

DEMAND FOR ON-LINE INFORMATION SERVICES

AS A
FUNCTION OF THE CHARGES

A Report

by

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The views expressed in this report are those of the
authors and do not necessarily reflect the views of

the Commission

MANAGEMENT SUMMARY

1. The report consists of three main parts. Part A analyses the framework in which the relationship between the demand for on-time information services and its price can be assessed. It also examines published material relevant to the problem. Part B describes the results obtained from the empirical work undertaken through interviews and postal questionnaires. Part C uses this material to define demand relationships over time and sets out the conclusions of the research together with recommendations for further work.

2. To analyse the responsiveness of demand to price either all other determining factors must be held constant or the effect of each of these factors must be separately assessed. As the first is impossible in the rapidly changing demand situation, the second had to be attempted. Thus the actual study is an analysis of the determinants of demand for on-line information with special reference to the effect of price.

3. In setting out the theoretical framework a number of special elements in the demand for on-line information were noted. They include:
 - (a) The extent to which on-line information services provide a different product than that available by other means.
 - (b) The special role played by the budget in determining the capacity of organisations to respond to price changes and its differential effect on the short and long term response to price changes.

(ii)

- (c) The existence of many possible price structures, including price per query, price per minute, two-part tariffs and annual subscriptions which affect both overall responsiveness and that of particular groups to changes in price.
- (d) There are important distinctions between the price paid to on-line suppliers, the cost borne by the organisation and the cost borne by the user which will affect responsiveness to price changes.
- (e) There are possibilities of using market power to produce monopoly situations, both in the supply of data bases or in the provision of transmission systems.
- (f) There is a theoretical case for subsidising information services but government involvement could reduce the responsiveness of demand.

4. We designed a questionnaire covering each of these special elements, the effect of price on demand for on-line services and the expected trends in demand growth.

5. Forty-two organisations provided information of whom twenty-two were interviewed. They include examples of each activity in the provision of on-line services, data base suppliers, hosts, nodes, intermediaries large, small and potential users.

(iii)

6. The sample is very limited and all the conclusions in this report must be regarded as tentative both because of this small sample and because on-line information services are still very much in the experimental stage.

7. With this reservation the conclusions from the empirical analysis were:
 - (i) At the present time demand is limited both by the type of information available and by the apparent need for information personnel to access the system. If these two factors cannot be modified demand will increase less than ten-fold over the next ten years. Greater growth is also not likely to occur unless commercial economic and product data bases become available (Conclusions 1-4,22)
 - (ii) Most respondents find pricing per minute the most acceptable form of charging but some large users could see the benefit of charges including both fixed and variable elements. (Conclusions 5- 7)
 - (iii) It was difficult for respondents to assess responsiveness to price changes because of limited experience and because much of this experience had involved experiments in which many users had obtained their searches free of charge. (Conclusion 8)
 - (iv) Taking this into account it appeared that the most likely reaction to changes in price up to 20% was to cut back usage by more efficient searching procedures. Elasticity appeared to be slightly less than - 1, rising to -1 at about 20%. Above this figure demand would fall off rapidly and demand would certainly be elastic (Conclusion 9).

 - (v) The response to a price reduction by existing users might be

(iv)

rather similar, close to -1 up to perhaps a 20% reduction, elastic for a greater reduction. The response by potential users is much harder to estimate. The price elasticity obtained from existing users understates the overall price elasticity but we cannot estimate by how much. (Conclusion 10).

(vi) The type of budget available to organisations was found to be a very important determinant of demand. Most thought that if there was no specific budget for information organisations would have difficulty in using on-line searching. This applies particularly to university users. Those with a budget either for on-line searching or information as a whole thought that it was difficult to vary their budget in the short-run but possible in the longer-run, if it could be justified in cost-effectiveness grounds (Conclusions 11-16 & 21).

(vii) There were differing views as to the extent to which on-line searching can be regarded as a distinct product. Users thought manual search was a close substitute. Information specialists thought not. (Conclusion 20).

(viii) Response to changes in the direct price would be greater than response to changes in elements regarded as overheads. (Conclusion 17).

(ix) The major bottleneck appeared to be in providing servicing once the on-line search has been completed. Terminal costs were not seen as a major bottleneck at current usage levels but could limit the spread to a large number of smaller users who do not already have suitable equipment. (Conclusion 18-19).

(x) The cross-elasticity of demand between services supplying

similar data appeared to be large.(Conclusion 23).

(xi) Elasticity of demand for on-line services with respect to the general level of economic activity appeared to be greater than unity (Conclusion 24).

(xii) There was some doubt as to whether expansion in output would result in decreased prices rather than only decreased costs because many costs are currently not being covered in prices charged. (Conclusion 26)

(xiii) There was great uncertainty about the likely charging policies of PTTs which appeared to be acting as a brake on demand.(Conclusion 27-28).

(xiv) Some large users were against any government intervention but most thought that there was a case for intergovernmental co-operation. They were less sure about the case for subsidy. (Conclusion 29).

(xv) The questionnaire responses suggested a growth in total demand of about ten-fold in relation to 1976 demand although greater expansion would be possible if there was a combination of favourable factors. (Conclusion 25).

(xvi) From the data available to us it was not possible to estimate the mathematical or numerical form of the demand function over time, although the properties of these functions were identified (Conclusion 30).

8. The consultants recommend two areas for further work:

(i) The monitoring of demand by European users of on-line services as material becomes available. This should commence later in 1976 and should be put onto a continuing programme basis (Conclusion 31).

The monitoring should include survey of potential users.

(iii) A study of American experience should also be undertaken, as

(vi)

this is the only market where the service has been available
for an adequate period for numerical analysis to be feasible.

(Conclusion 32)

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I TERMS OF REFERENCE

In December 1975 the consultants were commissioned to conduct a study on 'the demand for on-line information services as a function of the charges' in order to assist the postal administrations of E.E.C. member states and those who are defining the EURONET system to plan the organisational structure of the network and the telecommunications linkages and to determine a rational pricing policy for the provision of the service.

The terms of reference of the study required that the consultants should use data already available from PA and PANDATA studies as well as quantitative and qualitative material collected by the consultants from organisations providing and using the services. With this material they were asked to examine the likely short term and long term price elasticities of demand for on-line information services. In examining this relationship account was to be taken of a number of factors including:

- a) The different types of consumer using the services.
- b) Whether prices were to be related to costs of providing the services.
- c) Different levels of prices.
- d) Different types of pricing structures which might be employed.
- e) Likely adjustments in behaviour over various time periods (e.g. 3 months, one year, 3 years).
- f) Any other factor particularly likely to affect the sensitivity of such estimated relationships.

In addition to examining these price elasticities it was hoped that some mathematical representation of demand in both the short and the long run could be determined. This required an assessment of the importance of other determinants of demand as well as the relationship between price and cost. Here it was thought particularly important to examine the motives of current users and the factors which affect their usage, by interviewing managers of existing information networks.

Finally it was hoped that any mathematical relationship derived could be applied to available data on potential usage and in this way a forecast of demand at different price levels and structures over the next 10 years was to be obtained.

It was recognised that the use of on-line information systems in Europe was still very undeveloped, particularly in relationship to the United States. Estimates were therefore likely to be subject to wide margins of error. For this reason it was most important to describe the theoretical basis and the qualitative results of the work in detail, to point out weaknesses in the quantitative material and to examine the extent to which results were sensitive to changes in the major variables.

II Structure of the Final Report

In the submission made by the consultants the project was broken down into five main activities:

1. Analysis of existing published material on EURONET, on related systems, on the estimation of demand for information and the theoretical literature on demand elasticity estimation.

2. Definition of a methodology for determining the relationship between demand and price. This activity was to include the analysis of currently available data. Particular emphasis was to be directed towards the problem of differentiating between short and long term changes in demand following a price change.

3. Collection of further material - both factual and based on subjective opinion, relating to information demand and its responsiveness to price change from organisations working in the field, and analysis of this material.

4. Analysis of demand functions which best fit the available evidence. Estimation of price elasticity of demand for EURONET services based on comparable experience. Analysis of limitations of the approach and possible means of reducing these limitations with particular reference to qualitative information obtained.

5. Analysis of the possible effect on the PA and PANDATA forecasts of using different price levels and structures leading to alternative forecasts of demand.

The final report covers each of these activities and consists of three parts:

Part I defines the terms of reference, the way in which the consultants define the problem together with the method of approach employed. Annexes 1 - 4 provide detailed material relating to this including: the questionnaire, a list of the respondents, a theoretical discussion of the problems of analysing the demand for on-line information and a survey of secondary material.

Part II discusses the results obtained from the interviews and postal questionnaires together with more general material arising from discussions. It concentrates upon:

- (a) the effect of price on demand
- (b) the effect of other variables such as quality of the goods, the price and availability of substitutes

- (c) the extent to which demand for on-line information is affected by special factors such as how the on-line budget is determined and what costs must be paid from it
- (d) the extent to which current price levels can be accepted as a basis for estimating future demand and
- (e) the role of market uncertainties and government in determining likely demand. Annex 5 presents an analysis of published empirical data.

In Part III a functional relationship between demand and price over time is specified.

Finally the consultants' conclusions and recommendations are listed.

III DEFINITION OF THE PROBLEM

In order to carry out any analysis of quantitative and qualitative data on price and demand it is necessary to define a theoretical framework for the analysis. This involves an examination of the factors affecting demand for information and to some extent at least factors affecting price. (Although the consultants are not required to forecast or recommend future price levels, attention needs to be focussed on variations in demand over the most likely range of prices.)

The major factors which affect demand for a good such as information are set out in Annex 3, section 1. Four important influences on demand for a good are its price, consumers' income, the prices of other goods, especially substitutes and complements and the size of the market.

The effect of price is measured by the price elasticity. This depends on three main factors - the closeness and availability of substitutes, the importance of the good in consumers' budgets and the time period over which the demand is measured.

If close substitutes are available, price elasticity may be high over the range of price where substitutes are competitive. At current prices, the main substitutes, e.g. off-line or manual searching, are not thought to be competitive and elasticity may on this account be low - if prices rise to a level where these substitutes become competitive, price elasticity may rise considerably.

The method of budgeting used by firms has an important effect on elasticity. Fixed budgets for on-line information services imply a price elasticity of -1, at least in the short run. If these services form a small part of a total budget - say for research and development - price elasticity is likely to be less.

Theoretical arguments are inconclusive over whether price elasticity is likely to be greater or less in the short run, but apart from very short-term effects (one year or less) where rigid budgets and the time span of decision-making may be important, it is expected the the long run elasticity will be greater because of the longer time available to adjust to different

methods.

Income affects the demand for a good by individual consumers. But information is demanded frequently by firms and institutions. Here it is important to consider whether small firms will use on-line information and to what extent the effect on them of price is similar to the effect on large firms. Public institutions too, may be more sensitive or less sensitive to price changes, depending on their budget flexibility - some segments of the market such as medical students may have no budget for information at all, but have substantial demand for information if provided free.

Price changes in substitute goods may not be of particular importance, since off-line searching, probably the closest substitute, appears to be generally regarded as a poor alternative even if it were provided free.

The number of current individual consumers of on-line information in Europe is small, especially in comparison to the forecasts of PA and PANDATA. Demand characteristics may change radically as the market grows: a market with many consumers would generally lead to a smoother relationship of demand with price, showing continuous change rather than a jerky movement, with no change in demand over a part of the price range but a strong reaction after a price 'threshold' is reached.

Annex 3, section 2 describes the characteristics of information in general, on-line services and EURONET in particular and the way in which these characteristics may be expected to affect demand. Information is not generally demanded for its own sake but as an input into other processes. The consumer of information is typically uncertain about the value to him of any particular item of information. Decisions about the best method of obtaining information are often not made by the final consumer and the unit of information is difficult to define. On the production side, information is often produced as a by-product, which means that prices charged by suppliers of information may vary with the demand for the items with which information is jointly produced. If for instance demand for hard copies of data base material falls, the price which data base suppliers wish to recover is likely to rise.

In looking at the price to users of on-line information services the

time spent in searching should be regarded as part of the cost. The extent to which organizations allocate costs such as telephone charges to information departments and these departments allocate search costs to users will have a strong affect on demand.

Demand for EURONET may be highly elastic if access to alternative systems is permitted, over the range of price at which these systems are comparable (taking into account time costs of search and differences in data base coverage, efficiency of searching and similar factors). Outside this price range, if EURONET prices are substantially higher than rates elsewhere, elasticity would be less and so would demand; if EURONET prices are substantially lower, elasticity would also be low, but demand would be high.

If EURONET achieves an effective monopoly position, demand will be much less elastic, since price rises no longer run the risk of consumers going to other suppliers and the elasticity of demand for EURONET will equal the elasticity of demand for on-line information services.

Section 3 of Annex 3 describes the determinants of price and pricing structures. Price to the consumer includes charges and the cost experienced by user and both these elements may involve fixed charges and variable elements. The most usual current method of charging for on-line information systems is a charge per minute of search-time and this is expected to grow in relative importance. The monetary cost of an on-line search may typically include:

- a) a royalty to the provider of the data base
- b) cost of access to the data base
- c) cost of transmitting search
- d) cost of printed output (if any).

Other methods of charging in use for on-line information services are two-part tariffs and charge per question answered. In two-part tariffs the fixed charge sometimes takes the form of payment for purchase of hard copy (which in some cases may be desired by the user for its own sake). Another form of two part tariff requires investment in a dedicated line: large users who have acquired this facility sometimes hire it out to small users on a commercial basis. Charging per successful search or per question presents problems for suppliers (or intermediaries) since searching costs per question are highly variable.

Section 4 of Annex 3 explains in detail the crucial role of the firm's budget, both on the determination of demand for information and on its flexibility in the short and long term.

Section 5 discusses the role of government. It sets out various ways in which government plays a part in the market for information - as a supporter of investment in major infrastructure, such as EURONET itself, as a potential subsidiser of the provision or use of data bases or search systems, and as a major consumer, either directly, or because it is supporting research projects which consume information. The case for government support is set out. There are economic grounds to justify a substantial government or inter-government role in this field; however there are real grounds to fear a consequent reduction in responsiveness to consumer demand especially if consuming and producing interests are not involved in the management of the system.

IV SUMMARY OF SECONDARY SOURCES

A search of the available published literature has not produced any satisfactory source of price elasticity estimates or of data which could be analyzed to produce such estimates. There is however a substantial body of relevant material, which is reviewed in Annex 4. Two studies estimate demand functions for information, one for a scientific journal and the other for agricultural information. (See Annex 4 for bibliographical and other details for these and other references described later in this section of the report.) While not directly relevant to on-line information, these studies illustrate some of the methodological problems involved. A number of other references, cited in Annex 4 part 3 contain some relevant methodology without estimating a demand relationship.

Two recently issued publications are closer to our field of interest. One of these is a report in a survey of users of the SDC on-line service; the other is a report published by Aslib in the EUSIDIC European User series.

The SDC survey is believed to have covered about 2/3 of their on-line information users. Demand was found to be split into three main categories - commercial (about 1/3), educational (also about 1/3), government (20%) - with some other smaller users. The great majority of demand was initiated by the information departments of the organizations concerned. The mean cost for search was \$23.83 (the survey was carried out in 1974-5), but it was heavily skewed with a median below \$10. There is a useful analysis on the motivation of managers.

The Aslib report surveys existing cost data for a wide range of data bases and suppliers. It also discusses the prospects for European demand. Accessibility is argued to be the major determinant of demand.

It is clear that prices have not generally been set so as to cover total costs. The OECD report by Vickers gives an indication of these costs. However it is possible that some form of subsidy may continue in the future. Flowerdew and Whitehead explain a theoretical basis for assessing which costs should be borne by the consumer.

A paper by Wyatt about the Harvard experience describes the advantages of computer networks and shows that user demand is responsive both to price and to service time.

In the final section (5) of Annex 4 we review the literature specifically concerned with EURONET. The major item in this is of course the PA report of 1974 which contains demand forecasts for 1976-1985. PA forecasts 60,000 users in 1976 rising to 2,350,000 in 1985, with an average annual frequency of use per user rising from 1.7 to 3.7. PA arrived at these forecasts by disaggregating the market and then extrapolating existing trends, supplemented by additional information which they collected. The model is believed to involve some double counting, and is certainly subject to wide margins of error.

PA did not make explicit forecasts of price. Financing from public funds was however expected to diminish over time, virtually ceasing within the period 1980-1985. Some cost estimates are made for a specimen retrospective half hour search, and these range from \$20 in 1976 to \$5 in 1985. But they are stated to be only notional.

Some form of assumptions about price levels may be taken to be implicit in the extrapolation undertaken by PA. But the essential problem here is to separate the effects of changing price levels over time from that of the increased availability of services and from the learning process which is widely believed to form an essential part of the growth of demand for on-line services. The PA report gives no assistance at all on this problem.

V METHOD OF APPROACH

1. Measurement of Demand for On-Line Information

In order to estimate the demand curve for on-line information and for EURONET services in particular it is necessary to obtain information about either how consumers have behaved in the face of price changes or how they think that they will behave.

The two best ways of providing such estimates are direct market experiments and statistical estimates from historical data on prices and quantities purchased of the commodity. In direct market experiments the attempt is made to vary the price to some consumers while keeping it constant to others. If the experiment is done in otherwise stable conditions differences in demand between areas can be attributed specifically to differences in prices. The main problem with this type of approach is that the population in each area must have similar characteristics so that changes observed relate only to the price variations. In the case of on-line information services this type of experiment might be feasible once EURONET is in operation. However there would be considerable difficulties in keeping the markets separate because of the ease of access to different centres through the telephone system. Moreover such a process can be extremely expensive and in an infant market any observed changes may simply modify consumers' knowledge about the system and so reflect shifts in the demand curve rather than measuring its slope. The results would then reflect not only variations in price but also in familiarity with access to the service.

The second alternative, of examining historic data, depends on the availability of either time series or cross sectional material relating to demand, prices and other variables affecting consumer behaviour. Using such material demand curves can be estimated although it is extremely difficult to be certain that all other factors have been held constant. In particular when time series data is used it is likely that the market demand curve will have shifted considerably over time. This is especially important for a good like on-line information services where the market has been expanding rapidly as technology, knowledge about the product and access to on-line systems improve. In Europe most on-line services have only been in operation for short periods and there is therefore little such material available. In the United States the service has been used for some years and during that time there have been a number of changes in price.

If this material could be made available it would probably be relatively easy to obtain a measure of demand although it might still be extremely difficult to hold other factors constant. But this information is not currently available.

We are therefore dependent upon the third method of estimating demand - that of interviewing consumers about their buying habits and intentions. This has three main difficulties: the answers may not be well informed because users have not been using the system for any length of time, the answers may reflect many factors other than price and finally those who are not yet consuming the good may have no basis for making an estimate at all. To the extent that we wish to examine their future behaviour answers can anyway only be estimates based on past experience, existing plans and guesswork. The capacity to predict how an organisation might react to price changes is further limited by the fact that few changes specific to on-line data bases have been experienced by European consumers. There have been changes in the price of batch output and of hard copy material and experience here has some relevance but even here few organisations are likely to have full information available about their reactions. Finally the rapid inflation of the last few years has made it difficult for organisations to separate their reactions to general price increases from those where they are reacting to a real change in the price of a service relative to the price of other goods. Massive changes in prices, costs and revenues have modified behaviour and perceptions of value in ways which may well not persist in the longer term. For all these reasons responses by consumers of on-line information services are likely to give only a general indication of actual behaviour over the next few years.

On the other hand the suppliers of on-line services depend for their own future on how demand actually does change over the next few years. They may therefore be in a position to provide information both about how consumers have reacted to modifications in price in the past (although most of such data must relate to batch searches or other related services) and how they expect consumers to behave in the future. For this reason it was thought worthwhile to discuss the question of demand reaction with suppliers as well as with consumers of on-line and batch services.

2. Collection of Data

The question as to who is the supplier and who is the consumer is not itself a simple one. The relationship between each stage is often of the form set out in Figure 1. In this structure it is the individual on his own or within his department who requires particular information which is often available in a number of forms (e.g. hard cover through manual search, batch output or even library browsing as well as on-line). He is interested in obtaining the information and cares little about how such information is obtained. Those who decide whether or not to use the on-line system to obtain the information are usually either the information departments or the intermediary institutions. It is therefore to these groups that our questions have been posed.

On the supply side there are again a number of distinct operations which behave rather similarly. Although the data bank suppliers actually supply the information required it is the systems suppliers that provide the particular form of access to the information. They can therefore be regarded as the most important element in the provision of on-line information services. Networks simply carry the information from one place to another but enter into the price of the good both via transmitting costs and the quality of service provided - which affects the real value of the information obtained. Finally organisations that act as intermediaries are both consumers of the service provided by the systems organisations and suppliers of this service to find consumers. In this role they have two types of functions:

- a) That similar to the information department of an organisation of deciding how to obtain the information and actually carrying out search procedures and
- b) Acting as a link in the transmitting chain to the ultimate suppliers.

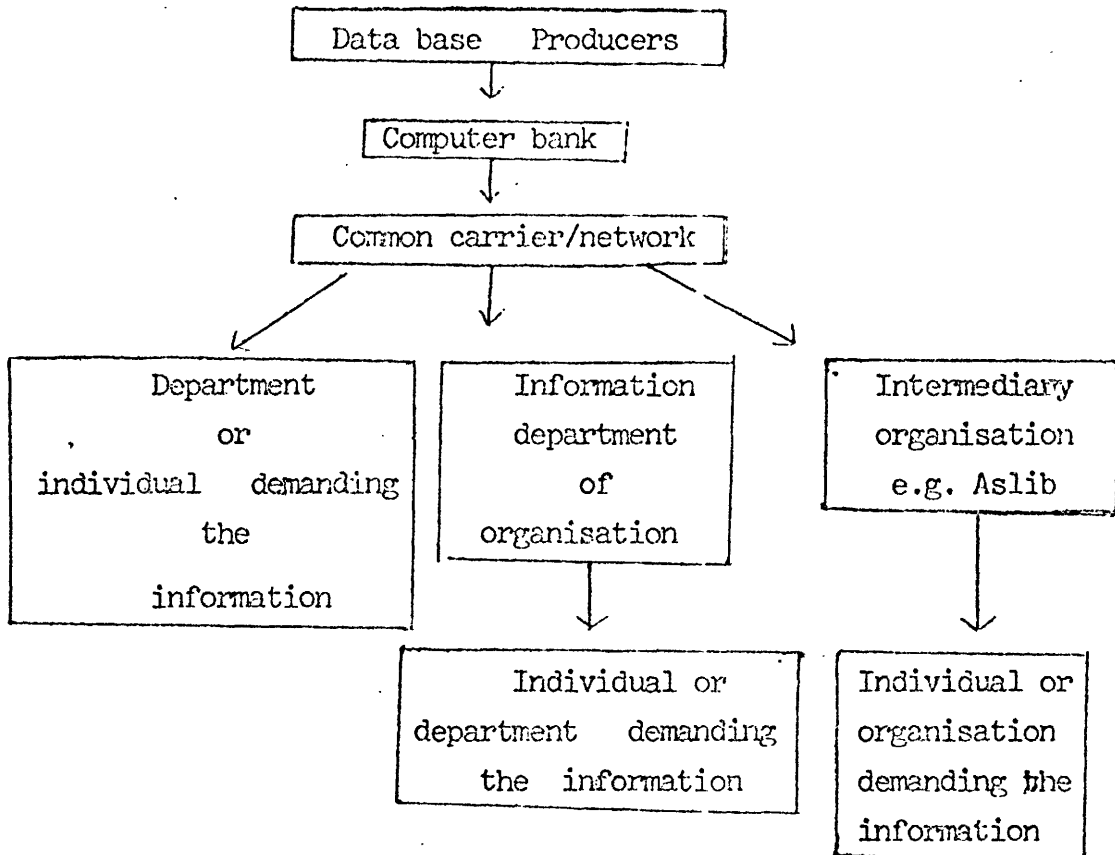
Intermediaries are therefore of particular interest in this project because they may often see both sides of the market process.

This very wide range of participants presents considerable problems for obtaining adequate information, for one would need to question a very large number of organisations before a full picture would emerge. It was decided to concentrate mainly upon intermediary organisations and upon different types of consumer organisations as these are the ones most likely

to have directly relevant experience. Within these intermediary organisations were included some who acted as elements in the network (activity b) as well as those that did searches.

Figure 1

Who is the Supplier and the Consumer of On-Line Information?



It was also thought desirable to question the providers of systems. Here there was a clear problem of conflict of interest in relation to the two main suppliers while in the case of the European Space Agency their experience of on-line systems is as yet limited. However the three major suppliers were approached.

It was decided to obtain direct information in two main ways: (1) by a written questionnaire sent to organisations providing or using on-line services and (2) by interviews with users and providers. In the case of the interviews the questionnaire was used to structure the discussion so that results of the two methods of approach have some comparability.

It was hoped that some of those questioned would be able to provide data on prices, demand and the effect of price changes upon demand. It was found in general that although organisations were prepared to provide such information most had only very limited data available at the present time.

3. The Structure of the Questionnaire

The aim of the questionnaire was to obtain as much information as possible on two key issues:

- a) What are likely to be the most important determinants of demand over the next decade?
- b) How important is price likely to be in determining changes on demand over this period?

The questionnaire was designed to apply to all the different types of respondents discussed in the last section. It covered nine areas:

1. The nature of the service used or provided.
2. Expected trends in the nature and cost of services available over the next 10 years.
3. The determinants of demand for the on-line services used or provided.
4. The pricing structure of these services.
5. Expected changes in price over the next two years, the effect of these on expected demand and the relative importance of other factors determining demand.
6. The assessment of the effect on demand of hypothetical changes in price.
7. The way in which the budget for on-line information is provided and how capacity to use the service would be affected by price changes.
8. The changes that respondents expect to take place in the service and in the number and type of users over the next 10 years.
9. Quantitative material that respondents are prepared to make available.

A copy of the questionnaire is attached at Annex 1 and Annex 2 gives a list of respondents.

VI THE SAMPLE

On-line information services have only been available in Europe for a short time. Indeed ESA has only gone on-line this year and the two American systems, although available for two or three years, only started marketing in earnest last year. There are few organisations with any great experience of on-line although many have employed batch services. For this reason the consultants did not try to obtain a random sample of organisations but instead approached those whom they were informed were knowledgeable about on-line services, and then approached other organisations who were suggested by the first group. Within this method of approach an attempt was made to obtain information from some organisations in each of the main activities involved in on-line services from the provision of data bases through to the potential user.

This method of approach inherently results in a biased sample of those who will provide the potential growth in demand over the next decade. Those that have been approached are generally, on the supply side, organisations already in the business of providing information and on the demand side those who are extremely information conscious (usually large firms) and therefore receptive to new technology and ideas. Their behaviour is possibly very different from that of the great mass of consumers who may be going to use on-line services over the next few years. But this problem cannot readily be avoided as those who have no experience of on-line or related services cannot be expected to give useful answers to complex questions about demand behaviour. To lessen the validity of this criticism considerable emphasis was placed on discussion with intermediaries who are the group most likely to be able to estimate demand response by the smaller organisations, with information specialists who have been involved in marketing experiments and with organisations who have been taking part in these experiments. But even taking this emphasis into account there is no doubt that results are biased towards the adventurous and the information conscious. This limitation can only be reduced by regular monitoring of the market over the next few years analysing both changes in behaviour by those already using the service and the spread of demand to different types of organisation.

Using the approach outlined above the consultants were able to

obtain replies from forty two organisations by the date at which the report was completed.¹ (A list of these organisations together with the way in which information is given was provided at Annex 2). These included representatives of the eight major activities that the consultants regarded as particularly important: data base suppliers, host organisations, retrieval centres, intermediaries, large users, small users, potential users and specialists in on-line information. Some of those with whom the problem was discussed fell into more than one of these categories in that they took part in more than one activity. Taking this into account the numbers in each group who provided information relating to that form of activity are given in Table 1. In this table the definitions of each group used are:

Data base suppliers	-	those who compile data bases
Hosts	-	those who provide a computer on which one or more data bases are made available
Nodes	-	those who provide direct access to available suppliers for consumers without being hosts themselves.
Intermediaries	-	organisations that carry out searches for others.
Large users	-	those who regard themselves as making important use of on-line services.
Small users	-	those who have used the service a few times possibly as part of an experiment
Potential users	-	those who know of on-line services and are seriously deciding whether or not to use
Information Specialists	-	individuals and organisations that specialise in research into and co-ordination of information services

1 Since the final report was completed five further replies were received. The information included did not result in any change in the emphasis of the report.

Table 1

The Respondents¹

<u>Type of Activity</u>	<u>Number of Communications</u>	<u>Special Features</u>
Data Base Suppliers	6	3 abstracts/bibliographies 2 numerical 1 technical information including product specifications etc.
Hosts	7	5 European institutes 1 private firm 1 American supplier
Node	1	At least 2 others in the process of becoming nodes, now intermediaries.
Intermediaries	10	2 national centres 6 institutes 1 educational establishment 1 private firm
Large Users	13	9 private organisations 1 university 1 public sector research organisation 1 industry financed institute
Small Users	4	all private firms including at least 1 who had never paid for the service
Potential Users	2	1 potential retrieval centre or intermediary 1 potential public sector user
Information Specialists	6	1 organisation 4 individuals including one in on-line research one involved in an on-line experiment one in public sector one in private sector
Others not specified	3	2 federations of information service providers 1 potential network supplier

1 Some respondents answered questions in more than one capacity.

The majority of interviews took place in Britain. There were also two visits to Germany, three to France and three to the Netherlands, as well as discussions with the FFAG Sub-Committee responsible for the project and with EEC representatives. The majority of organisations that responded to the postal questionnaire were also British perhaps because there have been experiments underway in the UK in the last few months and because ESA is now available on-line. This preponderance of British organisations contacted may have produced a bias, which can only be checked by monitoring as more on-line services become available.

Finally, it must be remembered at all times that the empirical results presented here are founded on this rather small sample of 22 interviews and 20 postal communications.

VII Approach to Empirical Analysis

The analysis of empirical results will follow the format of the theoretical structure out-lined in section III and in more detail in Annex 3. There it was stated that demand for a good, here specifically on-line information, is determined by the nature of the good (i.e. the type and quality of the product), the price at which the good is available, the price and availability of alternatives, the income of the consuming organisation and consumer tastes. Each of these factors will be discussed in turn using results from the completed questionnaires and additional material obtained from interviews and from other sources.

To this discussion of the factors normally expected to affect demand will be added our analysis of further elements regarded by respondents as particularly important for the demand for on-line information. This will concentrate on the effects of different budgetary procedures.

All of these factors concern the users' motivation in purchasing on-line information and it is material relating to this which will be analysed first. Then, in order to determine the effect these factors will have on demand we must examine likely pricing levels and structures which will be mainly determined by suppliers (although taking account of users' responsiveness). So at this stage it will be necessary to examine the likely determinants of pricing policies including possible changes in costs, problems arising from market imperfections and the possible effects of government intervention.

Having determined possible alternative pricing levels and structures an attempt will be made to predict likely demand on the basis of the analysis presented here and that by PA of potential demand. Finally, the implications of these predictions for the demand for EURONET will be assessed.

VIII The Nature of the Good

The sub-set of the sample that consists of users includes the ten intermediaries, the thirteen large users and the four small users. Table 2 shows the type of material that they were currently employing on-line. None of the four small users used anything but bibliographic information. Nearly one third of large users had material made available on-line by their own information departments. Some of this material consisted of bought-in tapes but it also included abstracts of their internal reports and other similar material and in at least one case commercial data. Most of the large users employing product data were

Table 2 Actual Use by Consumers

	Bibliographies Abstracts	Own Material	Product Data Including Patents	Total No. of Users
Intermediaries	10	3	2	10
Large Users	13	5	8	13
Small Users	4	0	0	4
Total Using	27 (100%)	7 (26%)	10 (39%)	27

searching patent files which were generally regarded as being of particular value. Intermediaries on the other hand did not mention that they had used the patent files. Intermediaries' product data was provided by themselves in their capacities as hosts. Similarly the three cases of intermediaries' own material arose as a result of host or data base activity.

The type of material that consumers were using was dependent more upon what was made available by suppliers than upon that which they regarded as most worthwhile. All users were accessing the system via information

specialists (usually via the information division of the organisation) and all but one were using one or more of the three major on-line suppliers - the European Space Agency, Lockheed and Systems Dynamics Corporation. Thus the majority of that which was available to them was bibliographic material and access was being controlled by those whose main job was in that area.

However, views on the potential use of on-line information systems and its value often clearly distinguished between usage if the type of material remained the same and if the material available was extended not just to a wider range of bibliographic data bases but to commercial and numerical data.

First, it was argued that currently available data was mainly of use to research and development personnel.

Secondly, data could generally only be obtained efficiently by those who used the system regularly. This was both because of the complexity of search procedures and because familiarity with key words or their equivalent was very important.

If these two elements continued, on-line information would only be a viable proposition for organisations requiring regular searches in similar fields of interest. These were likely by the nature of the information available to be large organisations with large research departments.

Other research and development departments with inadequate demand in any one field would require to use an intermediary; telephoning, writing to or going along to that intermediary when the demand arose. This would mean that there would always have to be a positive decision to use the system and the costs of searching especially in terms of time would be well above the minimum envisaged. Moreover the intermediary would also have to specialise in order to do efficient searching so that the closest intermediary would not necessarily be the most suitable.

These factors mean that most users do not see massive growth in their usage of the system unless different types of information are made available.

This is not to say that there would not be some growth by existing users with current data bases. Few have been using the system for any length of time and so many potential individual users do not yet know of the service. Answers to the questions on growth in use of existing services suggested that other things being equal demand might increase by as much as 100% over the next five to ten years but that saturation for this type of information might then have been reached. This figure is an impression arising from many different answers, which have been adjusted to allow for respondents assumptions about changes in available data, number of users and prices.

Almost all respondents thought that there was a large potential demand for other types of data base and that their provision would cause many other organisations to utilise on-line information. However because such data bases do not exist at the present time on-line no one could do more than indicate likely areas, without estimating the amount of potential demand.

One type of data which all who used it found particularly helpful but which falls within the R and D/Information Department framework was patents. A specific question was not asked about the use of patents but seven large firms volunteered that these are in many ways the most useful data received. At least two firms have their own Derwent tapes while the others were using petroleum patent information. Only one firm positively denied the value of computerised patent information and that was because they employed an enormously knowledgeable individual. If he were to go they would use the computerised information. In general, of the data currently available, patent information was regarded as being of the most value by those who used it and it was also thought that the price elasticity of demand for this information would be very small.

A second important aspect of current development is the provision of bases such as Cancerline and Toxline which are expected to cover in depth particular fields of interest where much research is taking place, where definition of terms is always changing and there is considerable need for regular updating. Within the R and D field this was seen as a useful development with considerable potential demand. Most respondents expected the biggest element of growth to arise from the provision of

different types of data base which would not necessarily be for the use of R and D specialists and would not necessarily need intermediary information scientists.

Table 3 shows the relative importance placed by different groups on each type of potential extension. The sample base for this question was the forty-two respondents but some eight respondents did not give any relevant answers on this point and it is likely that many respondents did not perceive the value of possibilities not as yet available to them. The results therefore reflect the views mainly of information conscious organisations. Of those who were questioned in detail on this area only one felt that they would be using in the future only currently available types of data base and that one was an information department of a research and development institute.

Two general points were made about the types of data base required. First, much of the material especially that relating to commercial and product information would require to be very specific, with a great deal of predigestion, and to be regularly updated. This was expected to be costly, but would produce a product readily usable by the individual requiring the information. Emphasis would be on immediate answers and so growth in demand would depend on easy access in the individual's own department.

Secondly, most of those who wanted numerical data bases wanted there to be problem solving capacity which would require new, technically advanced software which would also be expensive. Use, again, would depend on immediate availability in the users' own department.

In general data base suppliers were giving answers relating to their own likely development over the next ten years. Hosts and nodes (including potential hosts and nodes) seemed to see expansion on current rather than new lines while intermediaries and particularly large users were reflecting what they would like without taking great account of the difficulties. Information specialists generally saw the future as depending greatly upon this expansion of data type as well as more data bases similar to those already available. Most, though, had little idea of what sort of costs would be involved.

Table 3

Desired Extention of Material Available On-Line

	Data Base Suppliers	Hosts & Nodes	Intermediaries	Users including potential		Information Specialists
				Large	Small	
Commercial and Economic	1	2	2	7	1	2
Product Information/ Research Activities	4	1	2	6	3	2
Numerical	6	2	4	6	1	3
Problem Solving Capacity	6	2	4	5	1	3
None				1		
Total ¹ Number in Each Class	6	8	10	13	4	6

¹ Many regarded two or more types of material as potentially valuable.

The general consensus was therefore that at the present time demand would be limited by the type of material available although there was certainly still room for massive expansion. The breakthrough to general use could not however happen until material required by non-R and D departments was readily available and then demand would depend particularly upon ease of access and upon the coverage and accuracy of available data.

IX Price Structures for On-Line Services

The vast majority of on-line users were charged on a per minute basis (plus per line for off-line output through the three main suppliers). But there were a number of intermediaries who were charging per query as well as one where no charge was presently being made. Finally one large user was acting as his own host and was paying an annual charge for the tapes while charging others in a similar fashion.

In general even those who now charged, or were charged, per query expected to go on to a per minute charging system and all those receiving or providing a free service also expected to change this system.

Four of the data base suppliers were involved in no other on-line activity directly. Of these one currently only sold tapes but expected to provide the data through a network supplier in the future taking a royalty. A second already does both. A third leases files charging in relation to the number of potential users. Two others only use their data bases themselves in their position as hosts and intermediaries. The final base - a specialised numerical one - is currently available only through dedicated line leasing. This range of charging and access behaviour reflects more our attempt to cover as wide a range as possible rather than the expected overall situation.

The general impression from both data suppliers and from hosts was that on-line information services would be charged for to the vast majority of consumers in the way currently employed by ESA, Lockheed and SDC. One intermediary (likely to become a node) thought that there was a strong case for two-part charging to large consumers in order to increase the number and depth of searches on under-utilised systems.

The large user/host who was charged by annual subscription regarded this, for him, as a very satisfactory form of charging. The price was determined at the time at which budgeting took place and free access at all times was regarded as of considerable value. This firm had become an intermediary/host in order to reduce its own costs and because it had excess capacity. This is the type of development that could be predicted a priori and it was also the one predicted by those data base suppliers who sold tapes rather than let them on royalty.

Although both supplier and user liked the annual fee method of

charging both agreed that this limited access to large organisations except to the extent that commercial intermediaries were prepared and allowed to operate an access system charging on a per search or per minute basis.

The advantage of a system based on charging a price per question was that the consumer is enabled to assess the value of the information in relation to the cost. This depends to a great extent on trust built up between the consumer and the intermediary. Clearly many consumers would rather have the greater certainty of a specific answer than the right to so many minutes of access time. But suppliers who have in the past provided material in this way are generally changing over to per minute charging as they themselves are charged in this fashion. Or they are charging in relation to the difficulty of the question which again relates to their own costs. This is a result partly of the easier definition of costs as true on-line takes over and also of the economic environment which has caused organisations to assess costs more carefully. But it may well also be a function of easier on-line access for final consumers in that by charging an average cost those with easier problems can save money by doing it themselves. The general opinion is therefore that as on-line searching spreads charging per unit of time will become the norm.

A number of users in our sample had taken part in free experiments. One intermediary saw this as a way of spreading the service but expected that many of those using the service while it was free would not do so when it was charged for. Another intermediary expected that the charge would make little difference; however their experimental scheme had not been advertised. Of the five users who were known to have taken part in such a scheme two had gone on-line and were paying commercial charges, two were about to do so and one did not regard it as worthwhile. It is believed that free experimental periods are a good way of showing people what on-line is, and allowing them to assess whether or not it is worthwhile. Most respondents think however that free services should only be used in this way as a marketing strategy and do not regard this as a sensible long-term policy, except perhaps for university or medical school research.

There is very little differentiation in the way the three main suppliers structure their prices (although there are differences in level both at the supply point and in the price paid by the consumer). The only major difference is that ESA spell out the royalty charges specifically and some users have found this rather confusing. No users had been put off using specific data bases by the requirement of purchasing hard copy etc but this was because all already received the material (or paid the subscription in the case of AFI). But all interviewees agreed that they would be unlikely to be prepared to purchase this hard copy or take out the subscription if their only demand was to be able to search on-line. This suggests that these forms of restriction may already reduce demand.

Most of those answering by post simply stated how they were charged and made no further comment. But in discussion it became clear that the majority of users and suppliers regarded pricing based on time used as an essential feature of on-line searching. Table 4 shows the relative importance of different positions. Of the three who did not regard it as desirable one wanted a pricing system which reflected potential rather than actual usage, while two were happy with annual leasing. One, a supplier, disliked being uncertain about his level of income, while the other, a consumer, was so large that he thought annual leasing would be cheaper. This reaction suggests that as on-line services become important there may be a case for two part pricing for the large consumer.

Table 4 Reaction to Pricing Structure

<u>Price Based on Time Used</u>			
Absolutely Necessary	Very Desirable	Desirable	Not Desirable
10	10	1	3

X Reactions to Changes in the Level of Price

Respondents were asked how they would react to different price increases. These price increases were assumed to result in changes in the relative price of on-line information in comparison to the price of other goods and in particular the price of alternative ways of obtaining information. The current pricing levels were taken as the base from which charges occurred. Table 5 tabulates the answers of those who were willing to evaluate likely responsiveness to particular price changes defined in this way.

Table 5

Increase in Price	<u>Reaction to Price Increases</u>				No. of Answers
	Zero	Small	Large	Possibly Stop Using Altogether	
5%	86%	14%	0%	0%	22 100%
10%	50%	50%	0%	0%	22 100%
20%	14%	41%	45%	0%	22 100%
50%	0%	9%	41%	50%	22 100%

These results suggest that at the present time most users and suppliers regard the product as worthwhile and that small changes in price would not result in very much modification of demand. If prices increased by 10% about half the respondents would expect to reduce demand to some extent. The usual approach would be to attempt to reduce the search time per query rather than, at this stage, to reduce the number of queries. Some respondents thought this could be done without loss of value from the output because they often did searches in greater depth than was perhaps necessary because they enjoyed doing so. Others felt they had not yet mastered the systems and would concentrate on becoming more efficient by better preparation etc. In other words many respondents felt that at current prices there was enough slack in their usage so that its removal would allow the absorption of 10% cost increases resulting in the same value of output for the same budget. Others felt that this absorption could extend up to 20% without difficulty and indeed many thought that they would not try for such cost savings unless prices rose by as much as 20%. Thus up to price increases of 20% the demand from existing users appears to be inelastic - the quantity of on-line searching would decline, other things being equal, but not so much as to decrease revenue obtained.

Beyond a 20% increase most organisations felt that they would have to reassess the value of on-line. At this point they thought that alternatives might become more cost-effective so that there would be a cut-back in the number of searches as well as in their length and depth. By 50% almost everyone expected large cut-backs in usage and one half felt that organisations might stop using the system altogether. A number suggested that they would then only use the system for the most difficult of searches and for material not available elsewhere (one specifically mentioned patents). Almost the whole sample thought that where alternative ways of obtaining the information existed these would be employed instead. Finally, a number of respondents felt that the extent to which search time would be reduced would be so great that the special value of on-line searching would disappear and cut-backs might be even greater. At 100% even those who were still predicting a small drop in demand at 50% would probably stop using the system. This evidence suggested that with price rises greater than 20% in real terms demand would be elastic and revenue would decrease, probably quite rapidly between 20% and 30% and certainly very rapidly beyond this point.

Most of those who did not respond to the specific question on response to given price changes also remarked that they were happy to pay "the market rate" or would pay while the service remained cost effective. The general impression was that at price increases of up to 20% the service was worthwhile but above this cost-effectiveness would be extremely difficult to prove and demand would decline greatly. There is obviously some doubt as to what is regarded as "the market rate" but most seemed to think that current rates were reasonably fair but any major increase especially resulting from increases in royalties to either the PTTs or the data banks would not be acceptable.

No question was specifically asked with respect to price reductions and there must be a query as to whether these reactions are symmetric. One respondent suggested that demand would be responsive to price reductions with an elasticity of about -1, a 10% increase in demand with a 10% fall in the charge. Two types of response might be expected to price reductions: that existing users increase their number and length of searches and that new users enter the market. Because we could only talk to a few users who did not pay any price and potential users we can say little about the second type of response. Certainly there is evidence that

some users stop using the system when prices move from zero to positive and presumably some of those losses would not have taken place if prices had been lower. But the general impression is that it is the charging threshold itself which stops usage at the moment, e.g. because there is no budget available at all, rather than that many regard the service as too costly at market prices. This is particularly true for students and other academic users who may have no separately augmentable source of finance and who are the main consumers of some types of on-line information. Probably the major determinants of whether or not someone uses the service, apart from whether there is a price at all are knowledge of the existence and possibilities of the service and ease of access to that service. This is not to say that there will be no response but rather to say that reaction could well be almost symmetric, that is, a 50% drop in price might more than double the number of users. It would be surprising however if the number of users multiplied by say 5 for this reason alone.

The effect on demand by existing users might also be expected to be quite small over small reductions in price. Most respondents were having difficulty in obtaining extra money but many thought that their numbers of searches were currently more limited by such factors as related documentation and clerical costs, searchers' time etc. rather than the actual search price. This was especially true as most felt searches were good value for money at the moment. In the short-run therefore small reductions in price might well have quite a limited effect on demand. Larger reductions might be expected to give rise to increased usage simply because a budget was available but little evidence was cited of unsatisfied demand at the present time (as opposed to expected increases in demand). In the longer term one would expect organisations to adjust their availability of back-up services, and personnel so that use could be made of the cheaper service. But the general impression is that once the threshold of using the service at all has been crossed price is not the limiting factor - it is more the spread of knowledge of the value of on-line searching which will expand demand.

Although it has not been possible to obtain confirming evidence on this, it would appear likely that crossing the threshold itself will

be a decision that is responsive to price. Thus if we take as an underlying model of demand the relationship:

$$D = D(p, t)$$

indicating that demand depends on price but also changes over time due to the spread of knowledge of the value of on-line searching, it is likely that:

$\frac{\partial D}{\partial t}$ is itself a decreasing function of price.

The implication of this is that the price elasticity of demand of existing users will understate the overall price elasticity of demand, by an amount which will depend on the effect of changes in price level on the rate of entry of new users.

Thus for small price changes we expect demand to be relatively inelastic. For price changes of around 20% re-evaluation will probably take place and demand will become more elastic. A guess would be that the elasticity is therefore -1 at prices 20% greater and less than present rates and that this might increase to say -2 at 50%. Below a 20% change demand can be expected to be inelastic, although perhaps quite close to -1 in terms of actual search time because of increased efficiency in use. The best guess is therefore a unit elasticity over the current range of prices plus or minus 20% for existing users. We would also not expect (on very thin evidence) that many new users would enter the market purely for price reasons unless prices were to drop by at least 20%.

Two notes of caution should be included here. First, what role do different budgeting procedures play in determining responsiveness both in the short and long run. Secondly, what is meant by cost, that is, are we estimating the responsiveness to changes in the total cost of using the system or to changes in the price per minute? We will examine these complications in turn.

XI The Effect of Budgetary Procedures on Responsiveness

For many organisations the capacity to vary consumption of on-line information is, at least in the short-run, restricted by the way in which departmental budgets are determined.

The typical firm specifies annual budgets for each department. Within this budget the department can choose how to allocate money to different activities and may itself specify an internal budget which will control this allocation. To the extent that this budget is inflexible over a particular period then the elasticity of demand with respect to price will generally be -1. In practice most budgets have some flexibility but to be able to obtain extra finance will normally require that the individual or department make a special case. Not spending some of the allocation will normally be easier, but may be seen as jeopardizing future budget allocations.

Table 6 Budget Position

	Information Budget	Specific On-Line Budget*	No Information Budget	To Change Budget Requires Proof of Cost-Effectiveness	Total
Large Users	12	5	0	8	13
Small Users	3	0	1	3	4

* 1 further user probably had an R & D budget for on-line searching.

In our sample of 13 large users and 4 small users all but one of those who gave information on budgeting had information department budgets. The other's library had been closed within the last two years and replaced by a general technical services department. It is clear that the existence of an information department budget (or something similar) is very important in current on-line usage. It may be less important where intermediaries are utilised.

The existence of an on-line budget appears, unsurprisingly, to be positively correlated with usage. Those who do not have specific budgets mostly remarked on the difficulty of finding money from alternative uses for on-line services and particularly stressed the need for proof of cost-effectiveness, even though on-line is normally a small part of the total budget.

Once a budget has been made available it seems not to be so difficult to obtain some increased finance from either general growth or other sources if consumers are satisfied with the product. But proof of cost-effectiveness is clearly regarded as exceedingly important as it is specifically mentioned by almost two-thirds of the large users and three-quarters of the small.

This evidence and more general material arising from discussion suggests that although when prices rise firms with on-line information budgets will find it difficult to adjust in the short-run, at least the principle of using the system has been accepted and so many may be able to adjust their budget upwards if they can show value for money. If the organisation only has a budget for information in general there is likely to be far more difficulty, as on-line searching is likely to be the newest service and may be seen as encroaching on other more accepted aspects of information services. If the organisation has no information budget at all it will be even more difficult to obtain acceptance for any major payments for on-line services. No information budget suggests a low level of information consciousness and no easy basis for cost-effectiveness comparisons - both of which factors are likely to make agreement to increase spending difficult.

Even where an information budget exists it may be difficult to obtain acceptance of on-line searching because specific payments have to be made while internally provided information services may appear cheap because use of internal resources is not costed. This is the usual problem of buying in in comparison to own provision. Many firms mentioned it as a difficulty. At least two suggested that the way ahead, at least in the short-run, was to charge onwards to the final consuming department. If the cost is significant this will result in the problems mentioned above. But if the charge is less than the petty cash limit allowed within each department the only problem may be to persuade the individual demanding the information that the search is worthwhile. But there is still a real problem that the search has to be cost-effective to that department in comparison, typically, with a zero internal service. If petty cash is not a limiting factor then the decision can be taken on the grounds of the relative benefit of on-line searching compared to other methods. If there are limitations then the comparison will be wrongly weighted towards the use of internally provided information.

The way in which budgets are specified and allocated is therefore a very important determinant at least of short-run demand in private firms. In the longer run the view seemed to be that proof of cost-effectiveness was required but that if this was forthcoming the budget would also be made available. But it must be remembered that our replies reflect the views mainly of very information-conscious people and organisations. In organisations where profit is important but information is not highly regarded direct charging can be expected to be a strong initial deterrent although in the longer run the provision of obviously cost-saving information may break down the barrier.

So far we have examined the role of the budget in the behaviour of private firms. Other types of organisation may be expected to behave rather differently. In particular many discussants thought that universities and academic researchers in general would have particular difficulty in finding funds to use on-line services even though they might be expected to be among the groups who would both obtain the most benefit and perceive that this benefit exists. In Europe most academic researchers are not expected to fund their own information provision. It is expected that this will be available via a "well-found" library and is normally paid for out of a block grant to the institution. This is clearly going to make it exceedingly difficult for individual researchers to obtain funds for the direct payment for information involved in on-line searching, especially in multi-disciplinary institutions where usage will vary widely between research areas causing obvious conflict. Ten of the intermediaries and hosts specifically mentioned the difficulties that university researchers are likely to have in obtaining finance. Five ran special schemes (including free access) to assist utilisation by university researchers, including one private firm who regarded it as a part of marketing their products. Three of the information specialists also specifically mentioned problems faced by academics once on-line is no longer experimental (experimental services have often been provided free of charge).

This difficulty can be reduced by governmental decisions either to allow specific budgets for information services in universities, by augmented grants to individual researchers, or by direct subsidy to academic users.

The first may well come in time as greater pressure is put on allocating costs to specific research (e.g. in the moves towards computer pricing). The second has been accepted in a sense by the American government in the provision of Medline free to academic users. DIMDI's policy has been similar and much of the free experimentation has included academic researchers. But without a continuation and expansion of these differential policies or a complete change in budgetary procedures academic usage of directly priced on-line services is likely to remain small.

On the other hand funded non-academic research, consulting and professional services in general were seen as fields where there would be little difficulty in paying at least current rates. These types of projects have historically bought in services and a new efficient service available at a price related to use is exactly the type of service they require. Here the budget is of assistance in spreading the use of the service rather than a hindrance. A large untapped and potentially rapidly growing demand was envisaged here especially for product and numerical information but possibly also for commercial information. However it was thought that their demand for currently available information except in one or two specific areas (such as the material available through ARIANE) was probably not very large.

Finally there is a question of the effect of budgets on usage by government departments (or similar publicly owned institutions). In general it was thought that such organisations would have little difficulty in obtaining the necessary funds for paying for on-line services once the idea of using such systems was accepted in principle. Some hosts/intermediaries do provide the service more cheaply to government agencies but this seems to reflect agreements arising from government subsidy of the service rather than the belief that civil servants cannot obtain funds to pay for the service. In this case the subsidy can be seen as having a similar effect to the fixed payment part of a two-part tariff, and could lead to increased utilisation of under-utilised systems while helping the system to remain financially viable. The main difficulty envisaged by government and quasi-governmental organisations is that they will be forced to use the government sponsored systems even where using another would be more efficient. This constraint should benefit rather than harm EURONET except to the extent that such restrictions may cause a decline in efficiency and so reduce overall usage of on-line searching.

Thus the ways in which budgets are determined are likely to be extremely important in affecting:

- a) The number of users.
- b) The types of users.
- c) Responsiveness to a price change in the short-run.
- and d) Responsiveness in the long-run.

XIII The Effect of Different Types of Cost

The cost of using an on-line service is made up of a number of different elements which are likely to be paid for out of different budgets. Costs include the direct payment for the service, the related telephone costs, staff and time, overheads, related documentation and clerical costs and the cost of the terminal.

Many researchers have regarded the cost of the terminal as being a major deterrant to users but of those who discussed this topic only one said that if they did not already own a terminal they could not have used the service and in this case a suitable terminal was, in fact, available. Obviously if a special terminal is necessary there will be a substantial cost barrier to overcome but as long as on-line services can use standard terminals, since most firms are likely to require these before they become interested in on-line searching this will rarely be a serious problem. If terminal costs decrease we would expect organisations to keep more terminals (demand appears to be very elastic) which will help to overcome the current restrictions on use to information intermediaries which will assist the expansion of demand for commercial, numerical and product information. In other words the cost of a terminal is not seen as a constraint (indeed many organisations admit to over investment) but very large growth in demand requires terminals in every department and this will not occur until prices fall considerably. However there is likely to be a steady growth in demand for terminals for other uses, such as computing.

Secondly, all firms, except one, with whom the point was discussed charged telephone costs as an overhead rather than requiring that each department pays for its own calls. Thus the effect of increased telephone usage to obtain on-line services is not directly felt by those who decided whether or not to use the system. The effect of increases in telephone charges is therefore not likely to bear directly on the choice of whether or not to use on-line. However at least two departmental heads thought that a rapid increase in telephone costs to one department would cause disquiet and perhaps even a change in budgetary procedure. A number were also worried because they had been asked to economise on telephone use and felt that they should therefore take account of charges even though not directly borne. But generally we would expect a smaller response to changes in telephone rates as compared with equal changes in other cost elements. Nevertheless telephone rates may be important in the initial

decision to use or not to use on-line services where all variable costs are typically taken into account.

Overheads are normally allocated in the same way as telephone charges but staff costs and the purchase of extra documentation are usually charged directly to the information department as are the actual bills for the searches themselves. Most of those who discussed cost-effectiveness at all specifically mentioned that on-line searching was regarded as effective partly because it saved specialised staff time (even taking account of training) and so increases in staff costs are likely to affect the choice of whether or not to use on-line in favour of the computerised service - within the overall budget constraint. Again the structure may be different when starting to use the system at all because training time is quite an important cost and there may also be course charges, but these will both probably decrease over the next few years as more information department staff become familiar with computer systems.

Many of the users (including at least half of the large users) mentioned that a very important constraint was the increased documentation costs and clerical time involved in using on-line searching to its best advantage. On-line searching was seen here as providing a new and different service and as increasing the potential value of information services. But to obtain the increased potential it could often be necessary to incur increased costs. This means a higher budget for information which requires justification. Many respondents are finding justification difficult in the present economic situation even when the service is accepted as valuable. Thus the increased usage of on-line searching may not simply require substitution of finance from another part of the information budget but may well also need an increase in the total information budget. This is a further hurdle that on-line searching has to leap.

Finally, the direct payment for the on-line service is normally borne by the department that decides to use the system, which is often not the final consumer. Its decision-maker, typically an information department, may find it difficult to measure the relative benefit of providing material on-line or by other means, and this could have the effect of restricting or in some cases of encouraging use.

A change in the price per minute of on-line services will be

equivalent to a smaller proportional change in the cost of using the service. What proportion of total cost it will be depends (a) upon whether the organisation is already a consumer of on-line and (b) which costs are borne directly by the department that decides to use the on-line services. The significance of (a) is that small changes in direct costs would probably not be a major factor in the choice of whether or not to use on-line. The significance of (b) is that when many of the other costs are borne elsewhere or are fixed in the short-run (such as rental charges for terminals) a similar change in direct charges could be of more importance. There is also some evidence that provision of documentation and clerical assistance may be a constraint to the expansion of on-line searching at least in the short-run.

XIII Price and Availability of Substitutes

There are two distinct views about the existence of substitutes for on-line information searching. The first regards it as an entirely new product for which there is no close substitute. The second regards it mainly as a substitute for manual searching. But even those who hold the second view regard the product as being differentiated and place more or less emphasis on particular features including speed in obtaining the results, searcher's time saved and especially the interactive nature of the process.

Table 7 shows a clear distinction between existing consumers, suppliers and information specialists. Without exception all users regarded the relative cost of searching on-line and manually as a major determinant of whether or not they used on-line searching and of their level of use. Suppliers were less sure and even some of those who answered 'very important' thought that in many ways on-line should be regarded as a different commodity to be assessed on its own merit.

Table 7 Costs of Using the Service

	<u>Relative Costs</u>		Total Replies
	Very Important	Not Important between On-Line and Others	
Intermediaries and other suppliers	78%	12%	17
Large Users	100%	0%	13
Small Users	100%	0%	4
Information Specialists	25%	75%	4
Total	92%	8%	38

Information specialists clearly stand out as regarding on-line as a non-comparable good whose value should be assessed entirely separately from the relative cost of other means of searching. To some extent this difference may arise because these specialists are looking further ahead and are assuming that information will in future be made available on-line of a type which is not available in other forms.

However the evidence at the moment certainly upholds the view that most users assess the relative costs of using on-line in relation to other means of obtaining information. Benefits are mentioned but unless on-line can be shown to be cost-effective there will be little demand.

The costs of the alternative service will normally be, for the department, the staff cost and time plus clerical time. Most respondents agree that using trained staff the time saved by an on-line search is considerably greater than the direct costs of on-line usage. One user estimated direct costs per reference obtained by on-line searching as about 90% of manual search costs and there were other similar estimates.

One question of particular interest to the spread of on-line services is the extent to which relatively expensive information specialists must be used. If their use is necessary then on-line searching is unlikely to save many salaries although it may free staff to work at other jobs for a greater part of the time. Furthermore if information specialists remain a necessity it will be difficult for small users to go on-line except through intermediaries. Table 8 gives the views of different groups as to the need for an information specialist. As with the nature of the good, information specialists are the only group who now see usage by others as being possible to any great extent. The capacity of research workers to use the system is thought to be restricted because of the need for great familiarity with the data base and the greater time taken in doing a search. This is not thought by paying organisations to be offset by any greater benefits from the information. One information specialist, and one large user, did however think that as searching software becomes simpler these benefits will outweigh any extra costs.

Table 8 Use of an Information Specialist Required

	YES	NO	TOTAL
Suppliers	85%	15%	14
Large Users	91%	9%	12
Small Users	100%	0%	4
Information Specialists	25%	75%	4

Thus the existence of alternative means of obtaining the information and the relative price of such alternative means must be regarded as most important in determining demand. Although to some extent on-line searching is a new good comparability with similar goods helps to make it acceptable and cost-effectiveness in relation to other goods allows organisations to get round the problem of measuring benefits. The price of alternatives is therefore of the greatest importance. If the relative position should change greatly in favour of manual searching demand would undoubtedly be cut. However within the next few years most respondents saw staff costs as increasing and therefore expected on-line searching to become relatively even cheaper and more worthwhile.

The cross elasticity of demand between different on-line services appeared to be quite large. Most of those who could use more than one service had done so and had compared costs, usually per reference. But by no means everyone automatically took the cheaper search. Differences in the type of information and software available (free text searching, provision of abstracts, coverage, etc) were regarded as important in that they affected both the value of the result and the costs of documentation, clerical assistance etc. There therefore does appear to be a possibility of product differentiation. On the other hand many users complained that information was available from two or more sources and felt that this was a waste of resources and caused them difficulties in choice which they did not regard as beneficial. The general trend appeared to be for wanting more material available from the computer (probably off-line) so that the value of information received could be more readily assessed.

Most users were aware of the relative costs of using different services and took them into account. They did switch backwards and forwards depending upon their specific needs for a given search. Clearly the extent to which this is possible depends upon ease of access and the provision of similar or duplicate data bases. Given that such choices remain available then we would expect that consumers will be very aware of relative cost changes and will move readily from one system, in response to small price differences, to another when the product is very similar. But users are clearly also aware of trade-offs between time used and cost per minute, between different levels of detail in

the output, different search procedures and different coverage. This product differentiation depends mainly upon the data bases available and upon the software. This differentiation means that demand for each individual firm's product is certainly not perfectly elastic but relative direct costs are still exceedingly important.

XIV Income and the Determination of Budget Size

For most organisations the role played by income in determining consumers' demand is taken over by the role of income in determining the budget. As information budgets increase more money will be available for all types of information and for on-line information in particular. The question is therefore for most organisations what determines the size of the budget and in particular what effect does the income of the organisation have on the size of the budget.

In the private sector an important determinant of budget size can be expected to be profitability. If profitability is increasing then there are usually possibilities for increasing the size of budgets for central services (and information is usually such a budget or an item in such a budget). If there is a decline in profitability non productive departments are usually expected to cut-back expenditure in line with general restraint unless a particularly good case can be made that increased expenditure will cut costs elsewhere or provide a high benefit payback. Probably the major determinant of profitability is the level of economic activity in the economy, especially in the context of determining the effect of income on market demand for on-line services. All respondents to the questionnaire regarded the level of economic activity in the country as being an important element in determining demand.

What is the likely elasticity with respect to income? Undoubtedly there has been a massive growth in demand for information services over the last decades as the complexity of production, sales methods and other activities have increased and as firms have increased in size, diversified and extended their markets. This suggests an income elasticity of greater than 1. Also there is some evidence that organisations are prepared to pay higher prices for greater accuracy, coverage and detail, which again suggests quite a high elasticity. But very considerable research on the determination of budgets and on the growth of secondary information services over the last decades would be necessary before a numerical forecast could be arrived at.

In the public sector it is our impression that research budgets are highly income elastic and heavily dependent upon the general level of economic activity. This would also apply to government department expenditure where, the evidence of the last few years is that public expenditure is growing faster than income in general but that it is

particularly subject to cuts in time of recession. (Counter cyclical government investment policies which would expand government activity in a recession are now out of favour, because of their inflationary effects.)

Thus we would expect the growth in overall demand for on-line information to be heavily dependent upon the expansion of economic activity in Europe and that the growth in on-line demand would be more rapid than the expansion in overall output.

XV Expected Expansion in Demand at Current Price Levels

It is extremely difficult to take into account all the factors we have discussed as determining demand and to produce an estimate of their likely trend. Respondents were asked to estimate the likely increase in their own demand over the next ten years and also what level of general development they expected. Many felt that they could give no estimate at all particularly because their usage was in the experimental stage. This also means that percentage increases may look very large but be reflecting really very small absolute usage.

Table 9 Expected Increase in Demand Over Next Ten Years

	Own Demand (Both Consumers and Providers)	General Demand
Less than 100%	32%	11%
Between 100% and 1000%	54%	89%
Above 1000%	14%	
Total Number of Respondants	22	28

For instance one intermediary who predicted between 300% and 400% increase in demand over the next ten years was estimating from a base of only 10 searches per month. The typical view of users might be regarded as doubling use over the next couple of years but slower expansion thereafter. The mean estimate for the ten year period would therefore probably be less than 5 fold with very few predicting more than 10 fold.

Two suppliers with considerable experience predicted growth rates of demand for their own products of between 10% and 15% per annum and these replies together with other discussions suggest that perhaps even the five fold estimate is somewhat of an overestimate. Consumers would probably be expected to estimate lower increases than suppliers because suppliers are taking into account new users of their systems while consumers are only taking their own use into account (but this could be offset if consumers estimates assume that there will be new suppliers). For these reasons we would expect estimates of general growth in on-line demand to be greater than that for individual demand.

Views expressed on total demand were less specific than those about their own demand. . Few of the respondents thought that demand would only increase by a relatively small amount (under 100%). The majority expected a larger expansion but felt unable to quantify this because of uncertainties as to what types of data would be available, how effective would a network system be, what technological changes would have taken place and how information conscious current non-users would become. Most expected a break-through towards readily available computer information within the next twenty years but far fewer believed that it would be firmly established within the next decade. Thus although the impression is that most respondents expected a ten-fold increase overall and perhaps more, anything like the PA forecast (an almost 90 fold increase) would depend on rapid technological change, speedy availability, of new types of data base, massive marketing to make new users information conscious and a large general upturn in the world economy lasting for the whole of the period.

XVI Pricing Levels in Relation to Costs

At the present time the three main suppliers include in their unit charges their own direct costs and royalty payments to the suppliers of the various bases. On top of this users have to pay transmission costs between the host computers and nodes and telephone charges between nodes and their own locations.

It is not possible to obtain any quantitative estimate of the extent to which current charges cover all the costs of the services but except for transmission there is strong evidence that full costs are not being covered, although short-run marginal costs are covered in some cases. This is probably partly because many of the costs are joint with other products and partly because of government subsidies. We have no information about the profitability of the various suppliers and firms supplying transmission services.

With respect to data bases those who were in a position to provide evidence stated that on-line royalties were covering only a very small part of the total costs of the data base (see Table 10). Two estimates in relation to services where there was no government subsidy suggested that the norm was usually between 5% and 10%. This is possible only because other sources of income - mainly sale of hard copy but also including SDI services etc - pay for the bulk of costs. However everyone agreed that these other sources of income were likely to become less and less important over the next few years. One information specialist thought that much hard copy would disappear if on-line truly caught on and that revenue from what was left would be drastically reduced. This view was generally supported by respondents who were willing to express an opinion. Most also expect the cost of providing the data base to increase more rapidly than the rate of inflation. So total costs of data base provision are expected to increase substantially especially if on-line retrospective searching does become the main source of certain kinds of information. If on-line searching does not grow so rapidly then of course the amount the data bases must recoup from charges for searches is less because revenue from hard copy and other sources will continue.

Table 10 To What Are Costs Related?

	Data Bases	Hosts/Node ¹	Intermediaries ¹
Direct	0	1	1
Direct and Overheads	0	4	4
Small Contribution to Total Costs	4	2	0
Zero	0	0	1

¹ Most hosts charged prices related to these costs rather than full cost recovery. Most mentioned "cut-price" schemes which would entail loss making as no-one charged other consumers more than average cost.

A similar question can be raised about intermediaries some of whom were making use of experimental schemes and were not therefore charging true costs of provision.

A second element in the cost of data bases is the extent of subsidy. Many bases provided in the United States receive large subsidies or are provided free of charge from subsidised organisations. Others depend upon fees paid by industrial subscribers. There is evidence that many of the numerical data bases which might be expected to go on line are also spin-offs from subsidised research. Not all these subsidies are likely to continue especially where it becomes obvious that the data bases are being used as a commercial service. Thus existing data bases are likely to become much more expensive and will expect to draw more of their revenue from on-line. Other potential data bases for which consumers have expressed a need would probably have to be financed completely from charges for searching at least at the outset. All of these factors suggest that the data base costs are currently unrealistically low and a ten-fold or greater increase would be by no means suprising.

Whether this increase in provision costs actually increases the cost to the consumer of course depends upon the extent to which the cost can be spread over a greater number of searches. On our earlier predictions which also suggested a ten-fold or somewhat greater increase in demand the effect would be, very roughly, neutral. That is to say, the need to cover the full cost of data provision from the on-line search charge would just about balance the reduction in cost made possible by a greater number of users bearing charges about the same in real terms. Three respondents specifically agreed with this view.

It is difficult to obtain hard evidence about the costs of hardware and software. Most suppliers expected there to be considerable new investment in computer hardware specific to data base provision if growth in demand is sufficient. Few thought that there was currently any massive excess capacity in terms of storage while most agreed that increasing demand required new and extended data bases. The computer hardware required for numerical data bases and commercial and economic material would probably be less costly. Respondents expected total costs of hardware provision to rise although many thought that this would be offset by increased output with the net result being a fall in cost per unit. Estimates of the net effect varied from a decrease of 50% to an increase of 15% - 20% per search (including the costs of software).

Similar views were held about software. Most accepted that more software would be required but that the extra costs could be offset by extra useage. The only note of dissent here was from those who saw problem solving as being the basis for expanded demand, for this would require far more sophisticated programs when costs might well not be offset by predicted increased consumer demand over the next ten years.

Table II shows predicted changes in the cost of provision and it is clear that the view that costs will decline as output expands is more strongly held than that the whole cost curve will shift upwards because of the need for new investment etc. The factor here that appears most critical to the authors of this report is the extent to which current charges are realistic if costs are even to be recovered.

This factor, it is worth repeating, arises from the fact that development of the three main services has been almost certainly as spin-offs to other production processes. On-line systems would probably not have been set up at all if much of the technology had not been paid for from elsewhere, many of the personnel had not anyway been working on similar problems and even some of the hardware and software made available from other sources. But as on-line services grow they are going to have to stand on their own feet and not gain from the fact that many costs are being borne elsewhere. Thus other savings suggested above may well turn out to be entirely real in cost terms but not real in price terms if prices have to cover all costs of production. Whether or not they will have to do so depends considerably on the role that governments are prepared to play in underpinning research in information dissemination and so allowing on-line services to benefit without paying the full costs. To this extent a number of respondents thought that governments should be prepared to pay for basic research into software for problem solving on-line services even when they believed that those services should otherwise be expected to cover their costs.

The fear that the relationship between costs and prices will not remain as currently expressed is further strengthened by a certain amount of hearsay evidence that the American firms are not finding on-line services profitable at current price levels and that there is not a great deal of excess capacity available, even currently, to allow costs to be spread over more users.

Table 11 Expected Cost Changes in Real Terms

	Data Base Suppliers	Hosts/Node	Intermediaries	Users
Costs Expected to go up				
Transmission	3	3	3	3
Provision	4 ¹	2	1	1
<hr/>				
Costs Expected to go down				
Transmission	0	0	0	0
Provision	0	2	4	3
<hr/>				
Uncertain Transmission	1	3	4	3
Provision	0	3	1	2
<hr/>				
Costs Expected to Stay Same		1	1	4

¹ Data base suppliers are referring to the cost of providing the data base rather than the final per unit cost per search. But most agreed that the size of the increase required here could offset any other savings even with a very large growth in demand.

Finally with respect to production costs, very few of the hosts are charging prices covering the full cost of the service to all users, and only one intermediary said that they tried to cover all costs. Most intermediaries were on-chargeing any payments they made out plus staff costs and allocated overheads. But some users were receiving material at lower prices and some agreed that they were under-chargeing for staff time and overhead costs because on-line searches were a small part of their business which they wished to expand. Other intermediaries were passing on to consumers cut prices they were being charged by hosts. Thus the current price being paid by consumers was quite often below the expected price in the longer term. Even some of the large users were still making use of special offers available from the major suppliers. So again a downward movement in costs per unit may not necessarily be reflected in the actual price per unit.

The final item in direct (as opposed to user) cost is that of transmission. In general respondents either expected costs to go up or were uncertain (See Table 11). This uncertainty reflects difficulties in predicting the pricing policy of PTTs. Some factors are relatively clear. Transmission costs which relate to distance will generally decline especially if Euronet is set up because of the proliferation of nodes. Speeds of transmission are also expected to increase and therefore, excluding price changes, transmission charges per search are predicted to decline. Then come the uncertainties. Telephone charges have been increasing faster than inflation over the last few years and this is expected to continue, perhaps, some thought, just about offsetting the gains from increased speeds. Finally, there is the cost of transmission from host to node. Here the position depends crucially upon the pricing policies of the PTTs, and possibly upon technical changes such as the use of satellite communication. We are not in a position to estimate the costs of providing the necessary network but it seems likely that here again there are many joint costs and therefore considerable areas of discretion on the part of PTTs. We would expect costs per search to decline with usage because many of the direct costs will be in terms of indivisible investments. On the other hand we would expect actual charging to be constant per unit of time. Therefore PTTs will be required to choose whether to attempt full cost recovery (or profit) early on or to set prices so as to expand output and increase revenue over time. This appears to be the major element of uncertainty in the determination of the likely price level.

If we assume transmission costs remain roughly as they are at present for European on-line services then our general impression is that overall prices per search will not change greatly in real terms over the next ten years unless there are much greater increases in demand than are envisaged in this report. Decreases in costs which arise from increased output will be offset by increases in the proportion of costs that have to be borne by on-line services and by increases in investment costs required to provide the necessary technology and data base availability.

This conclusion could however be modified by two factors: utilisation of market power and government intervention. These are discussed in the next two sections.

Annex 5 assesses the material made available to us on costs, prices and demand for on-line information services at the present time and shows considerable responsiveness to price changes within the present pricing structures.

XVII Market Power

At the present time there are three main competitors in the on-line market two of whom use a non-PTT common carrier. However this situation may not continue. We have considered three possible future scenarios:

- (a) Competition continues as at present but with short-distance telephone call access to Tymeshare available throughout Western Europe.
- (b) A royalty is placed on the use of Tymeshare by the PTTs
- or (c) The use of Tymeshare is discontinued.

Under (a) for many users there would be quite large reductions in price. Under (b) prices would rise for many users and under (c) European providers, probably specifically EURONET, would be given a monopoly.

Which of these three scenarios comes about is clearly important for the growth of on-line service usage in general and for the viability of a European service in particular. The first would both remove uncertainty about access to suppliers and increase total demand because of the price reduction. But assuming competitive prices, taking into account product differentiation, this demand would be split between three suppliers all of whom are probably still on the downward part of their average cost curve, and thus not able to exploit full economies of scale.

EURONET could obtain some of the existing demand for the USA-based services either through the introduction of a royalty or if Tymeshare were to be made illegal throughout Europe. But they would not expect to divert all existing demand to the service unless all the data bases already available elsewhere, or close substitutes, were quickly made available to EURONET. The price at which these bases would be made available would presumably reflect the expected monopoly position and so push up the cost of provision through EURONET.

Most suppliers and users agree that although there is a significant affect of price on demand the real basis for a substantial increase in

on-line searching is the quality and type of data base, ease of access and readily available information about the system. Accepting this it is probable that the benefits to European consumers of having all three existing services available are likely to outweigh the benefits to EURONET of diverting part of the market to itself. Prices will then have to remain competitive and would be highly unlikely to increase to a level at which alternative methods of searching are cost-effective. But dropping prices (via very low transmission costs) or restricting competition in other ways so that the American suppliers no longer find the European market worthwhile could be counter-productive because of its effects on users' confidence and because of the reduction of services which would be implied. One user especially said that he would not necessarily switch to a lower cost service, if he believed that the lower costs were being introduced as part of a price war intended to eliminate alternative suppliers.

This line of argument seems to suggest that transmission costs should be set to cover costs taking a long view and that the same philosophy of charging should be applied to all services.

Market imperfections may also arise in the supply of data bases, which may be thought of as natural monopolies in the sense that the costs of setting up duplicates are so high. Subsidies to one part of the activity (say transmission costs) might result not in lower prices but in higher royalties being available to pay the data base suppliers.

It is clear that within the on-line information market there exists considerable potential for utilising market power. But such use will reduce the value of the service to consumers and probably inhibit growth. If growth of total demand of the type envisaged by the proponents of EURONET is to be achieved then there is no room for monopoly pricing. It is not even certain that EURONET customers will be maximized if EURONET is a monopoly.

XVIII Government Intervention

The remaining question on price determination is whether there is a case for government subsidy of on-line services. Most of those who responded to the questionnaire thought there was a case for governmental and intergovernmental assistance while fewer (twelve) thought there should be a long-term continuing subsidy of one form or another.

The major exceptions were the large users. All the six who specifically answered no were large users fearing government interference in what data would be provided and in ease of access. This applied to users in different countries and was not limited to those who had suffered because of problems in obtaining access to U.S. suppliers via Tymeshare.

Table 12 What Form of Government Intervention should be encouraged?

Assistance with Telecommunication Arrangements	Data Bank. Software	General	Short-Term Only	None
13	8	10	2	6

Thirteen respondents particularly mentioned assistance with telecommunication arrangements but probably one half of these were not advocating direct government subsidy.

Two regarded it as necessary for government to help with specific capital bottlenecks and the other specified candidates for subsidy were data base provision and fundamental research, including the development of software for problem solving.

One further argument was given for government assistance to on-line services: that the U.S. government has given very considerable subsidies in the past and may well continue to do so and therefore it would be difficult for European services to compete without similar subsidies. At the present time this might suggest that rather than subsidise a further service, U.S. services should be used instead. But this might entail greater costs in the long-term, especially if a U.S. monopoly or control developed. There are other arguments both for and against the view that the existence of subsidies in the U.S.A. requires subsidy in Europe. If however it is accepted that a European service is necessary it is essential that this service be priced at a rate which is competitive with the American suppliers taking account of transmission costs. The case for

a price below the competitive price if resource costs are not being covered is less obvious. The main reason for a price below long-term cost that has been put forward is that it is one way to spread the use of the system as rapidly as possible and so obtain conditions in which long-term cost recovery is possible. But even if prices are very close to zero user costs will still exist and the elasticities with respect to direct price do not appear great enough to make such a policy worthwhile. Instead prices should be set at levels which consumers can expect to continue and emphasis should be placed on informing the consumer and marketing the product of on-line information.

Although there are thus a variety of reasons both for and against some kind of subsidy to European on-line information services it may be prudent to retain the assumption made by PA and stated by them to be consistent with the basic principles developed by the special CIDST working group on pricing - financing for public funds is expected to diminish with time, virtually ceasing within the second half of the forecast period.

XIX Demand Relationships over Time

Among the factors we have found to be expected to affect the demand for on-line searching supplied through EURONET, the following appear to be the most important.

1. The autonomous growth of demand, as more individuals and organisations learn about the potentiality of these services.
2. Reaction to growth of the supply of new data bases and new software systems.
3. Choices open to customers; essentially whether or not Lockheed, SDC or similar services will be available in addition to EURONET.
4. Prices charged and user costs for services made available through EURONET.
5. Prices and user costs of computing services.
6. Prices and user costs of alternative information services such as off-line searching or manual searching.
7. Economic prosperity.
8. The nature and extent of the EEC/government control of the facilities offered.

Even in principle it would be impossible to indicate the characteristics of a model taking all of these factors into account. Moreover many of them will not be in the control of EURONET.

Figure 2 illustrates a more simplified demand model taking into account only three factors: calendar time, price (and user cost) and market organisation. This calendar time relationship will incorporate the effects of factors 1 and 2 above: factor 3 is represented by market organisation. The relationships assume implicitly certain expectations on factors 5 - 8. Mathematically the model is an attempt to picture two relationships:

$$D_m = D_m(t, p + c)$$

$$D_c = D_c(t, p + c)$$

D_m is the expected European demand for on-line services assuming that they are all supplied through Euronet. D_c is the expected demand for on-line services through Euronet if other computing services are available as at present. t represents a calendar year, p price and c user cost.

In Figure 2 the curves D_{M1} , D_1 , D_{M2} , D_2 , D_{M3} , D_3 represent demand curves in monopoly conditions for EURONET at 3 points in time, and D_{C1} , D_{C2} , D_{C3} represent demand curves in competitive conditions. Because the competition would not be perfect the competitive curves are not shown as straight lines, that is we assume that some users will use some EURONET services even if prices are generally above those of U.S. suppliers. The figure shows price and user cost separately but on the same axis and indicates that even at zero price demand may not have reached its full potential as savings in user cost could increase demand still further.

In order to make a meaningful estimate of the effect of price on demand it is necessary to estimate the demand function D_m , D_c at least over the area of interest. The graph shown in Annex 4 and derived from the PA report corresponds to something like the curve X_1 , X_2 , X_3 which joins points on different demand curves. We have seen a number of curves which have tried in this way to relate historical changes in demand to changes in price. Figure 2 shows how misleading these can be as estimates of the price elasticity of demand at one point in time.

The mathematical properties of the functions D_m , D_c can be fairly readily stated. The first order properties would be:

$$\frac{\partial D_m}{\partial t}, \frac{\partial D_c}{\partial t} > 0; \quad \frac{\partial D_m}{\partial (p+c)}, \frac{\partial D_c}{\partial (p+c)} < 0.$$

The second order properties would be:

$$\frac{\partial^2 D_m}{\partial t^2}, \frac{\partial^2 D_c}{\partial t^2} > 0 \quad \text{up to } t = t_0^m(p), t_0^c(p), < 0 \text{ thereafter.}$$

(This implies an S-shaped growth curve such as the Gompertz curve used by PA)

$$\frac{\partial^2 D_m}{\partial t \partial (p+c)}, \frac{\partial^2 D_c}{\partial t \partial (p+c)} < 0; \quad \text{the higher the price the lower the rate}$$

of growth.

$$\frac{\partial^2 D_m}{\partial (p+c)^2} > 0; \quad \text{the monopoly demand curve is concave to the origin, and:}$$

$$\frac{\partial^2 D_c}{\partial (p+c)^2} > 0 \quad \text{for } p + c \leq k_0(t)$$

$$< 0 \quad \text{for } p + c > k_0(t)$$

Where k_0 is approximately equal to the price plus user cost for on-line searches not using EURONET.

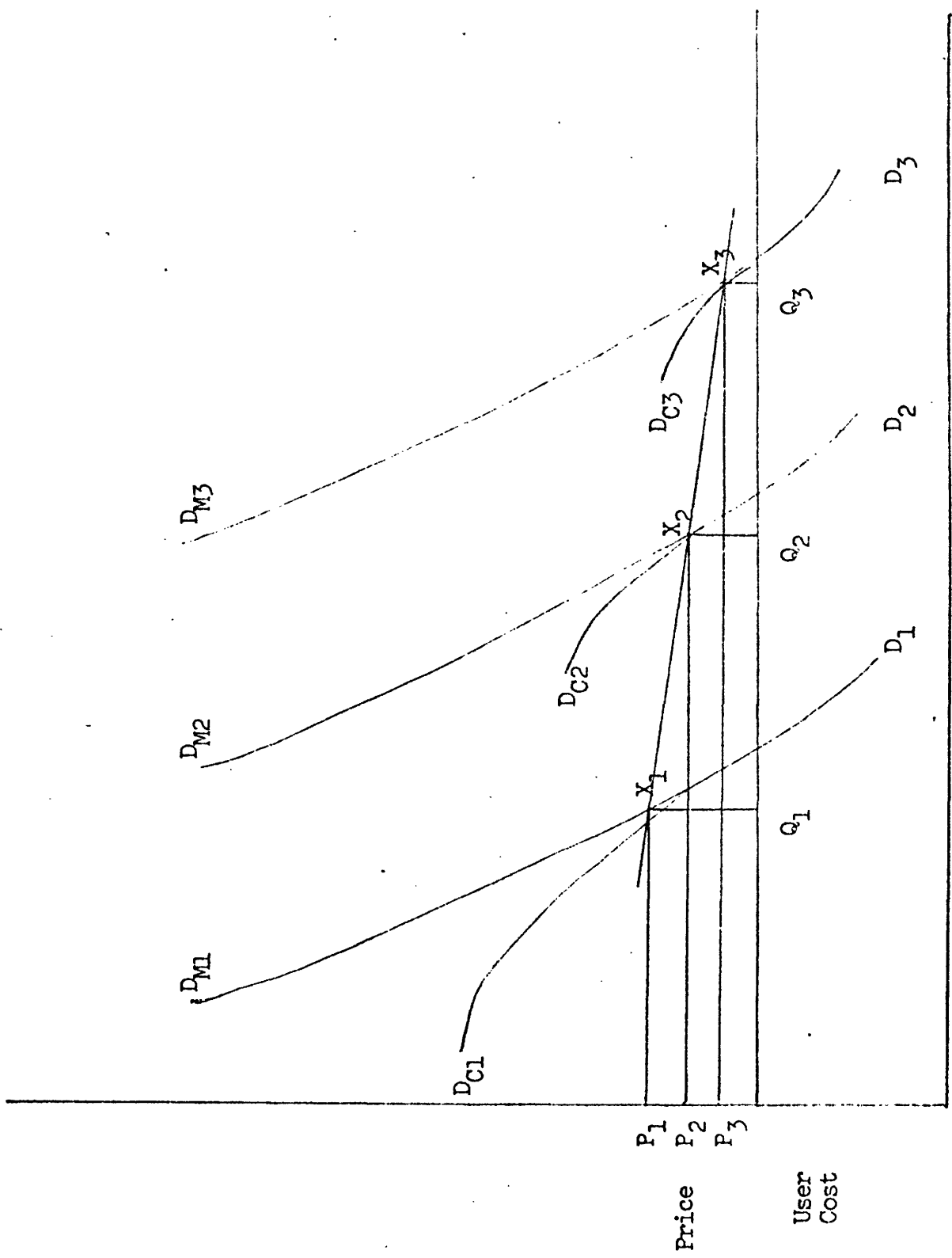


FIGURE 2
Demand relationships over time

Many functional forms fit these conditions. Our survey does not give much grounds for choosing between them except to suggest that demand elasticity is probably greater at high than at low prices. For consistency with PA it is probably best to choose a function which assumes the shape of a Gompertz curve when price varies in the way implied by the PA forecasts. Within this requirement it seems sensible to choose as simple a functional form as possible.

We are not able to propose an exact functional form however. The reason is that it is not satisfactory to present the functional form without having constructed numerical demand models to test the realism of the function proposed. The data to do this does not as yet exist in Europe. It could be done using United States data if this could be made available.

The sources of information available to us have been set out in this report, together with the findings of our own survey. We have from this work some basis for estimates of growth in demand and of the effect of price on demand, and they have been set out in Tables 9 & 5 respectively given in sections XV and X. The former do not appear to be consistent with the PA report. It is understood that the findings of this report are regarded as unsatisfactory in certain respects and that papers have been written putting forward alterations. These papers have not been made available to us. We also understand that there are views about likely price trends or pricing policies which may not be consistent with the views presented here, but we are not informed about the basis of those or the resulting expected prices. Again data from American services would be of use, even though not directly applicable to Europe, and would be invaluable in testing the validity of alternative functional forms.

We are thus in the position of having obtained sufficient information to make an informed guess at the relationship between price and demand given access to certain other available information, but not having had access to these remaining information sources. But it would be quite wrong to attempt a quantitative estimate of these relationships founded on material (the PA report) believed to be based on certain incorrect assumptions without adequate data on prices, and without any testing of our survey-derived hypotheses on existing data. It is hoped that nevertheless the Group may find our qualitative findings and survey results useful.

XX Conclusions and Recommendations

All the conclusions included in this report must be regarded as tentative both because of the small sample that we were able to contact and because on-line information services are still very much in the experimental stage.

With this reservation we present the following conclusions:

1. Almost all those who had experience of on-line services have used only bibliographic style materials, usually needed by research and development personnel but accessed by information specialists. If the data available remains of the same type then the types of people using it and the need for information specialists as intermediaries will remain the same. Under these circumstances demand is unlikely to expand to more than, at the outside, ten times its present level over the next ten years.

2. If other types of data are made available; particularly product information, commercial and economic information and numerical data, the services will begin to be used by a far wider range of people, often without the need for specialist intermediaries. Expansion of on-line use could then be much greater, exceeding a 10-fold increase over 10 years.

3. Such an expansion would depend on the provision of new data bases with pre-digested information and the provision of problem solving software.

4. At the present time the material regarded as having the most inelastic demand is patent information.

5. The usual on-line pricing system by which consumers are charged only for what they use is regarded as absolutely necessary if demand is to grow rapidly.

6. However some large users might gain at least in the long term from either an annual subscription or a two-part tariff form of pricing. This would also increase the certainty of revenue for suppliers.

7. The method often used by intermediaries of charging per query is likely to become less important as on-line services grow because of the ease by which costs can be allocated under the price per minute system.

8. Reactions to price in Europe at the present time are heavily affected by the existence of a number of experiments and marketing programmes which allow some level of free use.

9. Most users did not expect to reduce demand if prices were raised by up to about 10%. Above that level until about 20% most expected to cut back time per search so keeping costs constant. Above the 20% level many users thought that they would no longer use on-line services or at least that they would cut back usage heavily. This suggests a demand responsiveness fairly close to - 1 up to about 20% rise in price (probably slightly more inelastic for many small rises). Above this, demand can be expected to be elastic.

10. We have little evidence on which to base predictions about the response to cuts in price. It appeared that most existing users would not respond greatly to small changes and that again up to about a 20% reduction elasticity would be close to unity. For greater price cuts the evidence suggests an elastic demand. The price elasticity of existing users will understate the overall price elasticity of demand but we were unable to estimate the extent of this under estimate.

11. How an organisation specifies its information budget and within this budget how much it allows for on-line information has an important influence on the organisation's demand for on-line information. Most organisations with information departments had specified information department budgets which they found difficult to vary over the short-term. Over a longer period most thought they could vary the budget in response to demand for on-line services by final users but would have to justify budget increases because of price rises by demonstrating that the service remained cost-effective.

12. If an organisation has no budget for information it will be extremely difficult for an organisation to use on-line services.

13. Some of these problems can be reduced if the cost per search is less than the organisational limits on discretionary or petty cash expenditure. In this case final users may have discretion over when to use the service without going through a central information service.

14. University researchers are likely to find it particularly difficult to obtain finance for on-line searching.

15. Consultants and other professional services should find finance easier but their level of use will not be great unless more specific information is available in data base form.

16. Generally government departments had not experienced difficulty in finding the necessary finance but were sometimes limited to using particular systems.

17. Demand will respond differently to different types of cost depending upon whether they are included in the budget of those who decide whether or not to use the service. For instance users are likely to be less responsive to changes in telephone charges than they are to on-line charges.

18. A bottleneck in increasing usage appears to be the rate at which information services, documentation and clerical staff can be expanded to provide the hard copy records discovered in searching.

19. Terminal costs are not normally regarded as a major bar to the use of on-line systems but could limit the spread of use to a large number of final user sections.

20. Most users regarded manual search as a close substitute for on-line searching although they recognised that there are important differences in the product especially related to the speed at which the answer is obtained. Information specialists however regarded the on-line search as a very different product.

21. Staff costs are likely to increase more rapidly than other costs so that, at present charging rates, computerised information systems are likely to become more and more cost-effective.

22. But most users thought an information specialist was necessary for the successful use of on-line services. Information specialists disagreed with this view, but they did think that knowledge of the data-base was important.

23. Within on-line services the cross-elasticity of demand between two services supplying the same or similar data bases appeared to be large although there was agreed to be some differentiation of product.

24. The growth of economic activity in the economy as a whole was expected to have a major effect on the growth of demand for on-line information services, both in the private and probably even more in the public sector.

25. On the basis of questionnaire response it might be expected that the demand for on-line information by existing users might increase perhaps five-fold over the next 10 years. Most respondents were unable to estimate changes in total demand but those that did this expected a ten-fold increase (from the current low level), half of the increase coming from new users. Greater expansion than this, it was thought, would require a combination of many favourable factors.

26. There was some doubt as to whether the price per search was likely to increase over the period. There are believed to be major economies of scale which are not being utilised. However many costs are not currently borne by the on-line services. Data base royalties are expected to increase considerably. Investment is needed both in hardware and particularly in software. And in many cases prices do not currently cover costs. Therefore it is thought that demand must increase many times before the scale economies cover all costs, including investment costs and increased royalties and costs per search can consequently decline.

27. Most respondents were uncertain about the effect of transmission changes. Until the charging policies of the PTTs have been settled uncertainty may act as a brake on demand expansion.

28. Some respondents feared that EUROWEST would attempt to set up a European monopoly. Although this could improve the chance of realizing economies of scale it is likely that it would affect overall demand adversely. It would therefore be harmful to the expansion of on-line services in general.

29. Most respondents thought that governments should be involved to the extent of facilitating agreements between the PTTs. Some other thought that further capital assistance would be worthwhile. Some large users thought that any government involvement, unless limited to specific areas, was likely to prove harmful.

30. In order to express the relationship between price and demand it is necessary to separate out supply effects, learning effects and price effects. The first two of these can, for our purposes, be combined with a time trend. Demand functions need to be estimated which relate demand to time and price. Two separate demand functions are required, one for the monopoly and one for the competitive case. The properties of these functions have been identified, but no mathematical or numerical form is given, because acceptable time trends, price and demand data were not available to us.

31. The consultants are not aware of any adequate material available at the present time within Europe which would enable them to determine future demand in greater detail. Over the next few months as experience of on-line usage increases such material should become available. The British Library research on demand should also be complete within the next few months. Therefore the consultants recommend that further monitoring of demand for European on-line services should be undertaken later in 1976. Regular monitoring thereafter should also be undertaken.

32. Relevant material is almost certainly available within the United States. Although European experience is likely to be different in many ways the likenesses are probably more important than these differences. The consultants therefore regard it as very important

that analysis of American experience should be undertaken. We regard it as a major weakness of this report that no such work was possible.

DEMAND FOR ON-LINE INFORMATION SERVICES

AS A

FUNCTION OF THE CHARGES

Annexes

by

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July, 1976

The views expressed in this report are those of
the authors and do not necessarily reflect the
views of the Commission.

Annexes

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N.B. ALL INFORMATION PROVIDED WILL BE TREATED IN CONFIDENCE. NO INDIVIDUAL FIRM, OR INDIVIDUAL, WILL BE QUOTED WITHOUT CONSENT

Demand for On-Line Information Services

1. Type of Service Provided

- (i) What types of on-line service do you provide/use?
e.g. Bibliographies, abstracts, physical data?
- (ii) What subject areas are covered by these services?
e.g. pharmaceutical, civil engineering?
- (iii) At what types of organisation is the service aimed?
e.g. large firms, Research and development organisations, universities, individuals? Please could you estimate the relative importance of each type of organisation?
- (iv) What professional groups currently use the service?
What are their relative importance?
- (v) Is the information available through batch output or other means?
If so what proportion of users employ each method?
- (vi) Would you please add any other comments on the type of service which you regard as important.

2. Trends in Services over the Next Ten Years

/This question is worded for providers of information services - if you are a user could you tell us something about (i) what you would like to see happen and (ii) what you expect to see happen./

- (i) Do you expect to extend the types of information available? If so into what areas?
- (ii) By how much do you expect overall demand to increase in the next ten years?
- (iii) In what way do you expect each existing group of consumers to change demand?
- (iv) Do you expect new groups of consumers to use the service? If so which groups do you expect to be important?
- (v) How important do you expect each access method to be?
- (vi) Do you expect the real cost of providing the service to increase or decline? By how much?
- (vii) Do you expect the real cost of transmitting the service to increase or decline? By how much?
- (viii) Do you expect to have excess capacity in your service throughout the period?
- (ix) What bottlenecks do you expect to occur?
- (x) Do you expect alternative services to develop? If so, of what kind?
- (xi) Are there any other trends that you think may be important?

3. Factors Affecting Demand for the Particular On-Line Service Provided/Used

PLEASE TICK ALL IMPORTANT FACTORS AND COMMENT ON THE MANNER IN WHICH THEY AFFECT DEMAND

(i) What do you think are the main factors affecting whether a firm/you will use your/a particular service

- a. Type of business
- b. Extent of research and development work
- c. Size of organisation
- d. Ease of access to the service
- e. Cost of using this service rather than other means of obtaining the information
- f. Competitors use the service
- g. Other (please specify)

(ii) What do you think are the main factors affecting whether an individual within an organisation with access (or an individual within your firm) will use your/this service

- a. Ease of access to the system
- b. Whether he or his department pays for the service
- c. Whether he has used the service before
- d. Whether others have used the service
- e. Type of work involved in - if so what type?
- f. Other (please specify)

4. Pricing Policies

If you have never charged or been charged for the service please go to question 6.

(i) Do you charge (or are you charged) directly for the services?

(ii) If so what form does this charge take?
e.g. price per unit, annual subscription.

(iii) Does the price vary

- a. between types of consumers
- b. between large and small users or other groups

If so in what way?

(iv) Is the price directly related to the cost of providing the service?

(v) If so what types of cost are taken into consideration?

(vi) Have you changed your pricing policy in the last 5 years?

(vii) If so how did the change affect the demand for each type of user:

- a. large/small/individual
 - b. type of organisation
- By how much in each case?

(viii) Are there any other aspects of existing pricing policies you regard as important?

5. Future Pricing Policies

/This question applies to providers of on-line services - if you use a service please go to question 6./

- (i) Do you think that you are likely to change your level of prices over the next 2 years? If so what do you expect the effect to be on:
 - a. the number of consumers
 - b. the type of consumer
 - c. the extent to which they use the service
 - d. the revenue obtained.
- (ii) Do you think you are likely to change your pricing structure over the next two years. If so what do you expect the effect to be on
 - a. the number of consumers
 - b. the type of consumer
 - c. the extent to which they use the service
 - d. the revenue obtained.
- (iii) Do you think that the most important determinant of the expected change in demand in the next four years will be:
 - a. the type of service provided
 - b. the cost of that service
 - c. the ease of access to the service
 - d. the general level of economic activity
 - e. increased familiarity with the service
 - f. Other (specify)
- (iv) Are there any other points about future pricing policies that you would like to make?

6. Possible Price Changes

(Parts (ii), (iii) and (iv) apply to providers only)

- (i) What do you think the effect on demand would be in terms of both using the service at all and the level of use of raising prices by
 - a. 5%
 - b. 10%
 - c. 20%
 - d. 50%

/If this question is not appropriately worded in terms of the price structure you use/face please give similar details relating to changes in the existing price structure./

- (ii) Do you think different groups of consumers would react differently? If so how?
- (iii) Do you think these effects could be mitigated if the pricing structure was modified at the same time?
- (iv) Do you think it is more important to increase the number of users or the number of times each user employs the service? Why?
- (v) Are there any other points about demand response that you would like to make?

Annex for Users of On-Line Services

Budget Allocation

- i. Do you have a fixed budget for on-line information?
- ii. How easy would it be to increase this budget if
 - (a) price went up
 - (b) you wished to use the service more.
- iii. Would your response be different over a period of
 - (a) e.g. 3 months
 - (b) one year
 - (c) 3 years.
- iv. How much did it (will it) cost you to start up the service?
- v. What do you think are
 - (a) the relative costs
 - (b) the relative benefits of on-line rather than batch or manual systems.

Ease of Use

- i. Do you think that using the on-line system requires an expert on information processes?
- ii. Do you think the system could be simplified? If so in what ways?
- iii. How easy would you find it to change to another supplier?

7. Desirable Future Changes in On-Line Services in General

- (i) Do you think that on-line information services will develop greatly in the near future?
- (ii) How do you think this development could best be achieved?
- (iii) In particular do you think there is an important role for government assistance and for inter-government cooperation?
- (iv) What types of services do you think will have the most growth in usage over the next ten years?
- (v) What types of people and organisations do you think will start to use on-line services over the next ten years?
- (vi) What types of people and organisations will extend their usage of on-line services over the same period?
- (vii) What level of usage of services would you expect?
- (viii) Do you expect there to be excess capacity on the actual information system and capacity constraints on transmission or other similar difficulties?
- (ix) What other trends in general demand and provision do you expect?

8. Data Availability

/(i) and (ii) apply only to providers of services./

- (i) Do you have data on actual prices charged to consumers that you would be prepared to give us?
- (ii) Do you have data on actual demand by each consumer group which you would be prepared to give us?
- (iii) Do you have any data on how demand changed when prices changed which you could give us?
- (iv) Do you have any other data which you think would help us analyse the responsiveness of demand for on-line service to price and other factors?
- (v) Do you think it would be helpful for us to discuss the project further with you? If so could this be most usefully done by telephone or would it be possible for us to visit you sometime during April or May?

We thank you very much indeed for your assistance.

CHRISTINE WHITEHEAD
TONY FLOWERDEW
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LONDON SCHOOL OF ECONOMICS

Notes on the questionnaire

Nature of the service used or provided

When asking about the nature of the service our aims were to determine the type of on-line services which are available and are being used and who by, as well as the usual means of access.

Trends

In relation to trends over the next decade we wished not only to know how the nature of available information might change but also the extent to which the increased demand is likely to be made up of increased usage by existing users rather than by new users. Views on expected costs, both financial and time, were also asked for here.

Determinants of Demand

In the third section we asked for reasons why organisations choose to use the on-line services. Reasons were classified by the type of organisation, the financial costs of using the service, other user costs, related organisational behaviour and other reasons (to be supplied by respondents). In the second part of the section similar questions were asked about individual users of the service.

Pricing structures

The fourth section asked about existing pricing policies and changes that had taken place over the last few years. The most important information required here was the structure of prices for different consumer groups and their relation to costs and demand.

Expected changes in price

The next section follows on from the fourth and asks about expected price changes, how these changes are likely to affect demand in terms of number and type of consumer and the level of usage, and what is the relative importance of prices at their expected levels in comparison to other variables determining demand.

Effect of hypothetical price changes

Finally in relation to price, respondents were asked about the effect

on demand by different groups of hypothetical changes in price and in the structure of pricing.

Budgeting for information use

The next section (added to the questionnaire after the first interview had shown up the great importance of budgetary structure) covers the type of budget available for using on-line information services. It asks how flexible budgets are to changes in price and changes of demand arising from other factors and the extent to which response might vary in the short and long run. There was a further question on fixed costs of starting to use the service, both financial and time, which was discussed in greater detail in interviews. Finally, users were asked about relative costs and benefits of on-line services in comparison to alternatives, giving an alternative qualitative measure of expected elasticity of demand.

Expected changes in service

The last section relating to consumer responsiveness concentrated upon expected trends in on-line services in general. (Until this point the majority of questions had related to the respondents' experience with specific services.) Questions in this section were on the type of services and types of consumers which were expected to be important and included questions on changes in ease of access. A different type of question, about the role of government, was also included in this section. This was intended to elicit whether respondents thought that there was a case for government assistance either through direct subsidisation or by other means e.g. spreading information about the service; also whether the volume of the available services would depend upon inter-governmental co-operation.

Quantitative material

The final section asked whether respondents possessed data on demand and price of existing services and if so whether they were prepared to make these available to the consultants.

The sample

This questionnaire was sent to all organisations suggested by the Commission and by members of the E.F.A.G. sub-committee. At each of the early interviews

respondents were asked for the addresses of other organisations who might have relevant experience. Questionnaires were then sent to these. There is no suggestion therefore that the sample was in any way random. We have simply attempted to obtain information from a wide range of those who use and provide the service. Because those who actually use the service in Europe are likely to be in the forefront of information knowledge the respondents are not a representative sample of those who will use the service over the next ten years. But it is not possible, or probably useful, to obtain information from those who have not used such services. It will therefore be necessary to treat results with care and specifically to assess the importance of any factors which will result in differential response. Details of the respondents are given in Annex 2.

ANNEX 2

The Respondents

(Received by May 21st 1976)

Name of Organisation	Method of Obtaining Information
Allan & Hanbury	Postal Communication
Ariane	Interview
A.S.L.I.B.	Interview
British Library Research and Development	Telephone Interview
British Petroleum	Interview
British Petroleum Patents & Trade Marks Division	Postal Questionnaire
Burroughs Welcome Research	Interview
B.N.I.S.T.	Postal Questionnaire
Civil Aviation Authority	Interview
Dial-Tech, Department of Industry	Interview
B.I.M.D.I.	Interview
Excerpta Medica	Interview
A. Harley-Medline Experiment, British Library	Interview
Hatfield Polytechnic	Telephone Interview/Postal Questionnaire
Hoechst	Interview
I.C.S.U.	Postal Communication
Imperial Chemicals Industry	Interview
Inspec	Interview
Institute of Electrical Engineers Library	Interview
Institut Francais de Petrole	Interview

Method of Obtaining Information

Institut Textile de France	Interview
Mrs. Olga Kennard - Cambridge University Chemical Laboratory	Postal Questionnaire
Lockheed	Postal Communication
Lucas Aerospace	Interview
Mass Spectrometry Data Base Atomic Weapons Research Establishment	Postal Communication
Medical Research Centre	Telephone Interview
Merck Sharp & Dohme	Postal Communication
National Library of Australia	Postal Communication
N.O.C.I.	Postal Questionnaire
Norsk Senter for Informatikk	Postal Questionnaire
Pechiney, Uguine Kuhlmann	Postal Questionnaire
Post Office - Viewdata	Postal Communication
P.U.D.O.C.	Postal Questionnaire
Royal Institute of Technology Library Stockholm	Postal Communication
Shell U.K.	Interview
Shell Holland	Interview
Small User - unnamed	Postal Questionnaire
U.K.C.I.S.	Postal Questionnaire
Unilever Port Sunlight	Interview
Unilever Research	Interview
University of Illinois	Postal Questionnaire
Zentralstelle fur Maschinelle Dokumentation	Postal Communication
Communications received after the Final Draft had been completed	
Systems Dynamics	Postal Communication
University of London Library	Postal Communication
Science Reference Library	Postal Communication
World Health Organisation	Postal Questionnaire
AFDAC	Postal Questionnaire

ANNEX 3

THEORETICAL FRAMEWORK

1) The determinants of demand:

Demand for any good depends upon a number of important factors other than its own price including the price and availability of substitute and complementary goods, the closeness of these substitutes, the level of income, the tastes of the consumers and the number of consumers. We will look at each of these factors in turn.

a. The relationship between the demand for a good and its price is described by the demand curve. A useful measure of sensitivity of demand to its own price is elasticity. The price elasticity of demand is the proportional change in quantity demanded in response to a change in price and may be defined as the limit as Δp tends to zero of $\frac{\Delta q}{\Delta p} \cdot \frac{p}{q}$ or $p \cdot \frac{dq}{dp}$, where p stands for price and q for quantity purchased. This measure generally varies from one point to another on the demand curve, for instance because demand may not be very responsive to price changes when the level of price is close to zero while it may be extremely sensitive if the good is expensive. The elasticity or responsiveness of demand varies greatly between different commodities and this variation depends upon two important factors:

the closeness and availability of substitutes

the importance of the good in consumers' budgets.

It is also likely to vary considerably depending upon the length of the time period over which the response of demand to price changes is observed. Elasticity of demand with respect to price is nearly always negative - when price goes up, demand falls.

When the elasticity of demand is less than -1 the good is said to have an elastic demand. This means that if price is increased the decline in demand is so great as to decrease the total revenue spent by consumers on the good. If the elasticity lies between -1 and 0 demand is inelastic and revenue will increase when price is increased. If elasticity is exactly equal to -1 revenue will remain constant if prices are increased. This will occur if consumers have an absolutely fixed budget for the good and so must reduce quantity, when price increases, by just enough to offset the price increase and so keep within the budget.

The demand for a good is likely to be elastic where there are many similar goods (substitutes), which the consumer can use and obtain almost the same utility, provided these products are currently being marketed competitively. A small change in price can then lead to considerable switching of demand. In particular the demand for a single firm's product will normally be far more elastic than that for the product in general, except when there is only one firm providing the product. The closeness of substitutes depends on how narrowly the commodity is defined. For example the demand for abstracts provided on-line could be more elastic than the demand for an abstract service in general which in turn may be more elastic than the demand for information both through abstracts and through other sources. But in situations where product development is occurring rapidly, prices of substitutes may not be particularly competitive - for example, it is possible that on-line services could bear a substantial price increase before any substantial switch back to batch processing took place.

In short, the demand for a given on-line system will depend upon how easy it is to substitute other systems, how different are their costs and the extent to which a similar data base to the one desired exists - all of these factors are elements of the closeness of substitutes.

In general it is thought that where a good is a very small part of a consumer's budget demand will generally be very inelastic over quite large changes in price. However in the case of information, on-line searching may very well be a very small part of a firm's budget but not so small a part of an information department's budget. The price elasticity of demand in this case may depend on whether such decisions are made centrally or within the information department.

Finally the elasticity of demand is generally thought to be less in the short run than in the long run. The longer the period of time the easier it is for consumers and firms to substitute one good for another. This is not only because changes in price take time to be appreciated but because many decisions are made for particular time periods and changing from one good to another may require e.g. different investment and so will not be worthwhile until the original investment needs replacing. Over a period of years therefore a price increase, relative to the price of substitutes, will have a greater effect on consumption than over a shorter period.

On the other hand there are some factors which could make elasticity greater in the short run. One is the possibility of fixed short-run budgets, so that consumers of information services can only respond to an $x\%$ price rise by a compensating reduction in demand of $x\%$. In this case elasticity is exactly equal to -1 . In subsequent years however budgets may be revised upwards and the long term demand elasticity may be lower. Another possibility is that the case for paying, say, £50 an hour for a particular type of search may have been established, perhaps by cost-effectiveness methods. Following a price rise further studies may be considered necessary to see whether the service is still cost-effective at the higher price. Pending the results of those studies expenditure may be halted. Finally it could happen that temporal substitution of consumption is possible, and people will carry out extensive searches ahead of an anticipated price rise with a consequent temporary reduction of demand afterwards, like drinkers attempting to anticipate a budget increase in duty by buying up wines and spirits just before the budget. Since many demands for on-line information arise unpredictably and need to be met rapidly this case may not be very important.

Although the illustrations above are related to price increases, similar arguments apply to price reductions. With a fixed budget for on-line information a price reduction can bring at best an equal percentage rise in demand. Firms that did not use the service at a higher price could require some time to validate the economics of the system at the new low price.

b. The demand for a good is affected not only by its own price but also by other factors mentioned at the beginning of this section. Demand is often strongly affected by the level of money income of consumers. The sensitivity of the quantity demanded to total money income of all consumers is measured by the income elasticity of demand. This may be positive or negative, depending on whether demand increases or decreases with income. Most goods have positive income elasticities (they are called superior goods) but this may vary over the range of income for consumers. For example the elasticity of demand with respect to income for margarine may well be positive for those on lower incomes but may become negative as incomes rise. The same argument can apply to goods which involve different technologies - for example it is thought motor

cycles have positive elasticities in countries with low incomes and have negative elasticities in advanced countries where wealthier consumers are able to purchase cars. It is possible that a similar situation might exist for e.g. manual searching and on-line searching - but of course this is a matter of conjecture.

For many goods a more important distinction is between whether demand with respect to income is elastic (elasticity greater than 1) or inelastic (less than 1). The demand for goods with high income elasticity is likely to grow rapidly as GNP increases and information is thought to be such a good. But again this can change over time if for instance saturation point is reached. Consumers may simply not be able to digest more than a certain amount of information and once this is provided in the quickest, most useful way, any further information might well be regarded as a 'bad' rather than a good.

The concept of income elasticity is less appropriate to firms than it is to consumers. It may be that if firms have a high turnover they will be able to buy more information - for instance if they allocate as a budget a fixed percentage of turnover. On the other hand it is possible that a firm may see a period of low prosperity as indicating the need for a greater effort on R and D and hence on information. If we compare one firm with another instead of the same firm at different points in time, similar considerations may apply, and perhaps another point also needs to be made - the small firm may not be able to afford the R and D budget of the large firm and may spend more on information as a result.

c. Next the demand for any good depends upon the price of other commodities. This relationship, already discussed generally in relation to the effect on the elasticity, can be described by the cross-elasticity of demand. This relationship is measured by the percentage change in demand for the good in question resulting from a small change in the price of another commodity. If a price rise in one increases demand for the other the goods are termed substitutes; if the price rise causes a reduction of demand for the other good, the goods are termed complements. In on-line information we would expect to find that batch and manual searching are fairly close substitutes while there is a complementary relationship between

the demand for on-line information and the price of terminals. [This relationship need not be symmetric - one would not expect the effect of changes in the price of on-line searching on the demand for terminals to be equal to the effect of changes in terminal price on the demand for on-line searches.]

d. Finally there is the question of how many consumers there are in the market as the market demand for a good is the sum of all individual demands. Some goods are only likely to provide utility to certain groups of consumers and this is thought to be the case with on-line information, at least as currently conceived. It is therefore important to examine changes in the number of consumers likely to find the service of on-line information useful. This is the work already done by PA.

We have here described part of our task - to examine in more detail the relationship between the demand for on-line information as provided by EURONET and the price of such information. To do this we must also examine the effects of income, substitutes, complements and the size of the market on the demand. We can then apply these results to the potential population making use of the work already available. There are however a number of special features of information in general and of on-line information in particular which also affect demand. These factors are discussed in the next section.

2) The Nature of Information and On-Line Information Services:

Information differs in a number of ways from the conventional consumer good of economic theory. The ways which are of particular relevance here are:

a. In general the consumer does not desire information for its own sake. He wishes to obtain the information because he expects to be able to use it to help him obtain some other good. The demand for information is therefore a by-product of the demand for other goods and services. In this way it is somewhat like transport which is rarely demanded for its own sake. But the demand for information may be even more complex than

that for transport as information may only lead one to another activity which is itself a by-product. For instance information may be demanded because a firm is involved in some research work but the research work is also demanded not for itself but for the goods which may eventually come out of the research.

b. Partially for the reasons given under (a) it is extremely difficult to measure the benefits of information. Thus demand which is based upon the expected utility from obtaining the information is ill-defined. Probably the most important reasons for this lack of definition are:

- i ignorance and uncertainty of the value of the information received.
- ii a time lag between when the information is made available and when it is actually used.
- iii much information is collected for an unspecified future use and as such is an investment with a very uncertain return.
- iv the final consumer of information is rarely the person who pays for that information. This fourth point means that the user's cost is usually only his time in obtaining the information while the cost to the organisation is that time plus the financial costs of obtaining the information, any information service staff costs and time, and maybe other elements as well. It is also possible that internal bureaucratic control systems, or average cost pricing systems used internally, may make the cost perceived by the user higher than that incurred by the organisation.
- v the actual unit of information is ill-defined in that the quantity paid for (e.g. number of contact hours) does not represent a quantity of information demanded, which might be a number of relevant references, or something less easy to quantify.

This difficulty in measuring the value of information means that decisions as to whether or not to pay for an information service are unlikely to be based on a full estimate of the relative costs and benefits of having or not having the information. They are more likely to be based on some rule-of-thumb or bargaining decision which determines the information budget. Within an information dept. however the structure may be rather different as here measurement of relative cost for apparently equivalent services can be made.

c. The production of information is often a by-product of the production of other goods. This is less so for abstracts, bibliographies, data and other such forms of information (although data may be collected e.g. for control purposes and then used for forecasting or analysis of market behaviour) but it is important in terms of on-line information. Here the data bases are often a spin-off from the provision of hard-cover volumes, the computers have been installed for other purposes, transmission is through systems installed for general communication and terminals are used for many other types of information. Thus the capacity to obtain on-line information and its costs are jointly determined with many other factors. The provision is therefore difficult to cost, as is the system by which the consumer obtains the information.

On-Line Services

When we look at on-line services in particular rather than information in general the most important point to make is that these services differ from other information services only in the sense that they provide the material in a different format. At the present time almost all the information available on-line is also available by some other means either through batch use or by manual searching of published material. The value of an on-line search differs from that of other means in three ways:

- a The relative cost of this method rather than other means of obtaining information.
- b The speed by which the final user can obtain the information.
- c The kind of information provided may be different, partly due to the interactive method of searching.

Because the nature of information is so complex many users of on-line information may define simplified means by which to estimate the value of (c). Two possible approaches are to count the number of titles (if what is being searched are abstracts/bibliographies) obtained or, more relevantly to utility, to count the number of useful titles obtained by each means. Ideally what is required is to measure the benefit of the information obtained, from using the system, to the ultimate user and to the organisation directly, but for reasons mentioned above this is regarded as too difficult to be worthwhile. As a major benefit of on-line searching is seen to be a reduction in the number of non-relevant titles obtained the second measure is far the better.

(a) and (b) are both elements of costs and should include all financial costs which arise because of the use of on-line searching compared with those relating to other means. The speed of search reduces the time cost of search and this aspect should be valued at the benefit of the use to which the time saved is put. The value of obtaining the information more quickly may be considerable but can only be assessed by the individuals who want it. However the use of skilled manpower in-house may be greater for on-line searching.

When taking account of costs most demanders of the on-line service are likely to take account only of the costs borne by themselves e.g. if the service is provided by an information department which does not pay its own telephone bill then the costs that department are likely to take account of are the financial burden to themselves, and staff time involved. They will not necessarily take account of savings in users' time (except to the extent that users force an awareness of these factors on the information department) or those costs that are borne centrally. If on the other hand the telephone bill is paid by the information department the cost of on-line searching will include this and the relative cost of this rather than another method will be different from the first case.

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The use of a particular on-line service will depend not only upon the factors determining the demand for such a service in general but upon the relative merits of this service with respect to other on-line services. In a market where there are only two or three major suppliers of network systems one might expect to find a considerable amount of differentiation of product in order to attempt to tie users to a particular service even when there are price differences.

The most obvious form of service differentiation is the provision of different data bases. Here there are two important elements: (a) the number of bases relevant to the consumer made available and (b) the quality of coverage of the subject areas within the data base. For many large firms a wide range of data bases are useful while for other organisations a system will be of little use unless a specific data base or at least material in a specific area is available. In order to increase demand by increasing the number of users a wide range of data bases is necessary.

(b) the quality of the base is also important as this determines to a great extent whether manual searching of many sources is likely to produce greater utility than mechanical searching. Many data bases currently available are adequate for those who desire some information on a given subject but completely inadequate for those who require full information. Over time the quality of the material available through different access means may be just as important a variable in determining demand as the quantity.

A second possible way of differentiating the product is in terms of the access procedure. This applies especially to access to the data base host rather than to the network. For example some systems allow a considerable amount of preparation to take place before the computer is accessed and so reduce contact time. Some have much simpler means of gaining entry into the system. In relation to the second there are both gains and losses to simplicity. If the system is simple to access use will be far easier and costs will then be reduced. But if complex access also means a better search the investment may be worthwhile although reducing usage in the short term. Also having learned one system people may be loath to move to another. Training costs, including time required for training, may be quite significant. Thirdly the terminal and other hardware can be specific to a given system or useful for other systems or even completely dissimilar uses. If the terminal is specific then it is likely to stop some users from using the system altogether while making others put off starting to use the system. On the other hand once the user has obtained a terminal a specific terminal will be a strong disincentive to moving to another system. Where terminals are rented rather than purchased outright disincentives are less.

Other means of differentiating the product and tying consumers to a particular supplier of a general service include pricing structures which have a fixed fee for using the system at all or compel users to subscribe to a hard-copy service at high cost, perhaps together with a low unit cost. If consumers are prepared to pay the fixed fee they are more likely to use this service rather than others. But of course for many the utility of the service may be less than the cost taking account of this fee and so demand is reduced.

Finally legal and administrative means can be used to tie consumers. At the present time in the U.K. consumers are not generally permitted to use Tymeshare because of its role as a common carrier. A similar rule extended throughout Europe would of course make many substitutes to EURONET illegal and put EURONET itself in a monopoly position. There would of course be incentives to consumers to find ways round this system and EURONET would by no means necessarily obtain all the existing business.

There may indeed be many other ways of differentiating one on-line system from another but all of them entail either improving the benefits of the specific service so that it meets consumer requirements better than other services, or modifying the cost of this particular service in relation to other available services including constraining the use of these other services by one means or another.

Thus the demand for on-line information through EURONET is one way of obtaining the general product of on-line information; the demand for on-line information is itself one way of obtaining information in general; and information in general is one input into the R and D process and of course other processes as well. One would expect that in normal circumstances the price elasticity of demand for the first would be greater than that for the second and the second would similarly be greater than that for information in general. A priori we would expect the demand for on-line information provided through EURONET to be extremely elastic except to the extent that there were monopoly elements either in terms of the availability of data banks or in terms of monopoly in transmission and access. But this high elasticity will only apply over part of the price range. There are prices at which EURONET would clearly be the best buy for many users; others at which it would hardly stand a chance. Over these ranges elasticity may be quite low.

3) The determinants of price:

The cost to the organisation of using an on-line information system can be regarded as consisting of two elements:

- (a) the price paid to obtain the search
- (b) the user cost of obtaining the search - including time of information officers, researchers, etc.

Within (a) there are a number of different pricing structures with which the firm may be faced. The two most usual are pricing per unit and the payment of a two (or multi) part tariff. Both types exist in charging for on-line searching.

Within (b) there are a number of important elements including the provision or use of a terminal in order to be able to search at all and the training and time taken by the personnel doing the search.

These user costs can be split into fixed and variable costs when examining whether or not to do a single search but all are variable when the organisation is deciding whether or not to become an on-line user at all.

Thus when making the initial decision whether or not to become a user the price facing the organisation includes:

i The provision of a terminal, by purchase or lease, or the use of an existing terminal which will possibly exclude some other use of that terminal.

ii The training of staff to use on-line systems.

iii The staff time used in preparing and making the search and in disseminating the information.

iv The possible increase or decrease in research staff time involved in being present during the search, understanding the format etc.

v Any extra documentation costs resulting from the search including staff time.

vi The actual financial cost of doing the search.

Each of these price elements should be regarded as opportunity costs, that is to say they should be costed in relation to the value of other uses foregone. For instance if an existing terminal could have been used for another job then the cost of doing the search is the value of the other job not being done, or postponed.

Thus when determining whether or not to start using the service the financial cost of a search may well be a relatively minor part of the total cost of using on-line systems. It is of much greater importance in deciding whether or not to do a particular search.

If the on-line information system is charged for by a two part tariff the financial costs of starting to use the service are likely to appear much larger. The case for a two part tariff is often thought of as resulting from the common situation of a service with relatively high fixed and relatively low variable costs. It is certainly true in these situations that if a supplier wishes to make a profit or even simply cover his costs he will have to charge on a simple tariff a price considerably in excess of the variable cost of the service, and hence restrict demand below the socially optimal level. In this situation price discrimination (charging a different price to different consumers) is sometimes used, but it is not always practicable and sometimes illegal to do this. With a two part tariff in comparison to a per unit charge it may be possible for a supplier to increase his revenue but whether he can or not will depend on the structure of demand.

There is no need here to set out the formal conditions in which a two part tariff will increase the suppliers' revenue, social welfare or both. Qualitatively it can be explained as follows: suppose users have a wide range of possible searches they wish to make and for some of these they are willing to pay a lot, others only a little. Such users may take out a subscription because of the great value they attach to some of their searches. Having done so they may make plenty of use of the system by doing searches whose value is only just greater than the low per-unit price. Under a single tariff system the price would presumably have been higher and so fewer searches would have been made. To offset this gain from the two-part tariff there will be some potential users who attach a moderate value to being able to search occasionally, and would have paid the higher single tariff rate, but are deterred by the subscription given their relatively modest expected use. The importance of these two groups of consumers can be compared analytically if both individual and market demand curves are known.

If organizations are initially uncertain about the benefits to be derived from on-line information services, the existence of a two-part tariff may be an effective barrier to their using the service at all. For if they are inclined to underestimate the total benefits they will obtain they will not think it worthwhile to pay the initial fee.

Pricing Structures of On-Line Information Systems

There are three basic structures of pricing currently in use by suppliers of on-line and batch information systems: those related only to hours of search time employed, those which include an annual subscription or charge and those which charge a price per search (or per question asked). The first is the most usual and our research suggests that it will continue to grow in relative importance.

In this case the monetary cost of an on-line search to the consumer is usually made up of a number of elements including:

- (a) The royalty paid to the provider of the data file.
- (b) The cost of accessing the file.
- (b) The cost of transmitting the search.
- (d) The cost of printing out the output (where output is in batch mode).

(c) is normally made up of two parts: the cost of the telephone link from the searcher to the network and the cost of using the network.

The price of a search therefore varies for a variety of reasons of which the most important are:

- (i) which file or files are to be searched.
 - (ii) the length of computer time that the search takes.
 - (iii) the distance of the searcher from the nearest access point to the network and from that access point to the data storage unit.*
- and (iv) the number of references printed out, if there is batch output.

These in turn are dependent upon the area of interest, the detail of the information required, the skill of the searcher and the location of the organisation. The first and last of these are probably the most important and indeed much research and investment are being employed to cut the costs of transmission.

The second type of cost structure is the two-part tariff. The majority of suppliers using this form are data banks who require the purchase of hard copy before issuing a key word. For many users, especially large users

* It is worth noting that EURONET policy is not to vary prices to users in accordance with distances between access points and data storage units.

or those who are information conscious, this is in fact not a cost to using the service as the hard copy is purchased anyway. It is however likely to be a major restriction on smaller users whose total benefit from information derived from these sources is not great. Similar arguments apply when the entrance fee is to pay a subscription to an Institute or other organisation.

Where the first part of a two part tariff has been a large investment, such as a dedicated line, use has usually been confined to large organizations with a high demand for information. An interesting development has been that some have set up a commercial service as intermediary searchers for small users which has helped to cover their costs, while providing a service available to those whose total demand for such information is not great enough to make it worthwhile for them to require their own in-house facility.

The third type of cost situation is a charge for successful search or per question. This is a system used by some intermediaries and allows them flexibility in how they obtain their information. The price from the point of view of the final consumer is more closely related to the benefit which he expects to receive (an answer to a question rather than ten minutes time on a computer) and this may in itself increase demand. But in practice searching costs vary so greatly between questions that the method does not appear to be favoured by information intermediaries.

The structure of on-line service pricing is likely to affect strongly what type of consumer actually uses the service, how often and the way in which searches are undertaken and thus affect the total use of on-line services.

4) The Role of the Budget

In theory organisations should be prepared to purchase a good if the benefit obtained is greater than the cost of purchasing. However most organisations do not make such appraisals in relation to each purchase but, instead, assess the likely value of purchasing particular goods over a period and then set a budget for these goods.

If the value and costs of the good involved are well known and stable this procedure is not likely to cause many problems but if changes are taking place it may result in important distortions from the optimum. For instance if the budget for information is fixed for a year and prices increase after six months the department may be able to do nothing about it except cut back usage to keep within the budget, even though revenues have also gone up and the information at the new price still has a positive benefit.

The nature of the budget for information and for on-line services in particular will therefore often be a major determinant of effective demand. The most important factors are likely to be:

- (a) whether there is a specific budget available for on-line information.
- (b) whether the other items in the department's budget are substitutes for on-line searching.
- (c) how large a proportion of the budget is on-line information and indeed information.
- (d) whether the costs can be allocated to the final user and if so what type of budget procedures he faces.
- (e) whether and how the budget can be modified during the period it is supposed to cover.
- (f) which costs of using the on-line services fall on the budget by which the decision-maker is constrained.

Under (a) if there is no budget for on-line searching a decision to use the system must be specifically dependent upon taking money from some other defined use, from a general pool, if any, or making a special case to some central agency. These factors are likely to increase the difficulty and the staff time cost of getting started on the system. Once a budget has been agreed, and the value of the system evaluated, it may be easier to vary it in response to demand from final users. Further in a time of general stringency those with existing budgets are usually in a far better position to retain them than are those without to obtain a special allocation.

If in case (b) prices or demand do increase one possibility is to substitute from within the department's budget be it the information department or the final user department. If much of the budget is used for gathering information it may be easier to make a case on the grounds of

cost-effectiveness for continuing or expanding the use of on-line information services than if most of the available money goes on very dissimilar items. For this reason it might be thought that information departments (if they think the service worthwhile) will be less affected than final user departments.

But point (c) generally works the other way. If on-line services are a very small part of the department's budget then it will be easier to cut back something else by only a small proportion to pay for the increased demand on costs. If on the other hand on-line services are a large part of the budget there is likely to be greater inflexibility. In many firms information is a relatively small part of total turnover and within the information department on-line services are again a relatively small proportion. While this remains the case it is likely that consumers will find no great difficulty in increasing the budget at least when they can demonstrate that the service is cost-effective.

On-line information is likely to be a much greater proportion of an information department's budget than of a final user department's. For this reason many proponents of on-line systems have suggested that final users should be asked to pay for searches. The asymmetry arises because the cost of a single search is often within the petty cash limit of a final user department and therefore requires no special authorisation while in the information department a search is part of a large formal budget difficult to increase in percentage terms. Thus price changes and demand changes can be best met by users increasing their use of petty cash (or any other non-earmarked category within the budgetary system) rather than by seeking formal agreement to a larger budget for on-line searching.

The capacity to pass on costs is highly likely to be of importance in the growth of on-line systems provided that the value of such searching is rated as highly by the final user (point d) as it is by the information department.

The length of time for which the budget is determined and how flexible it is (point e) will clearly both be important in determining response to changes in price and demand in the short and long run and in defining how long is the short run. Within the budget period if there is a certain flexibility information demand may well be able to adjust so long as on-line services are a small proportion of costs but whether this is feasible or worthwhile will depend upon the penalties to the department

of either exceeding the budget or getting the budget increased.

Finally which costs are actually included in the costs borne by the decision-maker is of particular importance in determining the effect of changes in price (f). For instance many information departments may be required to pay computer and on-line service bills together with staff time, overheads etc., but are only allocated telephone costs in a fixed proportion or even do not pay telephone charges at all. If the telephone cost increases but other costs remain the same this then may have little or no effect on the demand for on-line services, not because the real price has not increased but because the information department does not have to bear the increased cost. Allocation of specific costs to the department using the service will result in better decisions as to whether or not to use a service but from the point of view of effective demand different budgetary systems may result in considerably differing responses to the same price change by consumers who obtain similar utility from the good. The importance of the type of budget employed by consuming organisations in determining demand for on-line services at least in the short-run can hardly be overstated.

In the longer run it would be expected that firms will adjust to price and demand changes in a way which better reflects their overall objectives. Thus long-term elasticities may be very different from short-term ones but whether they will be greater or less will depend upon the specific budget structure used by the organisation.

5. The Role of Government

A final conceptual question which is of relevance is what role government might play in the provision or subsidy of on-line information. It matters because (a) governments may take decisions to build for the long-term more easily than private firms so the quality and quantity of material and networking could be significantly different with government intervention and so affect the extent of demand.

(b) if governments are prepared to subsidise the service the price level (and structure) may not have to be set to cover costs or make a profit and so the price organisations have to pay is affected by government decision.

(c) government itself is a major user of information services and the main contractor for much research and so can heavily affect knowledge and use of the service.

The case for government (or inter government) assistance with provision or price subsidisation is based on three principles:

- (i) Cost reductions including quality improvements arising from co-operation or greater utilisation of capacity.
- (ii) The value to society of long-term investment may be greater than it is to the individual firm and so providers of on-line services should be allowed to obtain cheap funds to set up their service (or be subsidised in some other way). Individual firms, for reasons of cash flow, or imperfect access to capital markets, may require a higher or more certain rate of return than government which can, at least in theory, afford to take a longer view. On this argument government assistance with risky or long-term investment may be justified; information may sometimes fall into these categories.
- (iii) Information has some of the attributes of a public good and provides considerable spill-over benefits to the community which consuming organisations when determining demand would not take into account without subsidy. The benefits of information, in other words, may accrue to the community as a whole and not just affect the profits of the consuming organization.

The a priori case for inter-government co-operation is clearly strong in a situation where the value of the service to an individual demander depends greatly upon the variety and quality of data bases available. More users with similar requirements do not increase costs proportionately and this is, of course, a major part of the case for EURONET. Indeed within the European context surplus capacity in at least part of the system is likely for some time to come.

The case for subsidy under (ii) is one aspect of the general argument that some investment is worth more to the community as a whole than to individual organisations. This might be expected to be particularly true of on-line information networks because of the large speculative investment involved.

The extent to which the community benefits more than the individual from information (iii) has never been effectively measured. It is thought

that such a benefit does exist and so there is a case for some subsidy but the extent of the benefit and therefore of the required subsidy is unknown and the choice will normally be a political decision. But there is a further point here in that once information has been made available to one consumer there may be substantial costs in stopping its further free dissemination. This might lessen its commercial value to, say, a particular manufacturer who could make substantial profits if he had the unique opportunity to make use of the information to improve his product, but perhaps only marginally improve his profitability if all firms could do so. Nevertheless the social value of the product improvement could be very great. In this case the only way in which adequate provision can be achieved is through government intervention.

There is therefore reason to think that government may have a valid role in supporting an on-line information service which goes beyond simply co-operating to gain the benefits of economics of scale. But government intervention is not necessarily always beneficial. They could use resultant monopoly powers to increase costs to consumers and so decrease demand or to limit access to particular data bases. Moreover control of information services by government could produce less responsiveness to consumer needs than a commercial system which needed to sell its product to remain in business. These adverse elements of government intervention may also affect demand (and price) considerably but in a contrary direction. They might be partially obviated by involving consumers in the management of whatever system was set up.

ANALYSIS OF SECONDARY SOURCE MATERIAL

1. Introduction

The economic literature contains an enormous number of empirical studies of markets for goods having widely different characteristics either of demand or supply. For example, goods may be directly demanded for the services or utility they yield or the demand may be derived, such as that for intermediate goods and factors of production. Characteristics range from services and perishable goods which cannot be stored through to durable goods, such as cars or refrigerators. Supply characteristics may vary from situations in which it is possible to expand production quickly over a considerable range of output to situations (such as agricultural production) in which short run response may be quite small and it may take some time for output to respond fully to some change in demand conditions. Markets vary as to the number of substitutes for and complements to the good in question which exist and also the degree of competition or monopoly in the market.

Even if interest centres in the demand for some good and in particular the relationship between the quantity demanded and the price of the good it is still necessary to consider supply conditions in order to see whether it is possible to identify a demand relationship. In general if the quantity of a good sold at a given price is observed the data most probably represent the interaction of demand and supply factors rather than the reaction of the quantity demanded to variation in price.

The demand relationship may be identified in a number of ways. In the simplest case in which the price of the good is the only or the predominant influence on demand, if suppliers set the price and are prepared to supply any quantity at that price then the quantities bought as price varies correspond to the demand relationship. In the more general case in which other factors affect demand and/or supply it may be possible to identify the demand relationship by observing the effects on the quantity bought of changes in factors such as consumers' budgets, tax regulations, or costs and other supply factors. Clearly this problem must be considered in studying the market for information.

2. The Demand for Information

There are two studies of particular relevance concerned with the market for information; Berg (Journal of the American Society of Information Science Jan/Feb 1972) and Hayami and Peterson (American Economic Review 1972 62(1)). The first investigates the demand for scientific journals while the second is concerned with the potential social benefits of improving the accuracy of the information provided as a public service by the U.S. Department of Agriculture. In both cases the demand relationship is identified, since in the first study it is argued that the editors of the journal studied set the price and then supplied the quantity demanded at that price, while there are other supply and demand factors which help to identify the demand relationship (and hence the elasticities) for the agricultural products which affect the provision of information studied in the second case.

The Berg study investigates the demand for the Journal of Physical Chemistry by members and non-members (mainly libraries) of the American Chemical Society for the period 1956-1966. In addition to producing price elasticities of demand on the part of members and non-members, the study indicated differences in the demand characteristics of the two groups suggesting that a better allocation of resources would be obtained through a dual journal system in which institutional subscribers would receive the entire collection of articles for archival purposes, while ACS members would receive smaller, more specialised packages, matching their profile of interests. If such differences in the demand characteristics of consumers of on-line information exist, it is possible that knowledge of these differences might be useful data affecting the form of the supply of on-line information, but such an investigation is beyond the scope of the present study.

Similarly, while the Hayami and Peterson study suggests that the potential social benefits outweigh the costs of some improvement in the accuracy of information provided, a benefit-cost analysis of methods of improving the technical reliability of the service and the merits of alternative systems of accessing and interrogation in on-line information services lies outside the terms of reference of the present study.

3. Other relevant material on the demand for Information

Two issues of major importance in this study are (a) in what units should quantity of information be measured?, and (b) how do consumers of information assess benefits of information and what factors determine these benefits? There is an extensive literature which although not directly concerned with the demand for on-line information as such may be briefly mentioned for the sake of the light it sheds on these two issues.

Marschak J. ("Economics of inquiry, communicating, deciding" American Economic Review vol. 58 no. 1968 pp. 1-18) discusses the argument that information is not valued for its own sake but only to the extent that it modifies decisions. It follows that what is important is that the coverage and accuracy be appropriate for the decision to be made. (For example if a researcher wants to obtain background information about a subject a search which turns up 10% of references may be as useful, if not more, than one which finds 90% of the relevant references. On the other hand if a firm wishes to know what patented research has been done in a specific field only 100% coverage may be of use at all.)

Marschak also argues that the measure of information usually used - the bit - has little relevance to the value of information as it is simply a measure of transmission to which a value cannot be attributed without further knowledge about the nature of the information being transmitted.

Cost-effectiveness methods do not try to supply a measure of the value of output, but they do require a measure of output of an information system, and there is a substantial body of research in this field, reviewed in Chapter 6 of Flowerdew A.D.J. and Whitehead C.M.E. (Cost Effectiveness and Cost/Benefit Analysis in Information Services OSTI Report 5206 October 1974). The two most relevant references are (a) Ashmore, Smith and Stern (Cost effectiveness of current awareness sources in the pharmaceutical industry" Journal of the American Society for Information Service 1973 Jan-Feb pp. 29-39) who discuss the choice of data base on the criterion of alerts and unique alerts and (b) King D.W. and Bryant E.C. (The Evaluation of Information Services and Products, Information Resources Press, Washington D.C. 1971) which assesses the importance of a number of different measures

of performance such as speed of obtaining the information, accuracy of information and so on, as elements in an effectiveness measure. It is clear from our own research that these are the types of factor that information departments are taking into account when determining whether or not to use a given on-line information system to do a particular search.

Apart from the attempts to determine demand curves for information discussed in Annex 4 part 2 there have been very few attempts to examine the benefits (and therefore the price consumers are prepared to pay) for information. Two which imply ways in which organisations might go about obtaining such measures if they wish to determine quantitatively whether or not to use on-line services at particular prices are those by Dammers and by Wolfe et al. Both are interested in making the distinction between user cost and the cost to the organisation, which is likely to be a major source of difficulty in estimating the demand for on-line services. This is because demand for the service will often be determined by the information department and payment come from that department's budget while the ultimate user who will obtain the direct value of the information may have little say in whether or not to use the service.

Dammers H. F. (Economic evaluation of current awareness systems EURIM Conference Paris 20-22 November 1973) attempts to measure how much users would be prepared to include for SDI information in their own budget. Wolfe J.N., Bryden D.H., Scott A. Young R., Aitchison T.M. (The Economics of Technical Information Systems: A Study in Cost Effectiveness OSTI Report 5103 Edinburgh University 1971) also measure benefits to final users in a number of ways taking account of time saved and output costs if information is not available. They suggest that these factors will weigh differently depending upon whose decision will determine use of the service.

Nightingale R.A. ('A Cost Benefit Study of a Manually-produced Current Awareness Bulletin' Aslib Proceedings 1973 25(4) describes a study evaluating parts of BP's information service in which the benefits are seen as the value of time saved measured in terms of salary plus overheads at £4 per hour. This study is important in that it suggests how one might expect organisations and information departments to determine which of a number of ways of obtaining given information they would actually use - a major element in determining the responsiveness of demand to the price of on-line information services.

4. The Demand for On-Line Information Services

Two important publications on the demand costs and prices of on-line information have been published in the last few weeks. These are (a) the SDC report by J. Wanger, M. Fishburn and C.A. Cuadra entitled "On-Line Impact Study"; and (b) No.2 in the EBSIDIC European User Series "Information Economics" editors G. Pratt and S. Harvey published by Aslib.

The SDC report arises from a large survey of users carried out in late 1974 and early 1975. It is thought that at the time the survey covered about two thirds of the total on-line using community. This was made up of about one third commercial, one third educational, 20% government and some others and it was found that the vast majority of demand was initiated from information departments. The main determinants of starting to use the system and continuing use are discussed as well as more general descriptive material on how the system is used, staffing etc.

The most important conclusions from the point of view of our project appear to be:

- a) Existing users have not generally found the necessity for a terminal to be a major hindrance.
- b) There are some initial difficulties with staff that cost time and finance to overcome.
- c) The method of searching and the number per user varies considerably between types of user: Commercial users do the fewest searches while educational users do the most. But commercial users are more prepared to use more than one data base.
- d) Average search time is about 18 minutes but educational users take less time and government agencies more.
- e) The number and type of search depends on area of interest e.g. medical searches normally use only one data base because only one is readily available.
- f) The mean cost for search was \$23.83 but this was heavily skewed and most costs were below \$10.
- h) A major benefit was thought to be extension of information services and increased use of information. Productivity of staff was also thought to have increased. A greater breakdown of these benefits is shown in the following table from page 15 of the Brief Summary Report:

Question: What did your organisation initially anticipate would be the main benefit of using on-line systems?

(Managers, N = 472)

72.0%	Faster turnaround time	44.4%	Serve more users
67.5%	Access to additional sources of information	43.0%	Capability for literature-searching services
56.9%	Reduction of staff time	5.0%	Other
47.2%	Greater precision in searching	2.9%	Didn't know

Over 90% of managers thought these benefits were realised.

The report accepts that the evidence on costs is the least accurate in the survey for a number of reasons including low response. It also contains useful material on the motivation of managers who use the service as well as evidence on the problems of initial cost of usage. Some of the material can be and will be compared directly with our own findings.

The Aslib report provides information on available data bases (a list of which is given, in the first report of the European User Series - 'Data Bases in Europe' editor G. Pratt, published by Aslib 1975) and their costs and prices. It also includes a succinct historical review of the growth of on-line information services in Europe, describes currently available systems in detail and lists the groups for which available information will be of relevance.

Estimates of each type of cost (access costs, terminal costs, telecommunications charges and print charges) are then given and graphs provided showing the relative cost of searching different data files through different on-line suppliers. Different points of access and methods of access are also analysed so providing information on the variation in transmission costs. These suggest that transmission costs per hour vary considerably and are the major reasons for the differences in overall prices paid. There is however no adjustment of costs made to allow for

differences in the amount of useful output obtained from different sources.

Four reasons were given by Martha Williams in 1974 ('Use of Machine-Readable Data Bases', Annual Review of Information Science and Technology, Vol. 9) for the growth in on-line search in the U.S.A. They were:

- a) Greatly reduced costs of storage
- b) Decreased communications costs because of specialised networks
- c) The availability of tapes to make retrospective searching feasible
- d) Increased reliability of computer operations.

The Aslib report discusses their possible relevance to what may be expected in Europe. The first two reasons are of course the basic technological changes which have made the idea of EURONET, and other systems, possible. It is not certain that further savings will be experienced in the future. Reasons (c) and (d) both affect considerably the value of searching and (c) especially is expected to be a major determinant of demand. The importance of (d) may by now be mainly historic.

Given the current pricing structure the authors argue that the major determinant of demand is accessibility and that this is heavily influenced by the users' experience. Therefore user education together with increased accessibility through dial-up (preferably local call) will form the basis for expansion in European demand.

Neither SDC nor Aslib attempt to relate demand directly to price. It is worth pointing out that the current levels of charging are as low as they are because all three major on-line service systems are provided as spin-offs from other production processes. Data bases themselves are also generally spin-offs from the publication of hard cover material or similar activities.

This means that prices have not generally had to cover the total costs of using an independent system but only those costs which arise because of new usage. For entirely new systems or new data bases costs could be of a different order and prices if set to cover these costs would then be very much higher than those currently observed. Information on cost such as that available in Vickers P.H. ('The Costs of Mechanised Information Systems' published by OECD 1974) is of relevance in that it suggests the

range over which profitable or break-even prices would have to be set. Which costs should actually be borne by the consumer if social benefit is to be maximised is a complex economic and political problem, some aspects of which are discussed in Chapter 5 of Flowerdew and Whitehead where particular notice should be taken of the distinction between private and social costs.

Decisions about appropriate levels of subsidy or other forms of governmental assistance are of course outside the scope of this study and will presumably be arrived at by political means. It may be relevant to note however that there may be reasonable economic grounds for at least some level of support.

A final relevant area on demand before turning to the material on EURONET is that of the demand for a network. J. B. Wyatt ("Towards Computer Networking - The Harvard Experience" Annals of Economic and Social Measurement 3/3 1974) suggests that there is a very good economic and financial case for providing computer networks both on the grounds of cost and because services can be better suited to the consumer. Of particular relevance to our problem is that when the budget is placed in the hands of users it was found that a market does grow up in which demand is sensitive to price and service time and that users do differentiate between systems choosing that which best meets their own particular needs at least cost - not simply choosing either the best without respect to cost or the cheapest. Non-comparability between access methods and data bases was however found to be a hindrance.

Thus in the literature on on-line information services there is much which helps us assess the relative importance of different variables in determining demand by final users and organisations and there is considerable information on actual costs and prices. However there is very little indeed which addresses itself to the particular question of responsiveness to specific price levels and structure, and changes in these prices.

5. EURONET

The literature most directly concerned with EURONET consists of the reports prepared by P.A. International Management Consultants Limited and by Pandata BV for the Commission of the European Communities and the papers

by G. W. Davies and A. Tomberg presented at the Second European Congress on Information Systems and Networks.

The report Forecast of Users of On-Line Retrieval Services for Scientific and Technical Information in Europe 1976-1985 prepared by P. A. International Management Consultants Limited in November 1974 presented forecasts for the years 1976, 1980 and 1985 of (a) the number of users of on-line retrieval services for scientific and technical information in Europe (covering the EEC countries plus Switzerland, Austria, Spain, Portugal, Sweden, Norway, Finland and Iceland), (b) the average annual frequency of use per user and (c) the total data traffic flowing over the communication lines between users and the systems providing the on-line services (in bits per annum). The forecast values are reproduced below:

	1976	1980	1985
Users	60,000	960,000	2,350,000
Average use per user	1.7	2.8	3.7
Total traffic	0.1×10^{12}	3.3×10^{12}	10.4×10^{12}

The methodology underlying the production of the forecasts involved building a model which allows the totals to be obtained from disaggregate data concerning

- 20 geographical regions
- 23 subject area sectors
- 12 types of on-line service
- 4 languages
- 4 measures of data traffic.

Given various assumptions made concerning the general character of the information service field during the period, the component parts of the model were then forecast, in some cases by extrapolating earlier trends and growth patterns and in others on the basis of information procured by the team producing the P.A. report. Appendix B of the report contains forecasts disaggregated by region, sector, etc.

To evaluate the P.A. forecasts in the context of possible demand relationships it is necessary to investigate the role of prices in the forecasting model. (Page references are to the P.A. report.) The only

mention of price occurs in Section 3.1 Assumptions where it is stated (p. 11):

g) pricing policy

It is assumed that costs of alternative on-line services will be comparable. While commercial organisations are likely to insist on short term profitability, public services such as EURONET may not. Nevertheless, financing from public funds is expected to diminish with time, virtually ceasing within the second half of the forecast period. Prices are assumed to be independent of the geographical location of the user.

These assumption are in line with the basic principles developed by the special CIDST working group on pricing.

Later (p. 54) there appears:

Perhaps because of its abstract nature (e.g. to receive an item of information twice is not twice as valuable as receiving it once), information has never quite followed the market behaviour of material commodities. Compared with the overall impact of scientific information on whole communities, most users appear unwilling to pay much for the information that they seek.

No price data appear explicitly in the computation of the forecasts, though to the extent that prices affect other components of the model (such as the annual data on millions of search expressions per year, 1971-1974, used to fit the Gompertz curve to the growth of MEDLINE (p. 24, Figure 3,7)) some implicit price effects are presumably incorporated in the forecasts. However, it is clearly not possible to derive the implicit price structure corresponding to the forecasts of usage and traffic.

If it could be assumed (a) that the suppliers of on-line information set the price and then supply all that is demanded at that price and (b) that the price moved over time in fixed proportion to costs, it would be possible to say something about price, since the P.A. report does make some assumptions concerning costs (pp. 11-12):

h) Costs

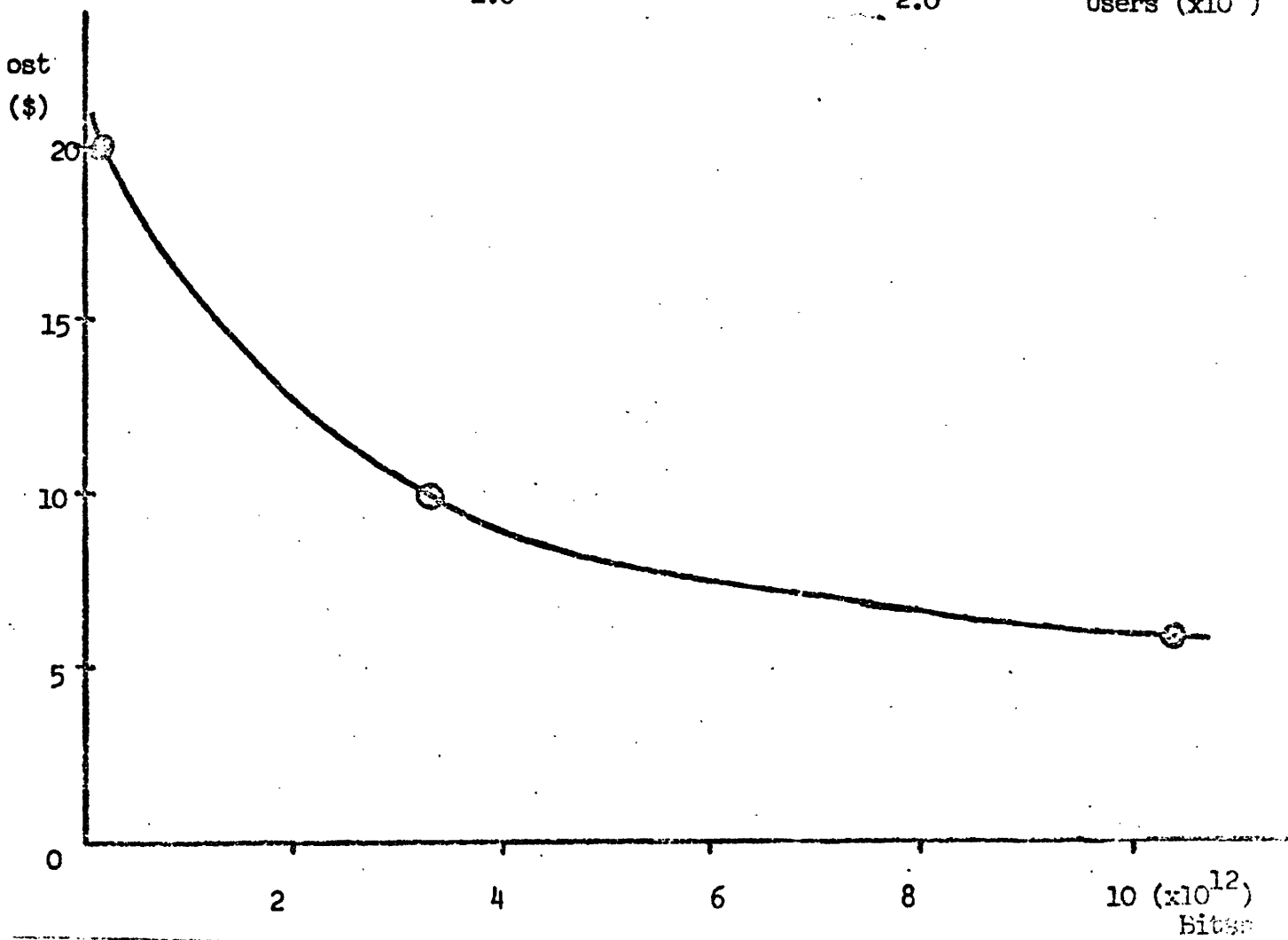
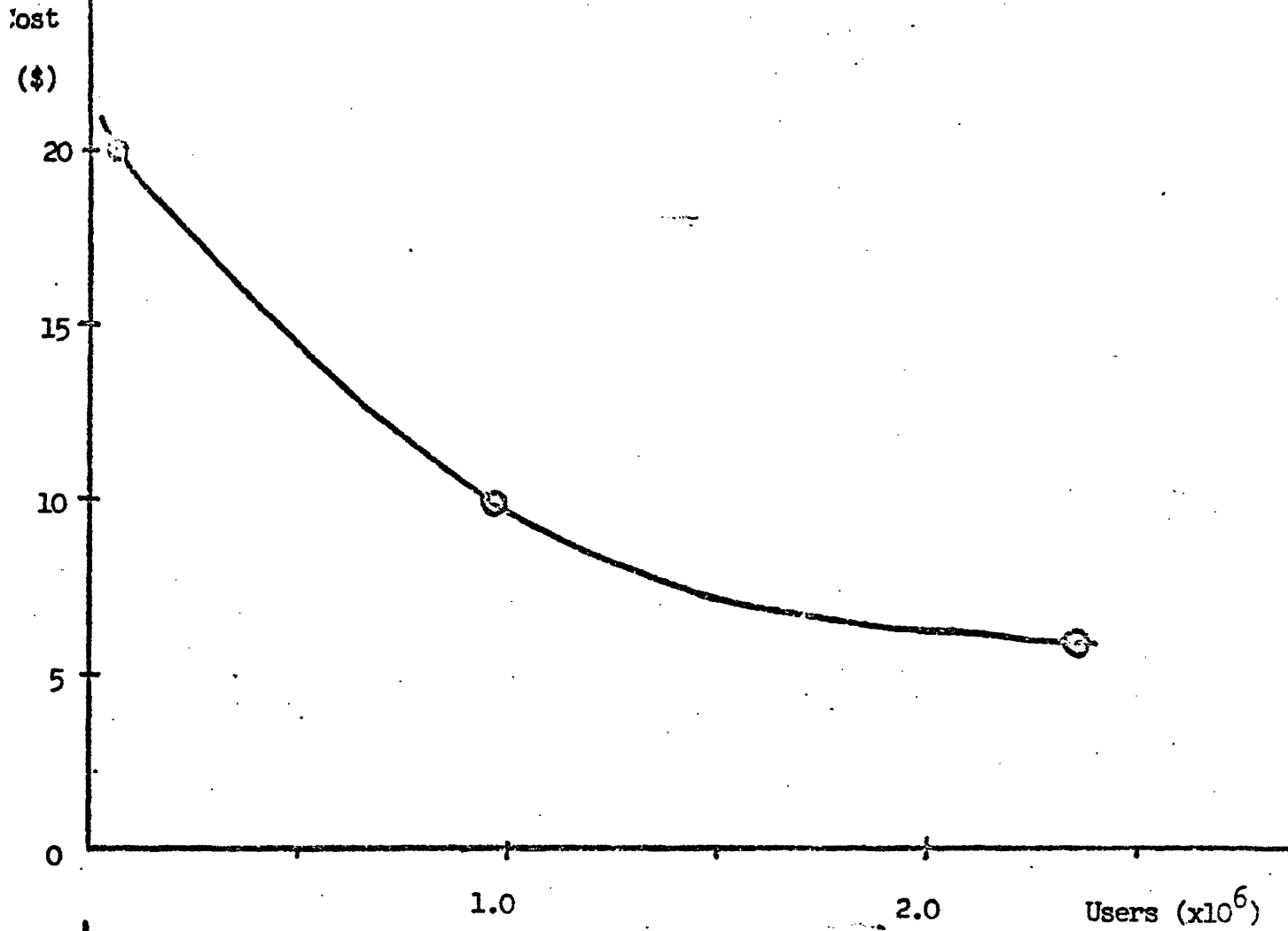
For a retrospective search against a single data base, yielding 25 citations during a half hour session, the total charge to the user (in 1974 US dollars) including communication, processing and printing is assumed to be:

1976	\$20
1980	\$10
1985	\$ 5

While these figures are only notional, they give an indication of both the perceived cost of a search to the user, and the potential revenue to the operators of services.

Unfortunately, the report does not explain why these numbers were chosen, so that it is probably wise not to assume that these cost figures can be used as a proxy for prices. Thus while the forecasts of usage and traffic in the P.A. report have considerable value, it is not easy to see how, in the absence of forecasts of price structures, they may be used to derive demand relationships and elasticities. Figure A.1, based on the P.A. data, can therefore be regarded as illustrative only.

FIGURE A1 Hypothetical Relationship Between PA Forecasts of Demand and Costs



ANNEX 5

SOME DATA ON PRICES AND THE GROWTH OF DEMAND

In order to build up a quantitative picture of the responsiveness of demand a selective search was made of the literature and the questionnaire was used in an attempt to collect data from the respondents (see question 8). The information from these sources may be grouped under three headings (i) costs, (ii) prices and (iii) demand.

(i) Costs The majority of the data available relate to the costs of information services. In addition to the PANDATA report referred to above there are G. Pratt and Susan Harvey, Information Economics (European User Series 2) and The Cost of Mechanized Information Systems (Directorate for Scientific Affairs, O.E.C.D., 1974), while a further five cost studies are summarized and discussed in N. V. System Dynamics S. A.'s Final Report on "Project 1: Analysis of Various Cost Studies in connection with EURONET". Unfortunately these data are of very little interest as none of the studies is concerned with pricing policy or pricing structures.

If it were the case that the price of a particular service was set to cover the costs of that service then the cost data would be relevant in setting lower bounds for prices. This is obviously not the case where cross-subsidization between services is possible and if there is any degree of government subsidization the relationship between costs and the pricing structure becomes very tenuous.

(ii) Prices Here the data referred to on-line charges, either per hour or per search and to off-line charges of printing citations etc and came mainly from respondents to the questionnaire. This source provided some information on tariffs of charges for SDC, Lockheed, TITUS, ARIANE, UKCIS and Excerpta Medica. In addition Dr. A. J. Harley of the British Library provided price data on MEDLARS in the U.K. and two Swedish reports (R. Hjerppe, Experiences of an Interactive Retrieval System - ESRO/RECON, Royal Institute of Technology Library, Stockholm, November 1974 and R. Hjerppe and A. Nord, Utilization of the ESRO/RECON System at the Royal Institute of Technology Library during the period November 1973 - December 1974, Royal Institute of Technology Library, Stockholm, November 1975) provide price data on ESRO/RECON.

The information on tariffs is relevant to the study in providing some observations on the prices of information services, but the data provided by respondents even when supplemented by further information obtained from the selective search of the literature gives only an incomplete picture of the prices of some services at a small number of points in time. Given the time and resources available it has not been possible to build up a fuller profile of the movement of prices for a wide variety of services at a large number of points of time.

(iii) Demand It was found that data on demand were even more difficult to obtain and interpret than those on costs or prices. A number of users of on-line information services who responded to the questionnaire were prepared to provide some data on their demand, but these constitute only a proportion of total demand and it is not clear how representative they may be. The main potential sources of information on total demand are the suppliers of on-line information services and in general they did not make this information available for the study.

The demand data presented by Dr. Harley and also those contained in the two Swedish reports are of interest in that they also present data on prices. Even if the demand for these services is not fully representative of those to be provided by EURONET, this information is important as it illustrates some of the difficulties involved in investigating the demand for a new product during the period of innovation. Any attempt to derive price elasticities is further complicated by the fact that the services have been provided free over some periods of time.

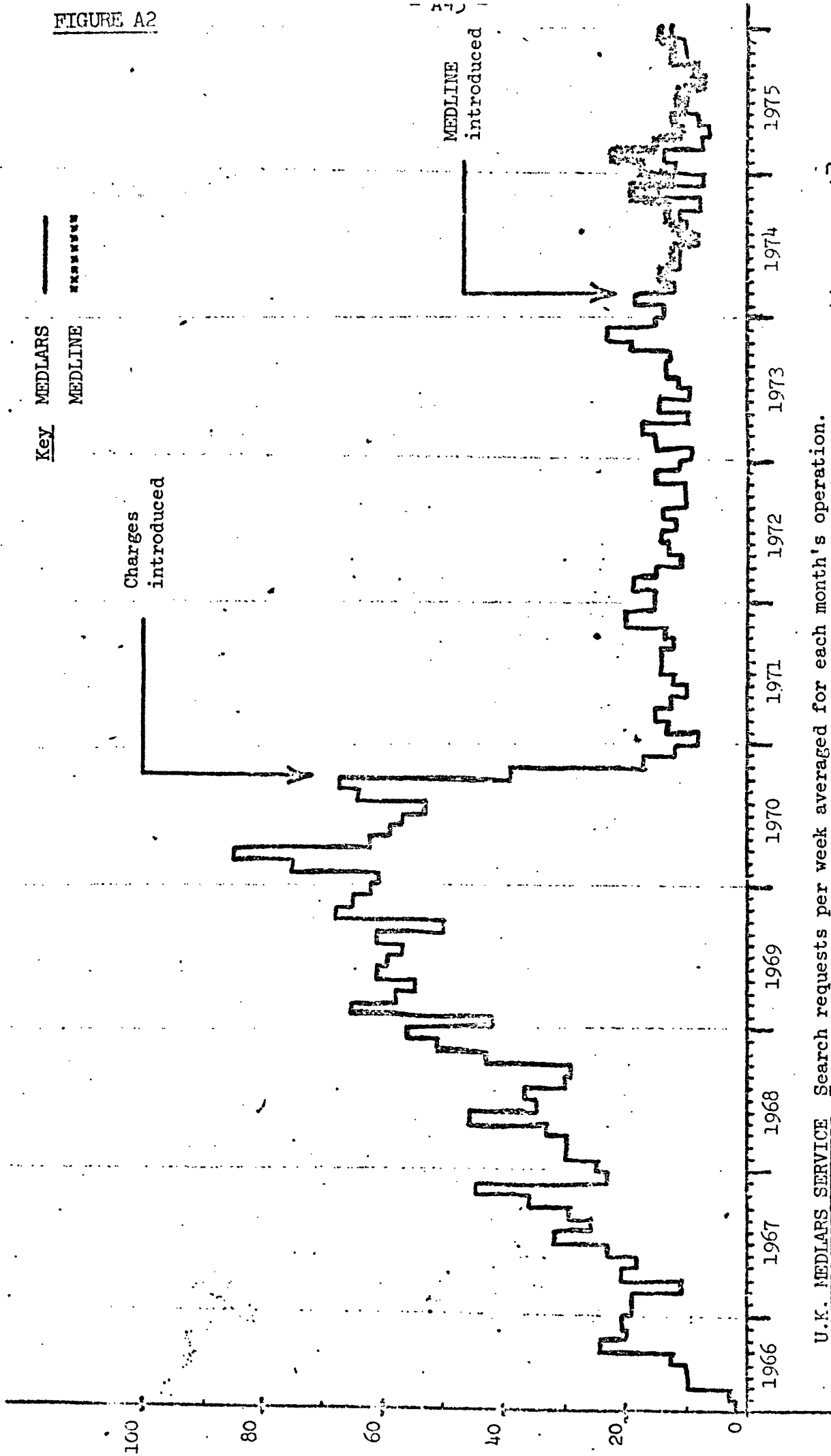
The data obtained from Dr. Harley relate to the number of retroactive search requests per week for MEDLARS in the U.K. for the period 1966 to 1975 and are presented in figure A2. From its introduction in 1966 to October 1970 the service was provided free and the steady growth during this period therefore represents mainly the rate of innovation of the service. In October 1970 changes were introduced and there resulted a dramatic fall in demand, although less dramatic than the diagram suggests since 20-25% of the demand in the period prior to the introduction of charges was from France and this demand would have switched to a new French access to MEDLARS which became available at this time anyway. The charges were £10 per search for commercial users, but only £6 for educational users and about 80% of total demand came from the second group.

Search requests
per week

Key MEDLARS
MEDLINE

Charges
introduced

MEDLINE
introduced



U.K. MEDLARS SERVICE Search requests per week averaged for each month's operation.
[Retrospective searches on whole file or 'pilot file' (last 2-3 years)(from 1970)]

In February 1974 MEDLINE became available and during the initial period after its introduction its use was provided free. The graph suggests that the demand for MEDLINE may have been beginning to grow along a similar trend to that followed by the demand for MEDLARS prior to 1970, but in April 1975 changes were introduced for MEDLINE and there followed a drop in demand. Clearly demand for both MEDLARS and MEDLINE is responsive to changes in price, although the data do not provide the basis for the formal calculation of elasticities.

The Swedish data also suggest that demand is responsive to price changes. Table A.1 shows the number of commissioned queries per month for RECON from October 1972, the month the service was introduced, to October 1973. (Data taken from Hjerpe, November 1974, p. 12).

"The number of queries per month ... shows a decline towards the end of the spring 1973, and then sharp rise in June. This sudden onset was due to the fact that RECON was offered free of charge to all researchers affiliated to KTH during June-August in order to get a higher utilization since only 9 queries were submitted in May, which meant RECON was idle most of the time in May." (Hjerpe, November 1974, p. 9).

Month	Number of commissioned queries	Percentage of queries which were free
October 1972	10	10
November	8	0
December	17	35
January 1973	14	0
February	12	0
March	10	0
April	6	0
May	7	0
June	22	82
July	29	72
August	30	63
September	20	45
October	26	27

Table A.1

Once again, while it is not possible to separate the trend effect from the effect of changing prices, the data do suggest some responsiveness of demand.