	169.29
GREECE			
131 GR- 1 Eastern Cont. Greece	4078.81	3425.13	653.68
132 GR- 2 Central/W. Macedonia	2882.51	2691.94	190.57
133 GR- 3 Peloponese	2387.85	2245.76	142.10
134 GR- 4 Thessaly	2336.71	2146.13	190.58
135 GR- 5 Eastern Macedonia	2064.55	2030.99	33.56
136 GR- 6 Crete	2127.39	2030.80	96.59
137 GR- 7 Epirus	1894.02	2511.05	-617.04
138 GR- 8 Thrace	1783.27	1782.93	.34
139 GR- 9 I. of East. Aeg. Sea	2452.59	2530.80	-78.21

TABLE 34.: Infrastructure Bottlenecks and Excess Capacities Estimated with the Aid of Fully Specified Potentiality Factors QPF for BEEM Including Infrastructure (IGES) and Country Dummies, 2nd Cross Section Year

			BEEM02	BEY022	BED022
	GERMANY				
1	GE- 1	Schleswig	18540.05	15308.04	3232.01
2	GE- 2	Mittelh.-Dithm.	19280.20	17576.46	1703.74
3	GE- 3	Hamburg	26165.32	19297.79	6867.53
4	GE- 4	Lueneburger Heide	15150.39	16656.60	-1506.20
5	GE- 5	Bremen	19033.67	18037.63	996.05
6	GE- 6	Osnabrueck	19324.54	17725.09	1599.45
7	GE- 7	Ems	18490.21	17086.57	1403.64
8	GE- 8	Muenster	20999.25	19297.23	1702.02
9	GE- 9	Bielefeld	20938.65	19538.98	1399.68
10	GE-10	Hannover	20733.15	19723.54	1009.61
11	GE-11	Braunschweig	22303.09	19278.30	3024.79
12	GE-12	Goettingen	15085.73	18981.40	-3895.67
13	GE-13	Kassel	18605.16	19137.67	-532.50
14	GE-14	Dortmund-Siegen	19509.39	21129.48	-1620.10
15	GE-15	Essen	22379.02	22619.63	-240.61
16	GE-16	Duesseldorf	25667.61	22677.57	2990.04
17	GE-17	Aachen	16825.30	20404.95	-3579.65
18	GE-18	Koeln	24295.04	22628.28	1666.77
19	GE-19	Trier	15465.49	17776.69	-2311.20
20	GE-20	Koblenz	17789.83	19574.25	-1784.42
21	GE-21	Mittel-Osthessen	17185.72	19261.68	-2075.96
22	GE-22	Bamberg-Hof	16166.86	18272.18	-2105.33
23	GE-23	Aschaffenb.-Schw.	16285.88	18247.92	-1962.04
24	GE-24	Frankfurt-Darmstadt	25234.17	21674.61	3559.56
25	GE-25	Mainz-Wiesbaden	21117.61	20756.75	360.86
26	GE-26	Saarland	20656.47	21182.33	-525.86
27	GE-27	Westpfalz	16887.12	19428.27	-2541.15
28	GE-28	Rhein-Neckar-Suedpf.	22814.93	21344.26	1470.67
29	GE-29	Oberrhein-Nordschw.	21349.33	21092.16	257.17
30	GE-30	Neckar-Franken	21428.54	20322.59	1105.95
31	GE-31	Ansbach-Nuernberg	18877.07	19311.24	-434.17
32	GE-32	Regensburg-Weiden	15381.16	17208.35	-1827.19
33	GE-33	Landshut-Passau	14522.16	16163.24	-1641.08
34	GE-34	Muenchen-Rosenheim	19999.81	19031.71	968.10
35	GE-35	Kempten-Ingolstadt	17687.73	17864.62	-176.90
36	GE-36	Alb-Oberschwaben	18220.19	18797.88	-577.69
37	GE-37	Oberrhein-Suedschw.	19118.94	19758.08	-639.14

Table 34 continued

			BEEM02	BEY022	BED022
	FRANCE				
38	FR- 1	Ile de France	16941.68	16151.73	789.95
39	FR- 2	Champagne-Ardennes	14374.77	12637.05	1737.73
40	FR- 3	Picardie	13679.41	12728.94	950.47
41	FR- 4	Haute Normandie	16252.32	14270.69	1981.63
42	FR- 5	Centre	13016.36	12342.18	674.18
43	FR- 6	Basse Normandie	11353.59	12379.63	-1026.04
44	FR- 7	Bourgogne	13276.08	13064.36	211.72
45	FR- 8	Nord-Pas de Calais	13163.44	14431.26	-1267.82
46	FR- 9	Lorraine	13345.05	14335.07	-990.02
47	FR-10	Alsace	15017.01	15335.53	-318.52
48	FR-11	Franche Comte	14126.13	13849.70	276.43
49	FR-12	Pays de la Loire	11303.85	11973.25	-669.40
50	FR-13	Bretagne	11295.26	11328.63	-33.37
51	FR-14	Poitou-Charentes	11902.80	11643.08	259.72
52	FR-15	Aquitaine	12706.71	12039.62	667.08
53	FR-16	Midi-Pyrenees	10701.44	11833.18	-1131.74
54	FR-17	Limousin	10250.00	11714.45	-1464.45
55	FR-18	Rhone-Alpes	14303.17	13933.18	369.98
56	FR-19	Auvergne	11482.69	11836.19	-353.50
57	FR-20	Languedoc-Roussillon	12231.39	12044.44	186.95
58	FR-21	Prov.-Alp./Cote d'Az	13134.04	12994.94	139.10
	ITALY				
59	IT- 1	Piemonte	9494.57	9065.49	429.08
60	IT- 2	Valle d'Aosta	10642.02	8723.42	1918.61
61	IT- 3	Liguria	9593.08	10125.57	-532.49
62	IT- 4	Lombardia	10498.57	9907.20	591.37
63	IT- 5	Trentino-Alto Adige	8563.75	8539.20	24.55
64	IT- 6	Veneto	9037.26	8725.91	311.35
65	IT- 7	Friuli-Venezia Giuli	8904.56	9024.57	-120.01
66	IT- 8	Emilia-Romagna	9344.54	8707.69	636.84
67	IT- 9	Toscana	8790.43	8854.52	-64.08
68	IT-10	Umbria	7749.20	7964.65	-215.45
69	IT-11	Marche	7618.63	7810.98	-192.35
70	IT-12	Lazio	8672.38	8154.25	518.13
71	IT-13	Campania	6454.33	6980.69	-526.35
72	IT-14	Abruzzi	6948.74	7423.73	-474.99
73	IT-15	Molise	5309.01	6164.83	-855.82
74	IT-16	Puglia	6232.75	6557.50	-324.75
75	IT-17	Basilicata	6011.42	5986.32	25.10
76	IT-18	Calabria	5549.57	6049.06	-499.49
77	IT-19	Sicilia	6481.85	6655.97	-174.12
78	IT-20	Sardegna	7536.90	6771.01	765.89

Table 34 continued

		BEEM02	BEY022	BED022
	NETHERLANDS			
79	NL- 2 Friesland	18330.94	17874.58	456.35
80	NL- 3 Drente	18600.00	18108.21	491.79
81	NL- 4 Overijssel	18188.61	18772.54	-583.92
82	NL- 5 Gelderland	19686.02	19794.49	-108.46
83	NL- 6 Utrecht	20319.23	21570.38	-1251.15
84	NL- 7 Noord-Holland	21567.57	21988.36	-420.79
85	NL- 8 Zuid-Holland	21470.15	21905.46	-435.31
86	NL- 9 Zeeland	24375.00	17281.13	7093.87
87	NL-10 Noord-Brabant	18118.24	20139.42	-2021.17
88	NL-11 Limburg	17503.31	20416.39	-2913.08
	BELGIUM			
89	BE- 1 Antwerpen	21120.49	18165.51	2954.98
90	BE- 2 Brabant	19095.21	17062.14	2033.07
91	BE- 3 Hainaut	14736.44	16542.45	-1806.01
92	BE- 4 Liege	17125.43	15603.10	1522.33
93	BE- 5 Limburg	16574.14	16457.34	116.80
94	BE- 6 Luxemburg	14172.95	15122.27	-949.32
95	BE- 7 Namur	14914.97	15553.88	-638.91
96	BE- 8 Oost-Vlaanderen	15486.40	17102.06	-1615.65
97	BE- 9 West-Vlaanderen	15964.99	16155.69	-190.70
	GD LUXEMBURG			
98	LU- 1 GD Luxemburg	16304.44	16800.42	-495.98
	UNITED KINGDOM			
99	UK- 1 North	7834.47	7753.84	80.62
100	UK- 2 Yorkshire/Humberside	7755.37	8039.78	-284.41
101	UK- 3 East Midlands	7970.86	8126.49	-155.63
102	UK- 4 East Anglia	7631.65	7916.52	-284.87
103	UK- 5 South East	9023.14	9460.11	-436.97
104	UK- 6 South West	8006.29	7980.25	26.04
105	UK- 7 West Midlands	7947.62	8105.99	-158.38
106	UK- 8 North West	8008.81	9222.79	-1213.98
107	UK- 9 Wales	7540.23	7822.45	-282.22
108	UK-10 Scotland	8301.04	7086.79	1214.25
109	UK-11 Northern Ireland	7345.39	6227.16	1118.23

Table 34 continued

			BEEM02	BEY022	BED022
		IRELAND			
110	IR- 1	East	.00	.00	.00
111	IR- 2	South West	.00	.00	.00
112	IR- 3	South East	.00	.00	.00
113	IR- 4	North East	.00	.00	.00
114	IR- 5	Mid West	.00	.00	.00
115	IR- 6	Donegal	.00	.00	.00
116	IR- 7	Midlands	.00	.00	.00
117	IR- 8	West	.00	.00	.00
118	IR- 9	North West	.00	.00	.00
		DENMARK			
119	DK- 1	Copenhagen Region	14356.73	.00	.00
120	DK- 2	Vestsjaellands Amt	12376.60	.00	.00
121	DK- 3	Storstroems Amt	12372.20	.00	.00
122	DK- 4	Bornholms Amt	11748.58	.00	.00
123	DK- 5	Fyns Amt	12432.62	.00	.00
124	DK- 6	Soenderjyllands Amt	12664.77	.00	.00
125	DK- 7	Ribe Amt	12821.51	.00	.00
126	DK- 8	Vejle Amt	12695.76	.00	.00
127	DK- 9	Ringkoebing Amt	12465.78	.00	.00
128	DK-10	Arhus Amt	13243.64	.00	.00
129	DK-11	Viborg Amt	12046.27	.00	.00
130	DK-12	Nordjyllands Amt	12166.07	.00	.00
		GREECE			
131	GR- 1	Eastern Cont. Greece	6439.06	6724.65	-285.59
132	GR- 2	Central/W. Macedonia	6681.11	5746.43	934.68
133	GR- 3	Peloponese	4963.35	4498.57	464.79
134	GR- 4	Thessaly	5308.45	4492.49	815.95
135	GR- 5	Eastern Macedonia	4454.89	4167.98	286.90
136	GR- 6	Crete	4642.83	4181.25	461.57
137	GR- 7	Epirus	4396.58	4907.30	-510.72
138	GR- 8	Thrace	3330.56	4249.89	-919.34
139	GR- 9	I. of East. Aeg. Sea	4695.88	5679.36	-983.48

Notes to TABLES 33 and 34:

The results of TABLE 33 are based on the following quasi-production function with country dummies:

```
BEEM01=2.541+0.121*IGES01-0.412*ENTGKM+1.094*BPG%01+
              (3.54)       (7.21)        (6.73)
           +0.032*POFL01+0.034*DUMYBR+0.069*DUMYDK+
              (1.84)     (2.60)        (4.35)
           +0.044*DUMYFR+0.037*DUMYNL
              (3.14)       (1.85)

              RSQA   = 0.8766    F-VALUE= 115.50
```

All variables are significant at the 95% level.
t-values in brackets, critical t: 1.66.

The results of TABLE 34 are based on the following quasi-production function with country dummies:

```
BEEM02=3.340+0.185*IGES02-0.294*ENTGKM+0.659*BPG%02+
              (3.47)       (3.44)        (2.91)
           +0.043*POFL02+0.073*DUMYBR-0.039*DUMYFR-
              (2.49)       (4.40)        (1.91)
           -0.197*DUMYIT+0.069*DUMYNL-0.247*DUMYUK-
              (8.22)       (3.14)        (9.99)
           -0.165*DUMYGR
              (3.85)

              RSQA   = 0.9520    F-VALUE= 233.29
```

All variables are significant at the 95% level.
t-values in brackets, critical t: 1.66.

TABLE 35.: Ranking List of Regions with Relative Underutilization and Overutilization of Regional Development Potential (Multiple BEEM-Functions) 1st and 2nd Cross Section Years

Regions		BER021	Regions		BER022
137	GR- 7	-24.57	138	GR- 8	-21.63
73	IT-15	-18.00	12	GE-12	-20.52
106	UK- 8	-17.25	17	GE-17	-17.54
75	IT-17	-16.62	139	GR- 9	-17.32
33	GE-33	-15.69	88	NL-11	-14.27
88	NL-11	-15.42	73	IT-15	-13.88
100	UK- 2	-14.52	106	UK- 8	-13.16
69	IT-11	-14.09	27	GE-27	-13.08
47	FR-10	-13.45	19	GE-19	-13.00
12	GE-12	-13.15	54	FR-17	-12.50
101	UK- 3	-13.07	22	GE-22	-11.52
72	IT-14	-12.90	91	BE- 3	-10.92
76	IT-18	-12.55	21	GE-21	-10.78
63	IT- 5	-12.34	23	GE-23	-10.75
83	NL- 6	-11.70	32	GE-32	-10.62
54	FR-17	-10.65	137	GR- 7	-10.41
68	IT-10	-10.51	33	GE-33	-10.15
21	GE-21	-10.08	87	NL-10	-10.04
22	GE-22	-9.94	53	FR-16	-9.56
96	BE- 8	-9.67	96	BE- 8	-9.45
26	GE-26	-9.58	20	GE-20	-9.12
84	NL- 7	-9.39	4	GE- 4	-9.04
104	UK- 6	-9.35	45	FR- 8	-8.79
120	DK- 2	-8.99	43	FR- 6	-8.29
71	IT-13	-8.65	76	IT-18	-8.26
46	FR- 9	-8.43	14	GE-14	-7.67
27	GE-27	-8.08	71	IT-13	-7.54
105	UK- 7	-8.02	46	FR- 9	-6.91
123	DK- 5	-7.69	72	IT-14	-6.40
23	GE-23	-7.63	94	BE- 6	-6.28
44	FR- 7	-7.39	83	NL- 6	-5.80
126	DK- 8	-7.35	49	FR-12	-5.59
65	IT- 7	-7.12	61	IT- 3	-5.26
48	FR-11	-7.06	74	IT-16	-4.95
37	GE-37	-6.30	103	UK- 5	-4.62
29	GE-29	-6.02	131	GR- 1	-4.25
13	GE-13	-5.93	95	BE- 7	-4.11
31	GE-31	-5.83	107	UK- 9	-3.61
32	GE-32	-5.79	102	UK- 4	-3.60
107	UK- 9	-5.68	100	UK- 2	-3.54
56	FR-19	-5.51	37	GE-37	-3.23
102	UK- 4	-5.41	81	NL- 4	-3.11
64	IT- 6	-5.03	36	GE-36	-3.07
20	GE-20	-4.74	56	FR-19	-2.99
6	GE- 6	-4.68	98	LU- 1	-2.95

Table 35 continued

Regions		BER021	Regions		BER022
93	BE- 5	-4.67	13	GE-13	-2.78
91	BE- 3	-4.59	68	IT-10	-2.71
43	FR- 6	-4.22	77	IT-19	-2.62
45	FR- 8	-4.10	26	GE-26	-2.48
36	GE-36	-3.86	69	IT-11	-2.46
19	GE-19	-3.77	31	GE-31	-2.25
50	FR-13	-3.47	47	FR-10	-2.08
121	DK- 3	-3.32	85	NL- 8	-1.99
139	GR- 9	-3.09	105	UK- 7	-1.95
103	UK- 5	-2.86	101	UK- 3	-1.92
55	FR-18	-2.86	84	NL- 7	-1.91
99	UK- 1	-2.78	65	IT- 7	-1.33
17	GE-17	-2.73	97	BE- 9	-1.18
81	NL- 4	-2.42	15	GE-15	-1.06
53	FR-16	-2.15	35	GE-35	-.99
67	IT- 9	-1.91	67	IT- 9	-.72
66	IT- 8	-1.66	82	NL- 5	-.55
30	GE-30	-1.61	50	FR-13	-.29
128	DK-10	-1.32	110	IR- 1	.00
87	NL-10	-1.01	111	IR- 2	.00
59	IT- 1	-.63	112	IR- 3	.00
4	GE- 4	-.11	113	IR- 4	.00
110	IR- 1	.00	114	IR- 5	.00
111	IR- 2	.00	115	IR- 6	.00
112	IR- 3	.00	116	IR- 7	.00
113	IR- 4	.00	117	IR- 8	.00
114	IR- 5	.00	118	IR- 9	.00
115	IR- 6	.00	119	DK- 1	.00
116	IR- 7	.00	120	DK- 2	.00
117	IR- 8	.00	121	DK- 3	.00
118	IR- 9	.00	122	DK- 4	.00
80	NL- 3	.01	123	DK- 5	.00
138	GR- 8	.02	124	DK- 6	.00
74	IT-16	.41	125	DK- 7	.00
122	DK- 4	1.54	126	DK- 8	.00
8	GE- 8	1.65	127	DK- 9	.00
135	GR- 5	1.65	128	DK-10	.00
16	GE-16	1.73	129	DK-11	.00
40	FR- 3	2.04	130	DK-12	.00
125	DK- 7	2.31	63	IT- 5	.29
42	FR- 5	2.82	104	UK- 6	.33
7	GE- 7	2.94	75	IT-17	.42
38	FR- 1	3.01	93	BE- 5	.71
130	DK-12	3.37	99	UK- 1	1.04
10	GE-10	3.40	58	FR-21	1.07
129	DK-11	3.44	29	GE-29	1.22
124	DK- 6	3.70	57	FR-20	1.55
11	GE-11	3.83	44	FR- 7	1.62

Table 35 continued

Regions		BER021	Regions		BER022
24	GE-24	3.90	25	GE-25	1.74
14	GE-14	4.24	48	FR-11	2.00
62	IT- 4	4.36	51	FR-14	2.23
28	GE-28	4.39	79	NL- 2	2.55
5	GE- 5	4.71	55	FR-18	2.66
136	GR- 6	4.76	80	NL- 3	2.72
41	FR- 4	5.11	64	IT- 6	3.57
25	GE-25	5.78	59	IT- 1	4.73
133	GR- 3	6.33	38	FR- 1	4.89
85	NL- 8	6.35	34	GE-34	5.09
15	GE-15	6.74	10	GE-10	5.12
9	GE- 9	6.77	30	GE-30	5.44
49	FR-12	6.85	42	FR- 5	5.46
82	NL- 5	7.02	5	GE- 5	5.52
132	GR- 2	7.08	52	FR-15	5.54
127	DK- 9	7.44	62	IT- 4	5.97
18	GE-18	8.65	70	IT-12	6.35
119	DK- 1	8.79	135	GR- 5	6.88
134	GR- 4	8.88	28	GE-28	6.89
35	GE-35	9.08	9	GE- 9	7.16
58	FR-21	9.12	66	IT- 8	7.31
79	NL- 2	9.29	18	GE-18	7.37
94	BE- 6	9.55	40	FR- 3	7.47
77	IT-19	9.76	7	GE- 7	8.21
95	BE- 7	9.91	8	GE- 8	8.32
61	IT- 3	10.50	6	GE- 6	9.02
57	FR-20	10.65	2	GE- 2	9.69
2	GE- 2	10.67	92	BE- 4	9.76
51	FR-14	11.39	133	GR- 3	10.33
92	BE- 4	11.46	136	GR- 6	11.04
52	FR-15	11.57	78	IT-20	11.31
60	IT- 2	12.33	90	BE- 2	11.92
70	IT-12	12.36	16	GE-16	13.18
108	UK-10	12.65	39	FR- 2	13.75
34	GE-34	12.70	41	FR- 4	13.89
39	FR- 2	13.12	11	GE-11	15.69
97	BE- 9	16.12	132	GR- 2	16.27
78	IT-20	16.36	89	BE- 1	16.27
1	GE- 1	17.82	24	GE-24	16.42
131	GR- 1	19.08	108	UK-10	17.13
89	BE- 1	19.17	109	UK-11	17.96
90	BE- 2	21.14	134	GR- 4	18.16
86	NL- 9	22.97	1	GE- 1	21.11
3	GE- 3	31.03	60	IT- 2	21.99
98	LU- 1	33.66	3	GE- 3	35.59
109	UK-11	42.99	86	NL- 9	41.05

Potential productivity figures for the variable BEEM obtained with the aid of a fully specified quasi-production function are presented in TABLES 33 to 35. When these results are compared with those obtained with the aid of the singular infrastructure functions presented in TABLES 26 to 28, quite a similar picture appears. Also for productivity, there is a range of underutilization to overutilization between -25% in the 1st and -22% in the 2nd year to +43% respectively +41%. The fit of the quasi-production functions is very good; they reach coefficients of determination of about 86% in the beginning and 95% at the end of the seventies. Like the BEPO-functions, the span of utilization rates is smaller for the fully specified functions compared with the singular ones.

The potential productivity demonstrates again that infrastructure and the other potentiality factors are quite powerful explanators of regional disparities. The figures obtained could, therefore, also be used for the four cells analysis developed above. But altough there would be some interesting differences between the results obtained with the aid of the BEPO- and the BEEM-functions, in the following only the analysis will be carried through for the first type of endogenous variable BEPO.

TABLES 37 and 38 contain the results of the four cell analysis. The two columns BPRO11 and BPRO21 in the first Table, and BPRO12 and BPRO22 in the second, are taken from TABLES 25 and 32. BPRO1 always means the utilization ratios obtained with the aid of the singular infrastructure function, whereas BPRO2 refers to the fully specified functions; the last digit informs about the first or second cross section year. The regions have been allocated to the cells and their subcategories in the following way:

- First, those regions have been selected that have roughly "normal" rates of utilization, i.e where the difference does not exceed +/- 1.5 percentage points around zero.

- Second, all other regions have been checked whether the difference between the two rates is smaller than 3 percentage points. These regions are considered to have roughly constant rates of utilization. If the sign is positive, they belong to a subgroup of cell I showing approximately constant rates of overutilization, whereas the second subgroup having constant rates of underutilization belongs to cell IV.

- Third, two other subgroups have been formed according to whether a region shows increasing underutilization or overutilization or decreasing underutilization or overutilization. These regions also belong to cells I and IV as long as they show the same sign (positive or negative) in both columns.

- Fourth, the last categories are relevant for regions which change either from negative to positive signs, i.e. mainly from underutilization to overutilization (cell II), or from overutilization to underutilization (cell III), In one case or the other, also a region having normal capacity utilization according to one of the two columns are represented.

A first inspection of the results seems to indicate that the +/- 1.5 range seems to have been too narrow in order to identify regions with roughly normal capacity utilization given the fact that it only covers very few regions. If a larger band would have been applied, some of the other regions now appearing in other groups would have appeared in this part of the table. Here it goes without saying that this type of classification is only a tentative one in order to allow to draw first conclusions. Other methods of grouping regions are possible and should perhaps be applied in future research. However, the two Tables help to obtain a very differentiated picture as to the relationship between infrastructure and other potentiality factors on the one hand and between these informations and a more intuitive classification of regions according to their level of development on the other.

One of the main results of the Study already mentioned several times is again reaffirmed, namely that the well developed regions are to be found almost in all cases in categories either with high constant or increasing rates of overutilization. On the other hand, less developed regions most frequently appear in the groups having high constant or increasing rates of underutilization. One the basis of the methodology applied, regions with roughly identical underutilization rates are those where infrastructure equipment is somewhat in line with the same region's endowment with other potentiality factors. In such a case, one will obtain the same estimate for potential income with the aid of a singular production function and of a fully specified function. If increasing underutilization is indicated, the infrastructure equipment of such a region is not as good as the availability of other resources. Especially in cases where the indicator values in the first column are relatively low and close to zero, those regions may be qualified as having a relative infrastructure bottleneck because infrastructure taken alone would not allow the same potential income as could be obtained with the aid of all potentiality factors taken together. Whenever a region shows decreasing underutilization, its infrastructure equipment in contrast is higher compared with the other determinants. These are regions where infrastructure excess capacities compensate for a bad location, a low degree of agglomeration and a bad sectoral structure.

A closer inspection can start from an analysis of numbers of regions in the different subcategories of cells I - IV in TABLES 37 and 38. Because of lacking data, estimates for utilization rates of the fully specified quasi-production functions cover only 118 regions so that Danish and Irish regions are excluded.

TABLE 36 illustrates the frequency distribution according to the four-cell analysis, whose results are presented in TABLES 37 and 38. These figures provide some interesting insights:

(1) The frequency distribution in both years is in general similar, but also shows interesting differences. First, regions with "normal" capacity utilization and those which change from underutilization to overutilization or vice versa are clearly underrepresented. The first class could naturally be increased if a broader band would be allowed compared with the 1.5% criterion. But as can be seen from TABLES 37 and 38, this would mainly reduce the numbers for cells II and III, but not so much the other categories. There exists, therefore, again a clear asymmetrical distribution: the vast majority of regions is to be found in the different subclasses of cells I and IV. These are regions that either retain their constant rates of utilization, although on different levels, or show strong differences between the two types of rates. What is especially remarkable is that the number of regions with constant rates decrease from 43 to 31, whereas the number of increasing or decreasing ones

rise from 57 to 69. This implies that the differences between the utilization of infrastructure on the one hand and the utilization of total resource stock increases. Out of the 28 regions in the fourth subgroup, 11 had already been in the same group in the first year, but 8 move from constant to increasing. These 8 regions represent a special group of problem regions. They are Mittel-Osthessen, Koblenz, Westpfalz, Campania, Trier, Epirus and Aschaffenburg-Schweinfurt. If those regions are added that continue to have large excess capacities - Aachen, Saarland, Hainaut, North West/UK -, this group does not seem to consist of typical less developed areas, but is characterized mainly by declining industries, but still by capacity increases in infrastructure to the effect that underutilization appears.

TABLE 36.: Frequency Distribution of Utilization Rates of 118 EC-Regions

Cells	Total number of regions in year 1st	2nd	Regions remaining in same category
Region with:			
Normal capacity utilization	2	3	0
Constant rates of overutilization (Cell I)	19	16	7
Constant rates of underutilization (Cell IV)	24	15	5
Increasing under- or over-utilization (Cells IV and I)	19	28	11
Decreasing under- or over-utilization (Cells IV and I)	38	41	26
Changes from negative to positive utilization (Cell II)	5	5	2
Changes from positive to negative utilization (CellIII)	11	10	4
	118	118	55

(2) The largest subgroup contains regions with decreasing underutilization or overutilization and where 26 out of 38 respectively 41 regions are identical in the two years. Besides the subgroups with constant rates of utilization, it is especially this group where most of the regions with high rates of underutilization or overutilization are to be found. They are basically characterized by having a comparatively better infrastructure equipment compared with location, agglomeration and sectoral structure. The regions that remain in this subgroup with high rates of underutilization are Islands of Eastern Aegean Sea, Languedoc-Roussillon, Sicilia, Midi-Pyrenees, Friesland, Abruzzi, Bretagne, Wales, Provence-Alpes-Cotes d'Azur, Puglia, Sardegna and Ems. This group seems to consist partly of regions similar to the ones found in the subgroup of areas with increasing underutilization, partly, however, they belong to the group of less developed regions from a Community point of view ranking low in overall economic performance.

(3) Most of the less developed regions are to be found in the subgroups of regions with high constant rates of underutilization or with decreasing underutilization. These are Epirus, Thrace, Campania, Languedoc-Roussillon, Sicilia, Isles of Eastern Aegean Sea, Abbruzzi, Basilicata, Sardegna, Calabria. But here also are to be found other regions which represent less developed areas seen from the respective national perspective although not always belonging to the least developed areas of the Community. These are Bretagne, Vestsjaellands Amt, Midi-Pyrenees, Wales, Friesland, Limburg, Lueneburger Heide, Goettingen, Luxembourg/BE, Limousin. This demonstrates that the utilization analysis gives a very differentiated picture as to identifikation of problem regions.

(4) The majority of the highly developed regions is to be found in the subgroups of constant overutilization, increasing overutilization and decreasing overutilization. These are Hamburg, Zeeland, Frankfurt-Darmstadt, Neckar-Franken, Koeln, Muenchen-Rosenheim, GD Luxembourg, Brabant, Lombardia, Piemonte, Duesseldorf, Copenhagen, West-Vlaanderen, Ile de France. However, like in the case of underutilization, there are also regions showing high infrastructure or total resource bottlenecks that do not belong to the highly developed areas. They are to be found with increasing or decreasing utilization rates, but not so much in the category

of constant utilization. Even some really low developed ones are classified here like Crete, Eastern Macedonia, Thessaly, Peloponese, Central/Western Macedonia.

(5) It is also interesting to note that cells II and III are relevant for only a few regions, 16 in the 1st and 15 in the 2nd year. Cell II contains regions that normally have an infrastructure excess capacity, but a deficit as far as the other resources are concerned, whereas cell III deals with the opposite relationship. If the 1.5%-criterion would also have been applied in the case where only one column shows such a low figure, and if the change in sign in these cases would not be considered significant, instead of 16 in the 1st and 15 in the 2nd year, only 9 would have remained. This demonstrates again that the pattern of distribution for the regions considered is a stable one and that it cannot be explained with recourse to measurement errors and stochastic variations alone. Nord-Pas de Calais is in both years the region with the largest difference between an infrastructure deficit and excess capacities for the other resources. The opposite extreme case is not so strongly developed, but is represented by Thrace in the 1st and by North/UK in the 2nd year. It should be noted that the 11 regions of cell III in the 1st and the 10 regions in the 2nd year are those that have an infrastructure bottleneck, but one that is compensated by excess capacities of other resources, and that they do not belong to the highly developed areas.

The information contained in TABLES 37 and 38 can also be used in order to answer the question whether and to what extent a relatively good infrastructure equipment serves as a compensation for a bad endowment with other resources or vice versa. The first case obviously applies where regions belong to cell IV and where infrastructure underutilization is larger than total resource underutilization, i.e. where decreasing underutilization has been identified. Those regions are Languedoc-Roussillon, Sicilia, Bretagne, Vestsjaellands Amt, Midi-Pyrenees, Islands of Eastern Aegean Sea, Abruzzi, Provence-Alpes-Cote d'Azur, Wales, Friesland, Lueneburger Heide, South West/UK, Basilicata, Sardegna, Puglia, Umbria, Drente and Ems, if underutilization of infrastructure of at least 3 percentage points is used as a limit.

TABLE 37.: Comparison Between Regional Rates of Utilization on the Basis of Sigular Infrastructure QPF (BPRO11) and on the Basis of Fully Specified Potentiality Factors QPF (BPRO21) 1st Cross Section Year

BEP001: Regions with Roughly Normal Capacity Utilization (Deviation <+/-> 1.5 % from Zero)

			BPRO11	BPRO21
121	DK- 3	Storstroems Amt	-1.21	-.38
130	DK-12	Nordjyllands Amt	-1.09	1.17
69	IT-11	Marche	-.71	.53
29	GE-29	Oberrhein-Nordschwarzwald	-.70	.65

BEP001: Regions with Approximately Constant Rates of Overutilization (Cell I)

			BPRO11	BPRO21
125	DK- 7	Ribe Amt	1.76	2.13
25	GE-25	Mainz-Wiesbaden	3.81	5.99
11	GE-11	Braunschweig	3.82	5.31
82	NL- 5	Gelderland	5.14	3.67
103	UK- 5	South East	5.20	2.53
43	FR- 6	Basse-Normandie	6.41	3.91
5	GE- 5	Bremen	6.84	6.12
85	NL- 8	Zuid-Holland	7.59	4.80
9	GE- 9	Bielefeld	7.72	5.23
28	GE-28	Rhein-Neckar-Suedpfalz	8.52	8.76
127	DK- 9	Ringkoebing Amt	9.31	11.08
18	GE-18	Koeln	10.24	8.08
61	IT- 3	Liguria	11.02	9.97
70	IT-12	Lazio	11.46	9.40
10	GE-10	Hannover	12.60	11.69
51	FR-14	Poitou-Charentes	14.93	14.13
30	GE-30	Neckar-Franken	16.04	13.47
24	GE-24	Frankfurt-Darmstadt	16.09	14.15
66	IT- 8	Emilia-Romagna	17.00	17.92
86	NL- 9	Zeeland	29.24	31.19
3	GE- 3	Hamburg	39.31	41.65

Table 37 continued

BEP001: Regions with Approximately Constant Rates of Underutilization (Cell IV)

			BPR011	BPR021
137	GR- 7	Epirus	-22.79	-23.34
76	IT-18	Calabria	-21.51	-19.51
71	IT-13	Campania	-20.64	-18.52
27	GE-27	Westpfalz	-17.95	-20.07
12	GE-12	Goettingen	-15.05	-14.95
33	GE-33	Landshut-Passau	-14.91	-12.22
20	GE-20	Koblenz	-13.15	-14.51
126	DK- 8	Vejle Amt	-11.65	-9.49
83	NL- 6	Utrecht	-11.42	-13.90
21	GE-21	Mittel-Osthessen	-9.51	-11.10
100	UK- 2	Yorkshire/Humberside	-9.02	-9.52
13	GE-13	Kassel	-8.50	-6.23
19	GE-19	Trier	-8.43	-9.81
8	GE- 8	Muenster	-7.86	-8.50
32	GE-32	Regensburg-Weiden	-7.64	-6.28
99	UK- 1	North	-7.50	-4.67
23	GE-23	Aschaffenburg-Schweinfurt	-6.64	-8.15
63	IT- 5	Trentino-Alto Adige	-6.63	-8.18
128	DK-10	Arhus Amt	-5.27	-4.01
81	NL- 4	Overijssel	-5.16	-2.62
6	GE- 6	Osnabrueck	-4.63	-4.41
102	UK- 4	East Anglia	-4.04	-2.60
55	FR-18	Rhone-Alpes	-3.54	-2.15
94	BE- 6	Luxemburg	-3.24	-4.69
84	NL- 7	Noord-Holland	-1.85	-1.53
37	GE-37	Oberrhein-Suedschwarzwald	-1.54	-.12

BEP001: Regions with Increasing Under- or Over-Utilization (Cells IV and I)

			BPR011	BPR021
26	GE-26	Saarland	-12.91	-17.31
91	BE- 3	Hainaut	-12.62	-19.55
106	UK- 8	North West	-12.19	-15.36
88	NL-11	Limburg	-9.61	-17.68
17	GE-17	Aachen	-7.94	-15.24
46	FR- 9	Lorraine	-4.60	-13.08

Table 37 continued

96	BE- 8	Oost-Vlaanderen	-2.32	-15.00
15	GE-15	Essen	-1.53	-7.19
73	IT-15	Molise	-.48	-4.96
54	FR-17	Limousin	-.13	-4.08
133	GR- 3	Peloponese	.81	9.62
134	GR- 4	Thessaly	1.04	8.33
36	GE-36	Alb-Oberschwaben	2.78	6.54
135	GR- 5	Eastern Macedonia	3.89	11.57
108	UK-10	Scotland	5.84	17.53
136	GR- 6	Crete	8.12	13.82
98	LU- 1	GD Luxemburg	13.03	21.86
35	GE-35	Kempten-Ingolstadt	14.19	17.64
34	GE-34	Muenchen-Rosenheim	17.60	22.57

BEP001: Regions with Decreasing Under- or Over-Utilization (Cells IV and I)

			BPR011	BPR021
57	FR-20	Languedoc-Roussillon	-23.82	-7.50
77	IT-19	Sicilia	-21.55	-10.76
50	FR-13	Bretagne	-21.41	-4.64
120	DK- 2	Vestsjaellands Amt	-21.10	-11.35
53	FR-16	Midi-Pyrenees	-20.51	-8.33
139	GR- 9	Isl. of East. Aeg. Sea	-19.75	-14.45
72	IT-14	Abruzzi	-16.31	-11.39
58	FR-21	Prov.-Alpes-Cote d'Azur	-14.33	-5.14
107	UK- 9	Wales	-13.95	-7.56
79	NL- 2	Friesland	-13.40	-4.44
4	GE- 4	Lueneburger Heide	-13.32	-7.81
104	UK- 6	South West	-13.12	-4.82
75	IT-17	Basilicata	-12.74	-9.60
78	IT-20	Sardegna	-12.70	-.03
74	IT-16	Puglia	-12.60	-4.72
68	IT-10	Umbria	-12.02	-6.59
80	NL- 3	Drente	-10.12	-2.44
7	GE- 7	Ems	-8.72	-5.25
65	IT- 7	Friuli-Venezia Giulia	8.06	1.53
64	IT- 6	Veneto	8.19	1.38
67	IT- 9	Toscana	9.78	6.28
122	DK- 4	Bornholms Amt	9.98	1.85
105	UK- 7	West Midlands	10.03	2.91
101	UK- 3	East Midlands	10.25	3.14
40	FR- 3	Picardie	10.45	4.50

Table 37 continued

41	FR- 4	Haute-Normandie	10.65	6.53
124	DK- 6	Soenderjyllands Amt	10.81	4.09
31	GE-31	Ansbach-Nuernberg	15.05	11.84
132	GR- 2	Central/Western Macedonia	16.21	3.16
38	FR- 1	Ile de France	16.59	10.65
119	DK- 1	Copenhagen Region	17.57	10.26
97	BE- 9	West-Vlaanderen	17.75	8.43
16	GE-16	Duesseldorf	20.24	12.01
49	FR-12	Pays de la Loire	20.79	15.03
89	BE- 1	Antwerpen	20.80	8.94
59	IT- 1	Piemonte	21.50	14.07
39	FR- 2	Champagne-Ardennes	24.35	17.84
62	IT- 4	Lombardia	37.67	19.18
131	GR- 1	Eastern Cont. Greece/Isl.	39.30	4.12
109	UK-11	Northern Ireland	39.66	24.97
60	IT- 2	Valle d'Aosta	45.58	29.50
90	BE- 2	Brabant	50.60	22.30

BEP001: Regions with Changes from Negative to Positive Utilization Rates (Cell II)

			BPR011	BPR021
138	GR- 8	Thrace	-12.86	5.35
52	FR-15	Aquitaine	-9.70	7.46
1	GE- 1	Schleswig	-7.40	4.96
2	GE- 2	Mittelh.-Dithmarschen	-6.71	.77
129	DK-11	Viborg Amt	-3.49	2.77
42	FR- 5	Centre	-2.61	6.73

BEP001: Regions with Changes from Positive to Negative Utilization Rates (Cell III)

			BPR011	BPR021
44	FR- 7	Bourgogne	.16	-3.36
48	FR-11	Franche-Comte	.35	-5.79
123	DK- 5	Fyns Amt	.76	-5.47
95	BE- 7	Namur	1.48	-4.99
88	NL-11	Limburg	2.34	-6.81
56	FR-19	Auvergne	2.46	-2.29
22	GE-22	Bamberg-Hof	3.13	-.20
14	GE-14	Dortmund-Siegen	3.72	-.61
87	NL-10	Noord-Brabant	4.14	-2.20
47	FR-10	Alsace	4.85	-9.10
92	BE- 4	Liege	5.79	-.43
45	FR- 8	Nord-Pas-de-Calais	7.36	-12.98

TABLE 38.: Comparison Between Regional Rates of Utilization on the Basis of Sigular Infrastructure QPF (BPR012) and on the Basis of Fully Specified Potentiality Factors QPF (BPR022) 2nd Cross Section Year

BEP002: Regions with Roughly Normal Capacity Utilization (Deviation <+/-> 1.5 % from Zero)

			BPR012	BPR022
25	GE-25	Mainz-Wiesbaden	-1.34	-0.12
18	GE-18	Koeln	-.64	-1.08
101	UK- 3	East Midlands	1.46	-.99

BEP002: Regions with Approximately Constant Rates of Overutilization (Cell I)

			BPR012	BPR022
29	GE-29	Oberrhein-Nordschwarzwald	2.13	3.24
51	FR-14	Poitou-Charentes	2.60	3.24
100	UK- 2	Yorkshire/Humberside	2.85	.35
84	NL- 7	Noord-Holland	3.64	1.92
69	IT-11	Marche	4.26	2.57
28	GE-28	Rhein-Neckar-Suedpfalz	7.13	8.27
85	NL- 8	Zuid-Holland	5.61	2.75
55	FR-18	Rhone-Alpes	5.62	4.90
10	GE-10	Hannover	3.04	6.45
97	BE- 9	West-Vlaanderen	6.45	6.33
31	GE-31	Ansbach-Nuernberg	10.26	6.98
5	GE- 5	Bremen	10.09	11.11
24	GE-24	Frankfurt-Darmstadt	15.04	14.02
41	FR- 4	Haute-Normandie	14.04	11.05
30	GE-30	Neckar-Franken	16.41	15.18
89	BE- 1	Antwerpen	22.86	22.44
3	GE- 3	Hamburg	41.59	43.08

Table 38 continued

BEP002: Regions with Approximately Constant Rates of Underutilization (Cell IV)

			BPR012	BPR022
12	GE-12	Goettingen	-18.31	-15.06
14	GE-14	Dortmund-Siegen	-12.69	-14.81
13	GE-13	Kassel	-11.45	-9.16
8	GE- 8	Muenster	-6.40	-6.11
23	GE-23	Aschaffenb.-Schweinfurt	-4.40	-7.56
80	NL- 3	Drente	-6.03	-6.79
32	GE-32	Regensburg-Weiden	-8.69	-4.27
15	GE-15	Essen	-5.79	-8.38
95	BE- 7	Namur	-5.60	-6.72
68	IT-10	Umbria	-5.45	-3.10
43	FR- 6	Basse-Normandie	-5.13	-4.21
81	NL- 4	Overijssel	-4.44	-5.05
33	GE-33	Landshut-Passau	-3.36	-.45
104	UK- 6	South West	-2.64	-3.90
56	FR-19	Auvergne	-2.01	-4.16

BEP002: Regions with Increasing Under- or Over-Utilization (Cells IV and I)

			BPR012	BPR022
17	GE-17	Aachen	-19.54	-23.78
26	GE-26	Saarland	-10.47	-14.55
21	GE-21	Mittel-Osthessen	-10.96	-14.33
91	BE- 3	Hainaut	-10.31	-15.91
20	GE-20	Koblenz	-9.02	-14.06
27	GE-27	Westpfalz	-8.44	-13.33
71	IT-13	Campania	-8.95	-16.98
19	GE-19	Trier	-7.59	-11.94
137	GR- 7	Epirus	-7.65	-12.96
106	UK- 8	North West	-6.93	-12.16
88	NL-11	Limburg	-5.80	-17.35
47	FR-10	Alsace	-3.13	-10.50
82	NL- 5	Gelderland	-.54	-7.58
102	UK- 4	East Anglia	-.21	-5.51
96	BE- 8	Oost-Vlaanderen	-.04	-3.58
49	FR-12	Pays de la Loire	.74	5.12
36	GE-36	Alb-Oberschwaben	2.33	6.19

Table 38 continued

108	UK-10	Scotland	4.55	20.79
98	LU- 1	GD Luxemburg	5.16	17.90
133	GR- 3	Peloponese	5.33	15.97
35	GE-35	Kempten-Ingolstadt	8.35	10.23
42	FR- 5	Centre	6.11	11.25
11	GE-11	Braunschweig	8.48	13.36
135	GR- 5	Eastern Macedonia	9.80	13.40
66	IT- 8	Emilia-Romagna	13.27	19.04
1	GE- 1	Schleswig	15.11	22.05
34	GE-34	Muenchen-Rosenheim	19.43	23.38

BEP002: Regions with Decreasing Under- or Over-Utilization (Cells IV and I)

			BPR012	BPR022
139	GR- 9	Isl. of Eastern Aegean Sea	-32.77	-26.62
138	GR- 8	Thrace	-28.42	-18.03
57	FR-20	Languedoc-Roussillon	-25.32	-9.78
76	IT-18	Calabria	-23.12	-12.89
77	IT-19	Sicilia	-21.39	-14.82
53	FR-16	Midi-Pyrenees	-20.83	-7.38
79	NL- 2	Friesland	-19.42	-11.40
94	BE- 6	Luxemburg	-18.08	-9.47
72	IT-14	Abruzzi	-16.92	-8.16
50	FR-13	Bretagne	-16.91	-6.81
107	UK- 9	Wales	-15.08	-6.23
54	FR-17	Limousin	-14.03	-9.50
58	FR-21	Provence-Alpes-Cote d'Azur	-13.52	-3.45
74	IT-16	Puglia	-9.52	-4.24
61	IT- 3	Liguria	-9.19	-4.08
4	GE- 4	Lueneburger Heide	-8.15	-5.45
78	IT-20	Sardegna	-8.07	-1.42
7	GE- 7	Ems	-6.33	-2.74
37	GE-37	Oberrhein-Suedschwarzwald	-5.35	-2.56
65	IT- 7	Friuli-Venezia Giulia	-5.50	-2.56
9	GE- 9	Bielefeld	3.06	.06
63	IT- 5	Trentino-Alto Adige	4.57	.47
48	FR-11	Franche-Comte	6.03	2.03
6	GE- 6	Osnabrueck	6.64	2.03
105	UK- 7	West Midlands	8.47	5.16
70	IT-12	Lazio	9.25	5.30
75	IT-17	Basilicata	14.21	8.45
109	UK-11	Northern Ireland	14.79	4.21

Table 38 continued

16	GE-16	Duesseldorf	13.67	7.79
62	IT- 4	Lombardia	15.62	7.72
40	FR- 3	Picardie	17.91	6.14
134	GR- 4	Thessaly	22.95	11.74
39	FR- 2	Champagne-Ardennes	23.33	15.41
59	IT- 1	Piemonte	23.75	12.24
92	BE- 4	Liege	25.47	11.00
132	GR- 2	Central/Western Macedonia	25.56	1.94
131	GR- 1	Eastern Cont. Greece/Isl.	26.40	5.05
86	NL- 9	Zeeland	32.19	27.85
90	BE- 2	Brabant	37.27	23.84
60	IT- 2	Valle d'Aosta	40.55	32.47
38	FR- 1	Ile de France	42.93	26.10

BEP002: Regions with Changes from Negative to Positive Utilization Rates (Cell II)

			BPR012	BPR022
99	UK- 1	North	-10.63	4.32
52	FR-15	Aquitaine	-6.86	5.81
67	IT- 9	Toscana	-2.05	.15
136	GR- 6	Crete	-.29	24.20
2	GE- 2	Mittelholstein-Dithm.	-.23	8.13

BEP002: Regions with Changes from Positive to Negative Utilization Rates (Cell III)

			BPR012	BPR022
83	NL- 6	Utrecht	.43	-5.37
44	FR- 7	Bourgogne	.71	-2.16
87	NL-10	Noord-Brabant	1.51	-9.73
93	BE- 5	Limburg	1.72	-1.25
46	FR- 9	Lorraine	2.04	-10.27
64	IT- 6	Veneto	2.34	-2.09
22	GE-22	Bamberg-Hof	.74	-1.94
73	IT-15	Molise	4.33	-6.05
103	UK- 5	South East	7.26	-2.55
45	FR- 8	Nord-Pas-de-Calais	9.11	-13.13

In addition, the regions belonging to cell II can be included since they represent cases where infrastructure overcapacity even compensates partly bottlenecks in other resources. This would enlarge the list by Thrace and Aquitaine, and if the limit of 3% is ruled out, by Schleswig, Mittelholstein-Dithmarschen, Viborg Amt and Centre/FR, amounting to a total of 24 regions or about one fifth of all regions. However, many of these regions also show considerable underutilization of total resources and only a few can be considered to really represent the case where an infrastructure overcapacity is fully needed in order to compensate for a deficit of other resources. All 6 regions of cell II in the 1st year mentioned would fall into this category and some of the regions with decreasing underutilization having low rates in the second column BPRO. On the basis of the second year information, one would have to add Calabria, Goettingen, Limousin, Liguria, North/UK, Toscana and Crete.

The second group of regions where infrastructure utilization rates are lower compared with total resource capacity are to be found in the group of regions with increasing underutilization (cell IV) and in cell III. Especially in the 1st year, this group is smaller, but increasing as already mentioned in the 2nd year. The regions concerned are Saarland, Hainaut, North West, Limburg/BE, Aachen, if the 3% criterion is applied and is enlarged by Lorraine, Oost-Vlaanderen, Essen, Molise, Limousin from the increasing subclass and by Bourgogne, Franche-Comte, Fyns Amt, Namur, Limburg/NL, Auvergne, Bamberg-Hof, Dortmund-Siegen, Noord-Brabant, Alsace, Liege and Nord-Pas de Calais, a total of only 22 regions. From Bourgogne to Nord-Pas de Calais, this subgroup comprises areas that have infrastructure bottlenecks, but at the same time a relatively better endowment with other resources so that the two columns show different signs. As already explained, the number of regions with increasing utilization has risen; especially 8 regions come from constant utilization in the 1st year. These are Mittel-Osthessen, Koblenz, Campania, Westpfalz, Trier, Epirus, Aschaffenburg-Schweinfurt, Gelderland, East Anglia. Cell III in the 2nd year adds Utrecht, Veneto, South East.

In summing up, the experiment to interprete differences between actual and estimated "potential" incomes as indicators of relative underutilization or overutilization of existing infrastructure and total resource endowments offers plausible results. A much more differentiated picture as to types of regional problems can be obtained if this method is adopted. This does not exclude that the often mentioned statistical problems have distorted the figures discussed. But for many regions where besides the available statistical information collected for this Study, additional intuitive knowledge is available when judging the plausibility of the results, the figures seem to be reliable. It goes without saying that any improvement in the statistical bases will necessarily also improve the results of this type of analysis.

The analysis of underutilization and overutilization of resources has been carried through as a first answer to the qualifications formulated above on the straight-forward policy conclusion for regional policy. The main conclusion was that regions with an underutilized infrastructure capacity in first line need help in order to attract or maintain entrepreneurs, private capital and qualified labour, whereas regions with infrastructure deficits need first new investments in public capital. One of the qualifications was that a relative excess capacity of infrastructure may be needed sometimes in order to compensate for a bad endowment with other resources. This hypothesis has been tested in presenting a group of regions with decreasing rates of underutilization. All the regions allocated to this subgroup are examples for such a compensation effect.

In addition, other information has been obtained which supports the general qualification that such a broad-based analysis covering so many regions with differing national backgrounds has to be supplemented by region-specific case studies. The general approach presented here is very helpful for an international comparison and for formulating specific hypotheses as to the relationship between resource endowments, infrastructure equipment and regional development in order to design a Community regional and development policy. With the framework developed here and with the aid of additional region-specific information, it will be possible to design appropriate regional development strategies that take into account differences in regional characteristics in resource endowments and that are based on a common general framework.

XI. RESULTS AND CONCLUSIONS OF THE NATIONAL REPORTS ON THE CONTRIBUTION OF INFRASTRUCTURE TO REGIONAL DEVELOPMENT

XI.1. INTRODUCTION

In this chapter, the findings of the National Reports regarding the contribution of infrastructure to regional development in the member countries are summarized. These summaries have been prepared by the authors of the respective Reports.

In principle, both the National Reports and the Community Analysis are based on the same common scheme of analysis. The data used have also been collected according to a common and agreed list of infrastructure indicators and definitions as explained in the previous chapters of this Report and in the Annex. As already mentioned, the statistical problems were much greater than anticipated, so that not all analytical steps which were originally envisaged could be undertaken. These statistical problems may also affect the reliability of the results.

However, despite the caveats, some conclusion can be drawn. In so far as they relate to the regions and the political framework of each individual member state, they also reflect the peculiarities and particular problems to the countries concerned. At the same time, the National Reports provide additional region-specific information on infrastructure endowment which could not have been used for the Community Analysis. Given the fact that this is the first time that such an undertaking has been attempted (both the development of a suitable theoretical approach to identify and to measure the contribution to infrastructure for all regions of the Community, and the empirical estimation), the Group does not feel too disappointed by the many difficulties encountered. However, it hopes that these first steps will be continued so that the possibilities for improvement can be realized.

XI.2. SUMMARY OF THE BELGIAN REPORT

by Henry van der Eycken

Pour permettre des conclusions eclairees de politique en matiere d'infrastructure, la lecture des rapports nationaux - que de brefs resumes ne peuvent remplacer - s'avere indispensable pour conserver la richesse des informations recoltees. Le present condense s'attachera a rappeler les differents aspects analyses dans le rapport ainsi que les reflexions suscitees par les resultats les plus interessants.

En guise de premisse, il nous faut rappeler que le niveau d'analyse geographique a savoir les regions de niveau II n'est pas un choix satisfaisant pour la Belgique. Il eut ete souhaitable de travailler avec des entites regionales correspondant au niveau de decisions politique et economique, ce qui correspond pour la Belgique aux regions de niveau I. Le rapport s'est neanmoins conforme a la decision du groupe dans un souci d'homogenite.

XI.2.1. Contenu du rapport
(a) Categories d'infrastructure

Les Informations recoltees pour 1970 et 1979 se regroupent en dix categories: transport, communication, energie, protection de l'environnement, sante, infrastructure speciale, sportive, sociale et culturelle.

(b) Niveau et evolution des disparites regionales d'un point de vue global

Le rapport a mis en evidence la grande sensibilite de l'indicateur global d'infrastructure dans le cas ou un indicateur d'une categorie principale presente des disparites importantes. Le test mene a consiste a inclure et puis a exclure dans le calcul de l'indicateur global, un indicateur de categorie dont le minimax ratio est fort eleve. Les resultats obtenus dans l'un et l'autre cas sont forts divergents. L'utilisation d'un indicateur global d'infrastructure est donc matiere a caution.

(c) Niveau et evolution des disparites regionales au niveau des categories d'infrastructure

Comme le rapelle le tableau des minimax ratios par categorie d'infrastructure [cf. TABLE 39], ce sont l'infrastructure speciale d'une part et la sante d'autre part qui presentent les disparites les plus et les moins importantes. De surcroit, les situations ne sont pas fondamentalement modifiees entre les annees etudiees.

TABLE 39.: Minimax-Ratios par categorie d'infrastructure en Belgique, 1970 et 1979

Categories d' Infrastructure	1970	1979
Transport	2.3	2.2
Communication	2.2	2.0
Energy	5.5	6.8
Environment	3.1	3.9
Education	1.6	1.8
Health	1.6	1.5
Special	15.9	14.5
Sport	4.2	6.4
Social	3.9	2.1
Culture	2.1	2.5

Le cluster c'est-a-dire le classement de chacune des neuf provinces belges pour les dix categories d'infrastructure en cinq classes (0-20%, 20-40%, 40-60%, 60-80%, 80-100%) couvrant l'intervalle compris entre le maximum et le minimum observe, a permis d'affiner au niveau des regions les impressions se degageant de l'analyse des minimax ratios. La prise en consideration de l'ensemble des disparites observees dans le cluster ne nous a cependant pas semble interessante dans la mesure ou une telle demarche impliquait un traitement identique te toutes les disparites, en proportion de leur importance bien sur, mais aussi en tant que signe d'un avantage ou d'un desavantage. Or des profils regionaux quelque peu differents peuvent etre a l'origine des disparites mineures sans que celles-ci ne constituent un quelconque effet benefique ou handicap pour la region. Une methodologie particuliere [cf. point (e)] a permis de degager les disparites principales.

(d) Analyses correlatives et fonction de quasi-production

Les coefficients de correlation simple entre les variables d'infrastructure et le produit regional brut par tete ne sont, pour la plupart, pas significativement differents de zero et lorsq'ils le sont, le resultat n'est pas stable d'une annee a l'autre. En ce qui concerne la correlation multiple, la multicollinearite entre les variables d'infrastructure explique la maigreur des resultats.

Les coefficients de determination de l'ajustement par la fonction de quasi production sont peu eleves. L'ajoute d'autres variables (location, agglomeration, structure sectorielle, taille) dans la fonction permettrait probablement d'elever ces coefficients sans pour autant modifier la conclusion que l'infrastructure n'est pas le seul instrument du developpement economique.

(e) Analyse particuliere

Cette analyse a consiste, a partir du cluster, a degager et a classer les disparites les plus importantes constituant les avantages et desavantages en matiere d'infrastructure en 1979 dans les differentes provinces ainsi que les modifications entre les annees 1970 et 1979.

Une telle demarche a ete essentiellement motivee par le soucis d'apporter des elements de reponse a la question portant sur le type d'infrastructure necessaire dans les differentes regions. Ces analyses se justifient dans la mesure ou il n'existe pas de trop grandes disparites entre les regions belges et que par consequent la comparabilite des resultats est assuree.

Cette homogenite n'est cependant que relative. Si les provinces ont des structures economiques assez proches, cela ne signifie pas pour autant qu'elles possedent des profils regionaux absolument identiques ni meme qu'elles doivent tendre vers le meme modele.

Pour tenir compte de cette caracteristique, la methode adoptee pour analyser les avantages et desavantages regionaux en matiere d'infrastructure consiste a mettre en evidence les situations extremes (position en premiere et derniere case du cluster) avec classement par reference au minimax ratio.

A l'oppose d'une methode qui aurait consiste a analyser la dotation infrastructurelle par rapport a une moyenne nationale, traduction de l'homogenite absolue des provinces et a tenir compte de toutes les disparites, l'analyse n'a retenu que les disparites importantes succeptibles d'indiquer les reelles distortions, pour ecarter les distortions mineures consequences de profils regionaux differents.

Les resultats obtenus dans le rapport doivent etre apprecies a l'aide des ratios maximum minimum (M.M.R.) de chacune des categories d'infrastructure. En effet, les ecarts dans le cluster sont d'autant plus importants que le M.M.R. correspondant est important. Dans ce cas les avantages et desavantages degages sont fort significatifs. A l'inverse, il est clair que plus le M.M.R. est peu eleve,plus l'analyse met en evidence des disparites mineures liees aux profils regionaux.

L'analyse des modifications dans les dotations infrastructurelles entre 1970 et 1979 s'appuie egalement sur le meme concept d'homogenite relative. Dans ce cas, la methode a consiste a relever les glissements importants (de 2 cases) entre les deux clusters. Dans la mesure ou l'ensemble des M.M.R. restent relativement stable entre les deux annees, les intervalles restent comparable et tout glissement important indique une modification significative de la dotation infrastructurelle de la region.

TABLE 40.: Modifications dans les dotations infrastructurelles entre 1970 et 1979 en Belgique

Region	Avantages en 1979	M.M.R.	Desavantages en 1979	M.M.R.
Antwerpen	Energie	6.8	Special	14.5
	Transport	2.2	Sport	6.4
Brabant	Social	2.1	Special	14.5
	Communication	2.0	Sport	6.4
	Education	1.8	Environment	3.9
	Sante	1.5		
Hainaut	-	-	Sport	6.4
			Communication	2.0
Liege	Transport	2.3	-	-
Limburg	Special	14.3	Energie	6.8
			Sport	6.4
			Transport	2.2
			Social	2.1
			Communication	2.0
			Sante	1.5
Luxembourg	Sport	6.4	Energie	6.8
	Environment	3.9	Sante	1.5
	Culture	2.5		
Namur	-	-	Tansport	2.2
Oost Vlaanderen	Transport	2.2	Sport	6.4
			Culture	2.5
			Communication	2.0
West Vlaanderen	-	-	Education	1.8

TABLE 41.: Ameliorations et deteriorations dans les dotations infrastructurelles en Belgique 1970 a 1979

Categories d'infrastructure	M.M.R. 1970	M.M.R. 1979	Ameliorations	Deteriorations
Transport	2.3	2.2	Luxembourg	-
Communication	2.2	2.0	-	Namur
Energie	5.5	6.8	-	-
Environment	3.1	3.9	Namur	Hainaut
Education	1.6	1.8	-	-
Sante	1.6	1.5	-	Antwerpen
Special	15.9	14.5	-	-
Sport	4.2	6.4	-	Limburg
Social	3.9	2.1	Brabant Namur	-
Culture	2.1	2.5	Brabant Namur	Hainaut Liege

XI.3. SUMMARY OF THE GERMAN REPORT

by Dieter Biehl

The German Report with 104 pages and a 30 page Annex comprises

- A brief summary of the basic elements of political and territorial organization as a general background for regional development and regional policy in the Federal Republic of Germany,

- a short discription of regional policy making and regional policy institutions,

- the results of the calculation of infrastructure indicators and comments on their disparities in relation to development indicators for the 38 regions chosen for the German Study,

- the findings of different other types of analyses, especially cluster analysis and the estimation of quasi-production functions.

For analysing the relationship between infrastructure equipment and regional development, the usual Level-II regions of the Community appear to be inadequate entities because they consist of Laender and Regierungsbezirke, i.e. basically administrative territories. They have, therefore, been replaced by a set of functional regions, the "Gebietseinheiten fuer das Bundesraumordnungsprogramm", called BROP-regions in what follows. These units have the advantage that they are both roughly equal in number to the official Level-II regions (38) and to take explicitly account of existing intra-regional economic connections.

Data for these regions had to be aggregated mainly from lower Level-III regions (Kreise), as with only a few exceptions no appropriate statistical data had been available for the BROP-regions.

Like in the other National Reports, it was possible to use a larger number of data for the national analysis compared with the Community Analysis [cf. TABLE 7 of this Report]. With the exception of urban infrastructure, indicators for all the other main categories and for the aggregate infrastructure indicators have been calculated. The calculation follows the procedure used also in the present Study Group Report, but partly applies additional weights. Furthermore, an additional variant has been developed where all infrastructure categories are related to area.

The figures obtained for the main category indicators show a dispersion between a maximum of 19:1 and a minimum of 1.9:1 if point infrastructure is related to population and network infrastructure to area [cf. this Report, TABLE 9 and TABLE 42 in this summary]. The largest span is shown for Cultural infrastructure (18.87/13.53 for first and second year) and the smallest for Health (1.9/1.9). Disparities measured in terms of a Maximum-Minimum-Ratio (MMR) for the aggregate infrastructure indicator INGE are comparably low and stable for the two cross-section years (2.24), although most of the main category indicators exhibit declining disparities.

A special investigation into the relationship between agglomeration and infrastructure endowment reveals that, in general, the highly agglomerated regions are best equipped with infrastructure, whilst the less populated and peripheral regions are normally less well endowed. Spatial concentration of infrastructure becomes particularly evident if all infrastructure categories are related to area. This measure of infrastructure density reveals many more disparities than the method adopted in this Report which relates point infrastructure to population and network infrastructure to area. MMR for total infrastructure indicator XNGE is 13.04/11.53 with a maximum span again for Cultural infrastructure (108.70/92.59) and a minimum span for Natural Endowment (2.90/2.50) as is shown in TABLE 42.

TABLE 42.: Maximum-Minimum-Ratios (MMR) of Main Infrastructure Category Indicators for 37 German Regions (without Berlin), 1970 and 1978

Infrastructure Indicators for Category	1970 IND/ INGE*)	1970 XNG/ XNGE+)	1978 IND/ INGE*)	1978 XNG/ XNGE+)
A Transportation	4.89	5.19	5.14	5.87
B Communication	3.69	33.44	2.01	22.32
C Energy	18.94	25.57	10.67	16.16
D Water	13.40	13.83	13.39	13.48
E Environment	2.81	31.75	2.14	23.92
F Education	2.13	15.15	2.91	18.48
G Health	1.90	17.92	1.90	18.66
I Sport and Tourism	4.20	54.35	4.41	49.75
J Social	6.85	90.09	5.15	62.89
K Culture	18.87	108.70	13.53	92.59
L Natural Endowment	2.90	2.90	2.50	2.50
Total Infrastructure Indicator INGE/ XNGE	2.24	13.04	2.24	11.53

*) Indicator values for IND/INGE are related to population for point infrastructures and to area for network infrastructures.
+) Indicator values for XND/XNGE are all related to area.

A complete ranking of the 37 BROP-regions (Berlin-West excluded) on the basis of its infrastructure endowment, allows interesting comparisons between the relative position of agglomerated, urbanized and industrialized regions on the one hand with less developed rural ones on the other. Although the BROP-regions, being functional regions, have explicitly been designed so as to combine agglomeration centers with their hinterland, there are still remarkable differences. Population density ranges from 3977 inhabitants per square km (Berlin) or 1216 (Duesseldorf) down to 176 (Bremen) in 1978. The five best equipped regions are Koeln, Hamburg, Essen, Muenchen and Duesseldorf which all clearly represent the type of highly developed areas, whereas the five least equipped ones are Westpfalz, Landshut-Passau, Mittel-Osthessen, Regensburg-Weiden and Lueneburger Heide, all of which are non-agglomerated, peripherally located or weak industrialized regions.

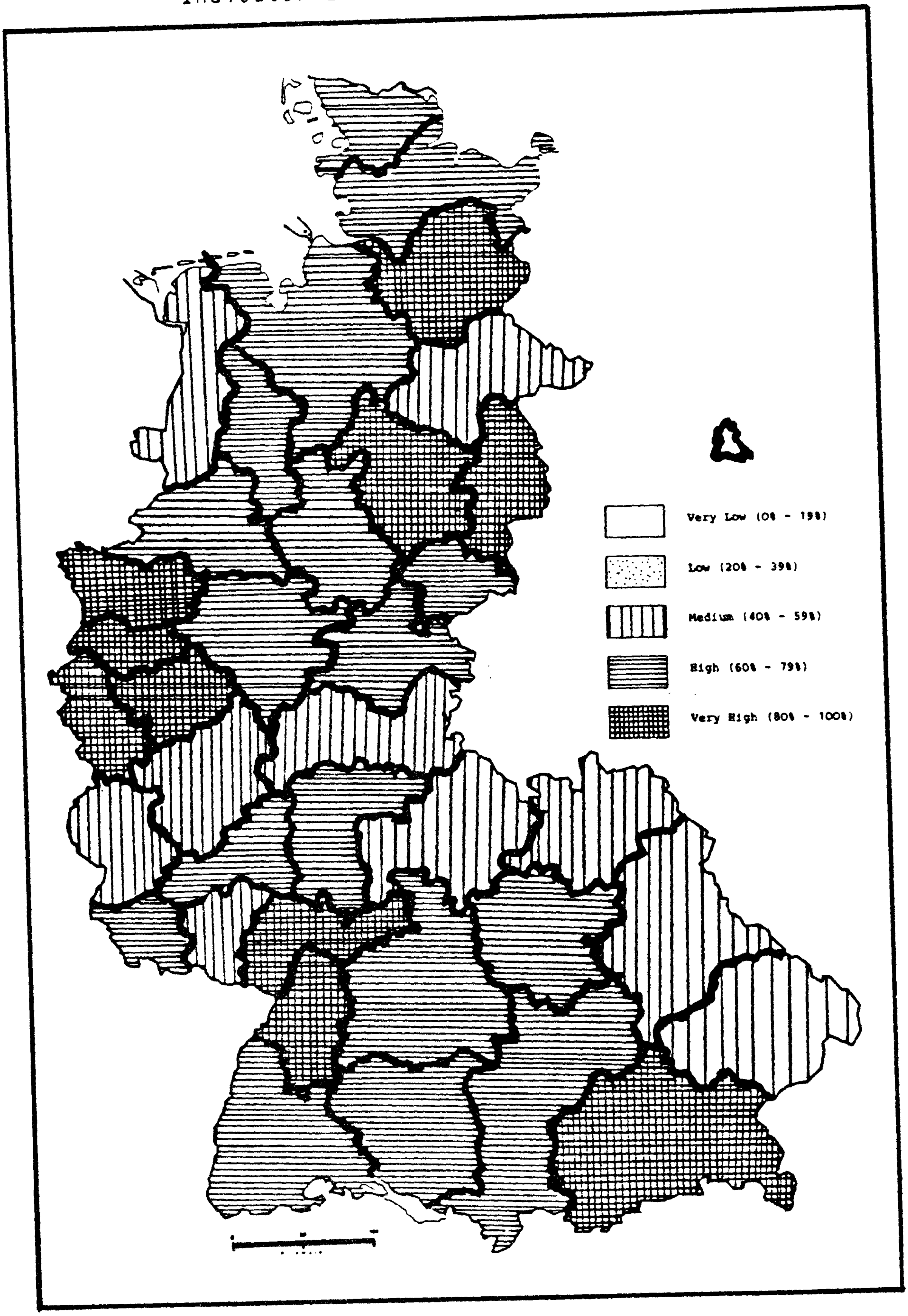
A simple grouping or cluster analysis based on the same five classes as used in this Report reveals that regional distribution of the different infrastructure categories differs considerably. Of the twelve categories, only four (Energy, Water, Social, Cultural) show a large spread across all five classes, five others (Transportation, Communication, Environment, Sports/Tourism and Natural Infrastructure) cover the range from 20 - 100 whereas the remaining categories, including total infrastructure, are concentrated in the 40% - 100% range. The most even distribution is observed for Sports/Tourism and Cultural Infrastructure. The category with the smallest number of changes in relative positions from first to second year is Transportation. This seems to demonstrate that this type of network category with a high degree of publicness represents a very large capacity size which will not easily show drastic changes.

If again agglomerated and non-agglomerated regions are compared, a general polarization tendency shows up clearly. A much more distorted picture is obtained if the grouping analysis is done for the total infrastructure indicators based exclusively on area. Most of the regions are now concentrated in the very low and low classes, and only very few, typically the highly agglomerated regions like Essen, Duesseldorf, Koeln and Hamburg, appear in the higher classes. MAPS 3 and 4 show the distribution of the total aggregate infrastructure indicators for 1978. INGE represents the basic indicator variant as also used in this Report, whereas XNGE is composed only of infrastructure endowment related to area.

The polarization hypothesis is supported by a formal cluster analysis, particularly if the area-related definitions of infrastructure are used. With the cluster analysis, a division into 3 - 4 groups can be obtained where the most agglomerated regions again form a special and clearly distinct group. A first analysis of the development indicators shows that the disparities for the more frequently used indicators like GDP per capita (BIWO), GDP per employed person (BIBK), GDP in industry and service sectors per employed person in these sectors (BIBG) and the general activity rate (ERWO) are slightly smaller than for total infrastructure endowment, ranging between an MMR of 1.35 to 2.04. Area related development indicators differ considerably more, ranging from 14.25 up to 33.33 with MMR of 16.66/14.29 for the agglomeration variable WOFL [cf. TABLE 43]. Most indicators decline from the begin to the end of the seventies.

MAP 3

Distribution of Total Aggregate Infrastructure Indicator INGE for 1978 in Germany



MAP 4

Distribution of Total Aggregate Infrastructure Indicator XNGE for 1978 in Germany

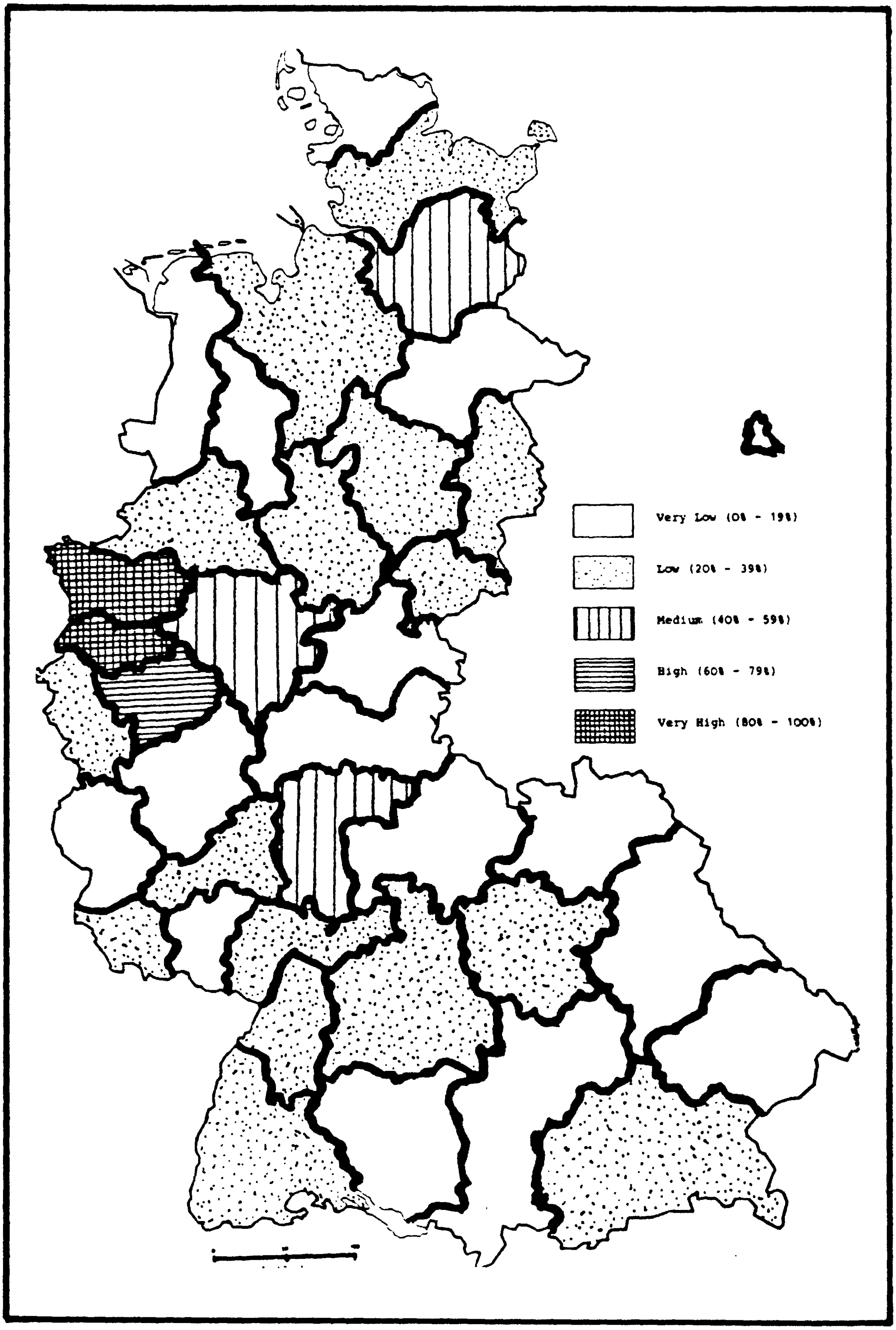


TABLE 43.: Maximum-Minimum-Ratios (MMR) of Development and Potentiality Factor Indicators for 37 German Regions (without Berlin), 1970 and 1978

Indicators	1970	1978
Population Density (WOFL)	16.66	14.29
GDP per capita (BIWO)	2.04	1.75
GDP per employed person (BIBK)	1.85	1.79
GDP in industry and service sectors per person employed in these sectors (BIBG)	1.54	1.75
GDP share of industry and service sectors in total GDPP (BIGA)	1.14	1.12
GDP per square km (BIKF)	25.00	25.00
GDP in industry and service sectors per square km (BIGF)	33.33	25.00
General activity rate (ERWO)	1.37	1.35
Activity rate for industry and service sectors (EGWO)	1.54	1.43
Total employment per square km (BSKF)	20.00	14.28
Employment in industry and service sectors per area (BSGF)	25.00	14.25

A large part of the German Report is devoted to the measurement of infrastructure with the aid of the potentiality factor approach. This approach has been developed in the context of regional policy analysis and advice in the Federal Republic. [cf. Dieter Biehl et al., Bestimmungsgruende des regionalen Entwicklungspotentials (Determinants of Regional Development Potential), Kieler Studien 133, Kiel 1975; Dieter Biehl, Grundlagen und Leitlinien fuer eine potential-orientierte Regionalpolitik in der Europaeischen Gemeinschaft (Basic Elements and Guidelines for a Potential-Oriented Regional Policy in the European Community), in: Regionalpolitik und Agrarpolitik in Europa, Berlin 1975, Dieter Biehl and Urban A. Muenzer, Agglomerationsoptima und Agglomerationsbesteuerung - Finanzpolitische Konsequenzen aus der Existenz agglomerationsbedingter sozialer Kosten (Agglomeration Optima and Agglomeration Taxation - Fiscal Policy Consequences of the Existence of Agglomeration Induced Social Costs), in: Ballung und oeffentliche Finanzen, Hannover 1980; Dieter Biehl, Determinants of Regional Disparities and the Role of Public Finance, Public Finance/Finances Publiques, 1980.]

Also in the German context, infrastructure appears as an important determinant of regional development. If the full set of potentiality factors is used to analyse interregional income and employment differences, a number of alternative specifications of the quasi-production functions are obtained which all are in line with theoretical expectations and are statistically significant. A large number of fully significant functions explains development indicators better than 90%; the best fit equations even have adjusted coefficients of determination between 98% and 99%. The two variants of total infrastructure indicators do not differ very much in most cases. With the aid of a special type of analysis, an answer can also be given as to the relative contribution of one of the potentiality factors to total explanation. According to this method, infrastructure contributes between 3.1% and 55% to total explanation of development indicators.

Among the four basic potentiality factors agglomeration, location, sectoral structure and infrastructure, location does not appear to be very important for the German regions. Given both the relatively small distances in Germany on the one hand and the fact that Germany has a multi-polar settlement system, the idea of a single "central" location cannot be attributed to any particular region, but appears to be relevant to a number of them. This is supported by findings of previous studies for Germany on the one hand and by the Community Analysis in the present Report on the other, where distance as a proxy for location becomes highly significant within the enlarged European context.

An attempt has also been made, with the aid of one of the best fit quasi-production functions, to answer the question of whether there are infrastructure bottlenecks and excess capacities respectively underutilization or overutilization of infrastructure capacities. If the difference between actual income per capita and the potential income, based on infrastructure endowment alone, is taken as an indicator, it is found that the percentage deviations are relatively small. Maximum underutilization amounts to 13.3% and maximum overutilization to 12.1%. The German findings are also more differentiated compared with the European ones as to the relationship between highly developed regions and overutilization on the one hand and less developed regions and underutilization on the other. But in general, the conclusion remains valid that the less developed regions are characterized by relative underutilization and the better equipped ones by bottlenecks.

These findings, which are in line with the results obtained when the same method is applied to all European regions, allow the same conclusions and require the same qualifications. Basically, the findings support, although at a lower degree, a two-tier regional policy strategy which consists in subsidizing "private" factors of production in order to attract entrepreneurs, private capital and qualified labour into the underutilization regions and to subsidize infrastructure investment in those regions showing overutilization if the latter are not capable to finance them by own resources. But as in the European case, many qualifications need to be considered. The most important qualification appears to be that infrastructure is less urgently needed for obtaining economies of scale in those regions that already rely on other potentiality factors such as location and agglomeration for that purpose. As to the less developed regions, they may need a certain compensation for bad equipment with other potentiality factors in form of a relatively higher infrastructure equipment. But such a crude first approach must be supplemented by detailed region-specific development analysis and programs as far as the coordination of public policies in this area is concerned. The findings presented here, therefore, support the policy of the Commission of the European Communities laid down in the proposed regional policy guidelines and in the new regulation for the Regional Fund.

The plethora of statistical problems encountered during the Study prohibited the application of more differentiated methods for identifying relative bottlenecks and excess capacities. This certainly will be possible when improved statistics and data for more years are available. The question as to which categories of infrastructure from the full list are of particular importance for regional development can also only be answered on the basis of an improved data base.

XI.4. SUMMARY OF THE DANISH REPORT

by Paul Ove Pedersen

The regional distribution of 11 infrastructure categories has been investigated for the beginning and the end of the 1970's. Of the 11 infrastructure categories transportation, communication, education, health, special urban, social and cultural infrastructure show approximately the same regional distribution while the differences fo energy, sports and environmental infrastructure deviates from the general pattern.

In general the Copenhagen region has a much higher infrastructure endowment than the provincial counties, while the differences between the provincial counties themselves are not very large. Among the provincial countries, it is generally the most peripheral regions which have the lowest infrastructure endowment.

Correlation coefficients between infrastructure indicators and various regional development indicators, such as employment structure and gross domestic product per inhabitant, show that there generally is a relatively high degree of co-variation between infrastructure endowment and regional development.

The two deviations from the general pattern are that percentage of employment in agriculture is negatively correlated with infrastructure endowment, and that percentage of employment in industry also has negative correlations with the infrastructure indicators except those for energy, with which it is positively correlated.

The co-variation between infrastructure and regional development is larger for the aggregate infrastructure indicator than the indicators relating to the individual infrastructure categories.

The correlation coefficients, however, are not able to show if it is the supply of infrastructure, which influences regional development, or if it is regional development which increases the demand for infrastructure and therefore leads to new investments in infrastructure. Both of these mechanisms are likely to exist in practice.

Lagged correlations between the infrastructure indicators and the regional development indicators indicate that infrastructure investments are determined by regional characteristics rather than the other way round. However, the differences between the correlation coefficients are in most cases not very large.

In the combined infrastructure indices only indicators of infrastructure capacity per inhabitant (except in the case of network infrastructure) have been used independently of how the infrastructure is distributed within the regions and independently of the actual utilization of infrastructure.

Correlations between regional development indicators and infrastructure indicators based on capacity, accessibility and utilization measures, respectively, however, indicate that regional development might be more related to the accessibility of infrastructure than to the capacity and utilization of infrastructure.

A quasi-production function postulating that gross regional product per inhabitant is a function of labour (measured as the activity rate) and infrastructure capital (measured as the aggregated infrastructure indicator and the indicator for energy infrastructure) has been tested by means of multiple regression analysis. The postulated quasi-production functions has a relatively good statistical fit, and the regression coefficients do not vary significantly from the beginning to the end of the 1970's.

This indicates that the interrelationship between infrastructure and regional development is quite stable during the 1970's.

XI.5. SUMMARY OF THE FRENCH REPORT

by Remy Prud'homme

The French Report, just as the other ones attempts to analyse the distribution of infrastructure between regions, to assess their importance in fostering economic development, and to discuss the role of an "infrastructure policy". It is interesting to note that although it was very time-consuming and painstaking to establish a data-base, the scarcity of regional data appears rather less severe in France than in most other EC countries.

We shall summarize the main findings of this Report. They are based on the common approach, used in all other cases, and also on a specific approach, namely an attempt to estimate the value of the total stock of infrastructure existing in each region.

XI.5.1. Findings Based on the Common Approach:

(a) The information given in the French Report is based on data gathered for 11 infrastructure categories (e.g. Transport, Communication, Energy, Water, Environment, Education, Health, Special, Sport, Social, Culture) and about 80 infrastructure sub-categories.

It shows that infrastructure endowment varies significantly between regions. Minimum-maximum ratios for the various indicators produced range from 2 to 4.5 for the 1970-75 period, and from 1.6 to 5.9 for the 1975-80 period, as indicated in TABLE 44.

Generally speaking, however (and contrary to what those ranges could suggest), differences between regions decreased over time for most infrastructure categories. The only exceptions are Transport and Energy. Those categories are also , together with Water, those for which mini-max ratios are greatest, i.e. the tyes of infrastructure that are most inequally distributed. Regional differences, as measured by mini-max ratios, are smallest for Communication, as well as Health, Social infrastructure and Education.

TABLE 44.: Maximum-Minimum Ratios of Infrastructure Endowment, France 1970-75 and 1975-80

	1970-75	1975-80
A Transport	3.0	3.2
B Communication	2.0	1.6
C Energy	4.5	5.9
D Water	4.0	5.9
E Enviroment	4.3	2.6
F Education	2.9	1.6
G Health	2.0	1.8
H Special	2.6	2.0
I Sport	3.0	2.7
J Social	2.1	2.0
K Culture	2.7	2.7

One could a priori postulate that the distribution of the various types of infrastructure between regions is somehow linked with the characteristics (activity rate, employment mix, etc...) of the regions. Empirical findings do not lend support to this hypothesis. There is no common distribution of the various infrastructure in regions having similar characteristics.

(b) The link between endowment for a given infrastructure and economic development appears rather weak. Substitutions and complementarities between different types of infrastructure might explain this finding.

The approach utilized did not make it possible to find out which types of infrastructure contribute most to economic development.

The statistical relationship between the overall level of infrastructure endowment (defined and calculated as commonly agreed) and economic development is also relatively weak. The findings for France do indicate a weak correlation. This correlation, of course, does not by itself prove a causal relationship. This can only be done by theoretical analysis. One can find an analysis to explain development by means of infrastructure; but one can also find an analysis to explain infrastructure by means of development.

FIGURE 14 shows that a given level of development can be associated with various infrastructure levels, and vice-versa.

FIGURE 14.: Infrastructure Endowment and Development

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      |
      |
   90 +
      |
      |                   .RA
      |
   80 +           .CA      .FR       .HN
      |              .CE     .LO      AL
      |     .BO     .PI
      |               .BN  .AU
      |         .PL  .AQ .HO     .PR  .LI
   70 +            .PC     .BR
      |
      |                  .MI
      |
      |                         .LR
      -------+------+------+------+------+----->
            60     70     80     90     100   I
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    D ^                            after 1975
  100 +                                    /
      |                                  .IdeF
      |                                /
      |                               /
   90 +                              /
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      |                          /            RA
   80 +                         / .FC  .CA   .HN
      |                       . CE
      |                      /    .
      |                     / BO PL      .LO      AC
   70 +                    /MO.
      |                   /.   BN
      |                  /.PI  .AQ      .LI
      |                 / PC  .AU MI    .PR
   60 +               /       .BR
      |              /
      |             /                      .LR
      --------+-------+-------+-------+-------+--->
             60      70      80      90      100  I
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It also shows that, if infrastructure plays a limiting role in regional development, it does not have the same impact in all regions.

Let us draw on FIGURE 14 (for the 1975-1980 period), the line that sets an upper limit to the cluster of points, and which is obtained by linking the points that represent region Centre and region Ile de France.

The regions closest to that line are those which have a high level of economic development relative to their level of infrastructure endowment. They are those that probably utilize best their infrastructure. Most of them are high or medium income regions.

If infrastructure endowment as a whole is a limiting factor, a bottleneck so to say, this would be particularly true for those regions. Additional infrastructure investments would probably do more for economic development in those regions than in the other (usually less developed) regions of France.

XI.5.2. Findings based on a specific approach:

An interesting feature of the French case study is the attempt made to evaluate the value of the stock of infrastructure of each region. For each type of infrastructure, a unit construction cost was found, which was multiplied by the number of units of the infrastructure (e.g. the cost of a school by the number of schools, the cost of a km of highway by the number of km of highways, etc.).

This procedure made it possible to aggregate the various types of infrastructure, by means of a weighting system that is probably less arbitrary than the implicit weighting system used in the common approach.

This specific approach is rather crude, because it ignores the fact that unit costs vary from region to region (they are higher in the more developed regions), and because some types of infrastructure could not be included.

For each region, the value of the stock of capital in infrastructure was then divided by the number of inhabitants. This is also at variance with the common approach, in which point infrastructure were related to population and network infrastructure to the number of square-km of each region. It was found that it would be more significant from a redistribution viewpoint, if not from an economic development viewpoint, and also that it produced the rather straightforward concept of infrastructure endowment per capita that can be related to the familiar concept of economic development (value-added) per capita. This relation is shown in FIGURE 15.

FIGURE 15.: Infrastructure Stock and Development
on a Per Capita Basis

```
                          before   1975

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 hab) |
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      |
 5000 +
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      |
 4000 +
      |       .HN
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      |AL/NPdeC. .RA .FC
      |LO ..       .PI  .CE.BO
 3000 +    PR    .PL
      |             .AQ
      |          .BR    .BN  .AU
      |             CR     .PC
      |                     .MP.LI
 2000 +
      ---------+---------+---------+------------>
              10        20       30000 Stock d'IF
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Figure 15 continued

after 1975

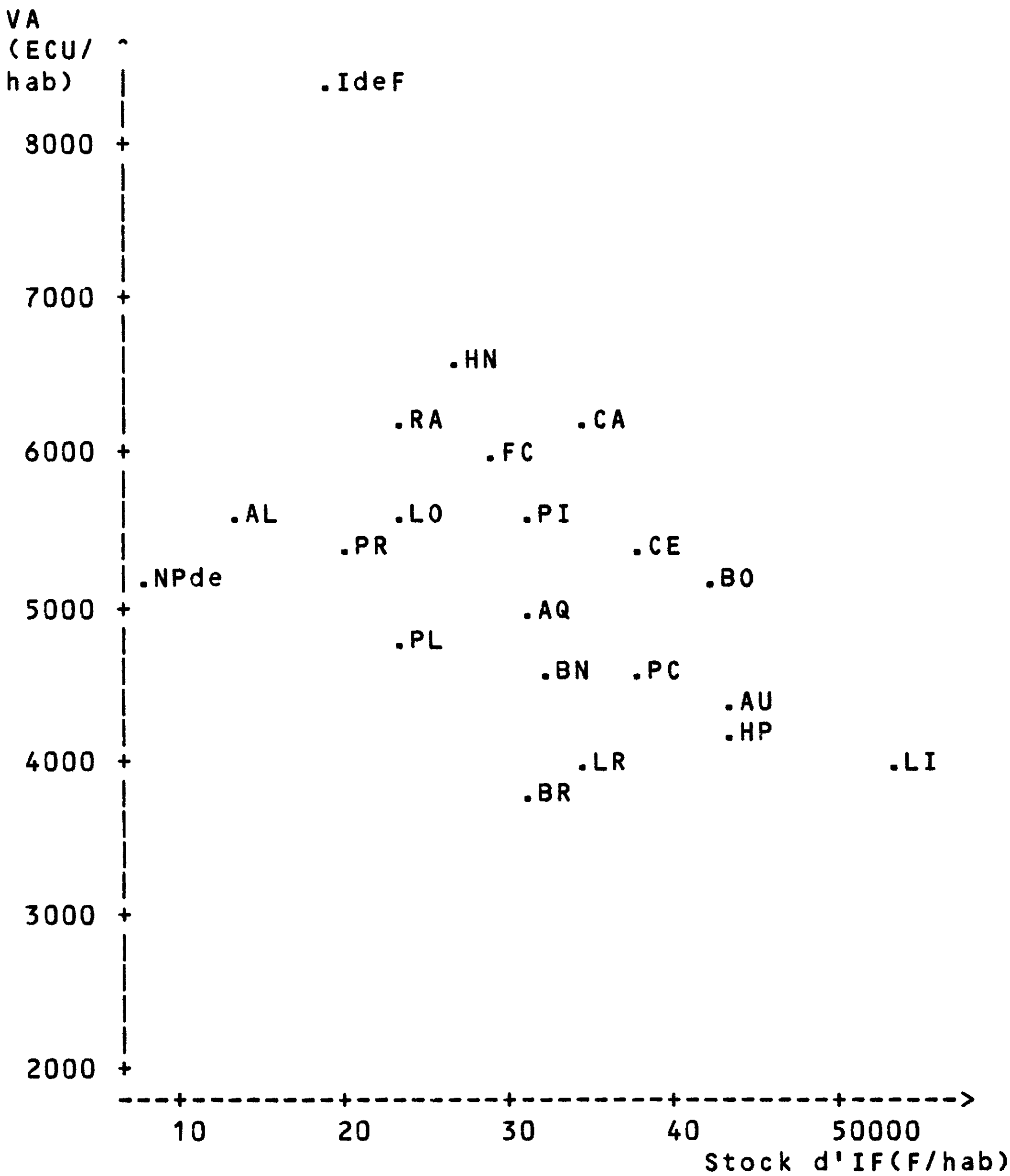


FIGURE 15 shows a marked negative correlation. The less developed a region, the greater its per capita infrastructure endowment.

The lack of certain particular types of infrastructure might hold economic development in the less developed regions; the analysis does not rule out this reasonable hypothesis although it does not lend support to it either. But the lack of infrastructure as a whole does not appear to be the limiting factor of regional economic development.

The negative correlation between regional infrastructure endowment and income can only be explained by transfers. If regional infrastructure were financed out of regional income, the poorer regions would find it difficult to have as much infrastructure as the rich ones, and impossible to have more. In effect, infrastructure investments in France are largely financed through the national budget. On purely economic terms, one could question the usefulness of such transfers. It seems likely that the marginal efficiency of a Franc of investment in infrastructure would be greater in the more developed regions where infrastructure is more likely to be a limiting factor, than in the less developed ones, where infrastructure does not appear to be a limiting factor.

Two points can be made, however. The first is, that the level of economic development of the poorer regions would be even lower, if it were not for their richer infrastructure endowment. The second is, that infrastructure, and particularly social infrastructure, are not only a factor of production, but also a compensation good. If they do not induce economic development, they "compensate" for the lack of it; their welfare usefulness is greater than their economic efficiency.

In conclusion, one could say that infrastructure should indeed be an important element of regional policy, but it should also be seen as only one of a number of instruments available, and probably not the best one.

XI.6. SUMMARY OF THE GREEK REPORT

by George Markatatos

Greece is divided into 9 regions (Level II) and 51 Nomos (Level III). In this study Level II has been used. However in the case of Greece this particular choice affects the results by limiting somewhat the scope of the conclusions. Although these regions are relatively smaller compared with the regions used in the other larger member countries, the levelling effect seems to be much more pronounced in the Greek case.

From the main infrastructure categories the following 9 have been used: Transport, Communication, Energy, Education, Health, Special Urban Infrastructure, Sportive and Touristic Facilities, Cultural Facilities, Natural Parks and Forests.

However, the categories "Special Urban Infrastructure" and "Natural Parks and Forests" are relatively unimportant in the Greek case. This in turn creates certain problems in regard to both the analysis and the drawing of conclusions.

Another limitation of the analysis arises from the lack of appropriate regional data. This restricts the construction of adequate infrastructure indicators necessary for a complete presentation of each region's infrastructure capacity. On the other hand, some useful indicators referring to qualitative regional characteristics could not have been used given the internationally agreed upon methodology to be followed. For example it would have been quite interesting to examine not only the capacity of the existing infrastructure endowment, but also differences as to the rate of utilization of those capacities; something which could not be done in this analysis.

The interregional disparities don't seem to be very pronounced with the exception of those existing between the centre and the periphery taken as a whole (Athens - rest of Greece). The greatest interregional difference is manifest in the case of the main infrastructure category "Health" for both cross-section periods.

Here too, the selection of level II proved problematic, since intraregional differences can not be shown. For example the intraregional differences in the region of Eastern Continental Greece and Islands and that of Central and Western Macedonia are very strong, because they contain both the most underprivileged departments (nomos-level) in all aspects (physical, economic, social etc.), and the country's two main urban conurbations. A better solution would be to try and collect data for level III (Nomos).

As expected, the development of total infrastructure over time has been positive. However, this development has not resulted in narrowing regional disparities. Quite to the contrary, for certain main infrastructure categories the existing disparities have widened (Energy, Special and Sports). However, the chosen two cross-section years are too close to give a clear picture of the level of infrastructure and regional development as well as their interrelationship.

At this point it seems appropriate to stress certain Greek particularities the implications of which our research could not take fully into account, due to methodological inadequacies.

First, the Greek geographical space is clearly divided into the mainland and a large number of islands.

For example, the methodology applied shows the East Aegean Islans region to be highly endowed in infrastructure. However, this is misleading in the sense that the particular methodological approach employed does not at the same time allow for full consideration of the huge transportation problems involved in the movement of both people and goods, either to and from the region or within it.

At the same time, in the Eastern Continental Greece and Islands regions which is the most developed one (since it includes the Athens conurbation), is also included the department of Cyclades, comprising several islands. As a result, the same problems of transportation, are overshadowed in this case by the inclusion of that department in the developed area of Athens. In addition, the fact that one of the poorest departments of the country (Evritania) is also included in the Eastern Continental Greece and Islands region, again results in the elimination of intraregional disparities.

The choice of level II also limits the results of the analysis based on the regional development indicators. For example, more realistic results would be obtained if we isolated the Athens metropolitan area and compared it with the other regions or with the rest of the region in which it is included.

Finally, the fact that the three regions of Eastern Continental Greece and Islands, Peloponese and West Continental Greece and Central and Western Macedonia occupy the first three positions in the regional ranking when the entire country is taken into consideration, should be attributed to their being the ones where the process of agglomeration is most developed.

Despite the problems mentioned and the limited number of observations, the results of this study show that in the Greek case also, there exists in general a relationship between infrastructure and regional development. This can be seen from the correlation analysis and especially from the quasi-production functions for infrastructure. Transportation, communication, energy, but also education, can be considered to represent determinants of development in the Greek case. On the other hand, there are negative relationships between Special urban infrastructure and Sport and Tourism infrastructure on the one hand and regional development on the other. In the case of Special urban infrastructure, this seems to be caused by the fact that the indicator used (fire stations) exists in a large number of localities, irrespective of their population size. In the case of Sports and Tourism infrastructure, it reflects the fact that in general many less developed regions rely heavily on tourism and hence are also better equipped with that particular type of infrastructure.

The inclusion of these two groups of infrastructure categories, one of which having a positive and the other having a negative relation with development indicators, in the construction of the aggregated infrastructure indicator seriously limits its validity. It would, therefore, be very interesting in a future study to see to what extent the results could be improved if these two groups of infrastructure, besides the other group for which no strong correlation exists, are analysed separately.

The results of the lagged correlation analysis suggest that the non-payable infrastructure components precede regional development while the payable ones seem to follow it.

If infrastructure is used as the capital element in a modified Cobb-Douglas production function, the aggregate infrastructure indicator, due to its composition, is significant in some cases only. In these cases, however (Transport, Communication, Energy and also Education) it clearly shows a significant influence.

If infrastructure is entered into a quasi-production function based on the potentiality factor approach according to which infrastructure is only one determinant of regional development besides agglomeration, location and sectoral structure, it also seems to be a weak determinant of regional development in the Greek case under the already mentioned restrictions. On the other hand, especially agglomeration and sectoral structure seem to be relatively powerful determinants of regional development. This could mean that a successful regional policy should aim at improving these conditions.

XI.7. SUMMARY OF THE IRISH REPORT

by Sean Barret

The Irish National Report examined the relationship between infrastructure and regional incomes for the nine Irish regions. While incomes range from 66 to 100 with the highest incomes in the East region which includes Dublin, the range of the infrastructure endowment was from 79 to 100. The population of the Irish regions varies from 82.509 in the North West to 1.254.000 in the East. Compared to the Community average of 7.3% in 1977, agriculture accounted for 52.3% of employment in the Irish Midlands. Employment in industry in the East at 38.6% approached the Community average of 40.5% but in the Midlands it was only 15.9%.

We examined infrastructure endowment in 47 subcategories which can be categoried in eleven main groups as follows: (number of subcategories in brackets)

Transport (9), Communication (2), Energy (7), Water (3), Environment (5), Education (4), Health (6), Urban infrastructure (2), Sport and Tourism (5), Social (2) and Culture (4).

We unfortunately are not able to attempt a time series analysis because there is little published data on regional policy in Ireland. We concentrated therefore on assembling as full a set of data as possible for 1978.

The correlation coefficient for income per head and infrastructure endowment were estimated as follows:

Transport (0.61), Communications (0.33), Energy (-0.08), Environment (-0.22), Education (0.39), Health (0.75), Urban (-0.36), Sports and Tourism (0.03), Social (0.24), Culture (-0.53).

The correlation coefficients for income per head and shares of employment by sectors were as follows:

Agriculture (0.91), Industry (0.80) and Services (0.91).

We see, therefore, that the infrastructure categories with the highest correlations with incomes per head in Ireland are Health, Transport, Education, Communications and Social. On the other hand there are negative correlations in respect to Culture, Urban, Environment and Energy.

Both the positive and negative correlations for infrastructure are lower than the correlations for employment share. This indicates that the lower incomes in Irish regions can be better explained by low employment shares in services and industry and high employment share in agriculture than by a relative lack of infrastructure compared to the higher income regions. A policy of general infrastructure finance from the EC would not reduce regional income disparities within Ireland. The data indicate that for Ireland a policy of promoting investment in directly productive activities in the low income regions should be supported from the Regional Fund (ERDF) and that an infrastructure policy should be based on certain infrastructure categories only. In particular the distribution of communications and third level education is unfavourable to the low income regions.

The MMR for incomes in Ireland is 1:1.51; for infrastructure it is 1:1.27. The low income regions thus generate lower incomes from a given infrastructure stock than do the better off regions. There are regions with significant differences in incomes but with similar infrastructure stocks. We would recommend that the application of the ERDF in Ireland be accompanied by case studies of each project prepared along the lines of the UNIDO manual. Ireland has in recent years invested over 30% of GNP with low growth resulting. Improving the quality of investment is vital and this should apply also to infrastructure investments. This is the most important contribution which we believe that the EC could make towards reducing regional income disparities in Ireland.

At national level we show several weaknesses in regional policy. These include weaknesses in policy formulation, implementation and monitoring. There is a contradiction between the nine region policy pursued at national level and the one region policy pursued by Ireland at Community level. Regional data at national level are scarce.

In addition to the need to promote the expansion of directly productive activities in the regions we note that public sector employment is heavily concentrated in the Dublin area. Two recent additions to the concentration refer to public sector organizations concerned with agriculture and fishing and the location of public sector services away from the major regions of agricultural and fishery output is questioned.

At present the major EC transfer to Ireland comes from the Agricultural policy. We point out that this has increased regional inequality. Outside the urbanized East region 71% of the benefits accrue to the three highest income regions and 21% to the four poorest regions.

XI.8. SUMMARY OF THE ITALIAN REPORT

by Maurizio di Palma

The data regarding infrastructure used in the Italian Report have been classified into about 165 basic categories, grouped into about 30 intermediate categories and then into 12 main categories. The regional breakdown corresponds to the level II of Community statistics, but in our study, due to the size being too small of Val d'Aosta region, Piemonte and Val d'Aosta are treated as one region. Statistical analyses point out the results described below.

(a) Elementary analysis (ranking, clustering, maximum-minimum-ratio) confirm the better infrastructural endowment of central and northern regions; moreover comparison of the two time periods, even if it is not too easy to perform (see below), shows a general growth of the avervage level of infrastructure; such growth is more evident in the central and northern regions, while in the South, apart from scattered exceptions, we do not witness important changes. As far as the actual discrepancies in the infrastructural endowment are concerned, the maximum-minimum ratios in TABLE 45 (period 1975-79) show higher discrepancies for Sport/Tourism infrastructure (MMR=9.09), Natural (6.67), Water (6.25), Cultural (5.88), Energy (5.26) and Social (5.00).

Intertemporal comparisons of the discrepancies are not easy to perform because the number and the definition of the basic categories available sometimes ar quite different in the two periods (for instance, airports and deep area habours are considered only in the second period, producing a clear raise of the transport MMR because of the much greater discrepancies of these two infrastructure compared with roads and railways). The decreasing tendency for some categories (and for the synthetic indicator) and the increasing tendency for the other categories should, therefore, be regarded considering the previous statements on the comparability of the data in the two periods. The comparability is much better for the development indicators. In the period 1975-79, the smallest disparities are evident for activity rate (1.37) and the largest for GDP per capita (2.33). All the indicators show a decreasing tendency.

TABLE 45.: Maximum-Minimum-Ratios of Main Infrastructure Categories and Development Indicators of 20 Regions in Italy, 1970-74 to 1975-79

	1970-74	1975-79
Infrastructure categories:		
Synthetic indicator	3.57	3.03
A. Transport	2.78	4.17
B. Communication	2.22	1.92
C. Energy	20.00	5.26
D. Water	6.25	6.25
E. Environment	-	-
F. Education	2.86	2.86
G. Health	3.03	2.22
H. Urban	1.64	-
I. Sport-Tourism	8.33	9.09
J. Social	5.26	5.00
K. Cultural	14.29	5.88
L. Natural	5.00	6.67
Development indicators:		
Activity rate	1.47	1.37
GDP per capita	2.63	2.33
GDP per employed person	2.33	1.92

(b) The quasi-production functions demonstrate a good fitting of the corresponding models and underline the determining role of infrastructure (measured through a synthetic indicator) in the explanation of development levels.

The models are of the type:

$$Y = a*L^{b} * I^{c} * S^{d} *A^{e}$$

where
Y= GDP per capita or GDP per employed person
L= Activity rate
I= Infrastructure Index
S= Sectoral structure (share of industrial employment)
A= Agglomeration (share of population living in the largest town)

In the explanatory models of per capita GDP levels we find the infrastructure index, the activity rate and the industrial employment share, in both periods and with significant coefficients in the first period (1970-74). To these variables we must add an urban agglomeration index. On the other hand the second development indicator, GDP per employed person, in both periods is significantly explained by infrastructure index, by the industrial employment share and by the agglomeration index. Summing up in view of the main interest of this research, we must point out that in all quantified models one of the determining factor for explaining development levels is the endowment with regional infrastructure.

TABLE 46.: Results of the Estimation of Quasi-Production Functions
1970-74 and 1975-79 in Italy.

	Development indicator			
	GDP per capita		GDP per employed person	
	1970-74	1975-79	1970-74	1975-79
a	0.0225	0.0111	1.852	3.431
b1	0.920	1.269		
s	(0.207)	(0.224)		
b2	0.479	0.477	0.437	0.392
s	(0.075)	(0.071)	(0.065)	(0.073)
b3	0.346	0.257	0.327	0.303
s	(0.110)	(0.103)	(0.081)	(0.093)
b4	0.148		0.145	0.068
s	(0.039)		(0.034)	(0.034)
RSQ	0.949	0.936	0.926	0.890

Note: s=standard deviation
a, b1,... b4 = estimated regression coefficients.

(c) The multiple regression models throw some light on the variables that combine with infrastructure equipment as factor of regional development, but they give no basis for assessing the respective roles of different types of infrastructure in regional development.

The contribution of different types of infrastructure to regional development aims is not independent of the type of aim pursued (level of income or level of employment), nor is it independent of regional features such as the industrial structure of production, the physical features of the region, the urban concentration, etc. Indeed, the same infrastructure category may play quite a different role, depending on the combination of aim and regional features: for each development aim and for each set of regional features. Particular groups of infrastructure categories will have a variously decisive influence.

The choice of statistical method is affected when the problem is approached from this point of view. One of the best methods for the purposes of this study is "rotated factor regression". A factor approach to the variables that explain development shows the basic structure of the variables and in particular reveals the most signifiant relationships between regional features and infrastructure. Regression for development indicators on the factors defined as a result of these relationships can throw light on the different roles played by the factors, i.e. by particular combinations of regional features and infrastructure categories in explaining the level of the individual indicators.

The analysis [cf. TABLES 47 and 48] point out the relevant role of water, social and communication infrastructure: the first two groups are closely linked to industrialization and, therefore, to regional development, especially in terms of per capita GDP; on the other hand, communication infrastructures are primarily linked to urban agglomeration and, therefore, to regional development, especially in terms of GDP per employed person and for the first period considered. Other infrastructure, among them mainly transport, theoretically relevant for regional development on the contrary, is mainly linked to the morphological characteristics of the ground and do not show an empirically appreciable link with development.

TABLE 47.: Results of Factor Analysis of Infrastructure Endowment in Italy, 1970-74 and 1975-79

VARIMAX Rotated Factor Matrix

(1975-1979)

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
TRANSP	-0.08922	0.10944	0.79659	0.30751	0.45422
COMMUN	0.59973	0.68410	0.09405	-0.02302	0.33989
ENERGY	0.47900	0.38390	0.66083	0.02516	0.25414
WATER	0.70197	0.59825	0.07949	-0.09588	0.25935
ENVIR	0.54198	-0.06487	0.36927	0.14016	0.45003
EDUCAT	0.21557	0.06389	-0.02604	0.92629	-0.00001
HEALTH	0.49662	0.16617	0.34613	0.62152	0.25674
SPOTOU	0.54954	0.03542	-0.32425	0.22791	0.59347
SOCIAL	0.82305	0.10609	0.10249	0.31986	-0.04531
CULTUR	0.29832	0.47241	-0.00730	0.63237	0.07229
NATUR	-0.10843	0.31581	0.11952	-0.06461	0.82339
AGHEMP	-0.60858	-0.47972	-0.24787	-0.34555	-0.30779
INDEMP	0.80878	-0.01890	0.30352	0.09860	-0.23489
SEREMP	0.06032	0.63651	0.03939	0.36250	0.61174
PLAINE	0.24116	-0.07077	0.80052	-0.13719	-0.16835
DENSIT	-0.02209	0.63223	0.65405	0.08679	-0.04517
URBCON	-0.10817	0.88820	0.03896	0.21468	0.14329
FELAFO	0.91244	-0.07303	-0.05820	0.29168	0.02860
proportion of total variation explained:	26.0	17.7	15.0	13.0	13.0

(1970-1974)

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
TRANSP	-0.12371	0.27383	0.23834	0.79395	0.23790
COMMUN	0.34230	0.73716	0.42612	0.03757	-0.29863
ENERGY	0.07663	0.12801	0.85355	-0.13420	-0.20555
WATER	0.71173	0.62977	0.14705	0.06978	-0.11043
EDUCAT	0.02782	-0.00388	-0.03702	-0.07452	0.93575
HEALTH	0.47923	0.36668	0.18752	0.46331	0.52338
SPOTOU	0.15448	0.04525	0.85119	0.13294	0.26772
SOCIAL	0.90939	0.04627	0.06371	-0.02123	0.14528
CULTUR	0.37903	0.50924	0.08868	0.21204	0.49486
NATUR	-0.42566	0.27027	0.77247	0.03015	-0.05830
AGREMP	-0.57909	-0.57095	-0.34426	-0.35795	-0.09300
INDEMP	0.74807	0.05652	-0.19055	0.40638	-0.10409
SEARMP	0.06114	0.68881	0.62063	0.09192	0.22253
PLAINE	0.28059	-0.11394	-0.14155	0.80782	-0.18838
DENSIT	-0.07297	0.63761	-0.06123	0.65642	0.00245
URACON	-0.07048	0.91725	0.10015	0.05692	0.15730
FELAFO	0.92482	-0.01166	-0.01473	-0.08011	0.11007
proportion of total variation explained:	22.9	21.0	17.2	13.7	10.8

TABLE 48.: Regression of Development Indicators on Rotated Factors (1970-1974) in Italy

Dependent variables	Rotated Factors I	II	III	IV	V	R**
			1970-74			
GDP p. capita						
-estimated parameters	0.736	0.495	0.223	0.292	0.078	
-standard deviation	0.085	0.075	0.075	0.075	0.075	
-% of explained variance	54.2	24.2	5.0	8.5	0.6	0.927
GDP p. empl. person						
-estimated parameters	0.508	0.599	0.394	0.373	0.060	
-standard deviation	0.081	0.081	0.081	0.081	0.081	
-% of explained variance	25.8	35.9	15.5	13.9	0.3	0.914
Activity rate						
-estimated parameters	0.872	0.072	-0.220	-0.033	0.146	
-standard deviation	0.112	0.112	0.112	0.112	0.112	
-% of explained variance	76.0	0.5	4.8	0.1	2.1	0.836
			1975-79			
GDP p. capita						
-estimated parameters	0.863	0.390	0.193	0.111	0.125	
-standard deviation	0.054	0.054	0.054	0.054	0.054	
-% of explained variance	74.4	15.2	3.7	1.2	1.6	0.961
GDP per empl. person						
-estimated parameters	0.709	0.461	0.307	0.214	0.225	
-standard deviation	0.085	0.085	0.085	0.085	0.085	
-% of explained variance	50.2	21.2	9.4	4.6	5.1	0.905
Activity rate						
-estimated parameters	0.817	0.196	-0.155	-0.017	0.115	
-standard deviation	0.141	0.141	0.141	0.141	0.141	
-% of explained variance	66.7	3.8	2.4	0.0	1.3	0.743

XI.9. SUMMARY OF THE DUTCH REPORT

by Peter Nijkamp

XI.9.1. Spatial Subdivision and Data

There are numerous spatial demarcations in the Netherlands, which may - in principle - constitute a useful frame of reference for a study on the relationship between regional development and infrastructure. The relevant spatial subdivision which has been used in the framework of this study is the provincial level (level II of the EC-statistics). These provinces are also administrative units with a major responsibility for physical planning and housing. These are 11 provinces. Many statistics include also some data on the new polders reclaimed from the interior lake (Ijsselmeer), but in the data analysis these data will be combined with those of the province of Gelderland. It is clear that, due to different regional bases for data collection, not all items of infrastructure and regional development could be precisely determined, at least not within the limited time period available for the study. Several of them had to be assessed, so that they cannot claim a high reliability, while others were not at all available at the provincial level.

For the spatial level II, the following provinces are being distinguished: 1. Groningen, 2. Friesland, 3. Drente, 4. Overijssel, 5. Gelderland, 6. Utrecht, 7. Noord-Holland, 8. Zuid-Holland, 9. Zeeland, 10. Noord-Brabant, 11. Limburg.

A drawback is that this regionalization is based on administrative rather than on functional viewpoints, but this drawback holds in all other countries as well.

The data on infrastructure endowment have been collected from the viewpoint of direct or easy availability, due to time constraints. Hence, some regional data on communication, energy, water and education could not be obtained. It should be mentioned, that in the aggregate Community study several of these data have not been used due to international comparability problems. In order to reduce the effects of population size and of the surface of a region, each infrastructure item has been standardized as follows:

- the items related to network and space opening

infrastructure by means of a joint spatial potential (i.e., the surface of a region),
- the items related to joint infrastructure by means of their demand potential (i.e., population size).

XI.9.2. General Observations

The matrix with infrastructure indicators includes a wide variety of items. Data on these indicators have been gathered for two time periods, viz. 1970-1975 and 1976-1980.

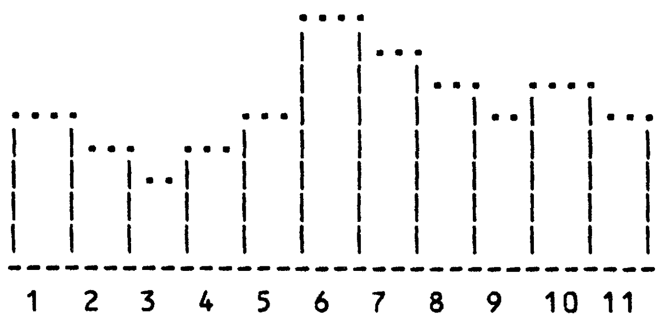
At first glance, the regions are relatively equally endowed with most of the selected infrastructure categories. However, in regard to the transport network serious interregional disparities do exist due to the lack of motorway and railway infrastructure in the 3 Northern provinces (1, 2 and 3) and in the province of Zeeland (9) and due to the abundance of transport infrastructure in the industrialized regions 7 and 8. It is also noteworthy that the area of available industrial estates in all provinces is nearly equal.

The core-area consists of the regions 7 and 8 (Noord-Holland and Zuid-Holland), the intermediate zone includes the central and the southern provinces Gelderland and Noord-Brabant, while the regions 1, 2, 3 and 9 form the periphery. Regions 4 and 11 are more or less ambivalent in their infrastructure categories. Both regions suffer on the one hand from a backward infrastructure complex which hampers regional development instead of forming a stimulus for it. On the other hand, they also have very modern infrastructure. This "fuzzy" character to these regions makes it very difficult to place into a core-periphery classification.

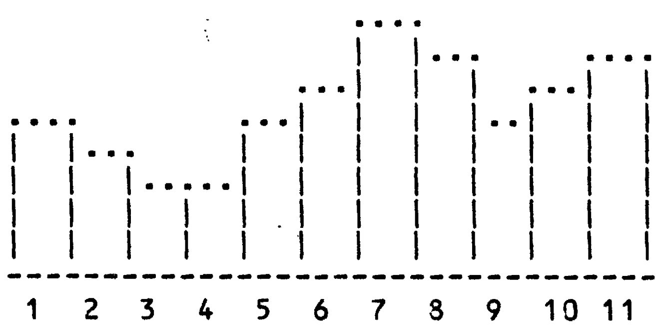
Regions with a good physical and socio-cultural performance (such as regions 7 and 8) have a relatively poor natural environment (expect region 5). The opposite holds true for the provinces of Friesland and Drente (regions 2 and 3). This might indicate that one should be very careful in ranking regions according to their infrastructure categories by not placing too much emphasis on the man-made public enviroment. Especially in a very densely populated country like the Netherlands, a high environmental performance in a region will be of more importance for regional development than man-made infrastructure.

An intertemporal comparison teaches that the above described disparities are neither seriously increased nor decreased during the period 1970-1980. The relative "backwardness" of the regions 1, 2, 3, and 9 in some categories might give an indication of decreasing disparities in the coming decade. There is a slight tendency toward more convergence. This is also reflected in FIGURE 16.

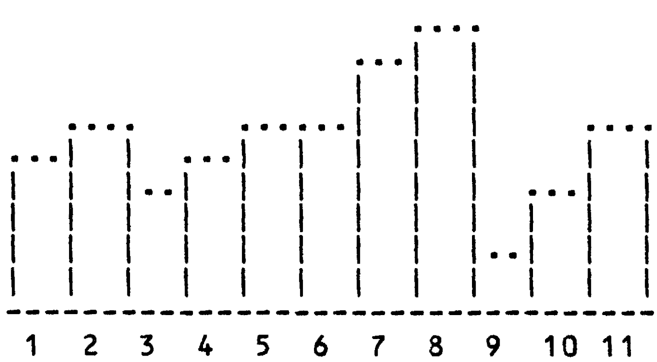
FIGURE 16.: Disparities in Infrastructure Endowment



1970-1975



1976-1980



growth from 1970-1975 with respect to 1978-1980.

These comparisons lead to the following conclusions:

- The relevant discrepancies among the provinces are fairly low (the MMR is less than 1.3.), although the central part (Utrecht, Noord-Holland and Zuid-Holland) clearly demonstrates a higher infrastructure endowment.

- The intertemporal changes also indicate that Noord-Holland and Zuid-Holland have managed to improve their relative position during the seventies.

- The COV (coefficient of variation) leads to similar results as the MMR.

Finally, a classification of provinces into weak and strong infrastructure endowment leads to the results of TABLE 49.

TABLE 49.: Classification of Dutch Provinces According to Weak and Strong Infrastructure Endowment

Provinces	Weak	Strong
1.Groningen	natural endowment	education
2.Friesland		education, sports, tourism socio-cultural
3.Drente		health, sport, tourism, natural endowment
4.Overijssel	health, urban	
5.Gelderland		nature
6.Utrecht	culture, environment	health
7.Noord-Holland	education	network, socio-cultural
8.Zuid-Holland	education, sport, social network, health, nature	network infrastructure
9.Zeeland		environment, urban, social
10.Noord-Braba.	culture	
11.Limburg	environment, education	

XI.9.3. Statistical Results

A hierarchical cluster analysis applied to the infrastructure data has led to the following conclusions:

- Spatio-temporal dynamics is, in contrast to the foregoing statements, very clearly observable. The changes in the positions of Noord-Brabant, Drente and Zeeland are examples of intercluster dynamics of provinces, while the changes in the hierarchical positions of the Noord-Holland and Zuid-Holland cluster illustrate alternations in the spatial distribution of infrastructure.

- The construction of infrastructure during the seventies has caused decreasing discrepancies between most of the provinces. Especially the similarity between the provinces Utrecht, Overijssel, Gelderland, Noord-Brabant and Limburg has increased, while the relative distance between these provinces and two western provinces has become smaller. The insufficient growth of certain infrastructure categories in the provinces of Groningen and Friesland, Drente and Zeeland has caused an increasing discrepancy between these provinces and the rest of the Netherlands.

A multidimensional scaling analysis ot the infrastructure results has led to the following conclusions:

Due to the decreased discrepancies caused by a more equal distribution of social welfare infrastructure, the differences between the various clusters of provinces are mainly determined by a different performance on network and natural infrastructure. The cluster can, therefore, be characterized as follows: In the provinces of Noord-Holland and Zuid-Holland, network infrastructure is dominating, at the expense of natural endowment. Centrally located between network, socio-cultural and natural infrastructure, the provinces Utrecht, Gelderland, Noord-Brabant and Limburg seem to have a more balanced infrastructure endowment. A serious lack of natural infrastructure characterizes the otherwise satisfactory profile of Groningen and Zeeland. The provinces Drente and Overijssel suffer from a lack of sufficient network infrastructure.

A principal component analysis demonstrated the existence of 3 main clusters:

- Network: transportation, communication, energy and water.
- Social welfare: sports and tourism, cultural facilities, social infrastructure, education and health.
- Quality of life: urban and environmental infrastructure.

Finally a scatter diagram and a correlation analysis between regional product and infrastructure showed a fairly good relationship between relative regional development indicators and infrastructure endowment.

XI.9.4. Quasi-Production Function Approach

The quasi-production function takes for granted that regional product is determined by traditional (substitutable) production factors (such as capital and labour) as well as by specific regional determinants (such as agglomeration, sectoral structure and infrastructure). Due to the lack of quantitative information regarding regional productive capital and sectoral structure, and due to the fact that agglomeration factors are already partly incorporated in employment opportunities and infrastructure components, only the two last mentioned potentiality factors will be included as production factors. As we are more interested in the relevance of the various infrastructure components in relation to the level of regional development rather than to test the relevance of the regional development potential theory, this choice is justified in our opinion. Hence, the following quasi-production function, based on a Cobb-Douglas specification, will be used:

$$Y = A * L^{b} * I1^{c1} * I2^{c2} * I3^{c3}$$

with:

Y = average regional product
L = employment oppurtunities
I1 = network infrastructure
I2 = social-welfare infrastructure
I3 = urban infrastructure.

The results of the multiple regression analysis, based on weighted aggregate infrastructure components in combination with data on regional product and employment opportunities as presented in TABLE A.3 of the Dutch Report are:

lnA = 0.17 (0.36)
B = 0.58 (0.33)
C1 = 0.15 (0.07)
C2 = 0.03 (0.15)
C3 = 0.19 (0.07), R**2 = 0.671

where figures in brackets represent the standard deviation. It turns out that as far as infrastructure is concerned, both network and urban infrastructure give a (statistically) significant explanation for regional development. The social welfare infrastructure indicator gives a slightly less significant explanation which may be due to the fact that it may depend more on population size than on the level of economic activity.

One may, however, not deduct from these results the conclusion that infrastructure investments in the relevant categories will lead a priori to an improvement in regional development. We have stressed the fact that infrastructure is a condition for regional development; the above mentioned results only prove that bottlenecks in network and/or urban infrastructure are likely to rise the question whether and when investments in infrastructure have positive effects on regional development.

XI.9.5. A Shift-and-Share Analysis

In order to identify those regions where investments in infrastructure could have positive effects on regional development, a shift-and-share analysis has been applied. The results of shift-and-share analysis enables us to classify regions in the following way:

		regional component	
		+	-
Structural	+	I	II
Component	-	III	IV

Since infrastructure is one of the elements making up the regional component, one can assume that the contribution of infrastructure as a policy instrument in regional planning will be most successful in those cases where the regional component shows a negative sign, i.e., in group II and group IV. As the structural component in group IV is also negative, a combination of both sectoral and locational policy is advisable.

The results of the shift-and-share analysis have led to the following classification:

group I	:	Utrecht
group II	:	Noord-Holland, Zuid-Holland
group III	:	Noord-Brabant, Gelderland, Drente, Limburg, Overijssel
group IV	:	Groningen, Friesland.

The province of Zeeland is difficult to classify because of its dynamics. In combination with the results of the above mentioned high-low classification it seems then that in the province of Friesland infrastructure investments could play an important role in regional planning, while more accent on sectoral policy seems advisable in the province of Groningen.

XI.9.6. Conclusions

After extensive analysis of the relationship between infrastructure and regional development, the following final remarks and suggestions can be made:

(a) General Conclusions

- The question as to what degree infrastructure contributes to regional development depends very strongly on the spatial level of analysis. A more defined spatial subdivision may reveal more interesting relationships.

- The time periods for studying the impacts of infrastructure policy are essentially very short. Long term interrelationships between infrastructure and other potentiality factors should, therefore, receive more attention.

- The conclusions draw from the analysis are also co-determined by the definition of the variables, the aggregation procedures, the normalization and the standardization.

- The statistical results demonstrate a high degree of correlation among successive infrastructure indicators in one category. This justifies the aggregate level of analysis.

- Regional infrastructure endowment appear to be represented in some clusters such as network clusters, a social welfare cluster and a quality-of-life cluster.

- The results demonstrate that densely populated industrialized areas tend to have a higher network infrastructure endowment than peripheral, agricultural and less populated areas.

- Interprovincial discrepancies among infrastructure categories have decreased during the seventies.

- Locational conditions have become increasingly important in explaining regional employment and growth differences. The infrastructure oriented factors accessibility and space-availability are important pull factors in the relocation planning process.

- Due to the variety of instruments used in regional planning an exact evaluation of the contribution of infrastructure investments to regional developments cannot take place.

- The question whether or not infrastructure will continue to play an important role in national and international regional development programs depends very strongly on the creativity of the policy-makers.

(b) Policy Recommendations and Suggestions for Further Research

- More attention will have to be paid to the long-term interactions between the various potentiality factors. Hence, the development of a dynamic version of the regional development potential theory is a meaningful follow-up for the international study.

- The innovative capacity of infrastructure (for instance, research centres functioning as development modes) has received no attention so far, while especially in this period of economic restructuring the industrial innovation is regarded as a key factor.

- The implications of locational perceptions in the spatial decisionmaking process deserves more attention, especially in peripheral regions.

XI.10. SUMMARY OF THE BRITISH REPORT

by Peter M. Jackson

Whilst the results of this study for the U.K. suggest that there is indeed a significant relationship between infrastructure and regional development, it is important that the limitations of the analysis which has been presented in this paper are clearly understood. These will, therefore, be briefly discussed prior to summarizing the general conclusions which can be drawn from the results obtained.

In the first instance it is important to be aware that the level of analysis - the level II regions of the EC - has an important effect upon the results obtained, whilst not necessarily being the approprate level of analysis for certain infrastructure services. In addition ít may also be the case that two cross-section years chosen may be too close to reveal the dynamics of the relationship under investigation. In future reserach it should be considered a matter of concern to investigate not only whether or not there actually is a significant relationship between the provision of infrastructure and regional development, but perhaps more importantly, what are the lags involved both generally, and in terms of the individual infrastructure categories.

The second major limitation of the analysis arises as a result of restrictions on the availability of appropriate data. As far as the indicators which have been employed to present the capacity of the infrastructure services are concerned it has been necessary in many cases to employ proxy indicators. In certain cases this may have distorted the results of the analysis - for example in the case of education where the number of schools has had to be utilized as the appropriate indicator. This is not an ideal indicator of the capacity of education services and its value will be determined to a significant extent by certain characteristics of the regions themselves. This is evidenced by the fact that the sparsely populated regions such as Scotland and Wales score relatively high on these indicators due to the fact that a large number of schools, albeit frequently small ones, are required to service a widely dispersed population. The results of the analysis, therefore, are significantly constrained and severely restricted.

Furthermore, it should be recognized that the process of weighting, standardization and normalization of the absolute values of the infrastructure and development indicators has a significant effect on the results obtained from the analysis. The U.K. indicator data was considered initially in an unweighted form and then weighted according to agreed criteria, the results obtained exhibiting considerable differences. Similarly the U.K. data was standardized on the basis of population, area, population or area and population multiplied by area in order to ascertain which method produced the most apparently satisfactory results. From this analysis it was clear that the standardization of the network and point infrastructures as discussed previously was indeed the most appropriate method which could be adopted. This was particularly true when considering the "extreme" regions discussed at the beginning of this Report. The actual method which has been utilized in this study is justified on the a priori grounds that network infrastructure services are related to areas and point infrastructure services to population. However, it is important to recognize that both the method of weighting the indicators and the method of standardization fundamentally affects the final outcome of the analysis. It is evident that the basis of the analysis presented in this Report is an examination of the capacity of the existing infrastructure endowment of a region. To the extent that the degree of utilization of the infrastructure services has not been explicitly included in the analysis, the bottleneck approach suggested in the Groups' Interim Report has not been truely tested. One should, therefore, be cautious about interpreting a low level of provision of a certain infrastructure service as representing a constraint to further development, until such time as the degree of utilization of that capacity which actually is available has been fully investigated.

As a final caveat to the interpretation of the results of the analysis it is important to recognize the dimensions of the regional disparities we are investigating. Not only are the levels of provision of the various infrastructure categories remarkably similar in the U.K. but so too are the indicator values of regional development, whichever one is preferred. The analysis, therefore, is concerned with an investigation of a very limited range of regional variations, the importance of which should not be overstated in the absence of any more significant regional differences.

Given these limitations, how can the results of the analysis of the relationship between infrastructure and regional development be summarized? In the first instance, it is clear that the correlation coefficients between the infrastructure indicators and G.D.P. per capita as the preferred development indicator, show that there is a significant degree of co-variation between infrastructure endowment and regional development. In order to test for the direction of any causal link between these two elements, lagged correlation coefficients were computed. The results of this exercise tend to confirm the view that the provision of infrastructure services promoted regional development rather than development leading to an increased demand for infrastructure.

An attempt, using factor analysis, to identify groups of infrastructure categories which could be employed as source variables in further investigations proved rather unsatisfactory. The factors identified both at the main category level and at the sub-category level could not be interpreted in any meaningful way in the context of the research, but they were rather a somewhat confusing collection of apparently disparate infrastructure categories. The estimation of the simplified Cobb-Douglas quasi-production function produced a reasonably good fit, particularly in the second period. However, one should be cautious about interpreting this as reflecting a change in the relationship between infrastructure and regional development during the 1970s in view of the improvements in the infrastructure data base for the second period. A further multiple regression analysis was undertaken in order to estimate a further function which included all the regional characteristics. Although results of this exercise did not include infrastructure as a significant variable in the first period, this had changed by the second period at which time infrastructure, population and activity rate explained almost 90 per cent of the variation in regional GDP per capita.

Whilst the limitations outlined above necessitate a certain degree of caution in the interpretation of the results fo the analysis, it does appear that the major hypotheses proposed by the Group in their Interim Report are supported by the findings presented here. However, as discussed in this Report, there are significant areas where further research is required and it is not possible to make any definitive statements as to the exact nature of the relationship between infrastructure and development until such time as this additional work has been completed.

XII. POLICY AND RESEARCH CONCLUSIONS

XII.1. Policy Conclusions

The multiplicity of results arising of this Study cannot easily be summarized for the purposes of regional policy. There are several reasons:

- The task assigned to the Study Group was both a difficult one and restricted to the analysis of only one instrument of regional policy, namely infrastructure. A wider briefing would perhaps have made the task of the Group easier, but it would have placed increased pressure on the time and research funds available. It was, therefore, not possible to deal with the whole range of regional policy problems, and in particular with the numerous interdependencies, such as those existing between demand and supply factors.

- Although there is a not insignificant volume of literature on infrastructure problems, we do not yet possess a general theory of infrastructure which can simply be applied in the European context. The Group, therefore, had to proceed in a somewhat eclectic manner in order to bring together insights from a variety of approaches with different theoretical backgrounds. This reflects the fact that infrastructure is not a homogeneous phenomenon.

- The statistical and data collection problems have been much greater than would normally be expected due to large differences in definitions and restricted availability of regional infrastructure information. The Group had to devote much more of its scarce research time solving these problems and consequently some additional types of analysis which would otherwise have been possible could not be undertaken.

The results and the conclusions of this Study represent only a first step toward the analysis of the contribution of infrastructure to regional development. It is nevertheless the first time that both a theoretical approach intended to define and measure infrastructure endowment, its impacts on regional development, and an empirical investigation as to the possibilities of quantifying these concepts for all European regions has been realized. Despite the limitations mentioned, a number of conclusions for Community regional policy purposes can be drawn:

(1) In general, infrastructure does contribute to regional development. This is supported by most National Reports and by the findings of the Community Analysis. Although the results differ between the various categories of infrastructure, the different types of analysis applied in the Study (descriptive comparisons, disparity analysis, grouping and clustering analysis, correlation analysis, multidimensional scaling, estimation of quasi-production function, bottleneck and excess capacity analysis) do confirm the hypothesis developed in the first part of this Report. Even if the problem of demand versus supply influences could not be fully treated, it follows from the infrastructure properties of capitalness and publicness that there must be a significant supply side effect.

The better the infrastructure endowment of a region, the higher its regional development potential defined in terms of potential income, productivity and employment. In most cases, the influence of infrastructure on income and productivity is statistically more significant than on employment. This may be due inter alia also to the problems of measuring employment, particularly as far as family helpers in agriculture and in traditional service sector branches are concerned. An infrastructure policy accordingly remains an important element of regional policy, be it on a local, a regional, a national or a Community level.

(2) There is no similarly clearcut answer to the question of whether or not different infrastructure categories exercise different influences on regional development. The statistical problems discussed above prohibited the application of the bottleneck identification analysis to each individual infrastructure category. In most categories this would have required a larger number of infrastructure subindicators and a higher degree of comparability. But it also reflects the differences in the types of services provided by the individual infrastructure categories and the differences in

the degree of indivisibility. The larger the capacities to be compared, the higher the probability that several regions may have the same capacity indicator but exhibit relatively large differences in income. It is not surprising, therefore, to find that in some cases there exist higher correlations between, for example, income and social service infrastructure compared with income and transportation infrastructure. In the former case, capacities can be tailored more closely to effective or perceived demand than in the latter, where, for example, linking a peripheral region to the more centrally located ones requires a certain road network to be built independent of the rate of utilization. If it had been possible to quantify both existing capacity and capacity actually used in terms of the same measure (e.g. ton/miles of persons and goods actually transported and potentially transportable), one would have been able to demonstrate that differences in rates of utilization are also influenced by differences in the degree of indivisibility or "publicness" in general.

The contribution of infrastructure categories may also depend on what political weight is given to a more equal distribution of infrastructure across a country, and how other policy goals are treated. It may be that a policy for example intended to distribute educational facilities more equitably across regions, may end up producing a negative correlation in our analysis, given the definition for education capacity used. The reason is that poorer regions normally have a higher percentage of children in their population than richer ones, particularly if indicators for obligatory school age classes would have been used. This implies that an improved analysis will also have to reconsider some of the definitions applied in this Study.

Another factor explaining differences in the endowment with individual infrastructure categories may be that regions at different stages in their development need different types or larger capacities of infrastructure. This could have been tested with the aid of better and more comparable indicators, had they been available. The fact that no answer could be given to that question does, therefore, not mean that the problem is irrelevant, but rather that the possibilities for testing special hypotheses have been too restricted. They remain important research items for future work.

(3) According to the Regional Development Potential Approach, infrastructure is one of the four main determinants of regional development potential, the other three being location, agglomeration and settlement structure, and sectoral structure. This supports the argument that decisions on infrastructure investments and on their subsidization should be based on a comprehensive multidimensional development program as since long requested by the Commission of the European Communities. These programs should bring together all available information on the characteristics of the individual regions concerned and on the specific "needs" for infrastructure. If the infrastructure "mix" is not fixed for all regions, but depends on their stage of development, their location, their agglomeration and settlement structure already reached, their sectoral structure etc., a general evaluation based on the findings of this Study can only be a first approximation and serve as general framework, but has to be supplemented by region-specific analysis. The results of the present research and of possible improvements can then be used as terms of reference in evaluating the results of regional development programs and in helping to formulate relevant hypotheses to be studied more in detail.

(4) With the aid of one of the many significant quasi-production functions it is possible to obtain estimates for the level of potential income, productivity or employment that can normally be expected for a given capacity. On the basis of a ranking list for all regions, a first possible policy decision can be to decide what level of development is considered to indicate that a region is underdeveloped. Regions below this critical threshold are then those normally profitting from subsidies out of the Regional Fund. If this selection is done as usual on the basis of information on actual income or (un)employment, then this means that also the degree of underutilization or overutilization of regional development potential has been implicitly chosen as an additional criterion. However, this implicit decision can naturally be made explicit.

The quasi-production function approach allows to roughly classify all regions according to relative resource use. As the results obtained have shown, there is a tendency that less developed regions are underutilizing and highly developed regions are overutilizing their capacities. But there are also other combinations ranging from groups of regions with roughly normal utilization, with roughly constant underutilization or overutilization up to decreasing or increasing intensities if the estimates of singular infrastructure functions are compared with the fully specified ones.

On the basis of this additional information, a first straight-forward policy conclusion would be to subsidize in regions with excess capacities private factors of production (e.g. by investment, mobility, training, innovation premiums) in order to enable those regions to attract or to retain the quantities and qualities of private factors needed to reach a normal utilization of their development potential. In weak regions with an infrastructure deficit, new infrastructure investments could be subsidized. Subsidization would have to continue until the region would exceed the threshold level fixed for subsidization.

There are, however, a number of qualifications to be considered.

First, a region having an infrastructure surplus may nevertheless need an infrastructure subsidization. A first case would be where infrastructure surplus is only compensating a deficit of other resources. As has been shown, the number of those regions is relatively low. A second case covers all areas that belong to least developed regions. For them, it cannot be excluded that they need a certain minimum capacity that is larger than their actual equipment and without it they would not be able to increase capacity utilization. It is, however, possible, to increase the rate of subsidization for mobile factors of production to the effect that the disadvantages caused by the lack of appropriate infrastructure are fully compensated. But such a strategy runs the risk that a potential investor does not know in advance what his subsidy benefit would be and how long it would be paid. Infrastructure services, in contrast, if they are available, are a more reliable base for entrepreneurial decisions.

Second, the aggregate infrastructure indicator used may have overestimated the possibilities for substitution between the individual infrastructure categories. It could e.g. be that the method used in order to take account of restricted substitutability by calculating the geometric mean of all main indicators does still imply some substitutability that may not exist in reality. This argument could be relevant especially in cases where the pattern of infrastructure composition, the infrastructure "mix", deviates strongly from the usual pattern. As it can be assumed that those distortions do exist more frequently in less developed regions, a small rate of underutilization may not be reliable, the aggregated infrastructure indicator on which these rates are based may hide serious bottlenecks in some elements of this total.

On the other hand, there are also qualifications as far as the highly developed regions are concerned. They do not always need a higher infrastructure capacity even if a bottleneck is estimated, if this infrastructure bottleneck is compensated by a better endowment with the other resources, e.g. with a high degree for agglomeration, a good settlement structure or a modern future-oriented sectoral structure. If the bottleneck according to the fully specified function is low or even disappears, an infrastructure bottleneck would not justify a capacity extension. In no case, a subsidization would be required as by definition highly developed regions by far exceed the critical threshold for subsidization. This threshold criterion, however, should not only take into account the relative position of a region in the Community ranking, but also in the national ranking because national regional policies cannot abstract from national disparities even if all national regions from a European point of view would belong to the group of well developed areas. If a region does only appear in a national ranking, but not in the European ranking as a problem region, a solution to the subsidy problem could consist in reducing the percentage share of subsidization. In any case, the criteria to be applied in such cases should have a Community character.

That a relative bottleneck of a more developed region does not automatically imply that infrastructure capacities are to be expanded has the following reason: the region concerned may already be overagglomerated such that expanding the infrastructure capacity will cause additional congestion because this measure will increase immigration, development of new activities etc. Given the importance of a policy intended to protect the environment and to reduce the deleterious effects of pollution and congestion in densely populated areas, the policy conclusion as to infrastructure expansion should not only be taken on the basis of the relative rates of overutilization. All this again stresses the need for supplementing the results of the present Study by region-specific analyses.

(5) Infrastructure categories also differ as to their degree of excludability. Some infrastructure services are normally sold on the basis of prices or fees ("infrastructure payantes"). Examples of this include railways, electricity, telephones. Whereas it is generally assumed that a better endowment represents a higher supply of productivity increasing inputs, and thereby favours regional development, it may be that in the case of paid infrastructures, the relative levels of pricing of these facilities are more important than availability as such. Indeed, the granting of special low transport rates or energy prices is a well known element of regional aid. It is also, therefore, possible to assist underdeveloped regions through subsidizing infrastructure services. This is an expenditure saving policy if the sum of the subsidies to private entrepreneurs or to households is lower than the cost of creating new infrastructure facilities which would produce the same advantages for producers or consumers.

A special case for subsidization can be made in the context of innovation policy. If a region is disadvantaged because it has too many old and declining industries, it may be an efficient policy to subsidize the transfer of know-how in relation to the organization of entreprises, exploitation of new markets, adoption of new technologies and the use of patents. Since technological knowledge can be considered to represent "public" capital in the theoretical meaning of the term, public subsidization can be justified. This does not necessarily require that these services become part of a public institution: On the contrary, it would create additional possibilities for private activities if private suppliers of these types of services were also subsidized in those cases where they provided small and medium enterprises in problem areas with their services. In some countries, technology transfer agencies have nevertheless already been created as public institutions and chambers of industry and commerce have also established departments for this purpose.

However, it must be recognized that, as far as e. g. public mass transportation in particular is concerned, a massive subsidization does not take place in the peripheral regions which would need such an aid, but rather in the highly urbanized and agglomerated regions. In these regions railway, bus and underground transportation is usually heavily subsidized both as far as the investment or capital cost is concerned and as far as the variable transportation costs are concerned. Where this is the case, the less developed regions are clearly discriminated against even on the basis of the same pricing rules: A subsidy in the latter regions would then only restore competition between the two types of regions. Fair spatial competition between regions can naturally also be reestablished if subsidization in agglomerated areas is abolished.

(6) Finally, it must be stressed again that infrastructure is but one category of the whole range of instruments which can be used to aid regional development. This implies that infrastructure should not be used as an isolated instrument, but always as an integrated part of a comprehensive development strategy. For example, the improvement of accessibility only via the building of roads, railways or airports, may have the effect that foreign producers will profit from a reduction in long distance transportation costs and will thereby be able to become even more competitive in the backward regions. It is, therefore, extremely important to aid private activities in these regions, and not to concentrate on infrastructure investment alone.

XII.2. Conclusions for Future Research

The preceding conclusions regarding regional policy have to be supplemented by conclusions for future research based on the experience gained during the work for this Study. They are of interest both for the Commission, and for other researchers and policy makers interested in the issues dealt with in this Report.

(1) Infrastructure generally has a very long gestation period. The larger the degree of indivisibility, the greater are the additions to an existing stock or capacity when an expansion is undertaken. This in turn means an initially large excess capacity which is to be filled by private activities to be induced or attracted into the region. Although we attempted, via the cross section analysis, to capture some of the long term development influences of infrastructure, the temporal distance between the first and the second cross-section years is clearly too short. In addition, the economic situations in the first and second years are not fully comparable, as shows up in the different correlations and coefficients of determination for the two years.

A useful follow-up study would be the development of a dynamic version of the regional development potential theory that covers a much longer time period and allows to take into account lagged effects.

(2) There is a discrepancy between the spatial subdivision in the analytical field and in the policy field. It would, therefore, be interesting to apply the approach developed here to other types of regions which are used as policy units at the national level. Smaller regions such as those based on the labour market concept, would also facilitate the analysis of the employment implications of infrastructure.

(3) The general findings obtained so far have been based on fairly simple statistical tools. Given the sometimes weak nature of the data, more advanced techniques, would have been more satisfactory, and might have allowed more interesting structural relationships to be identified. These tools can now be applied to the available data, and additional

insights gained from the existing data set.

(4) Given the importance of technological progress in relation to regional development, the innovative dimension of infrastructure would appear to offer a fruitful avenue for future research.

(5) The bottleneck problem also deserves additional empirical investigation. As has already been mentioned, this implies an attempt to obtain additional indicators which would permit the relationship between demand or utilization of infrastructure and new investment to be examined.

(6) As this study shows, the minimum size or threshold problem, and the relationship between phases of regional development and infrastructure requirements are also of special importance to less developed regions. Since relative overcapacities in the weak regions have been found both in some National Reports and in the Community Analysis, it appears to be of particular importance here to undertake a more detailed investigation.

(7) This study concentrates on the allocational effects of infrastructure, rather than the distributional problems. It may be that whilst interregional income and wealth distribution is improved, the intraregional distribution is made worse. Since the welfare concept covers both aspects, distributional implications of infrastructure policies should also be the subject of further study.

(8) Infrastructure investments are financed partly out of current revenues and partly from capital market credits. Higher level governments normally participate through grants in aid in the financing of lower level infrastructure investment. Since fiscal or financial capacity may have an important influence on these investments, an interregional flow-of-funds analysis may be of great importance for regional policy making.

(9) Given the high degree of complexity of the infrastructure phenomenon, one or more detailed case studies comparing the development record of selected regions which differ with respect to their performance may also be an interesting exercise.

With these case studies, it would be possible to examine the very long term growth paths of regions, and to draw conclusions for the future.

(10) The regional data collected for this study already reflect the impact of regional policies. It may be useful, therefore, to engage in a comparative study between a member country with a less developed regional policy. Such an analysis could also shed light on the under/overutilization problem if it was possible to test whether or not too much interference with regional development goals tends to produce oversupply with some types of infrastructure and undersupply with others.

INFRASTRUCTURE STUDY GROUP

THE CONTRIBUTION OF INFRASTRUCTURE TO REGIONAL DEVELOPMENT

- Appendix -

Summary of the report
the contribution of infrastructure
to regional development

A case study on Spain and Portugal

by
Dieter Biehl and Urban A. Muenzer

with the assistance of
Alfred Boltz and Peter Ungar

FOREWORD AND ACKNOWLEDGEMENTS

This appendix presents a summary of the results of a research project analysing the contribution of infrastructure to regional development in Spain and Portugal. This project is a follow-up Study to the Report of the Infrastructure Study Group. It applies the same approach described in the main text of the Report. The full Report on this research is available in German. In the following, an English summary is presented.

The authors give special thanks to the following institutions and persons, without whose help the study could not have been undertaken

in Spain:

Dr. Martin Lopez, Subdirector General, Instituto de Estadistica. Professor Cuadrado Roura, Secretario General Tecnico, Ministerio Transportes,Turismo y Communicaciones. Yvonne Navarette, Dr. Fernando Fernandez, Jesus Gutierrez, Banco de Bilbao

in Portugal:

Dr. Stefan Tobisch, Gabinete para a Cooperacao Economia Externa, Lissabon. Prof. Valenta de Oliveira, Presidente da Commissao de Coordenacao da Regiao do Norte, Prof. Lopez Porto, Dr. Fatima Caravalho.

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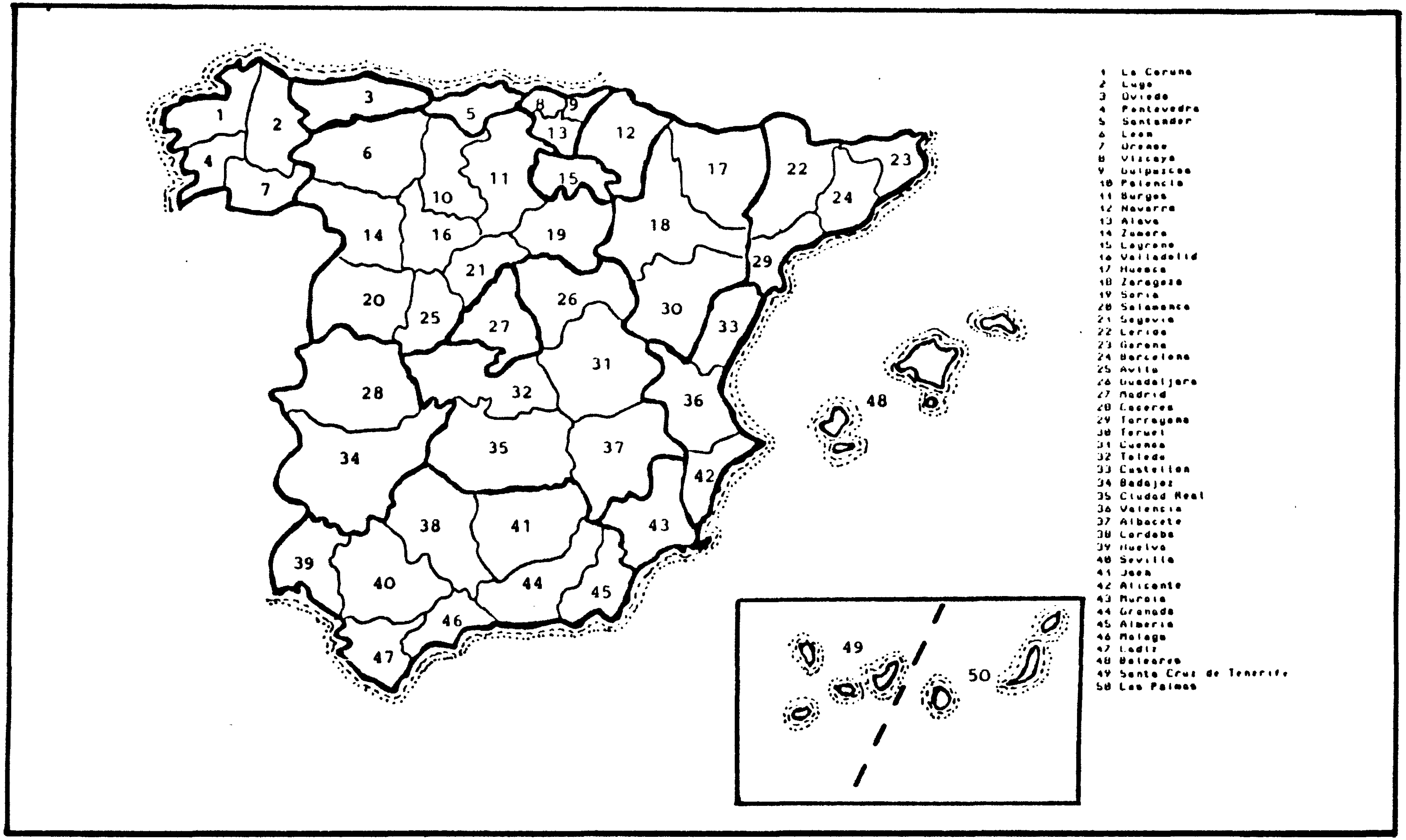
PART ONE

CASE STUDY SPAIN

I. REGIONAL ORGANIZATION OF SPAIN

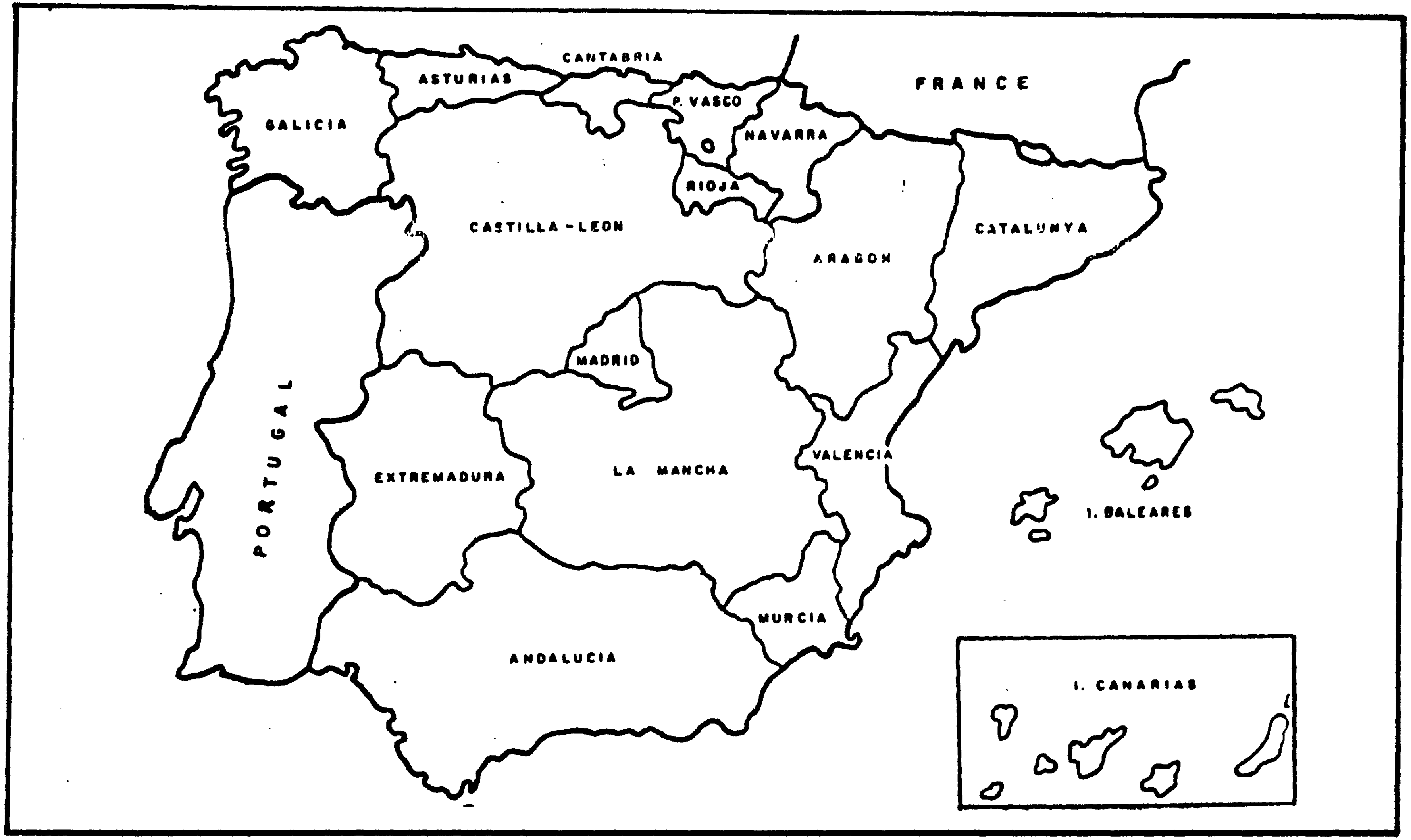
The traditional Spanish regions are the 50 provinces on which the following analysis is based. In addition, a regional subclassification into 17 autonomous regions has been proposed. At the time of preparing this Report, the final decisions on the implementation of this new regional structure had yet been taken. This regional breakdown has been selected in order to present an additional analysis which is more close to a possible future political and functional regional delimitation of Spain.

MAPS 1 and 2 present the 50 provinces and the 17 autonomous regions. Table 1 shows the relationships between the 50 provinces and the 17 autonomous regions. As far as the Canarian Islands are concerned, they have been excluded from the later regression analyses because of their large distance from the Iberian peninsula and the fact that they represent a free trade area.



M A P 1

Regional Organization of Spain:
50 Provinces



MAP 2

Regional Organization of Spain:
17 Autonomous Regions

TABLE 1.: Regional Organization of Spain

AUTONOMOUS REGIONS	PROVINCES
1. ANDALUCIA	Almeria, Cadiz, Cordoba, Granada, Huelva, Jaen, Malaga, Sevilla
2. CATALUNA	Barcelona, Gerona, Lerida, Tarragona
3. MADRID	Madrid
4. PAIS VALENCIANO	Alicante, Castellon de la Plana, Valencia
5. GALICIA	La Coruna, Lugo, Orense, Pontevedra
6. CASTILLA-LEON	Avila, Burgos, Leon, Palencia Salamanca, Segovia, Soria, Valladolid, Zamora
7. PAIS VASCO	Alava, Guipuzcoa, Vizcaya
8. CASTILLA-LA MANCHA	Albacete, Ciudad Real, Cuenca Guadaljara, Toledo
9. ARAGON	Huesca, Teruel, Zaragoza
10. ASTURIAS	Oviedo
11. EXTREMADURA	Badajoz, Caceres
12. MURCIA	Murcia
13. BALEARES	Baleares
14. CANTABRIA	Santander
15. NAVARRA	Pamplona
16. RIOJA	Logrono
17. CANARIAS	Las Palmas, Santa Cruz de Tenerife

II. REGIONAL DEVELOPMENT DISPARITIES OF SPANISH REGIONS

II.1. INDICATORS AND CROSS SECTION YEARS

A list of the most important indicators selected for describing infrastructure equipment and the level of development in Spanish regions is presented in TABLE 2. Following the approach for the other national analyses, two cross section years have been selected. The first cross section year mostly covers data for 1971 and the second cross section year for 1977 and 1979. Thanks to the well developed system of regional statistics in Spain, it was partly possible to compare data for regional development and infrastructure equipment for these three years. However, data has not always been available for the years 1977 and 1979. As far as data on living standards are concerned, they refer to 1975. These data have also been used for the second cross section year.

II.2. ANALYSIS OF THE 50 PROVINCES

TABLE 3 presents some basic data which have been used in order to calculate the development and the infrastructure indicators for 1971 and 1979. If one chooses income per capita as a first indicator for characterizing the development level of a region, a dispersion of regional income per capita between a minimum of 43.876 and a maximum of 124.424 Ptas. is obtained as shown in TABLE 4 for the first cross section year. The maximum-minimum-ratio (MMR) is 2.84. This MMR decreases to 2.55 in 1977 and 2.37 in 1979. The minimum region in the last year also has a comparatively higher income compared to the first year (42.17% of the maximum region compared with 35.26%). The unweighted and the weighted coefficients of variation improved too.

MAPS 3 and 4 show the geographical distribution of regional per capita incomes 1971 and 1979 for the 50 provinces. TABLE 5 supplements the information on income per capita by other indicators for income, sectoral structure, employment and for total surface, population and population density. In general, they support the findings on regional income, i.e. that disparities decreased over the period considered.

TABLE 2.: Selected Basic Indicators for Spain

Income Indicators

BIPM	Domestic product	Valor Anadido Bruto, (Mill. de Ptas.)
BPPO	Domestic product per capita	(Ptas.)
BPEM	Domestic product per employed person	(Ptas.)
BIPA	Domestic product agriculture	Valor Anadido Bruto, (Mill. de Ptas.)
BIPI	Domestic product, industry	Valor Anadido Bruto, (Mill. de Ptas.)
BIPS	Domestic product, service sector	Valor Anadido Bruto, (Mill. de Ptas.)
BIIS	Domestic product, industry- and service sectors	Valor Anadido Bruto, (Mill. de Ptas.)
BPFL	Domestic product per area (qkm), (general income density)	(Mill. de Ptas.)
BISF	Domestic product of industry- and service sectors per area (qkm), (Special income density)	(Mill. de Ptas.)
BGEG	Domestic product in industry- and service-sectors per employed persons in these sectors	(Ptas.)

Employment Indicators

EMTO	Total employment
ERWQ	Labour force participation rate
EISP	Labour force participation rate in industry and service sectors
EMFL	General employment density (employed persons per area) per area)
EGFL	Special employment density in industry and service sectors per area (qkm)

Table 2 continued

Infrastructure Indicators	
INDA	Transportation
INDB	Communication
INDC	Energy supply
INDD	Water supply
INDF	Education
INDG	Health
INDI	Sportive and touristic facilities
INDJ	Social infrastructure
INDK	Cultural infrastructure
INDL	Natural endowment
INGG	Aggregate infrastructure indicator for all categories
INGP	Aggregate infrastructure indicator for production relevant categories
Other Potentiality Factors	
POPT	Total population
FLGS	Area, total surface (qkm)
POFL	Population density (Agglomeration), (also EMFL, EGFL) (Population or employed persons per qkm)
ENTF	Location indicator (Distance between province capitals to Barcelona in km)
B%IS	Sectoral structure indicator (Share of industry and service sectors in GDP)
E%IS	Employment structure indicator (Share of employed persons in industry and service sectors in EMTO)

TABLE 3: Development Indicators Spain, 50 Provinces

		FLGSKM	POPT71	POPT79	POFL71	POFL79
1	La Coruna	7876.	1032473.	1079613.	131.	137.
2	Lugo	9803.	421366.	406468.	43.	41.
3	Oviedo	10565.	1055833.	1116384.	100.	106.
4	Pontevedra	4477.	786556.	865960.	176.	193.
5	Santander	5289.	470723.	503622.	89.	95.
6	Leon	15468.	559364.	526862.	36.	34.
7	Orense	7278.	440084.	430625.	60.	59.
8	Vizcaya	2217.	1051174.	1170813.	474.	528.
9	Guipuzcoa	1997.	630565.	686506.	316.	344.
10	Palencia	8029.	199793.	187867.	25.	23.
11	Burgos	14269.	359776.	358916.	25.	25.
12	Navarra	10421.	468083.	500174.	45.	48.
13	Alava	3047.	203055.	249346.	67.	82.
14	Zamora	10559.	255748.	230179.	24.	22.
15	Logrono	5034.	235091.	249545.	47.	50.
16	Valladolid	8202.	416187.	468642.	51.	57.
17	Huesca	15671.	220756.	214306.	14.	14.
18	Zaragoza	17194.	760211.	813662.	44.	47.
19	Soria	10287.	116065.	102356.	11.	10.
20	Salamanca	12336.	377309.	361595.	31.	29.
21	Segovia	6949.	160817.	149909.	23.	22.
22	Lerida	12028.	346874.	350680.	29.	29.
23	Gerona	5886.	414778.	456461.	70.	78.
24	Barcelona	7733.	3955847.	4518596.	512.	584.
25	Avila	8048.	209349.	186337.	26.	23.
26	Guadaljara	12190.	148735.	142579.	12.	12.
27	Madrid	7995.	3809623.	4539484.	477.	568.
28	Caceres	19945.	463512.	424715.	23.	21.
29	Tarragona	6283.	437182.	499200.	70.	79.
30	Teruel	14804.	171875.	154671.	12.	10.
31	Cuenca	17061.	248618.	219033.	15.	13.
32	Toledo	15368.	476261.	471538.	31.	31.
33	Castellon	6679.	388405.	423144.	58.	63.
34	Badajoz	21657.	695530.	645163.	32.	30.
35	Ciudad Real	19749.	509410.	477691.	26.	24.
36	Valencia	10763.	1783573.	2010303.	166.	187.
37	Albacete	14858.	339623.	336944.	23.	23.
38	Cordoba	13718.	729177.	718472.	53.	52.
39	Huelva	10085.	402932.	412667.	40.	41.
40	Sevilla	14001.	1339376.	1439805.	96.	103.
41	Jaen	13498.	665792.	642394.	49.	48.
42	Alicante	5863.	933264.	1110542.	159.	189.
43	Murcia	11317.	835971.	923073.	74.	82.
44	Granada	12531.	741009.	751821.	59.	60.
45	Almeria	8774.	378310.	402388.	43.	46.
46	Malaga	7276.	858695.	985726.	118.	135.
47	Cadiz	7385.	883250.	966568.	120.	131.
48	Baleares	5014.	538534.	633226.	107.	126.
49	Tenerife	3208.	583905.	698033.	182.	218.
50	Las Palmas	4065.	557050.	682471.	137.	168.

Table 3 continued: Income Per Capita and Income Density

		BPP071	BPP079	BPFL71	BPFL79
1	La Coruna	60822.	290237.	7973.	39785.
2	Lugo	47676.	250773.	2049.	10398.
3	Oviedo	86982.	342569.	8693.	36199.
4	Pontevedra	61683.	289868.	10837.	56067.
5	Santander	94691.	351919.	8427.	33510.
6	Leon	66374.	292498.	2400.	9963.
7	Orense	43876.	220291.	2653.	13034.
8	Vizcaya	109904.	372296.	52110.	196612.
9	Guipuzcoa	120639.	398383.	38093.	136951.
10	Palencia	69707.	354517.	1735.	8295.
11	Burgos	83310.	338427.	2101.	8513.
12	Navarra	94368.	373636.	4239.	17933.
13	Alava	124424.	482494.	8292.	39484.
14	Zamora	54710.	247277.	1325.	5390.
15	Logrono	84669.	382528.	3954.	18963.
16	Valladolid	88691.	354701.	4500.	20267.
17	Huesca	95744.	408365.	1349.	5585.
18	Zaragoza	83741.	368126.	3703.	17421.
19	Soria	68901.	287448.	777.	2860.
20	Salamanca	65880.	295341.	2015.	8657.
21	Segovia	70801.	298801.	1639.	6446.
22	Lerida	95775.	385257.	2762.	11232.
23	Gerona	104953.	467295.	7396.	36239.
24	Barcelona	110143.	443382.	56344.	259080.
25	Avila	48813.	233679.	1270.	5410.
26	Guadaljara	75665.	343550.	923.	4018.
27	Madrid	105589.	458299.	50313.	260218.
28	Caceres	46007.	230067.	1069.	4899.
29	Tarragona	94311.	424469.	6562.	33725.
30	Teruel	65658.	302429.	762.	3160.
31	Cuenca	54027.	259089.	787.	3326.
32	Toledo	64267.	276745.	1992.	8491.
33	Castellon	80501.	349361.	4681.	22134.
34	Badajoz	49960.	203474.	1605.	6062.
35	Ciudad Real	56748.	263848.	1464.	6382.
36	Valencia	79258.	366022.	13134.	68365.
37	Albacete	53786.	252695.	1229.	5731.
38	Cordoba	58082.	233255.	3087.	12217.
39	Huelva	66259.	309935.	2647.	12682.
40	Sevilla	64901.	277040.	6209.	28490.
41	Jaen	45151.	208160.	2227.	9907.
42	Alicante	77386.	338294.	12318.	64078.
43	Murcia	64950.	295897.	4798.	24266.
44	Granada	45468.	212504.	2689.	12750.
45	Almeria	51762.	256921.	2232.	11783.
46	Malaga	60634.	266185.	7156.	36062.
47	Cadiz	63486.	258815.	7593.	33874.
48	Baleares	117636.	440974.	12635.	55691.
49	Tenerife	69878.	296558.	12719.	64528.
50	Las Palmas	79067.	318654.	10835.	53499.

Table 3 continued: Sectoral Structure and Labour

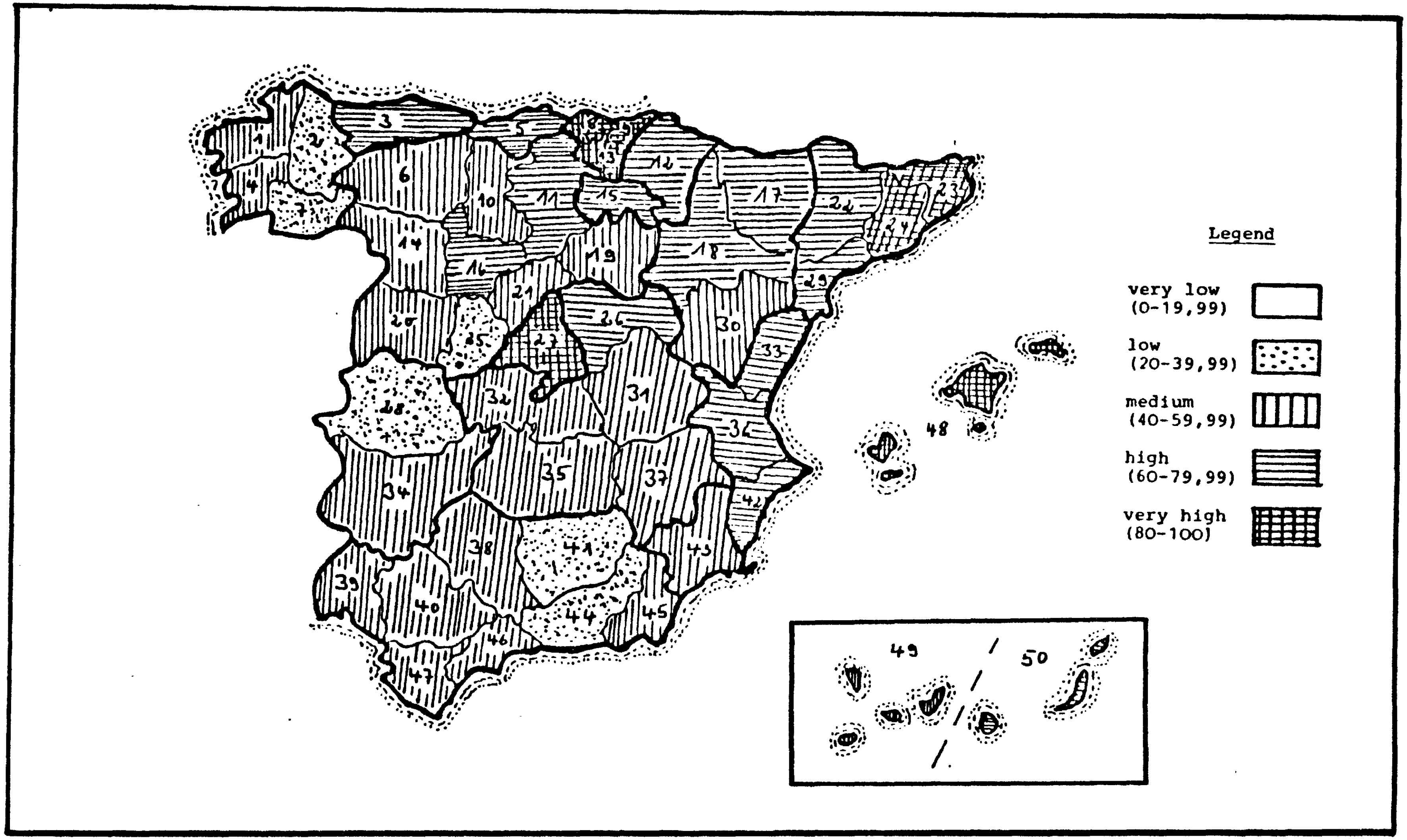
	B%IS71	B%IS79	ERWQ71	ERWQ79
1 La Coruna	81.62	87.96	42.59	37.44
2 Lugo	69.52	75.43	49.42	50.32
3 Oviedo	91.62	93.96	40.61	38.60
4 Pontevedra	77.95	86.27	45.56	43.81
5 Santander	87.72	91.90	40.11	38.83
6 Leon	75.41	88.43	41.91	41.13
7 Orense	81.35	87.54	47.41	47.43
8 Vizcaya	96.69	97.22	39.29	36.08
9 Guipuzcoa	93.37	95.97	41.51	40.32
10 Palencia	74.65	84.07	38.58	31.12
11 Burgos	77.63	86.08	42.96	37.33
12 Navarra	84.16	89.21	40.16	37.45
13 Alava	92.37	93.71	42.86	40.14
14 Zamora	72.37	78.60	40.75	35.76
15 Logrono	75.13	83.90	43.63	39.72
16 Valladolid	81.00	92.00	35.10	33.54
17 Huesca	72.78	78.37	44.96	39.18
18 Zaragoza	88.52	93.25	37.90	37.55
19 Soria	66.06	81.81	37.16	30.98
20 Salamanca	81.12	89.93	35.78	31.47
21 Segovia	69.37	80.36	39.94	35.60
22 Lerida	65.61	80.10	40.75	39.65
23 Gerona	88.52	93.03	45.19	43.16
24 Barcelona	97.98	98.85	41.04	38.52
25 Avila	65.98	81.32	37.27	32.10
26 Guadaljara	75.04	86.24	37.69	34.86
27 Madrid	98.80	99.36	38.72	35.66
28 Caceres	72.00	83.69	36.55	31.00
29 Tarragona	84.71	91.41	40.82	39.33
30 Teruel	67.72	79.81	39.87	34.50
31 Cuenca	61.52	64.46	35.90	32.46
32 Toledo	70.60	81.58	36.32	33.92
33 Castellon	78.27	88.06	42.03	38.56
34 Badajoz	66.63	81.48	34.86	32.07
35 Ciudad Real	74.73	79.69	35.45	34.49
36 Valencia	88.60	93.72	38.05	37.43
37 Albacete	68.36	81.65	35.86	32.21
38 Cordoba	73.65	84.76	35.28	32.24
39 Huelva	79.71	82.41	33.38	29.69
40 Sevilla	81.75	90.31	34.58	29.69
41 Jaen	71.24	82.34	33.76	32.28
42 Alicante	88.55	93.85	38.55	38.21
43 Murcia	84.83	88.89	34.27	33.96
44 Granada	78.77	88.09	32.89	29.85
45 Almeria	72.19	72.56	33.70	32.46
46 Malaga	87.75	92.18	35.29	30.98
47 Cadiz	82.83	88.56	33.60	30.08
48 Baleares	90.99	95.67	44.56	39.69
49 Tenerife	86.31	92.51	35.55	32.72
50 Las Palmas	85.00	90.53	34.86	34.90

TABLE 4.: Regional Income Per Capita at Current Prices Spain, 50 Provinces

	1971 in Pesetas	1971 in % of Maximum Region	1977 in Pesetas	1979 in Pesetas	1979 in % of Maximum Region
National Average	81010.	65.11	238743.	347367.	71.99
Regional Min.	43876.	35.26	132933.	203474.	42.17
Regional Max.	124424.	100.00	338349.	482494.	100.00
MMR	2.84		2.55	2.37	
VC	28.65		24.63	22.52	
VC weighted	31.85		29.58	26.88	

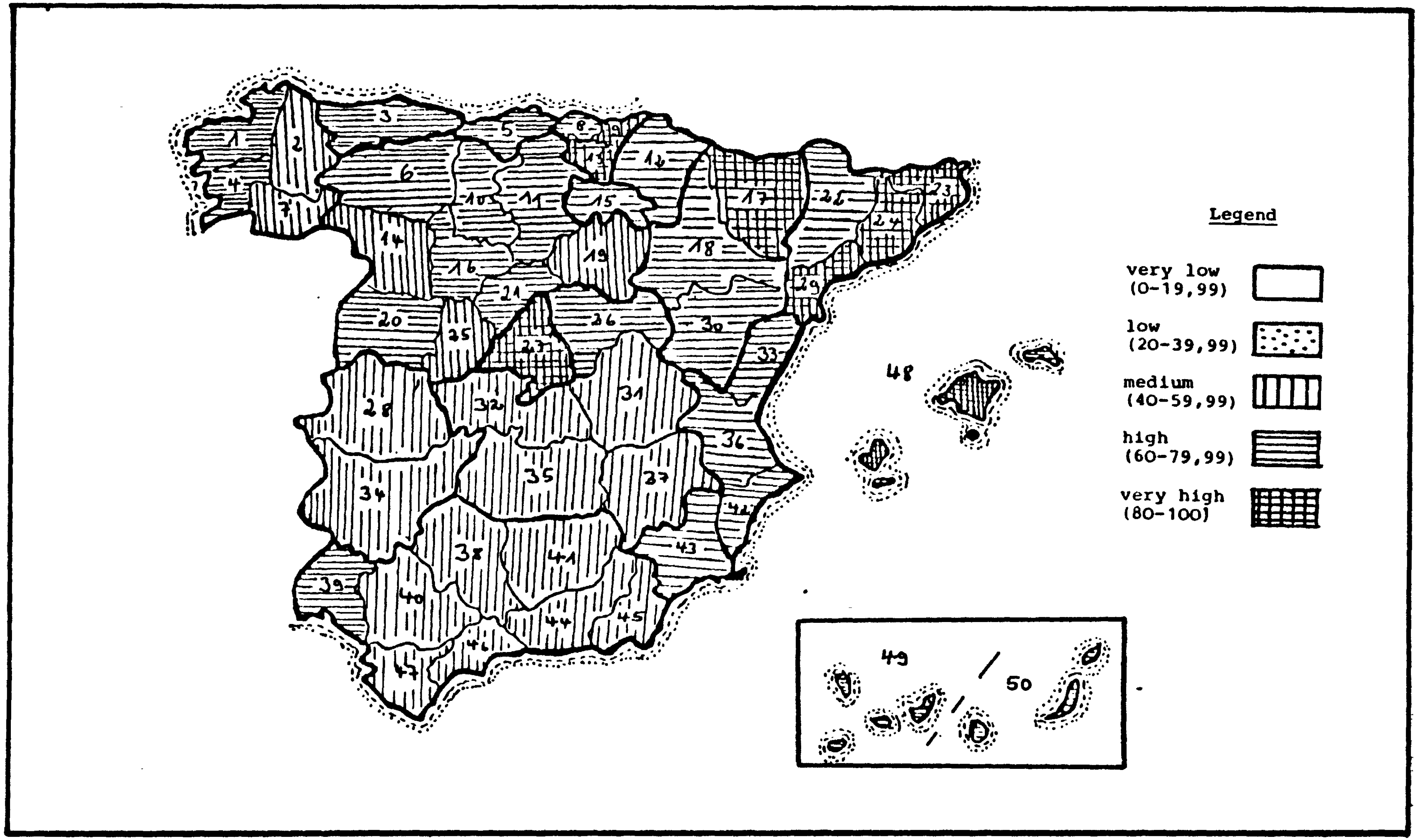
TABLE 5.: Maximum-Minimum-Ratios (MMR) and Coefficients of Variation (VC) of Indicators Used, Spain, 50 Provinces

Indicators	MMR 1971	MMR 1977	MMR 1979	VC 1971	VC 1977	VC 1979
INCOME						
BPPO	2.84	2.55	2.37	28.65	24.63	22.52
BPEM	3.14	3.05	2.77	25.07	22.63	18.99
BPFL	73.91	83.07	90.98	156.32	159.29	153.49
STRUCTURE						
BP%A	32.15	61.50	55.48	45.41	55.18	52.80
BP%I	3.67	3.05	2.74	26.97	27.93	23.91
BP%S	1.99	2.23	1.90	15.09	18.06	15.71
B%IS	1.61	1.76	1.54	11.65	10.43	7.99
EMPLOYMENT						
ERWQ	1.50	1.74	1.69	10.20	12.55	12.53
E%IS	3.12	2.72	2.69	23.67	20.29	18.38
EMFL	50.07	65.55	73.02	125.93	131.86	131.27
FURTHER INDICATORS						
FLGS	10.84	10.84	10.84	47.00	47.00	47.00
POPT	34.08	42.42	44.35	107.08	114.86	116.08
POFL	45.34	56.43	58.73	123.61	128.87	129.34



M A P 3

Geographical Distribution of Regional Per Capita Incomes, 1971, Spain, 50 Provinces



M A P 4

Geographical Distribution of Regional Per Capita Incomes, 1979, Spain, 50 Provinces

II.3. THE DEVELOPMENT OF THE 17 AUTONOMOUS REGIONS

The development indicators calculated for the 17 autonomous regions are shown in TABLES 6 to 8. As could be expected, income disparities are lower compared with the 50 provinces. The lowest regional income is now 48.380 (Extremadura), the highest is 117.636 (Baleares) in the first cross section year. 1979, Extremadura remains as minimum region with 2104031 Ptas. but Madrid advances with 458299 Ptas. to maximum region. Disparities for income per capita (BPPO) clearly decrease from 2.43 over 2.30 to 2.14. The same tendency can be observed for most of the other development indicators selected.

A more detailed analysis shows that three groups of regions can be distinguished:

- The first group comprising the highly developed regions is to be found in Northeast with the exception of Madrid. The four regions Vizcaya, Guipuzcoa, Barcelona and Madrid represent only 4% of total Spanish surface, but cover almost 1/3 of population, 2/5 of GDP and more than 2/5 of industrial production. Compared with the European Community, also these highly developed regions only reach about 3/4 of the EC-average in terms of per capita incomes.

- Andalucia and Galicia show a certain development gap compared with the other regions, but seem to dispose of a sufficient growth base as far as size and population density are concerned.

- A large number of predominantly agrarian and thinly populated regions are located in inner Spain and along the border to Portugal.

If per capita income is expressed in percent of the maximum region, a comparison between 1971 and 1979 again demonstrates a certain leveling tendency. Of the 17 regions 14 increase their relative position with Madrid, Pais Valenciano, Galicia and Rioja succeeding in having the strongest increase (higher than 10 percentage points). A strong looser is Pais Vasco, income per capita of which falls from 97.8% to 85.94%. Other loosers with about 3.7% are Baleares and Cantabria. That most of the 17 regions improve their relative position can also be seen from the improvement in the coefficient of variation [cf. TABLE 6].

The geographical distribution of income per capita for the 17 regions is presented in MAP 5 and 6.

The results obtained for the comparison between the 50 provinces and the 17 autonomous regions can be summarized as follows:

(1) Income disparities decrease naturally due to the change in the regional classification. However, the relative disparities remain in an order of magnitude comparable to those found for the other EC-member states.

(2) Important determinants of regional development potential needed later for regression analysis do not change very much as to span and in-between distribution.

(3) The 17 automomous regions seem to have become less homogeneous and rather more heterogeneous. Especially the high income regions are delimitated relatively narrowly, whereas the poorer regions are significantly larger in size. The 17 regions, therefore, do not appear to be very suitable for an economic- functional analysis.

(4) Due to the large difference in size, there will presumably be no large economies of scale. This may imply that the result obtained for the other member countries according to which larger regions due to economies of scale show higher potential incomes, will not be true for Spain.

TABLE 6.: Regional Income Per Capita at Current Prices, Spain, 17 autonomous Regions

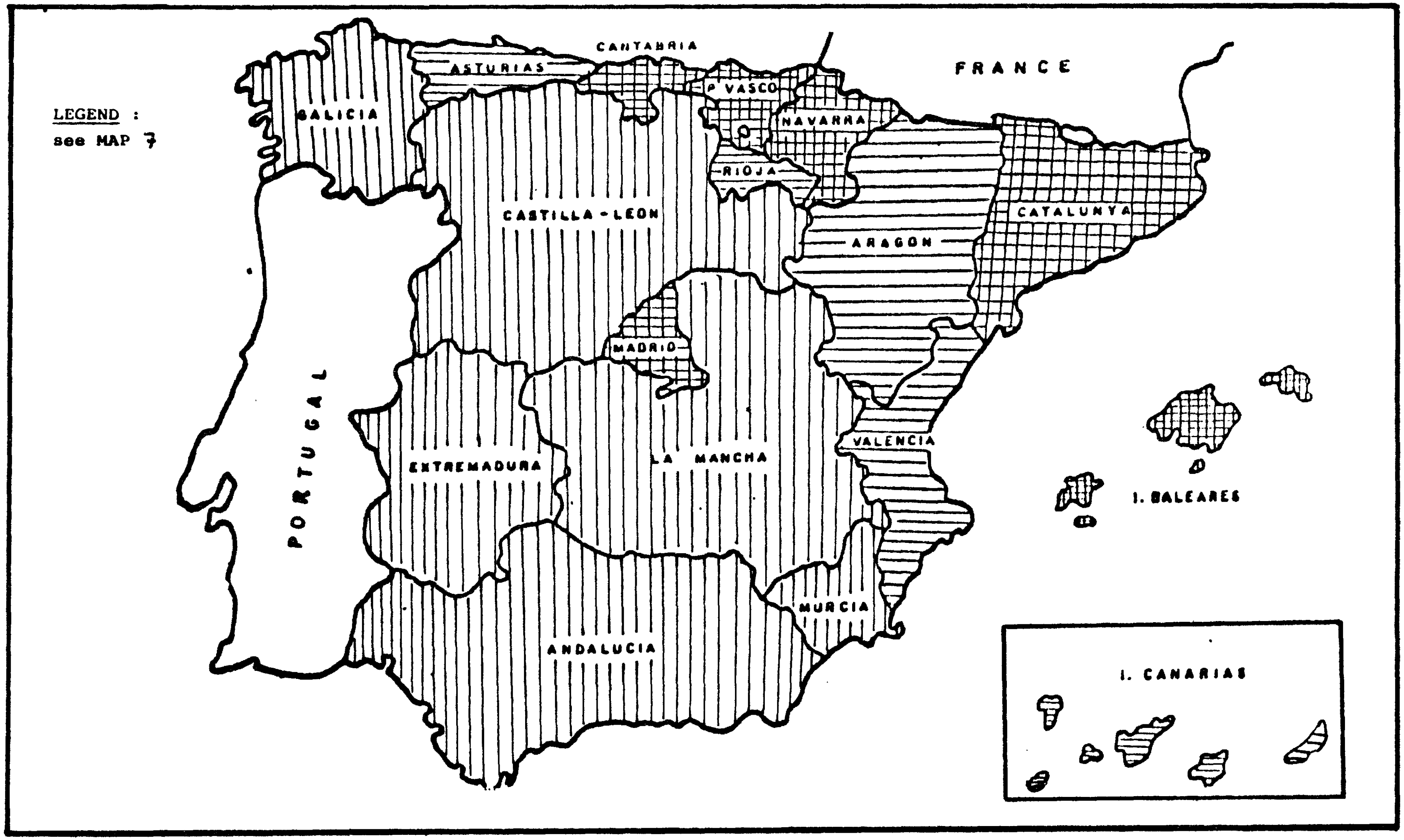
	1971		1977	1979	
	in Pesetas	in % of Maximum Region	in Pesetas	in Pesetas	in % of Maximum Region
National Average	81010.	68.86	238743.	347367.	75.80
Regional Minimum	48380.	41.13	139743.	214031.	46.70
Regional Maximum	117636.	100.00	321988.	458299.	100.00
Max.-Min.-Ratio	2.43		2.30	2.14	
Coeff. of Variation	25.14		21.80	19.69	
Wighted Coeff. of Variation	26.76		25.12	22.83	

TABLE 7.: Income Per Capita, Spain, 17 autonomous Regions

		BPP071	BPP077	BPP079
1	Andalucia	57923.	173642.	253770.
2	Cataluna	107415.	302764.	440136.
3	Madrid	105589.	321988.	458299.
4	P. Valenciano	78851.	235891.	355344.
5	Galicia	56226.	182732.	273533.
6	Castilla-Leon	70219.	207062.	307025.
7	P. Vasco	115060.	312769.	393840.
8	Cast.-La Mancha	59483.	184898.	271522.
9	Aragon	83344.	249294.	366825.
10	Asturias	86982.	239288.	342569.
11	Extremadura	48380.	139742.	214031.
12	Murcia	64950.	197429.	295897.
13	Baleares	117636.	288988.	440974.
14	Cantabria	94691.	241278.	351919.
15	Navarra	94368.	263970.	373636.
16	Rioja	84669.	242553.	382528.
17	Canarias	74364.	193733.	307481.

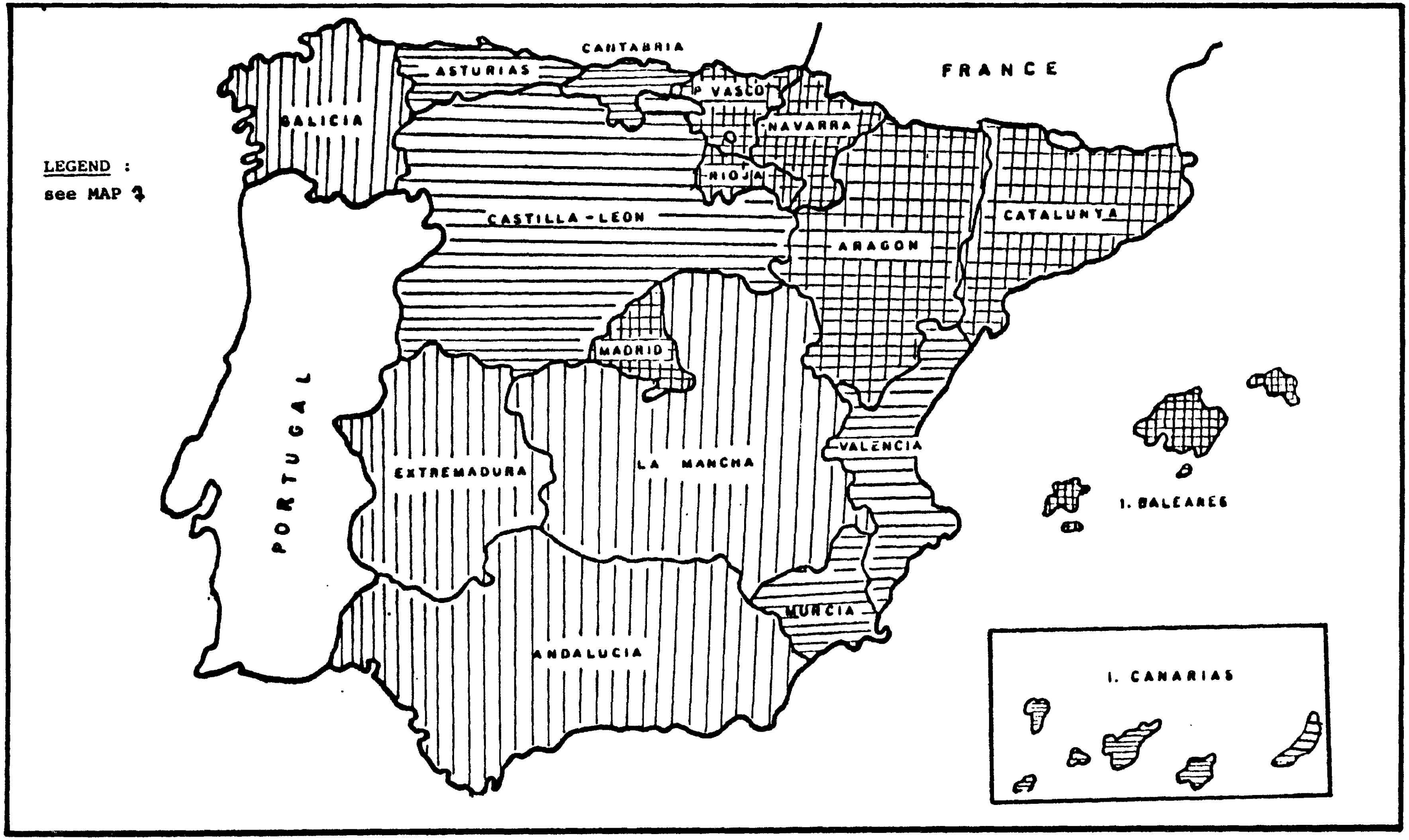
TABLE 8.: Maximum-Minimum-Ratios (MMR) and Coefficients of Variation (VC) of Development Indicators Used, Spain, 17 autonomous Regions

Indicators	MMR			VC		
	1971	1977	1979	1971	1977	1979
INCOME						
BPPO	2.43	2.30	2.14	25.14	21.80	19.69
BPEM	2.29	2.13	2.01	21.52	19.11	16.53
BPFL	38.90	48.83	47.28	116.15	126.05	123.57
STRUCTURE						
BP%A	26.18	31.59	32.16	52.90	53.57	53.58
BP%I	2.41	2.59	2.47	24.62	24.72	23.15
BP%S	1.71	1.74	1.67	17.13	17.87	15.92
B%IS	1.44	1.28	1.25	9.89	7.16	5.92
EMPLOYMENT						
ERWQ	1.33	1.42	1.40	8.40	8.45	8.44
E%IS	2.14	1.87	1.76	20.02	16.21	14.04
EMFL	23.55	28.01	28.95	96.29	102.45	100.80
OTHER INDICATORS						
FLGS	18.78	18.78	18.78	99.37	99.37	99.37
POPT	25.52	25.35	25.33	81.87	83.25	83.59
POFL	21.91	26.35	27.30	97.13	102.25	103.09



M A P 5

Geographical Distribution of Regional Per Capita Incomes, 1971, Spain, 17 Autonomous Regions



M A P 6

Geographical Distribution of Regional Per Capita Incomes, 1979, Spain, 17 Autonomous Regions

III. INFRASTRUCTURE EQUIPMENT OF SPANISH REGIONS AND THEIR DISPARITIES

III.1. METHODOLOGY AND DATA BASE

The infrastructure indicators used in the following analysis for Spain have been collected and calculated in line with the methodology explained in the main Report and also applied in other National Reports. With the exception of category E (Environment), all main infrastructure category indicators could be obtained and aggregated in order to compute a total infrastructure indicator. Indicator category I (Sport and Tourism) could not be considered because these data seem not to be sufficiently comparable. In total, 82 data Series for 16 subcategories and 10 main categories have been used.

III.2. RESULTS OF THE ANALYSIS FOR THE 50 PROVINCES

TABLE 9 gives the indicator values for the infrastructure categories retained for the 50 Spanish provinces. The regional distribution of the aggregate infrastructure indicators INGG01 and INGG02 for the first and the second cross section years are represented in MAPS 7 and 8. Like the MAPS 3 and 4 for geographical income distribution these maps also demonstrate that especially in the first cross section year - again with the exception of Madrid - there exists an obvious north-south descent. However, this descent is clearly weaker in the second cross section year, especially as far as the provinces belonging to the regions Extremadura, La Mancha and Andalucia are concerned. Above all the costal regions seem to have improved their relative positions.

III.3. RESULTS OF THE ANALYSIS FOR THE 17 AUTONOMOUS REGIONS

The infrastructure equipment analysis presented above has also been carried through for the 17 autonomous regions. Given the fact that the 50 provinces seem to be relatively small sized regions compared with the other member countries of the Community, the 17 autonomous regions, despite their strong disparities in size, seem to be better suited for a Community-wide analysis. Accordingly, the more important results of the analysis have, therefore, been presented for these 17 regions.

TABLE 10 gives an overview on the individual indicator values for both cross section years and the resulting total infrastructure indicators INGG and INGP. The last indicator, INGP, represents the aggregate infrastructure indicator for categories A, B, C, and F, which are considered to be especially relevant for regional production.

Like in the case of the 50 provinces, again Madrid, the territory which remained unchanged, represents the best equipped region. In both cross section years and for both variants of the total indicator, Madrid appears with a maximum equipment, although it reaches 100 only in the categories B, F and K.

As could be expected, the results obtained for the 50 provinces show a larger dispersion for INGG and INGP compared with the 17 autonomous regions. Among the provinces, the least equipped province has a value of below 20 percentage points of the maximum region Madrid. As to the 17 autonomous regions, the least equipped region has an indicator value of 39% for INGG and 27% for INGP. The main reason for this result seems to be that the regions in some cases comprise both well and less well equipped provinces. At the same time, significant changes in the ranking order are to be found. As a consequence, there is a clear reduction of disparities during the period.

TABLE 11 presents the disparity measures MMR and VC for the main categories, for INGG and INGP whereas MAPS 9 and 10 illustrate the geographical distribution of the total infrastructure indicators.

TABLE 9.: Infrastructure Indicators 1st and 2nd Cross Sections Years Spain 50 Provinces

		INDA01	INDB01	INDC01	INDD01	INDF01
1	La Coruna	54.34	26.40	28.04	46.94	50.12
2	Lugo	30.00	17.90	41.15	39.80	21.72
3	Oviedo	57.12	37.39	75.01	69.39	46.26
4	Pontevedra	64.41	28.78	33.94	37.76	17.83
5	Santander	67.10	42.90	47.63	78.57	31.14
6	Leon	27.76	29.41	66.48	41.84	29.29
7	Orense	30.30	13.94	95.90	20.41	15.60
8	Vizcaya	79.66	68.03	77.71	95.92	61.93
9	Guipuzcoa	93.81	53.45	61.01	100.00	26.05
10	Palencia	46.70	27.66	63.81	56.12	20.55
11	Burgos	37.69	29.51	38.98	53.06	22.06
12	Navarra	15.54	47.02	25.44	100.00	47.12
13	Alava	46.01	53.54	44.90	95.92	26.34
14	Zamora	25.09	17.21	82.04	40.82	24.97
15	Logrono	30.29	41.07	25.25	78.57	24.38
16	Valladolid	64.32	45.20	59.04	63.27	87.35
17	Huesca	23.49	35.70	100.00	92.86	23.72
18	Zaragoza	64.00	56.84	38.99	69.39	74.97
19	Soria	25.93	28.16	11.98	26.53	24.40
20	Salamanca	25.36	31.93	71.46	45.92	97.94
21	Segovia	27.76	31.38	23.90	74.49	36.10
22	Lerida	21.25	41.49	78.75	86.73	27.15
23	Gerona	66.14	54.14	24.38	79.59	17.80
24	Barcelona	75.69	81.21	45.75	82.65	55.06
25	Avila	35.74	21.25	11.87	40.82	18.76
26	Guadaljara	24.82	28.56	43.85	40.82	29.00
27	Madrid	79.95	100.00	80.11	88.78	100.00
28	Caceres	16.42	20.49	54.19	46.94	18.43
29	Tarragona	79.81	37.36	45.30	75.51	22.16
30	Teruel	21.46	22.55	21.96	42.86	19.59
31	Cuenca	19.38	20.23	28.95	25.51	18.75
32	Toledo	30.12	22.27	47.00	51.02	12.76
33	Castellon	35.30	33.92	34.57	81.63	20.40
34	Badajoz	19.49	19.47	16.84	40.82	16.40
35	Ciudad Real	22.42	21.77	10.95	48.98	17.69
36	Valencia	41.50	48.28	43.84	96.94	53.01
37	Albacete	23.87	23.28	10.13	51.02	17.38
38	Cordoba	33.10	24.60	15.68	47.96	19.64
39	Huelva	26.05	24.12	32.51	46.94	13.08
40	Sevilla	43.93	35.86	29.71	65.31	45.29
41	Jaen	22.94	20.41	23.98	62.24	15.84
42	Alicante	52.81	47.62	36.80	76.53	18.75
43	Murcia	38.21	30.08	43.79	60.20	29.05
44	Granada	22.09	26.68	13.70	47.96	74.78
45	Almeria	44.13	23.09	20.38	41.84	16.77
46	Malaga	47.40	40.01	29.65	60.20	16.94
47	Cadiz	39.61	30.77	36.50	66.33	15.19
48	Baleares	100.00	96.60	34.60	44.90	21.84
49	Tenerife	83.47	41.89	12.89	70.41	40.12
50	Las Palmas	90.61	51.53	15.94	74.49	28.20

Table 9 continued: Main Categories G-L, 1st Year

		INDG01	INDI01	INDJ01	INDK01	INDL01
1	La Coruna	57.81	10.86	29.62	10.41	48.31
2	Lugo	41.34	17.48	21.51	13.21	43.16
3	Oviedo	51.02	14.43	34.77	31.65	64.11
4	Pontevedra	35.29	16.25	41.60	10.71	56.40
5	Santander	76.67	20.60	36.14	20.28	83.87
6	Leon	40.76	18.04	42.47	12.65	52.94
7	Orense	21.98	8.40	28.56	6.37	50.63
8	Vizcaya	62.40	1.21	63.29	22.94	85.42
9	Guipuzcoa	55.11	14.31	79.79	18.38	87.14
10	Palencia	41.18	14.25	62.53	15.26	32.51
11	Burgos	57.01	36.39	53.11	25.36	51.29
12	Navarra	68.99	16.43	92.88	53.09	74.65
13	Alava	69.83	14.10	63.41	17.54	87.35
14	Zamora	33.53	11.21	45.68	17.05	43.30
15	Logrono	50.38	.49	72.80	14.20	54.56
16	Valladolid	53.30	13.21	62.62	6.94	31.62
17	Huesca	54.47	12.49	58.80	21.62	90.36
18	Zaragoza	80.80	18.30	78.26	28.62	32.15
19	Soria	42.46	79.84	56.52	39.27	40.14
20	Salamanca	41.90	18.05	46.63	28.79	65.14
21	Segovia	25.39	.92	72.31	23.96	40.76
22	Lerida	53.00	22.43	66.47	20.36	66.52
23	Gerona	66.45	100.00	87.21	26.57	100.00
24	Barcelona	53.31	8.90	81.32	25.05	83.84
25	Avila	28.72	40.28	49.98	20.99	32.65
26	Guadaljara	100.00	.00	59.22	15.31	48.57
27	Madrid	67.44	6.46	82.81	100.00	35.85
28	Caceres	32.58	27.29	55.99	17.71	56.63
29	Tarragona	48.05	77.67	75.71	24.40	35.84
30	Teruel	43.75	48.38	51.54	15.31	43.45
31	Cuenca	24.43	30.09	76.91	15.61	57.30
32	Toledo	25.85	13.16	64.49	22.85	25.20
33	Castellon	55.52	46.89	79.60	10.69	30.40
34	Badajoz	34.23	10.86	48.89	12.20	62.63
35	Ciudad Real	44.08	14.24	50.69	11.67	26.26
36	Valencia	61.37	7.81	85.08	15.21	54.37
37	Albacete	34.03	.00	66.66	15.05	23.08
38	Cordoba	38.15	.87	59.25	11.09	52.36
39	Huelva	34.07	16.62	50.06	4.35	94.57
40	Sevilla	44.45	4.90	48.57	13.54	38.75
41	Jaen	31.44	8.52	26.02	8.85	43.35
42	Alicante	50.94	21.95	72.96	13.05	22.99
43	Murcia	49.14	1.03	55.57	14.83	32.26
44	Granada	44.46	11.83	50.90	28.81	43.70
45	Almeria	43.58	28.12	54.10	12.27	14.19
46	Malaga	69.35	21.28	48.69	7.60	40.57
47	Cadiz	63.52	9.59	52.92	12.27	42.51
48	Baleares	62.12	.93	100.00	31.00	23.48
49	Tenerife	49.47	.00	28.68	15.57	41.48
50	Las Palmas	48.91	.21	46.50	18.71	5.46

Table 9 continued: Main Categories A-F, 2nd Year

		INDA02	INDB02	INDC02	INDD02	INDF02
1	La Coruna	47.06	55.49	40.80	79.80	69.55
2	Lugo	22.14	43.85	33.88	76.77	17.16
3	Oviedo	44.70	70.20	49.91	88.89	58.27
4	Pontevedra	62.16	50.60	15.48	66.67	16.30
5	Santander	52.17	69.79	24.97	87.88	50.31
6	Leon	20.75	60.40	58.15	78.79	42.90
7	Orense	24.01	44.22	80.63	55.56	17.50
8	Vizcaya	72.26	87.63	79.64	98.99	82.12
9	Guipuzcoa	88.04	82.24	90.72	100.00	29.81
10	Palencia	33.15	64.80	34.04	78.79	21.66
11	Burgos	28.16	60.78	36.84	79.80	23.94
12	Navarra	29.95	73.20	11.58	97.98	42.85
13	Alava	78.68	79.70	28.44	98.99	27.79
14	Zamora	16.83	55.92	65.65	67.68	19.36
15	Logrono	28.53	72.33	10.39	95.96	31.50
16	Valladolid	51.63	68.06	36.80	90.91	82.41
17	Huesca	16.74	73.02	76.07	92.93	20.09
18	Zaragoza	53.29	82.28	24.97	93.94	86.40
19	Soria	18.90	59.49	6.25	80.81	22.21
20	Salamanca	17.68	63.55	79.34	64.65	100.00
21	Segovia	20.66	70.24	12.85	89.90	24.58
22	Lerida	16.52	73.85	84.17	98.99	24.47
23	Gerona	55.92	81.01	21.05	94.95	18.92
24	Barcelona	67.90	95.40	100.00	98.99	62.22
25	Avila	26.41	58.40	9.33	68.69	16.28
26	Guadaljara	18.80	64.63	55.56	77.78	22.53
27	Madrid	69.29	100.00	70.16	97.98	92.01
28	Caceres	11.34	46.63	79.03	62.63	15.56
29	Tarragona	73.73	76.43	68.66	95.96	21.51
30	Teruel	13.46	59.49	95.15	86.87	15.99
31	Cuenca	12.51	55.78	16.60	70.71	14.00
32	Toledo	20.76	58.86	63.49	76.77	14.80
33	Castellon	32.28	66.87	56.18	84.85	17.45
34	Badajoz	13.41	50.83	10.51	60.61	34.51
35	Ciudad Real	16.59	55.96	15.67	76.77	16.96
36	Valencia	41.32	76.33	26.09	97.98	64.30
37	Albacete	21.11	53.72	4.16	79.80	16.26
38	Cordoba	24.66	54.46	23.08	84.85	38.41
39	Huelva	27.65	52.18	20.24	75.76	15.09
40	Sevilla	37.24	61.88	23.02	87.88	48.36
41	Jaen	16.10	49.31	12.22	80.81	16.40
42	Alicante	41.09	75.39	25.08	89.90	25.82
43	Murcia	32.91	59.71	23.83	87.88	47.83
44	Granada	25.32	52.11	8.50	68.69	85.70
45	Almeria	35.87	49.30	9.63	66.67	16.91
46	Malaga	40.36	61.96	44.02	76.77	36.53
47	Cadiz	54.03	55.10	31.57	80.81	26.59
48	Baleares	77.09	90.03	26.10	67.68	31.85
49	Tenerife	100.00	58.51	12.46	83.84	53.59
50	Las Palmas	90.93	61.89	11.28	95.96	26.80

Table 9 continued: Main Categories G-L, 2nd Year

	INDG02	INDI02	INDJ02	INDK02	INDL02
1 La Coruna	55.60	10.85	51.16	20.87	75.90
2 Lugo	25.33	26.97	46.46	13.83	56.25
3 Oviedo	58.66	15.74	47.31	28.10	57.78
4 Pontevedra	44.82	15.42	57.32	13.87	75.54
5 Santander	79.88	35.76	58.30	21.38	55.09
6 Leon	46.41	15.61	54.79	28.43	34.53
7 Orense	28.22	7.15	34.77	11.63	56.37
8 Vizcaya	59.10	.48	85.87	16.33	95.67
9 Guipuzcoa	56.91	10.48	100.00	15.90	100.00
10 Palencia	36.21	27.61	61.82	18.13	26.37
11 Burgos	70.42	31.07	65.52	18.41	34.93
12 Navarra	76.57	12.86	77.65	37.74	48.99
13 Alava	100.00	9.57	84.33	20.26	59.58
14 Zamora	35.59	24.99	41.33	17.47	29.86
15 Logrono	48.33	7.88	75.85	14.30	30.91
16 Valladolid	57.32	12.33	69.67	34.56	21.88
17 Huesca	42.69	49.30	67.19	29.08	43.52
18 Zaragoza	78.52	9.76	78.67	25.29	21.31
19 Soria	45.93	88.90	50.43	48.59	45.59
20 Salamanca	64.00	26.67	52.87	69.82	35.94
21 Segovia	51.33	32.79	66.43	14.40	43.19
22 Lerida	56.75	20.47	77.55	19.10	52.95
23 Gerona	62.04	85.23	96.26	27.50	90.95
24 Barcelona	57.37	5.29	85.14	23.36	78.66
25 Avila	62.88	9.42	50.41	24.76	26.95
26 Guadaljara	92.09	18.08	61.28	16.80	41.54
27 Madrid	65.29	5.60	69.80	100.00	33.03
28 Caceres	40.58	40.11	52.92	20.45	51.38
29 Tarragona	45.61	100.00	85.38	23.27	27.96
30 Teruel	52.85	65.66	56.26	17.58	37.00
31 Cuenca	26.30	38.66	57.31	16.06	40.61
32 Toledo	45.03	14.68	70.75	29.12	18.97
33 Castellon	55.87	50.03	81.11	14.25	31.77
34 Badajoz	42.37	10.72	60.57	12.25	47.84
35 Ciudad Real	45.75	25.13	63.47	14.68	24.53
36 Valencia	50.48	4.86	88.17	16.33	33.16
37 Albacete	30.73	5.38	70.92	9.52	29.86
38 Cordoba	58.91	.75	63.25	10.28	43.22
39 Huelva	33.29	25.78	56.67	3.81	71.84
40 Sevilla	47.41	7.18	63.52	16.16	27.76
41 Jaen	29.76	9.79	61.88	12.51	31.22
42 Alicante	37.79	13.02	73.68	13.12	19.89
43 Murcia	47.74	5.23	81.44	13.30	17.59
44 Granada	54.45	16.76	54.24	30.91	27.62
45 Almeria	39.38	18.43	64.27	10.74	12.37
46 Malaga	56.11	23.83	65.01	10.41	28.25
47 Cadiz	51.33	1.61	69.50	12.80	37.04
48 Baleares	61.25	8.32	80.99	31.30	35.98
49 Tenerife	56.82	.00	63.28	19.02	43.57
50 Las Palmas	48.93	6.20	60.54	19.02	5.77

Table 9 continued: Aggregated Indicators INGG and INGP

		INGG01	INGG02	INGP01	INGP02
1	La Coruna	44.72	70.01	42.12	63.80
2	Lugo	35.30	43.87	29.42	33.52
3	Oviedo	63.28	72.51	58.32	67.21
4	Pontevedra	41.03	50.56	36.38	36.50
5	Santander	62.18	68.55	50.82	56.55
6	Leon	44.45	59.43	39.69	51.42
7	Orense	30.52	45.35	31.52	42.78
8	Vizcaya	82.13	92.44	79.89	98.09
9	Guipuzcoa	71.58	86.41	59.39	81.34
10	Palencia	46.75	50.20	40.33	43.38
11	Burgos	49.41	56.00	34.96	42.86
12	Navarra	64.58	63.90	34.19	39.49
13	Alava	63.44	75.07	46.18	57.69
14	Zamora	41.42	46.11	34.28	40.44
15	Logrono	48.56	48.88	33.07	35.05
16	Valladolid	56.75	70.74	69.56	69.86
17	Huesca	60.05	59.65	41.98	45.21
18	Zaragoza	69.47	70.83	63.83	67.81
19	Soria	38.55	46.32	24.03	24.31
20	Salamanca	58.78	74.90	54.54	66.82
21	Segovia	45.77	47.89	32.91	31.82
22	Lerida	57.48	63.50	41.42	48.68
23	Gerona	63.47	69.69	39.47	44.82
24	Barcelona	77.63	93.44	70.12	97.43
25	Avila	33.93	43.13	22.67	26.90
26	Guadaljara	48.27	57.67	34.44	42.94
27	Madrid	100.00	100.00	100.00	100.00
28	Caceres	39.85	48.16	26.91	34.73
29	Tarragona	56.96	67.90	46.49	65.67
30	Teruel	36.59	52.64	23.88	40.62
31	Cuenca	35.07	38.14	24.01	24.54
32	Toledo	38.20	51.04	28.15	40.03
33	Castellon	45.70	56.19	33.89	46.64
34	Badajoz	33.13	41.19	20.11	27.27
35	Ciudad Real	31.18	40.61	19.60	27.25
36	Valencia	63.64	64.36	51.93	58.64
37	Albacete	31.94	33.80	19.77	20.35
38	Cordoba	37.27	51.47	25.02	40.39
39	Huelva	34.92	39.99	25.42	31.50
40	Sevilla	48.10	55.01	42.65	48.94
41	Jaen	31.50	37.31	22.96	24.42
42	Alicante	47.79	50.09	40.57	46.02
43	Murcia	46.47	51.86	38.87	47.30
44	Granada	44.79	51.44	31.16	38.28
45	Almeria	33.46	35.85	27.16	28.32
46	Malaga	43.21	55.53	34.92	54.76
47	Cadiz	44.54	55.72	32.05	48.62
48	Baleares	61.73	68.47	58.10	59.93
49	Tenerife	46.54	62.62	40.99	54.36
50	Las Palmas	40.88	45.31	42.55	44.16

TABLE 10.: Infrastructure Indicators for Categories A-L
Spain, 17 autonomous Regions
1st Cross Section Year

		INDA01	INDB01	INDC01	INDD01	INDF01
1	Andalucia	37.01	29.89	25.86	57.40	30.08
2	Cataluna	58.61	72.64	40.50	82.10	47.57
3	Madrid	85.80	100.00	65.96	88.78	100.00
4	P. Valenciano	46.69	46.29	34.79	88.93	38.66
5	Galicia	48.08	23.72	53.67	38.32	30.61
6	Castilla-Leon	38.32	30.37	68.15	49.38	45.30
7	P. Vasco	82.16	61.59	63.70	97.23	45.51
8	Cast.- Mancha	26.19	22.57	35.63	45.87	17.16
9	Aragon	47.71	47.68	70.89	69.89	57.57
10	Asturias	61.44	37.39	100.00	69.39	46.05
11	Extremadura	19.71	19.88	45.47	43.32	17.07
12	Murcia	39.34	30.08	64.70	60.20	28.89
13	Baleares	100.00	96.60	41.22	44.90	21.63
14	Cantabria	70.57	42.90	47.68	78.57	30.90
15	Navarra	17.20	47.02	25.19	100.00	46.98
16	Rioja	33.03	41.07	23.68	78.57	24.14
17	Canarias	90.46	46.60	17.20	72.34	34.04

		INDG01	INDI01	INDJ01	INDK01	INDL01
1	Andalucia	62.42	40.83	48.76	12.87	53.94
2	Cataluna	70.30	100.00	80.31	24.80	81.72
3	Madrid	87.95	23.14	82.81	100.00	41.35
4	P. Valenciano	75.00	69.52	80.75	13.99	45.68
5	Galicia	55.73	46.57	31.69	10.27	55.82
6	Castilla-Leon	55.59	78.18	52.50	18.90	52.57
7	P. Vasco	79.25	26.62	68.82	20.83	100.00
8	Cast.- Mancha	50.93	43.30	62.17	16.31	41.03
9	Aragon	91.60	78.09	70.55	25.29	63.20
10	Asturias	66.55	52.13	34.77	31.65	73.94
11	Extremadura	43.78	61.04	51.73	14.40	68.92
12	Murcia	64.09	4.91	55.57	14.83	37.21
13	Baleares	81.02	4.43	100.00	31.00	27.08
14	Cantabria	100.00	81.29	36.14	20.28	96.73
15	Navarra	89.98	58.75	92.88	53.09	86.10
16	Rioja	65.71	2.32	72.80	14.20	62.93
17	Canarias	64.17	.50	37.38	17.10	24.62

Table 10 continued: Infrastructure Indicators for Categories A-L
Spain, 17 autonomous Regions
2nd Cross Section Year

		INDA02	INDB02	INDC02	INDD02	INDF02
1	Andalucia	35.76	56.14	34.41	80.06	42.00
2	Cataluna	52.13	91.35	88.27	99.12	57.20
3	Madrid	74.43	100.00	78.76	98.66	100.00
4	P. Valenciano	43.86	74.91	41.62	94.54	49.81
5	Galicia	45.70	50.53	83.05	71.60	40.25
6	Castilla-Leon	30.35	62.61	88.99	78.04	51.78
7	P. Vasco	79.33	84.94	88.34	100.00	62.57
8	Cast.- Mancha	20.30	57.06	58.64	77.11	16.58
9	Aragon	40.84	77.62	93.18	93.39	69.83
10	Asturias	49.73	70.20	100.00	89.50	62.67
11	Extremadura	14.56	49.16	87.21	61.86	28.84
12	Murcia	35.66	59.71	51.00	88.49	51.22
13	Baleares	81.40	90.03	42.98	68.14	33.58
14	Cantabria	57.18	69.79	35.34	88.49	53.95
15	Navarra	31.86	73.20	17.04	98.66	45.54
16	Rioja	33.83	72.33	13.94	96.62	32.14
17	Canarias	100.00	60.18	23.79	90.19	42.28

		INDG02	INDI02	INDJ02	INDK02	INDL02
1	Andalucia	60.38	29.61	69.74	14.31	42.93
2	Cataluna	70.97	64.35	94.77	23.42	74.97
3	Madrid	81.73	14.70	77.30	100.00	40.42
4	P. Valenciano	59.07	37.31	91.68	15.07	36.00
5	Galicia	54.46	35.59	55.22	16.23	78.90
6	Castilla-Leon	67.46	59.09	64.48	31.95	41.18
7	P. Vasco	79.03	12.91	100.00	16.66	100.00
8	Cast.- Mancha	54.90	47.53	73.17	18.12	37.36
9	Aragon	85.80	61.17	81.57	24.97	40.98
10	Asturias	73.44	40.48	52.40	28.10	70.71
11	Extremadura	52.15	54.95	63.72	15.50	60.62
12	Murcia	59.76	13.79	90.20	13.30	21.53
13	Baleares	76.67	20.76	89.70	31.30	44.03
14	Cantabria	100.00	100.00	64.56	21.38	67.42
15	Navarra	95.86	32.05	86.00	37.74	59.95
16	Rioja	60.50	19.83	84.00	14.30	37.82
17	Canarias	66.26	7.45	68.58	19.02	27.47

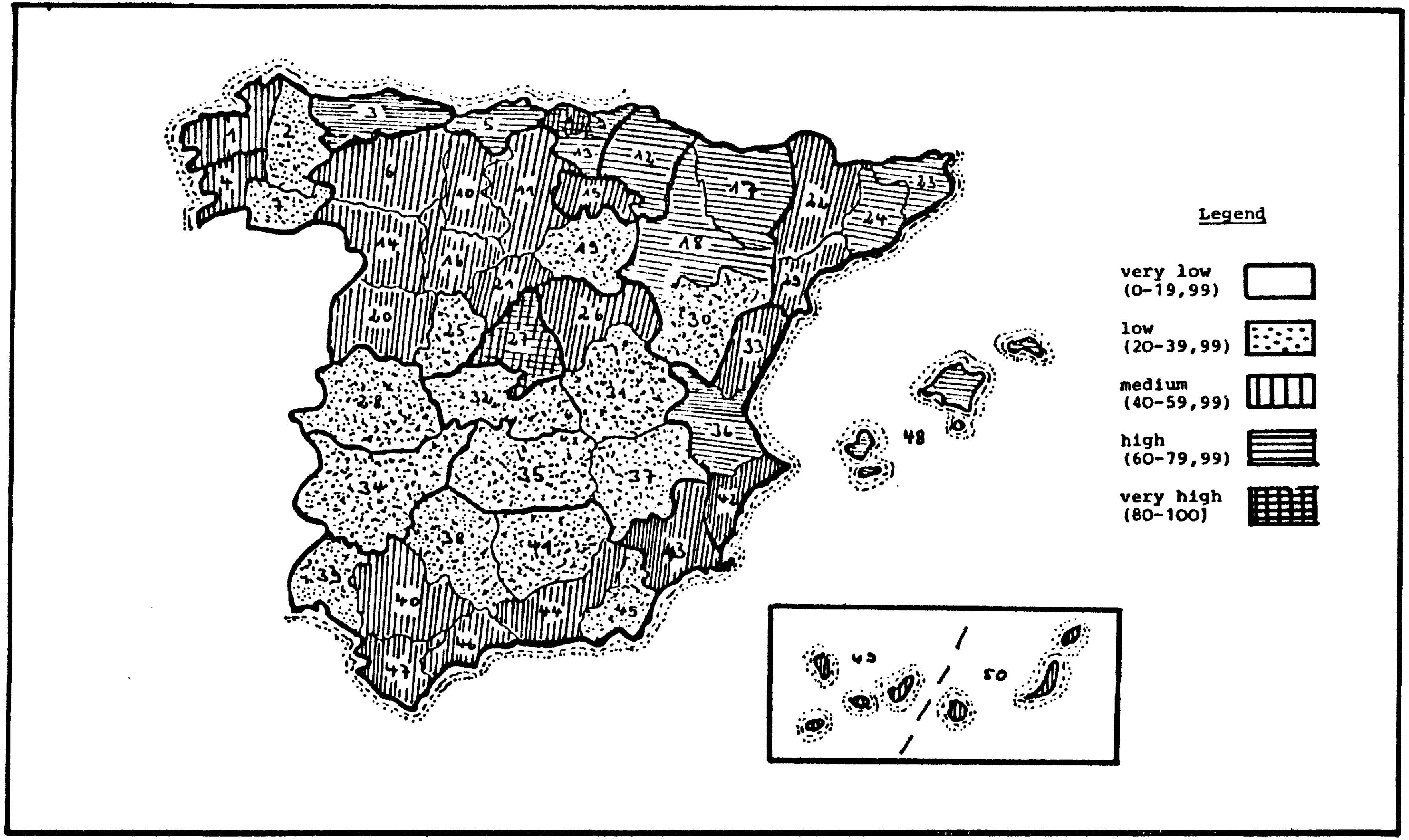
Table 10 continued: Aggregate Infrastructure Indicators INGG and INGP, 1st and 2nd Cross Section Years Spain, 17 autonomous Regions

	INGG01	INGG02	INGP01	INGP02
1 Andalucia	44.54	54.25	35.11	47.17
2 Cataluna	71.83	83.18	61.70	80.03
3 Madrid	100.00	100.00	100.00	100.00
4 P. Valenciano	57.26	61.62	47.61	58.38
5 Galicia	42.79	62.43	42.66	60.23
6 Castilla-Leon	53.18	66.80	50.20	62.17
7 P. Vasco	78.02	88.47	71.35	89.28
8 Castilla-La Mancha	39.46	48.90	28.27	37.23
9 Aragon	70.73	76.84	63.64	77.02
10 Asturias	66.74	77.54	65.75	78.16
11 Extremadura	38.72	51.05	27.07	41.86
12 Murcia	49.33	55.68	44.46	55.50
13 Baleares	63.75	71.07	62.46	65.18
14 Cantabria	63.35	70.39	52.99	60.02
15 Navarra	66.12	65.62	36.06	41.92
16 Rioja	49.31	50.05	34.22	36.98
17 Canarias	47.33	59.08	45.70	56.69

TABLE 11.: Maximum-Minimum-Ratios (MMR) and Coefficients of Variation (VC) for Infrastructure and Income Indicators Spain, 17 Autonomous Regions

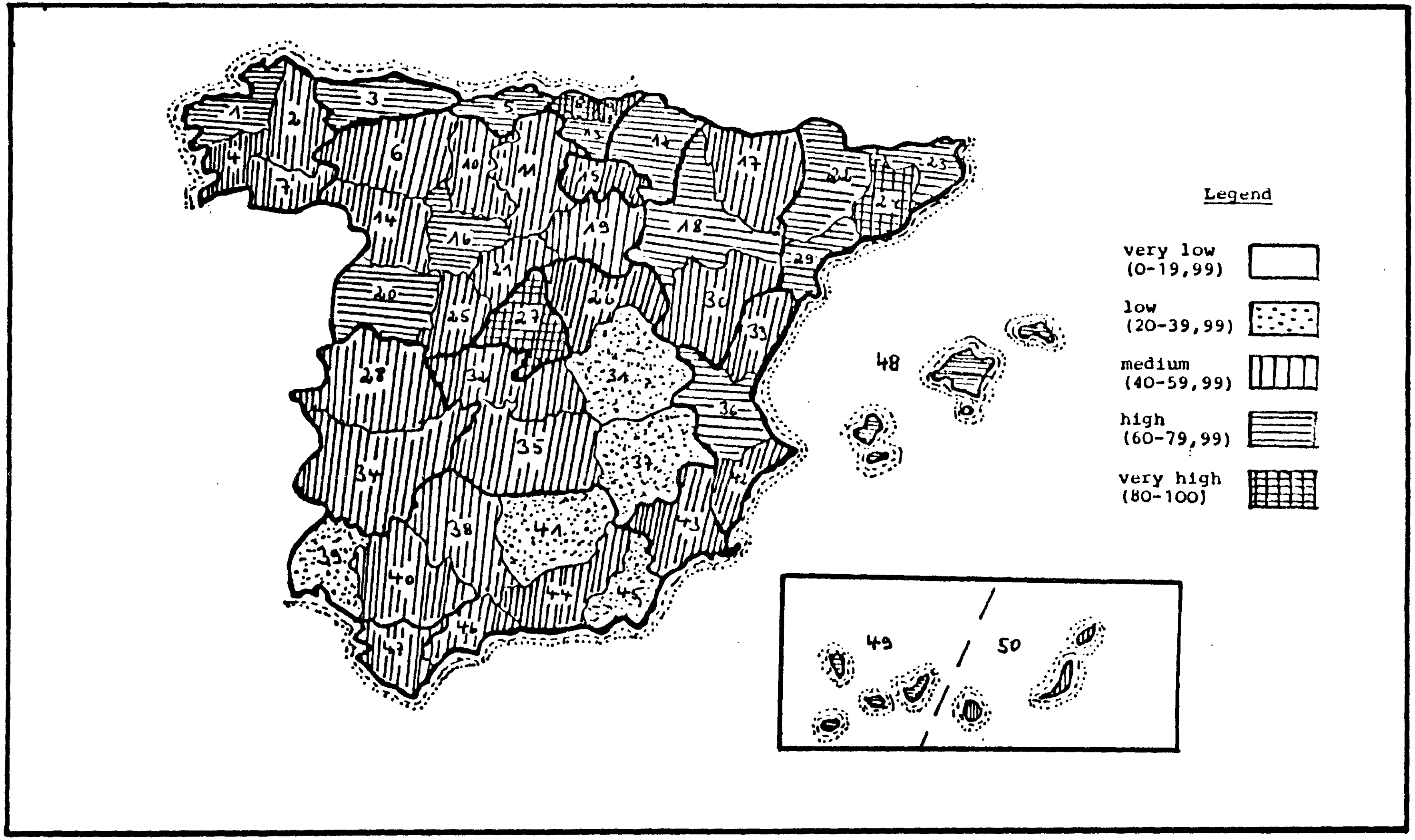
Categories	MMR		VC	
	1971	1979	1971	1979
A. Transportation	5.81	6.87	46.16	46.32
B. Communication	5.03	2.03	49.16	20.34
C. Energy Supply	5.81	7.17	43.31	47.55
D. Water Supply	2.61	1.62	27.91	13.26
F. Education	5.86	6.03	48.86	36.95
G. Health	2.28	1.92	21.46	19.78
I. Sport and Tourism	201.69	13.43	66.59	61.14
J. Social	3.16	1.91	32.79	17.99
K. Culture	9.73	7.52	81.26	76.28
L. Natural Endowment	4.06	4.65	37.02	39.10
INGG *)	2.58	2.04	26.41	20.79
INGP *)	3.69	2.70	34.99	28.83
GDP Per Capita	2.43	2.14	25.14	19.69
GDP p. Employed Pers.	2.29	2.01	21.52	16.53
Income Density	38.90	47.28	116.15	123.57

*) Indicator I is excluded from INGG and INGP



M A P 7

Geographical Distribution of Regional Infrastructure Endowment, 1971, Spain, 50 Provinces



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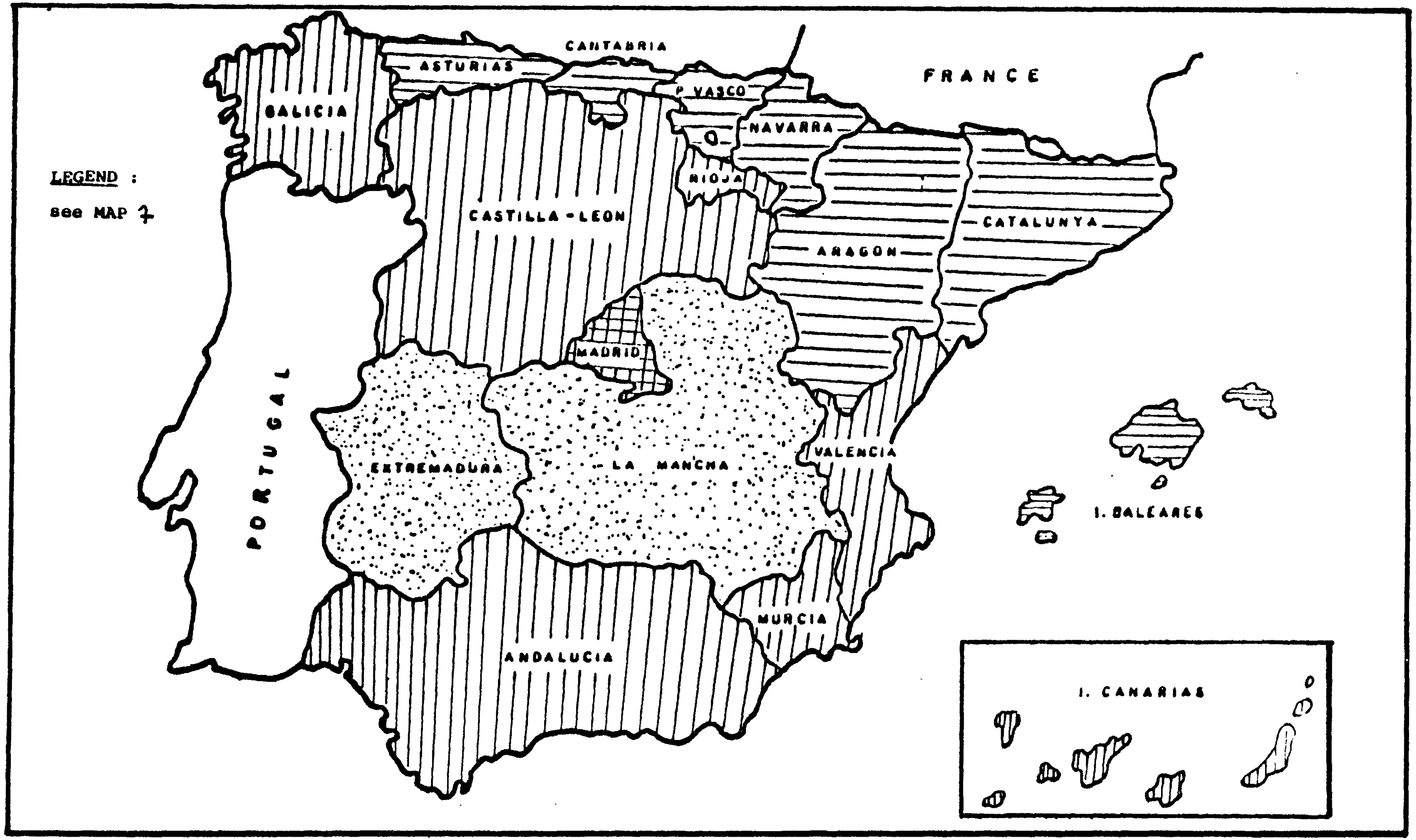
Geographical Distribution of Regional Infrastructure Endowment, 1979, Spain, 50 Provinces



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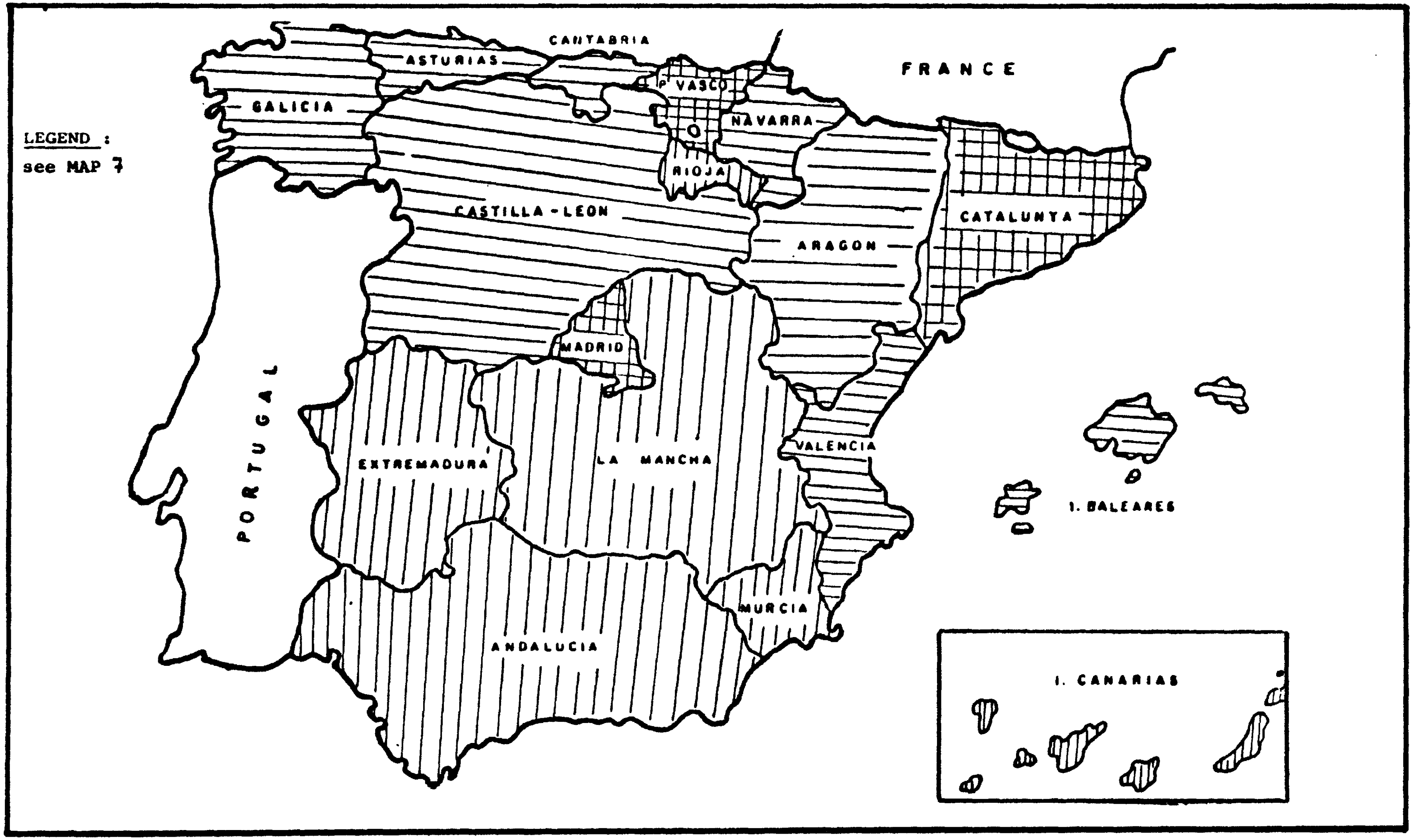
Geographical Distribution of Regional Infrastructure Endowment, 1971, Spain, 17 Autonomous Regions



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Geographical Distribution of Regional Infrastructure Endowment, 1979, Spain, 17 Autonomous Regions

IV. RESULTS OF THE REGRESSION ANALYSIS

A first simple test of the hypothesis that infrastructure determines the levels of potential income and employment, demonstrate that infrastructure has a statistically significant influence on the macroeconomic development indicators. With the exception of indicator I (Sport and Tourism) where the data are not sufficiently comparable, all other main category indicators have the expected positive sign and are significant in the majority of cases. The relationship between level of development and infrastructure categories is clearly seen from the test of absolute figures, but is much more pronounced if relative indicators are used. This supports the thesis that it is relative infrastructure equipment that determines regional development possibilities. In the production relevant categories like Transportation, Communication or Water Supply, infrastructure effects are larger and more significant compared with categories which are rather consumption oriented, like Health, Culture or Natural infrastructure. The influence of the aggregated indicator is almost always larger than the influence of any single category. The aggregated indicators are always significant, their sign is always positive and corresponds with the theoretical expectation.

V. INFRASTRUCTURE AS A CAPITAL INPUT IN A QUASI-PRODUCTION-FUNCTION

In analogy with the methodology applied for the Community-wide analysis, also in the case of Spain, modified Cobb-Douglas-Production Functions have been estimated. In these functions, the capital element is represented by the total infrastructure indicator whereas the available data on employment have been used as the labour input variable. The estimates show that this combination of exogenous variables yields an important improvement in the explanation of the endogenous variables.

The statistical measures obtained support the basic hypothesis of the potentiality factor approach. As in the case of the other countries, it seems reasonable to design a regional development strategy based on this approach which attaches a special importance to infrastructure.

VI. INFRASTRUCTURE IN A FULLY SPECIFIED POTENTIALITY FACTOR QUASI-PRODUCTION-FUNCTION

In conformity with the general methodology, fully specified quasi-production-functions have been estimated also for Spain. The potentiality factors are represented by indicators for location, agglomeration, sectoral economic structure and, last but not least, infrastructure. In addition, total population, total employment or total area have been included as indicators for regional size. A number of selected equations are presented in TABLE 12 for the 48 Provinces. As can be seen, the combination of these potentiality factors also yield significant results with relatively high coefficients of determination.

All regression coefficients with the exception of the agglomeration variable in case where the activity rate in the secondary and tertiary sector (EISP) is used as endogenous variable are significant at the 95% level and show the expected signs. The only exceptions are POPT, EMTO and FLGS. Contrary to what normally could have been expected that these indicators reflect economies of scale and, therefore, show a positive sign, they always have a negative influence. This is due to the fact, that the richer regions are small and the poorer regions large.

If one compares the relative contribution of the different exogenous variables, infrastructure explains a significant part of total dispersion especially in the case of the per capita income functions. The t-values of the coefficients are higher for the infrastructure indicator compared with the other variables. Infrastructure explains between 30 and 50%, the other variables share the explanation of the residual variance.

TABLE 12.: Estimation of relative Income and Employment Indicators in Fully Specified Quasi-Production Functions, 48 Provinces, 1st and 2nd Cross Section Years

Endogenous Variable	RSQA	Exogenous Variables
BPPOL1	.9047	INGGL1*+ ENTFKL*- POFLL1*+ POPTL1*- E%ISL1*+
BPPOL1	.9111	INGGL1*+ ENTFKL*- EMFLL1*+ POPTL1*- E%ISL1*+
BPFLL1	.9935	INGGL1*+ ENTFKL*- POFLL1*+ FLGSL1*- E%ISL1*+
BPFLL1	.9921	INGGL1*+ ENTFKL*- POFLL1*+ EMTOL1*- E%ISL1*+
BGPOL1	.8873	INGGL1*+ ENTFKL*- POFLL1*+ POPTL1*-
BGPOL1	.8864	INGGL1*+ ENTFKL*- EMFLL1*+ POPTL1*-
BGPOL1	.8844	INGGL1*+ ENTFKL*- POFLL1*+ EMTOL1*-
BGFLL1	.9891	INGGL1*+ ENTFKL*- POFLL1*+ FLGSL1*-
BGFLL1	.9888	INGGL1*+ ENTFKL*- POFLL1*+ EMTOL1*-
EGFLL1	.9919	INGGL1*+ ENTFKL*- POFLL1*+ FLGSL1*-
EISPL1	.8445	INGGL1*+ ENTFKL*- POFLL1 + FLGSL1*-
BPPOL2	.7942	INGGL2*+ ENTFKL*- POFLL2 + POPTL2*- E%ISL2*+
BPPOL2	.8093	INGGL2*+ ENTFKL*- EMFLL2*+ POPTL2*- E%ISL2*+
BPFLL2	.9915	INGGL2*+ ENTFKL*- POFLL2*+ FLGSL2*- E%ISL2*+
BPFLL2	.9901	INGGL2*+ ENTFKL*- POFLL2*+ EMTOL2*- E%ISL2*+
BGPOL2	.7977	INGGL2*+ ENTFKL*- POFLL2*+ POPTL2*-
BGPOL2	.7996	INGGL2*+ ENTFKL*- EMFLL2*+ POPTL2*-
BGPOL2	.7898	INGGL2*+ ENTFKL*- POFLL2*+ EMTOL2*-
BGFLL2	.9886	INGGL2*+ ENTFKL*- POFLL2*+ FLGSL2*-
BGFLL2	.9881	INGGL2*+ ENTFKL*- POFLL2*+ EMTOL2*-
EGFLL2	.9909	INGGL2*+ ENTFKL*- POFLL2*+ FLGSL2 -
EISPL2	.7419	INGGL2*+ ENTFKL*- POFLL2 + FLGSL2 -

Note: An asteric (*) indicates that regression coefficient is significant at the 95 % Level.

VII. IDENTIFICATION OF OVER- AND UNDERUTILIZATION REGIONAL DEVELOPMENT POTENTIALS

In order to identify over- or underutilized regional development potentials, two fully specified quasi-production-functions for the first and the second cross section years had been selected and used in order to estimate the hypothetical income per capita for the 48 provinces. These are the selected equations:

(1) BPPOY1= 0.666+544*INGGL1-.060*ENTFKL+.079*
*EMFLL1+.438*E%ISL1-.192*POPTL1

RSQA= .900513

(2) BPPOY2= 1.478+.367*INGGL2-.088*ENTFKL+.084*
*EMFLL2+.417*E%ISL2-.168*POPTL2

RSQA= .786651

These estimates are confronted in TABLE 13 with the actual income per capita figures. The deviations between the estimated and the actual values are expressed as percentage points (BPRES) in terms of the potential income figures BPPOY.

As can be seen, the fit of the two cross section functions is very good. The deviations, representing rates of over-/and underutilization, are located located inside a band of -13 to +10 percentage points (-15 to +28%) in the first and -18 to +15 percentage points (-19 to +24%) in the second cross section year [relative deviations in brackets].

The region with the lowest difference between the hypothetical and actual income in the first cross section year is Logrono (region number 15) and Santander in the second year (number 5). However, Logrono is to be found in the group with very strong overutilization in 1979, whereas Santander belongs to the group of highly overutilized regions in 1971. Also other regions seem to have experienced not small changes in their utilization during the period under investigation. Among them are Palencia (No. 10) and Almeria (No. 45). Badajoz (34) and Cordoba (38) changed into the direction of underutilization of potential. The most spectacular change is registered for Madrid: In 1971 Madrid can be qualified as having roughly "normally" utilized capacity with a deviation of -1.60%. However, in 1979, this province is the only one with an extreme overutilization of +19.18%.

In the Community-wide study, regions with an underutilized potential tend to have a relatively low income and regions with overutilized capacities a relatively high income per capita. The Spanish provinces show a similar picture: Among 14 regions shown in TABLE 13 as being relatively underutilized (i. e. greater than +6), 12 also have a below average income per capita. In contrast to this, among the relatively overutilized (this means: smaller than -6) 13 regions only 6 have an above average, but 7 a below average income. In the second year, the result is almost the same for the relatively underutilized areas: 10 regions with below average income are confronted with 3 beyond average income; as to the relatively overutilized ones, this relationship of 6:7 changes to 5:6. Whereas these results for the relatively underutilized regions are in line with the Community findings, this is no longer true for the relatively rich and relatively poor regions. In the Spanish case, there exist a considerable number of less well developed regions that show a relative overutilization of potential so that potentiality factors and among them infrastructure seem to be a bottleneck factor for future regional development.

VIII. CONCLUSIONS

Despite the strong differences in level of development, historical and sociological backgrounds, the potentiality factor approach has proved to represent a powerful tool of regional analysis. With the aid of an astonishing wealth of regional data that had been made available for the analysis, the potentiality factor approach is able to describe and to explain also disparities in regional development in Spain. To be sure, like in the case of the other member states, this approach has to be supplemented and deepened by a more detailed and region-specific analysis. But the results obtained support the basic hypothesis that infrastructure plays an important role in regional development also in Spain and that a well designed infrastructure policy can help to reduce interregional disparities inside Spain and through this between Spanish regions and the regions of the 10 member countries of the actual European Community.

TABLE 13.: Relative Rates of Under- and Overutilization in Terms of GDP per Capita, 48 Provinces

	BPPON1	BPPOY1	BPRES1	BPRER1
1 La Coruna	48.88	46.28	-2.61	-5.33
2 Lugo	38.32	35.95	-2.36	-6.17
3 Oviedo	69.91	62.56	-7.35	-10.52
4 Pontevedra	49.57	48.26	-1.32	-2.66
5 Santander	76.10	72.47	-3.64	-4.78
6 Leon	53.34	48.25	-5.10	-9.55
7 Orense	35.26	35.20	-.06	-.18
8 Vizcaya	88.33	95.38	7.05	7.98
9 Guipuzcoa	96.96	93.10	-3.86	-3.98
10 Palencia	56.02	61.16	5.14	9.17
11 Burgos	66.96	56.91	-10.05	-15.00
12 Navarra	75.84	73.44	-2.40	-3.17
13 Alava	100.00	93.28	-6.72	-6.72
14 Zamora	43.97	45.82	1.85	4.21
15 Logrono	68.05	68.21	.16	.23
16 Valladolid	71.28	69.47	-1.81	-2.54
17 Huesca	76.95	69.05	-7.90	-10.27
18 Zaragoza	67.30	72.10	4.79	7.12
19 Soria	55.38	57.43	2.05	3.70
20 Salamanca	52.95	61.99	9.04	17.08
21 Segovia	56.90	61.83	4.93	8.66
22 Lerida	76.97	69.22	-7.75	-10.07
23 Gerona	84.35	89.29	4.93	5.85
24 Barcelona	88.52	92.62	4.10	4.63
25 Avila	39.23	44.66	5.43	13.84
26 Guadaljara	60.81	64.68	3.86	6.35
27 Madrid	84.86	83.51	-1.35	-1.60
28 Caceres	36.98	42.13	5.15	13.94
29 Tarragona	75.80	77.27	1.47	1.94
30 Teruel	52.77	49.82	-2.95	-5.60
31 Cuenca	43.42	42.71	-.71	-1.63
32 Toledo	51.65	47.11	-4.55	-8.80
33 Castellon	64.70	63.01	-1.69	-2.61
34 Badajoz	40.15	36.04	-4.11	-10.24
35 Ciudad Real	45.61	40.27	-5.34	-11.71
36 Valencia	63.70	66.49	2.80	4.39
37 Albacete	43.23	44.10	.87	2.02
38 Cordoba	46.68	42.67	-4.01	-8.59
39 Huelva	53.25	48.16	-5.09	-9.57
40 Sevilla	52.16	51.59	-.57	-1.09
41 Jaen	36.29	38.57	2.28	6.30
42 Alicante	62.20	63.01	.31	1.30
43 Murcia	52.20	55.37	3.17	6.07
44 Granada	36.54	46.74	10.20	27.90
45 Almeria	41.60	44.91	3.31	7.95
46 Malaga	48.73	52.40	3.67	7.54
47 Cadiz	51.02	54.15	3.12	6.12
48 Baleares	94.54	81.32	-13.22	-13.99

Table 13 continued

		BPPON2	BPPOY2	BPRES2	BPRER2
1	La Coruna	60.15	62.35	2.19	3.65
2	Lugo	51.97	44.54	-7.44	-14.31
3	Oviedo	71.00	64.70	-6.30	-8.87
4	Pontevedra	60.08	57.00	-3.08	-5.12
5	Santander	72.94	72.77	-.16	-.22
6	Leon	60.62	56.74	-3.88	-6.40
7	Orense	45.66	48.35	2.69	5.89
8	Vizcaya	77.16	92.48	15.32	19.85
9	Guipuzcoa	82.57	95.13	12.56	15.21
10	Palencia	73.48	66.09	-7.39	-10.06
11	Burgos	70.14	64.26	-5.88	-8.39
12	Navarra	77.44	73.87	-3.57	-4.61
13	Alava	100.00	94.15	-5.85	-5.85
14	Zamora	51.25	53.51	2.26	4.41
15	Logrono	79.28	71.95	-7.33	-9.24
16	Valladolid	73.51	76.63	3.11	4.24
17	Huesca	84.64	72.97	-11.67	-13.78
18	Zaragoza	76.30	73.53	-2.77	-3.63
19	Soria	59.58	66.33	6.75	11.33
20	Salamanca	61.21	68.16	6.95	11.35
21	Segovia	61.93	63.24	1.31	2.11
22	Lerida	79.85	75.43	-4.42	-5.54
23	Gerona	96.85	93.17	-3.68	-3.80
24	Barcelona	91.89	107.24	15.34	16.70
25	Avila	48.43	59.29	10.86	22.41
26	Guadaljara	71.20	72.02	.81	1.14
27	Madrid	94.99	76.77	-18.22	-19.18
28	Caceres	47.68	52.10	4.42	9.26
29	Tarragona	87.97	87.24	-.73	-.83
30	Teruel	62.68	64.76	2.08	3.32
31	Cuenca	53.70	51.07	-2.63	-4.90
32	Toledo	57.36	58.35	.99	1.73
33	Castellon	72.41	73.27	.86	1.19
34	Badajoz	42.17	47.54	5.36	12.72
35	Ciudad Real	54.68	52.91	-1.77	-3.24
36	Valencia	75.86	67.42	-8.44	-11.13
37	Albacete	52.37	53.59	1.21	2.32
38	Cordoba	48.34	54.19	5.85	12.10
39	Huelva	64.24	54.68	-9.56	-14.88
40	Sevilla	57.42	55.77	-1.65	-2.87
41	Jaen	43.14	46.55	3.40	7.89
42	Alicante	70.11	66.55	-3.56	-5.08
43	Murcia	61.33	60.30	-1.03	-1.67
44	Granada	44.04	54.43	10.38	23.58
45	Almeria	53.25	49.57	-3.68	-6.90
46	Malaga	55.17	61.97	6.80	12.33
47	Cadiz	53.64	61.52	7.88	14.70
48	Baleares	91.39	83.08	-8.31	-9.09

PART TWO:

SUMMARY CASE STUDY PORTUGAL

I. REGIONAL ORGANIZATION OF PORTUGAL

In Portugal, too, the analysis of contribution of infrastructure to regional development has to be based on administratively delimitated areas and cannot start from functional regions. The traditional regional classification consists of 18 districts and the two autonomous isle-regions Acores and Madeira.

The Portuguese regional breakdown is represented in MAP 1 and TABLE 2. The larger part of the analysis deals with this regional classification. In some cases, an additional investigation has been carried through for another regional breakdown, namely four main regions and eight subregions.

II. AVAILABILITY OF REGIONAL DATA

In line with the general approach adopted, it was tried to obtain data for the same development and infrastructure indicators. However, it had not been possible to cover also the two autonomous regions Acores and Madeira because those data are not provided by the National Statistical Office and are also not always published in the statistical publications of the two regions.

As far as the development indicators are concerned, information on GDP and on sectoral employment was only available for the first cross section year 1970. This implies a serious restriction for the analysis.

III. REGIONAL DEVELOPMENT DISPARITIES IN PORTUGAL

The first part of the analysis deals with a description of regional development levels, whereas the second part covers infrastructure data. In the third part of the analysis, quasi-production-functions where estimated in order to quantify the influence of infrastructure on income or employment. TABLE 1 contains a list of the most important indicators used for the analysis.

M A P 1

Regional Breakdown, Portugal:
18 Districts

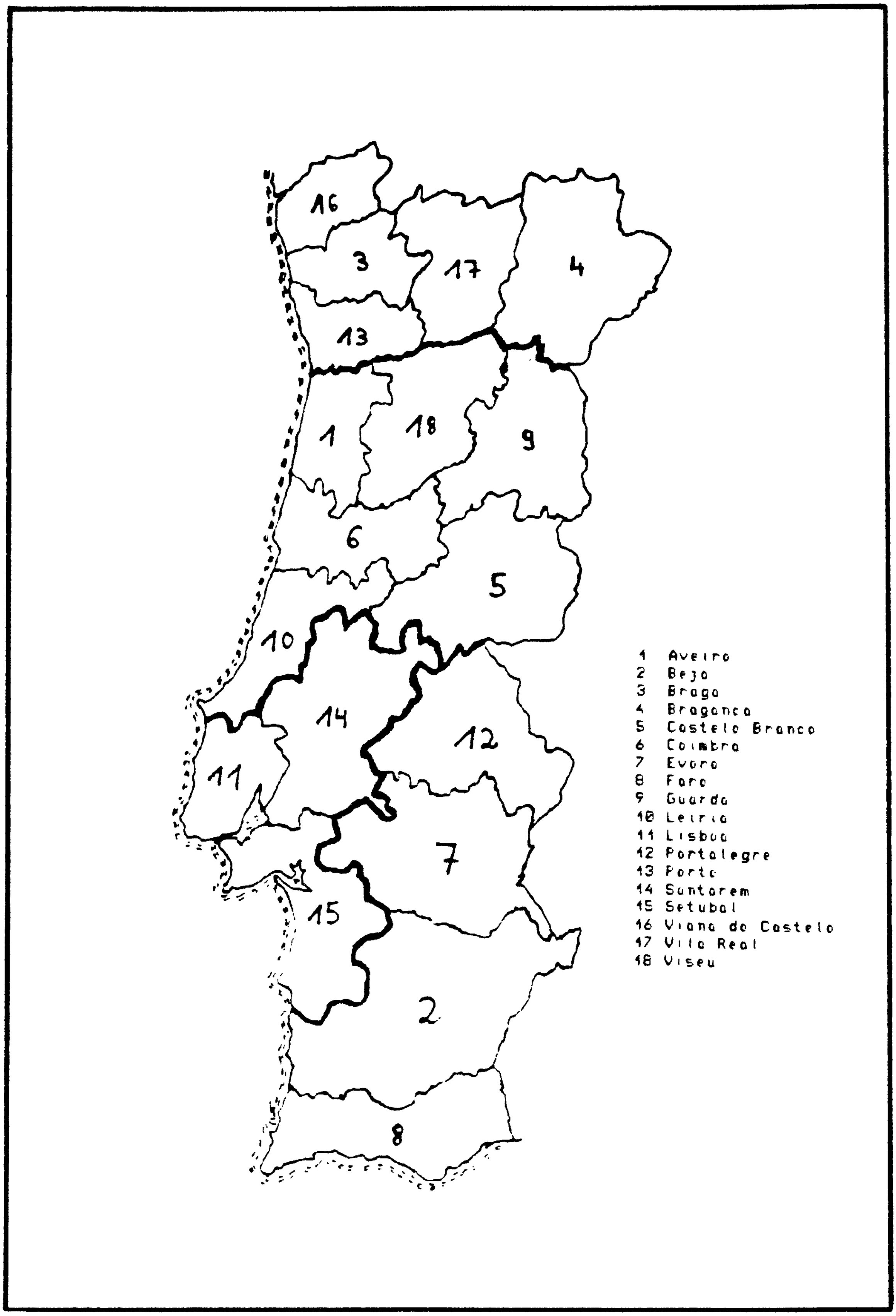


TABLE 1.: Selected Basic Indicators, Portugal

INCOME INDICATORS

Key		Description
BIPM		Domestic product (GDP) (PIB, 1000 Esc.)
BPPO	*)	GDP per capita (1000 Esc./per person)
BPEM	*)	GDP per employed person (1000 Esc./per employed person)
BIPA		GDP in agriculture (PIB, 1000 Esc.)
BIPI		GDP in industry sector (PIB, 1000 Esc.)
BIPS		GDP in service sector (PIB, 1000 Esc.)
BIIS		GDP (PIB, 1000 Esc.) in Industry and Service Sector
BPFL	*)	GDP per area (General income density) (1000 Esc./qkm)
BISF		GDP in industry and service sectors per area (Special income density) (1000 Esc./ qkm)
BGEG		GDP in industry and service sectors per employed person in these sectors (1000 Esc. per employed person)

EMPLOYMENT INDICATORS

Key	Description
EMTO	Total employment
ERWQ	Labour force participation rate
EISP	Labour force participation rate in industry and service sectors
EMFL	General employment density (employed persons per area)
EGFL	Special employment density in industry and service sectors

*) If 'N' appears as fifth digit in these keys, normalized figures (in % of maximum region are calculated.

Table 1 continued

INFRASTRUCTURE INDICATORS	
INDA	Transportation
INDB	Communication
INDC	Energy supply
INDD	Water supply
INDE	Environment
INDF	Education
INDG	Health
INDI	Sportive and touristic facilities
INDJ	Social infrastructure
INDK	Cultural infrastructure
INDL	Natural endowment
INGG	Aggregate infrastructure indicator for all categories
INGP	Aggregate infrastructure indicator for production relevant categories
OTHER POTENTIALITY FACTORS	
POPT	Total population
FLGS	Area (Surface) in qkm
POFL	Population density (Agglomeration) (also EMFL, EGFL) (Population or employed persons per qkm)
ENTF	Location indicator (Distance of regional Capitals to Lisboa in km)
B%IS	Sectoral structure parameter (Share of industry and service sectors in GDP)
E%IS	Employment structure parameter (Share of employed persons in industry and service sectors in EMTO)

III.1. DEVELOPMENT DISPARITIES ON DISTRICT LEVEL

TABLE 2 gives an overview on basic development indicators. According to this Table, there are quite similar disparities for income per capita and income per employed person. The least developed region, in both cases Viana do Castelo, only reaches about one quarter of the highest income regions Setubal respectively Lisboa. With a maximum-minimum-ratio (MMR) of 3.96 (BPPO) and 4.09 (BPEM) and weighted coefficients of variation of 51.19 respectively 43.35, Portugal is the country with the largest interregional income disparities compared with the ten member states of the European Community and Spain [cf. TABLE 5]. Compared with Spain, even three regions out of eighteen lie below the minimum value of 35.26 for Spain in 1971.

Income density (BPFL) shows even larger discrepancies with an MMR of 64.10. However, here the disparity is larger in Spain with a MMR of 74.01. It has to be considered that the Portuguese regional figures oscillate around a significantly lower national average. The cartographic presentation of the regional income distribution for the 18 Portuguese districts in 1970 in MAP 2 clearly shows the dominant position of Lisboa and Setubal. Porto, the industrialized region in Northern Portugal, follows at a large distance.

TABLE 3 stresses differences in sectoral structure. E%IS70 represents the indicator for employment structure. Braganca has the highest agricultural share (73%), Lisboa the lowest (8%). That Lisboa has an extremely low agricultural share is due to its highly urbanized character. Even if only half of all Portuguese regions with the highest agricultural share (Braganca to Castelo Branco) are considered, the lowest figure is still 51%. This demonstrates the importance of agriculture for employment and for regional development in Portugal outside the capital region.

If economic structure is measured with the aid of the percentage contribution of the three sectors agriculture, industry and services to GDP, differences between the sectors are less pronounced. Beja is now the region having the lowest non-agrarian share with 39.17%. If one compares again half of all Portuguese regions with a low agricultural share, the figure for Viseu (35%) is not far away. Braganca with about 40% agricultural share in value added has a significantly lower figure compared with its employment position.

TABLE 4 presents information on degrees of agglomeration of Portuguese districts. Population density ranges from 18 respectively 20 up to 577 in 1970, and up to 758 in 1981. There are only two regions with high population density, Lisboa and Porto. Two others, Braga and Aveiro in the next group have already density figures which are only about half as large, followed by three other regions with roughly a density of 100. TABLE 5 shows the MMR and the unweighted coefficients of variation (VC) for the indicators used.

TABLE 2.: Area, Population and Population Density, Portugal, 18 Districts

		FLGSKM	POPT70	POPT79	POFL70	POFL79
1	Aveiro	2810	542797	638600	193	227
2	Beja	10223	202447	184700	20	18
3	Braga	2672	611854	719900	229	269
4	Braganca	6609	177945	196300	27	30
5	Castelo Branco	6679	252241	244000	38	37
6	Coimbra	3948	402208	434300	102	110
7	Evora	7357	175284	175800	24	24
8	Faro	4960	267122	308800	54	62
9	Guarda	5519	210373	216300	38	39
10	Leiria	3519	378848	415800	108	118
11	Lisboa	2758	1592463	2019700	577	732
12	Portalegre	6066	145077	137600	24	23
13	Porto	2395	1306352	1575000	545	658
14	Santarem	6734	432466	460300	64	68
15	Setubal	5100	465432	626200	91	123
16	Viana Castelo	2256	250758	261900	111	116
17	Vila Real	4329	264803	287300	61	66
18	Viseu	5004	410506	435300	82	87

Table 2 continued: Employment and Income, Portugal,18 Districts

	EMTO70	BPPO70	BPFL70	BPEM70
1 Aveiro	194100.	21485.	4150.	60082.
2 Beja	78925.	14679.	291.	37654.
3 Braga	217195.	13974.	3200.	39365.
4 Braganca	55810.	13700.	369.	43681.
5 Castelo Branco	89340.	12893.	487.	36402.
6 Coimbra	137105.	19003.	1936.	55746.
7 Evora	71965.	15664.	373.	38153.
8 Faro	103110.	12844.	692.	33275.
9 Guarda	72270.	9957.	380.	28985.
10 Leiria	131005.	18488.	1990.	53466.
11 Lisboa	640330.	32368.	18689.	80498.
12 Portalegre	58370.	15404.	368.	38286.
13 Porto	482880.	19674.	10731.	53224.
14 Santarem	153230.	17071.	1096.	48179.
15 Setubal	192435.	33045.	3016.	79924.
16 Viana do Castelo	106375.	8346.	928.	19673.
17 Vila Real	80850.	9067.	555.	29696.
18 Viseu	134350.	14478.	1188.	44238.

Table 2 continued: Sectoral and Employment Structure and Labour Force Participation Rate, Portugal, 18 Districts

	B%IS70	E%IS70	ERWQ70
1 Aveiro	82.71	71.83	35.76
2 Beja	39.17	32.29	38.99
3 Braga	79.79	66.88	35.50
4 Braganca	60.17	26.74	31.36
5 Castelo Branco	59.70	49.14	35.42
6 Coimbra	80.33	57.98	34.09
7 Evora	42.71	47.63	41.06
8 Faro	70.56	54.95	38.60
9 Guarda	51.15	37.69	34.35
10 Leiria	74.94	55.82	34.58
11 Lisboa	95.24	91.82	40.21
12 Portalegre	46.29	41.02	40.23
13 Porto	91.51	87.75	36.96
14 Santarem	65.56	56.39	35.43
15 Setubal	89.77	78.74	41.35
16 Viana do Castelo	51.58	40.25	42.42
17 Vila Real	51.19	29.97	30.53
18 Viseu	65.29	34.49	32.73

MAP 2

Geographical Distribution of Regional Per Capita Incomes, 1970, Portugal, 18 Districts

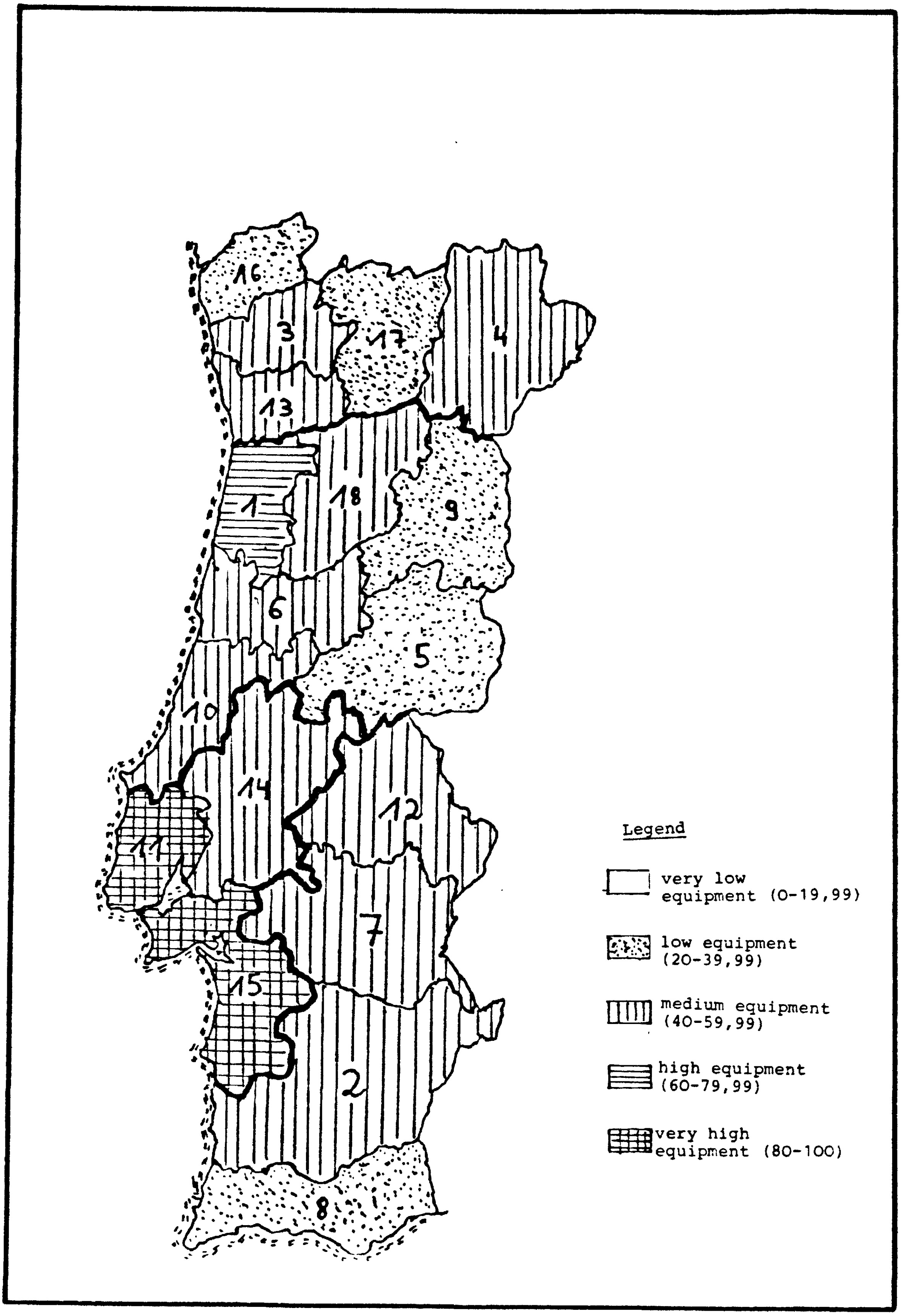


TABLE 3.: Ranking of Structural Indicators E%IS and B%IS 1970, Portugal, 18 Districts

	E%IS70		B%IS70
4 Braganca	26.74	2 Beja	39.17
17 Vila Real	29.97	7 Evora	42.71
2 Beja	32.29	12 Portalegre	46.29
18 Viseu	34.49	9 Guarda	51.15
9 Guarda	37.69	17 Vila Real	51.19
16 Viana do Castelo	40.25	16 Viana do Castelo	51.58
12 Portalegre	41.02	5 Castelo Branco	59.70
7 Evora	47.63	4 Braganca	60.17
5 Castelo Branco	49.14	18 Viseu	65.29
8 Faro	54.95	14 Santarem	65.56
10 Leiria	55.82	8 Faro	70.56
14 Santarem	56.39	10 Leiria	74.94
6 Coimbra	57.98	3 Braga	79.79
3 Braga	66.88	6 Coimbra	80.33
1 Aveiro	71.83	1 Aveiro	82.71
15 Setubal	78.74	15 Setubal	89.77
13 Porto	87.75	13 Porto	91.51
11 Lisboa	91.82	11 Lisboa	95.24

TABLE 4.: Agglomeration Indicator POFL 1970,1979, and 1981, Portugal, 18 Districts

	POFL70	POFL79	POFL81
1 Aveiro	193.17	227.26	221.98
2 Beja	19.80	18.07	18.23
3 Braga	228.99	269.42	262.25
4 Braganca	26.92	29.70	27.45
5 Castelo Branco	37.77	36.53	34.80
6 Coimbra	101.88	110.01	112.18
7 Evora	23.83	23.90	24.36
8 Faro	53.86	62.26	65.09
9 Guarda	38.12	39.19	37.16
10 Leiria	107.66	118.16	120.15
11 Lisboa	577.40	732.31	747.51
12 Portalegre	23.92	22.68	23.18
13 Porto	545.45	657.62	647.52
14 Santarem	64.22	68.35	67.62
15 Setubal	91.26	122.78	127.27
16 Viana do Castelo	111.15	116.09	112.38
17 Vila Real	61.17	66.37	60.67
18 Viseu	82.04	86.99	84.09

TABLE 5.: Maximum-Minimum-Ratios (MMR) and Unweighted Coefficients of Variation (VC) of Selected Indicators Used, Portugal, 18 Districts

Indicators	MMR	VC
INCOME		
BPPO70	3.96	39.32
BPEM70	4.09	34.65
BPFL70	64.29	162.35
STRUCTURE		
BP%A70	12.77	50.86
BP%I70	5.79	48.53
BP%S70	3.98	42.54
B%IS70	2.43	25.58
EMPLOYMENT		
ERWQ70	1.39	9.36
E%IS70	3.43	35.70
EMFL70	30.07	126.41
OTHER INDICATORS		
FLGSKM	4.53	41.56
POPT70	10.98	84.42
POFL70	29.16	121.64

III.2. DISPARITY OF DEVELOPMENT INDICATORS FOR AN ALTERNATIVE REGIONAL CLASSIFICATION

At the time of the study, the discussion in Portugal as to a new regional system had not come to an end. Although, therefore, no official new regional classification exists, some of the proposals contain a system of four main regions which are again subdivided into two subregions so that a total of eight subregions is obtained. Each main region is divided into a costal region and an interior region. These four main regions could be considered to be roughly comparable to the average size of other European regions.

This regional classification was also used in order to show development disparities between the generally richer and better developed costal areas and the interior regions that especially in the North of Portugal are of a mountainous character. The allocation of the 18 districts to the four main and the eight subregions is shown in TABLE 6. Information on interregional income distribution for these regions on the basis of the already used indicators for income per capita (BPPO), income per employed person (BPEM) and income density (BPFL) is given in TABLE 7. As could be expected, disparities in income and employment are significantly reduced if the 18 districts are aggregated to the larger new regions. Lisboa Litoral has again the highest income per capita with 32.521 Escudos (=100). The lowest income region is Norte Interior with a value of only 33.61% of this maximum figure. Disparities are reduced in terms of MMR to 2.98 and 46.88 in terms of weighted coefficients of variation for the eight subregions. If the four main regions are considered, disparities are reduced still farther to 2.07 (MMR) and 33.56 (weighted coefficient of variation). Lisboa maintains its top position; the lowest income region is now Sul, the Southern part of Portugal with a percentage of 48.30 of Lisboa.

With those disparity measures for the four main regions, the internal income disparities in Portugal are lower than e.g. in Italy. However, the average national income per capita is much lower than in Italy.

TABLE 6.: Regional Organization of Portugal

Districts	Main Regions	Subregions
Braga Porto Viana do Castelo Braganca Vila Real	1. Norte Braga, Porto, V. d. Castelo, Braganca, Vila Real	1. Norte Litoral Braga, Porto, V. d. Castelo 2. Norte Interior Braganca, V. Real
Aveiro Coimbra Leiria Castelo Branco Guarda Viseu	2. Centro Aveiro,Coimbra Leiria, C. Branco, Guarda, Viseu	3. Centro Litoral Aveiro, Coimbra Leiria 4.Centro Interior C. Branco, Guarda, Viseu
Lisboa Setubal Santarem	3. Lisboa Lisboa, Setubal Santarem	5. Lisboa Litoral Lisboa, Setubal 6.Lisboa Interior Santarem
Faro Beja Evora Portalegre	4. SUL Faro, Beja, Evora, Portalegre	7. Sul Litoral Faro 8. Sul Interior Beja, Evora, Portalegre

TABLE 7.: Income Indicators for Main and Subregions in Portugal

Main Regions		Subregions	
	BPPON1		BPPON1
4 Sul, Evora	48.30	2 Norte Interior	33.61
1 Norte, Porto	52.85	7 Sul Litoral (Faro)	39.49
2 Centro, Coimbra	57.36	4 Centro Interior	39.76
3 Lisboa, Lisboa	100.00	8 Sul Interior	46.77
		1 Norte Litoral	51.52
		6 Lisboa Interior	52.49
		3 Centro Litoral	61.11
		5 Lisboa Litoral	100.00
MMR :	2.07	MMR :	2.98
weighted Coeff. of Var.:	33.56	weighted Coeff. of Var.:	46.88
	BPFLN1		BPFLN1
4 Sul, Evora	7.81	8 Sul Interior	3.95
2 Centro, Coimbra	26.87	2 Norte Interior	5.19
1 Norte, Porto	44.29	4 Centro Interior	7.71
3 Lisboa, Lisboa	100.00	7 Sul Litoral (Faro)	8.12
		6 Lisboa Interior	12.87
		3 Centro Litoral	30.06
		1 Norte Litoral	58.27
		5 Lisboa Litoral	100.00
MMR :	12.80	MMR :	25.32
weighted Coeff. of Var.:	76.91	weighted Coeff. of Var.:	113.51
	BPEMN1		BPEMN1
4 Sul, Evora	48.35	7 Sul Litoral (Faro)	41.40
1 Norte, Porto	57.94	2 Norte Interior	44.06
2 Centro, Coimbra	65.80	8 Sul Interior	47.29
3 Lisboa, Lisboa	100.00	4 Centro Interior	47.47
		1 Norte Litoral	56.08
		6 Lisboa Interior	59.95
		3 Centro Litoral	70.83
		5 Lisboa Litoral	100.00
MMR :	2.07	MMR :	2.42
weighted Coeff. of Var.:	28.91	weighted Coeff. of Var.:	38.65

IV. INFRASTRUCTURE EQUIPMENT OF PORTUGUESE DISTRICTS AND REGIONS

IV.1. METHODOLOGY AND DATA BASE

Due to the generous help obtained from many institutions and individuals in Portugal, it was possible to collect a relative large number of infrastructure indicators for the present study. For the categories Transportation, Communication, Energy Supply, Water Supply, Education and Health, the density of information is similar compared with the main study for the ten member countries.

IV.2. MAIN RESULTS OF THE INFRASTRUCTURE ANALYSIS FOR 18 DISTRICTS

The indicator values for the ten main categories, for the aggregate infrastructure indicator INGG and the production oriented indicator INGP are presented in TABLE 8 and 9 for both cross sections years. Indicator I (Sports and Tourism) could not be used for the analysis because of missing data for the districts Braga, Braganca and Vila Real. Category K was ommitted because no data at all is available.

In the first cross section year, regional infrastructure equipment is clearly dominated by Lisboa. The capital region shows for five of the ten main categories the maximum equipment indicator of 100.

The dominant position of Lisboa as to infrastructure equipment in the first cross section year can also be judged by the fact that the next best equipped region, Coimbra, reaches only a figure of 60.19. End of the ranking scale is Braganca that especially due to the low indicator for J (Social Facilities) has only 17.72. A group of the less well equipped districts with indicator values below 30 comprises Beja, Guardo, Viana do Castelo, Vila Real and Viseu. In general, all these regions show equipment figures for almost all main categories.

A marked change in the picture as to infrastructure equipment is obtained with the aid of the aggregate infrastructure indicator for the second cross section year. Lisboa is still the top region, but now only two main categories, F (Education) and J (Social) have the maximum figure of 100, whereas other districts occupy the top place for the other main categories. As to Transportation, it is Porto which already in the first cross section year ranked second. Portalegre with only 76% of maximal communication equipment in the first year is now at the top in the second. Energy Supply (C) is maximal in Braganca in both Years. Coimbra is equal to 100 for Education (F) and Health (G) in the 1st Year, but looses this position in F to Lisboa. As to D (Water Supply) and E (Environmental Infrastructure), the best region is Setubal, previously placed second. Relative important changes also can be observed for the categories D (Water Supply) an J (Social Infrastructure). The distance between the best and the worst equipped region is drastically reduced. As to D, the span decreases from 100:14.41 to 100:39.61. This can be interpreted as being caused by the improvement in Water Supply especially in the worst equipped Portuguese regions Viseu, Vila Real and Braga.

The measures of dispersion MMR and VC for the infrastructure indicators are presented in TABLE 10. In order to allow comparisons, also income indicators are shown in this Table for the first cross section year. If one compares the two cross section years, a general tendency to level out equipment differences can be seen. This is especially true for the aggregate indicator, but also for a number of main category indicators. The strong disparities as to category A remain roughly constant, but increase slightly for categorie G and show a decreasing tendency for other categories. As mentioned already, category D shows a strong leveling effect whereas the improvement in equipment in category J are distorted by the figures for Branganca. A cartographic presentation of the disparities for the aggregate indicator INGG is MAP 3 and 4.

TABLE 8.: Infrastructure Indicator Categories A-L for 18 Districts, 1st Cross Section Year

		INDA01	INDB01	INDC01	INDD01	INDE01
1	Aveiro	43.28	65.84	31.03	21.14	46.51
2	Beja	9.71	54.33	8.70	31.57	23.89
3	Braga	28.68	37.43	37.70	18.85	44.01
4	Braganca	15.28	27.79	100.00	27.58	16.76
5	Castelo Branco	12.08	55.50	18.31	31.00	34.17
6	Coimbra	29.87	64.58	34.97	31.06	40.28
7	Evora	10.12	75.07	5.31	51.88	45.92
8	Faro	73.41	66.15	8.02	46.52	50.97
9	Guarda	14.10	45.92	23.40	25.09	22.25
10	Leiria	24.38	59.79	40.17	26.01	44.32
11	Lisboa	100.00	100.00	68.89	100.00	100.00
12	Portalegre	12.90	75.78	15.34	54.07	47.31
13	Porto	93.84	70.91	79.40	50.89	62.67
14	Santarem	17.42	60.04	52.35	34.33	48.14
15	Setubal	44.59	78.43	27.75	86.08	86.11
16	Viana do Cast.	24.85	36.72	14.02	17.88	29.13
17	Vila Real	16.66	33.68	28.50	18.38	15.69
18	Viseu	21.31	38.12	29.18	14.41	25.39

		INDF01	INDG01	INDI01	INDJ01	INDL01
1	Aveiro	6.04	31.01	5.66	13.27	21.49
2	Beja	9.67	34.59	47.65	5.75	52.61
3	Braga	11.55	33.10	8.52	16.22	36.27
4	Braganca	15.05	34.25	.13	.11	23.94
5	Castelo Branco	14.78	41.57	19.43	26.29	27.15
6	Coimbra	100.00	100.00	85.31	43.71	43.93
7	Evora	21.95	81.33	2.29	14.18	86.84
8	Faro	15.55	38.97	74.40	12.12	7.59
9	Guarda	16.22	36.50	2.54	7.88	23.75
10	Leiria	11.74	77.45	75.75	25.78	34.75
11	Lisboa	92.20	81.42	38.10	100.00	30.22
12	Portalegre	16.37	80.04	.15	16.73	78.11
13	Porto	35.34	50.38	17.62	42.81	10.08
14	Santarem	16.69	44.08	1.55	17.38	63.80
15	Setubal	10.70	24.17	100.00	31.54	80.46
16	Viana do Cast.	8.79	31.41	11.11	3.93	100.00
17	Vila Real	15.14	29.37	1.01	13.19	87.69
18	Viseu	11.84	39.33	18.34	12.79	41.35

Table 8 continued: Infrastructure Indicator Categories A-L for 18 Districts, 2nd Cross Section Year

		INDA02	INDB02	INDC02	INDD02	INDE02
1	Aveiro	50.03	67.61	35.29	60.33	41.00
2	Beja	9.64	67.64	7.86	62.95	72.89
3	Braga	38.62	40.55	33.69	39.61	30.32
4	Braganca	33.22	31.20	100.00	87.21	25.42
5	Castelo Branco	24.10	69.73	16.75	67.32	50.32
6	Coimbra	45.02	73.35	32.37	68.34	49.39
7	Evora	21.14	95.88	6.69	93.55	92.69
8	Faro	71.92	74.16	11.13	83.45	91.61
9	Guarda	17.49	54.38	19.82	62.05	39.16
10	Leiria	26.73	68.38	48.80	58.73	62.91
11	Lisboa	95.20	91.97	82.23	93.67	98.15
12	Portalegre	12.73	100.00	34.90	94.56	93.49
13	Porto	100.00	70.50	78.04	54.25	55.23
14	Santarem	16.70	70.57	53.49	71.40	65.00
15	Setubal	48.97	73.74	45.31	100.00	100.00
16	Viana do Cast.	41.18	42.79	13.52	46.03	21.41
17	Vila Real	45.04	38.22	34.73	57.69	25.08
18	Viseu	31.02	45.28	32.90	52.59	31.73

		INDF02	INDG02	INDI02	INDJ02	INDL02
1	Aveiro	13.04	25.02	31.88	66.45	26.51
2	Beja	13.95	38.97	21.32	45.26	58.93
3	Braga	13.98	28.05	.31	52.28	51.83
4	Braganca	13.33	34.45	.10	29.51	19.58
5	Castelo Branco	18.04	44.58	11.39	74.60	29.96
6	Coimbra	91.16	100.00	59.46	73.56	50.53
7	Evora	29.10	81.11	8.67	66.63	100.00
8	Faro	16.06	39.78	100.00	35.23	9.32
9	Guarda	14.74	39.39	2.16	67.77	26.55
10	Leiria	12.86	33.30	54.57	63.50	40.90
11	Lisboa	100.00	64.78	22.82	100.00	32.95
12	Portalegre	15.11	70.11	5.26	62.06	90.15
13	Porto	40.02	46.39	9.88	68.30	10.99
14	Santarem	18.32	34.80	1.27	59.39	64.25
15	Setubal	19.57	20.72	89.46	54.83	93.61
16	Viana do Cast.	10.29	26.77	12.31	35.07	85.28
17	Vila Real	13.99	24.19	.49	24.32	99.00
18	Viseu	9.17	40.53	15.83	28.17	51.00

Table 9.: Infrastructure Indicators INGG and INGP
Portugal, 18 Districts

		INGG01	INGG02	INGP01	INGP02
1	Aveiro	31.40	47.37	30.28	38.35
2	Beja	23.56	39.63	16.26	17.75
3	Braga	33.15	42.75	29.29	31.82
4	Braganca	17.72	42.28	31.67	37.22
5	Castelo Branco	32.13	47.42	23.12	28.98
6	Coimbra	60.19	76.19	57.09	60.65
7	Evora	37.16	61.77	19.32	27.21
8	Faro	31.76	44.42	31.25	33.92
9	Guarda	26.29	41.16	24.94	24.93
10	Leiria	41.33	51.60	32.25	35.53
11	Lisboa	100.00	100.00	100.00	100.00
12	Portalegre	42.15	63.37	24.93	31.08
13	Porto	58.71	63.27	73.64	74.36
14	Santarem	42.70	55.60	34.63	35.59
15	Setubal	52.48	66.11	35.76	45.92
16	Viana do Cast.	25.54	37.22	20.51	24.16
17	Vila Real	29.15	42.96	24.85	32.83
18	Viseu	28.81	40.47	25.79	27.70

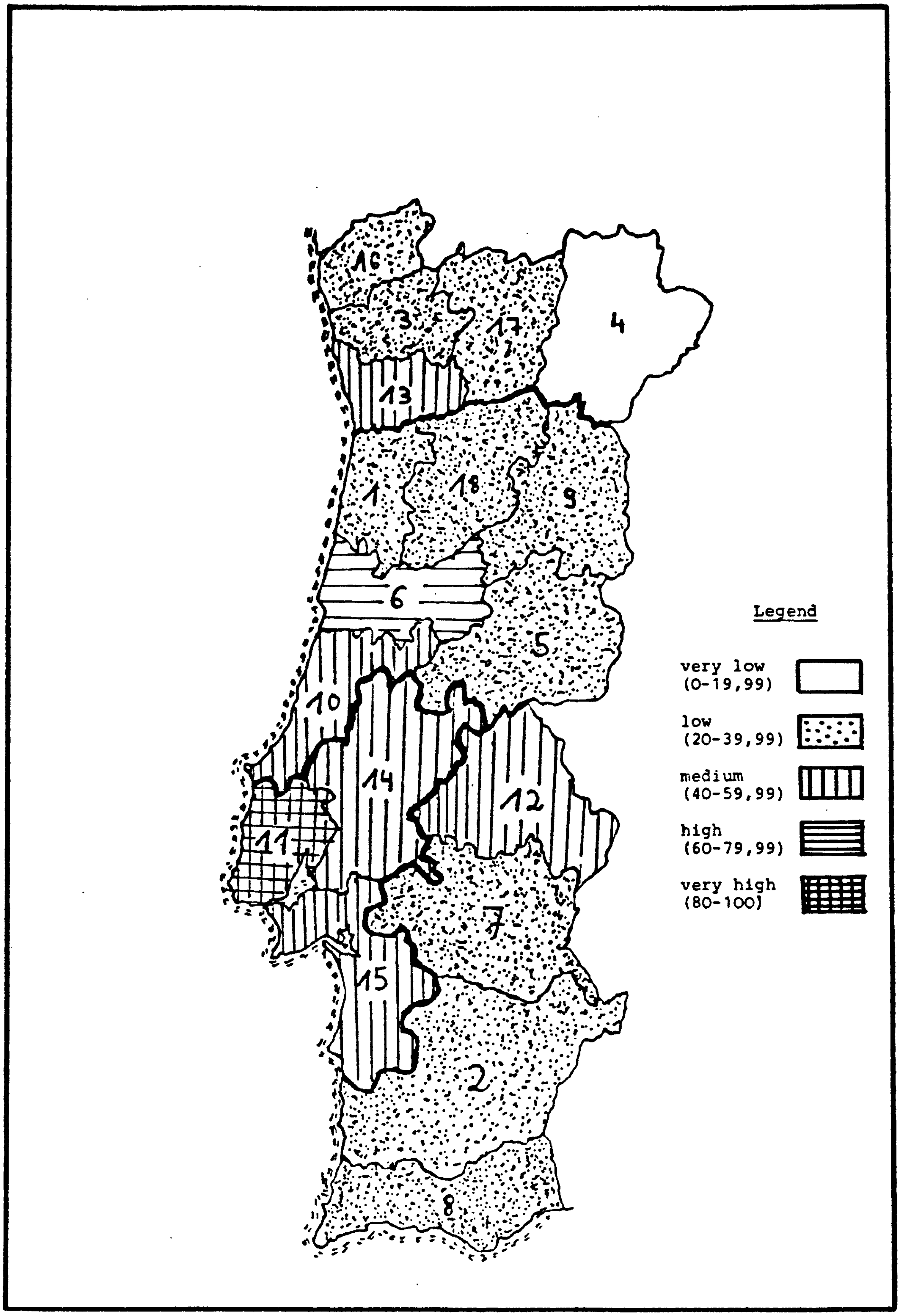
TABLE 10.: Minimum-Maximum- Ratios (MMR) and Coefficients of Variation (VC) for Infrastructure and Income Indicators, Portugal, 18 Districts

Category	MMR		VC	
	1st	2nd	1st	2nd
A. Transportation	10.30	10.37	83.07	62.49
B. Communication	3.60	3.21	31.61	29.52
C. Energy supply	18.83	14.95	72.59	67.34
D. Water supply	6.94	2.52	59.94	25.41
E. Environment	6.37	4.67	49.75	46.23
F. Education	16.55	10.91	110.13	100.01
G. Health	4.14	4.83	45.80	47.39
I. Sport and Tourism	798.67	>1000.0	115.11	120.52
J. Social	901.76	4.11	98.91	34.45
L. Natural Endowment	13.18	10.73	59.21	56.71
INGG *)	5.64	2.69	46.74	29.19
INGP *)	6.15	5.63	58.31	49.88
GDP per Capita (BPPO)	3.96	---	39.32	---
Income density (BPFL)	64.29	---	162.35	---
GDP per employed Person (BPEM)	4.09	---	34.65	---

*) Main Category Indicator I is not included in INGG and INGP

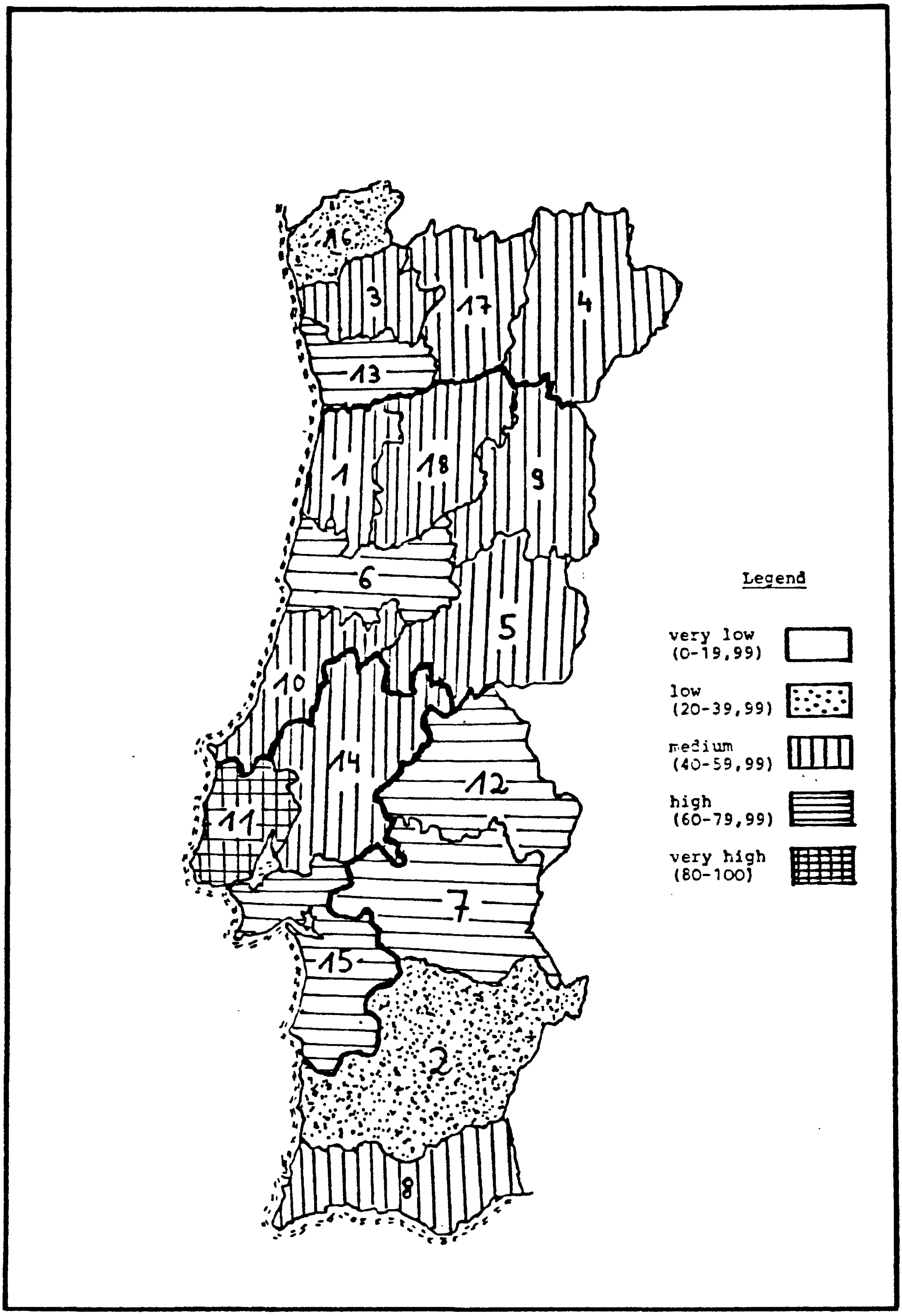
M A P 3

Geographical Distribution of Regional Infrastructure Endowment, 1st Cross Section Year, Portugal, 18 Districts



M A P 4

Geographical Distribution of Regional Infrastructure Endowment, 2nd Cross Section Year, Portugal, 18 Districts



IV.3. THE RESULTS OF THE ANALYSIS BASED ON MAIN REGIONS AND SUBREGIONS

The same analysis as for the 18 districts has been undertaken for the 4 main and 8 subregions. TABLE 11 shows the results for the four main regions and TABLE 12 for the eight subregions.

Again, a leveling effect is to be ascertained which is due to the increased size of the units of analysis. Lisboa still is the best equipped region, although there are partially significant differences in equipment. The Northern region around Porto has a value of 57.26 and occupies the second rank to Sul. This seems to demonstrate that the South of Portugal has improved its relative position considerably during the period of investigation. This statement, however, is not valid for the INGP-variant where Sul also in the second year reaches only 47.01 and remains at the end of the ranking order. The relative improvement in the position of the South is, therefore, to be traced back to infrastructure categories which do not form a part of the production oriented aggregate indicator INGP. These categories are especially Water, Environment and Social Facilities which show improvements for the South.

If the four main regions are subdivided into the eight subregions, the costal regions are regularily better equipped than the interior regions. But again, a certain approximation is to be observed from the first to the second cross section year between the two types of subregions.

V. RESULTS OF SINGULAR REGRESSION ESTIMATION WITH INFRASTRUCTURE AS EXOGENOUS VARIABLE

The basic proposition of the potentiality factor approach is that infrastructure- besides location, agglomeration and sectoral structure- is one of the main determinants of regional potential in terms of income and employment. In line with the procedure applied in the Community-wide study for the ten member states and the supplementary investigation for Spain, also for Portugal infrastructure is first considered as being the only relevant exogenous variable in a regression function estimated in order to explain selected income and employment indicators for the 18 districts. Since infrastructure is here considered in isolation, it has to be expected that its relative contribution to income and employment is reduced if the other potentiality factors are also included.

In general, a positive association between all infrastructure indicators and the respective income variables is obtained. Category L (Natural Endowment) is the only infrastructure category with a negative sign. Productivity density (BPFL) is a better development indicator than personal income. In most cases, the production related variant of the aggregate indicator yields better results than the general aggregate indicator INGG. The RSQ-figures for INGP in case of the productivity density BPFL is 0.69 instead of 0.55 for INGG. The best result for INGG is with EISP (RSQ of 0.62).

Like in the case of the EC-wide analysis and in Spain, also in Portugal employment is less well explained by infrastructure equipment. As mentioned in these other Reports, this is due to the fact that a significant positive relationship between infrastructure and income per inhabitant or per employed person can be obtained even if employment has remained constant and only income increased with improved infrastructure equipment. In those cases, if only employment is then tested, the statistical fit will be clearly lower.

VI. INFRASTRUCTURE AS A CAPITAL INPUT IN A QUASI-PRODUCTION FUNCTION

Although the number of observations in the Portuguese case is relatively low, it has been tried to estimate modified Cobb-Douglas production functions as in the case of the other studies. In line with the basic idea of a Cobb-Douglas function, the two exogenous variables have been determined as employment and capital, the latter being represented by infrastructure. The functional type is of the usual double-logarythmic nature.

This attempt has not been very successful in the Portuguese case. The main reason seems to be the relative small number of observations. With 18 districts and three degrees of freedom, the statistical test measures increase very strongly so that it becomes very difficult to obtain significant estimates. The best results are obtained with the aid of the income and productivity density variables where both exogenous variables are significant at a 5% error-level. For the general GDP density variable BPFL and the productivity density variable BGFL RSQ-values of 0.9556 respectively 0.9334 are obtained. Fully specified quasi-production-functions have not been estimated for Portugal because they require a greater set of observations than is available with 18 districts. This also has the consequence that no analysis as to relative underutilization or overutilization in Portugal could be done.

In summarizing, the results obtained with the different types of anlysis support also for Portugal the thesis that infrastructure is an important determinant of regional development. This statement is to be evaluated in the perspective that Portugal is a country with a relatively low level of development compared with most of the other EC-member countries and with Spain. Although a more detailed analysis may show differences as far as the role of infrastructure in different national backgrounds and under different levels of development concerend, the basic proposition is nevertheless supported. This also implies that infrastructure policy can play a significant role in development of Portuguese regions and in reducing the gap between Portuguese regions and the other EC-regions.

TABLE 11.: Infrastructure Indicators for 4 Main Regions in Portugal

	INDA01	INDB01	INDC01	INDD01	INDE01
1 Norte, Porto	67.69	59.61	100.00	41.62	53.38
2 Centro, Coimbra	36.38	63.23	62.88	28.76	42.20
3 Lisboa, Lisboa	100.00	100.00	91.23	100.00	100.00
4 Sul, Evora	60.94	75.11	16.56	53.67	47.78

	INDA02	INDB02	INDC02	INDD02	INDE02
1 Norte, Porto	93.92	65.12	78.08	57.32	44.30
2 Centro, Coimbra	54.87	74.87	48.06	66.52	48.32
3 Lisboa, Lisboa	100.00	100.00	100.00	100.00	100.00
4 Sul, Evora	69.28	96.11	31.31	90.40	93.78

	INDF01	INDG01	INDI01	INDJ01	INDL01
1 Norte, Porto	37.06	64.27	27.67	36.97	76.55
2 Centro, Coimbra	41.37	85.53	83.06	30.04	50.35
3 Lisboa, Lisboa	100.00	100.00	100.00	100.00	100.00
4 Sul, Evora	22.15	85.30	87.51	16.18	93.27

	INDF02	INDG02	INDI02	INDJ02	INDL02
1 Norte, Porto	37.81	69.72	13.83	64.73	73.06
2 Centro, Coimbra	36.32	86.03	72.72	72.04	54.10
3 Lisboa, Lisboa	100.00	95.69	72.64	100.00	100.00
4 Sul, Evora	23.43	100.00	100.00	57.61	98.42

	INGG01	INGG02	INGP01	INGP02
1 Norte, Porto	57.26	63.07	63.63	65.18
2 Centro, Coimbra	46.57	58.54	50.60	51.75
3 Lisboa, Lisboa	100.00	100.00	100.00	100.00
4 Sul, Evora	43.92	66.24	36.83	47.01

TABLE 12.: Infrastructure Indicators for 8 Subregions in Portugal

	INDA01	INDB01	INDC01	INDD01	INDE01
1 Norte Litoral	84.95	60.46	73.92	39.60	55.26
2 Norte Interior	24.89	32.92	100.00	23.05	16.64
3 Centro Litoral	49.15	67.00	61.04	26.79	45.41
4 Centro Interior	24.24	47.33	39.95	23.02	28.05
5 Lisboa Litoral	100.00	100.00	74.26	100.00	100.00
6 Lisboa Interior	27.39	63.12	89.13	35.53	49.70
7 Sul Litoral	88.43	69.54	13.84	48.14	52.62
8 Sul Interior	16.76	70.69	16.13	46.53	39.00

	INDA02	INDB02	INDC02	INDD02	INDE02
1 Norte Litoral	98.58	67.57	63.05	51.79	45.37
2 Norte Interior	51.41	40.35	100.00	73.21	25.58
3 Centro Litoral	56.48	79.29	60.11	65.38	50.24
4 Centro Interior	33.67	61.77	36.32	61.88	39.13
5 Lisboa Litoral	100.00	100.00	88.05	100.00	100.00
6 Lisboa Interior	24.50	80.51	83.22	75.03	65.90
7 Sul Litoral	90.82	84.61	17.31	87.68	92.90
8 Sul Interior	20.19	98.74	23.11	86.67	86.78

	INDF01	INDG01	INDI01	INDJ01	INDL01
1 Norte Litoral	34.56	63.26	19.22	36.46	67.82
2 Norte Interior	19.02	45.76	.88	9.39	70.44
3 Centro Litoral	47.62	95.31	67.09	30.88	49.64
4 Centro Interior	16.97	57.39	19.96	18.34	43.25
5 Lisboa Litoral	100.00	100.00	70.02	100.00	90.00
6 Lisboa Interior	19.88	64.37	2.08	20.57	91.40
7 Sul Litoral	19.05	56.92	100.00	14.33	10.87
8 Sul Interior	19.76	91.82	25.89	13.75	100.00

	INDF02	INDG02	INDI02	INDJ02	INDL02
1 Norte Litoral	36.52	62.80	9.13	67.62	61.19
2 Norte Interior	15.83	45.40	.28	29.59	64.00
3 Centro Litoral	42.22	78.80	56.76	75.80	51.01
4 Centro Interior	14.84	66.23	15.34	56.41	43.89
5 Lisboa Litoral	100.00	87.04	49.22	100.00	90.72
6 Lisboa Interior	20.87	55.72	.98	67.06	80.60
7 Sul Litoral	18.30	63.71	100.00	39.44	11.70
8 Sul Interior	23.13	100.00	16.04	64.32	100.00

	INGG01	INGG02	INGP01	INGP02
1 Norte Litoral	57.36	61.97	64.83	64.61
2 Norte Interior	31.08	45.03	38.06	43.95
3 Centro Litoral	51.49	63.32	59.92	59.94
4 Centro Interior	31.90	44.17	31.99	33.59
5 Lisboa Litoral	100.00	100.00	100.00	100.00
6 Lisboa Interior	46.31	57.92	45.07	44.41
7 Sul Litoral	33.59	45.51	38.44	40.78
8 Sul Interior	36.99	57.99	26.70	33.17

European Communities — Commission

The contribution of infrastructure to regional development — Final report

By Dieter Biehl, Infrastructure Study Group

Document

Luxembourg: Office for Official Publications of the European Communities

1986 — I, 484 pp. — 21.0 × 29.7 cm

EN, FR

Part 1 : ISBN 92-825-5882-7
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