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# TAX/BENEFIT SYSTEMS AND GROWTH POTENTIAL OF THE EU

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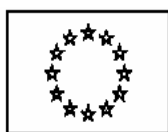
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# **TAX/BENEFIT SYSTEMS AND GROWTH POTENTIAL OF THE EU**

## **ENEPRI Research Report No. 55/May 2008**

**Kari E.O. Alho, Editor\***

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### **Abstract**

The EU has ambitious goals for economic performance. The goals are to be reached in combination with social cohesion and environmentally sustainable development. The main economic policy instruments to be used by the EU member states are taxes and benefits. The economic and political framework for implementing measures in these areas is currently delineated, and is both encouraged and constrained by factors such as population ageing, globalisation and more intense international competition in tax and social policies.

The aim of the project “Tax/benefit systems and growth potential of the EU – TAXBEN” (SCS8-CT-2004-502639), as outlined in SSP Priority 8, Topic 3.1, Task 4, was to carry out an in-depth analysis of tax/benefit policies in five broad areas in which these policies play a crucial role with respect to EU goals. These areas are employment, corporate taxes subject to tax competition, productivity growth and convergence, macroeconomic policies under a single monetary policy, and the environment and climate change. The project was carried out by seven European economic policy research institutes of the ENEPRI network.

The project team used many novel approaches, especially in building new tools that rely on general equilibrium models, so that both the direct and indirect effects of taxation could be analysed. New applications of existing large-scale multi-country models were also used to evaluate the impact of tax policies. In addition, recourse was taken to econometric estimation of the relationships between key economic target variables, on the one hand, and tax/benefit (and other fiscal policies) and labour market indicators, on the other, using large international datasets. A number of theoretical approaches were taken in relation to economic policies under the single currency. The analysis covered the EU-15 countries, the new member states and in some cases other OECD countries, while some research efforts considered a global approach to policy-making.

Altogether, the project’s output was 24 working papers for the 5 work packages and 5 seminars in addition to the final conference. The project delivered a large number of research insights on actual behaviour related to tax/benefit systems and reached conclusions that should be taken into account in policy-making and reforms to tax/benefit policies in the EU.

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# **TAX/BENEFIT SYSTEMS AND GROWTH POTENTIAL OF THE EU**

## **ENEPRI Research Report No. 55/May 2008**

**Kari E.O. Alho, Editor**

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## **1. Executive Summary**

### **1.1 Objectives of the project**

The overarching aim of the 26-month project “Tax/benefit systems and growth potential of the EU – TAXBEN” (SCS8-CT-2004-502639), financed by the European Commission under Framework 6 of Research, was to contribute, in line with the issues specified in SSP Priority 8, Topic 3.1, Task 4, to a better knowledge of the functioning and need for reform of the tax/benefit systems in the EU and thereby contribute to the Lisbon process. The project studied current problems related to the slow economic growth of the EU and the role of tax/benefit systems in this process.

Among the specific goals of the project was to provide policy options to improve the potential growth of the EU and the attainment of high levels of employment, taking into account the challenges of enlargement and the EU’s environmental aspirations. The extensive use of numerical general equilibrium models and econometric estimations permitted the evaluation of the impact of various existing tax/benefit systems. Moreover, these approaches yielded knowledge about policy options, which was primarily quantitative but to some extent theoretical as well, and which should be useful in actual policy-making under different political constraints.

The project had the objective of analysing five areas relevant to the tax/benefit systems in the EU:

- 1) the link between tax/benefit systems and employment;
- 2) the EU tax systems under tax competition and enlargement;
- 3) the growth potential of the EU and its relation to the tax/benefit systems;
- 4) the macroeconomic role of tax systems and promotion of reforms under the single monetary policy; and
- 5) the achievement of sustainable growth in conjunction with high environmental quality, and the role of green taxes and emissions trading in the energy sector.

### **1.2 Organisation of the project**

The project was organised along this division of objectives into five work packages (WPs). The sixth WP consisted of project management, organising the final conference and drafting this final report.

The project consortium was composed of the following organisations: the Centre for European Policy Studies (CEPS), Brussels, as the coordinator; the Research Institute of the Finnish Economy (ETLA), Helsinki, as the scientific coordinator; the Centre d’Etudes Prospectives et d’Information Internationales (CEPII), Paris; the Centre d’Etudes Prospectives d’Economie

Mathématique (CEPREMAP), Paris; the Netherlands Bureau for Economic Policy Analysis (CPB), The Hague; the PRAXIS Centre for Policy Studies, Tallinn; and the Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim.

### **1.3 Research output of the project**

The original plan of the project was to produce 16 working papers, and to organise 5 seminars and a final conference. During the work, the research effort widened such that altogether 24 working papers were produced. The planned 5 seminars on the different WPs were held, as was the final conference. In addition, the project team held 3 workshops on the entire project. All the material was submitted to European Commission representatives.

The deliverables were disseminated through website of the project ([www.taxben.org](http://www.taxben.org)), organised and managed by CEPS. The seminar material was also made available through this medium. Each partner institute further disseminated information on their work through their own national networks and websites.

### **1.4 Concise summary of the scientific contributions**

The project achieved its goals using relevant existing methods and building new tools for quantitative economic analysis. Thus, while seeking to address important policy issues, the project added to the scientific arena as well. In general, the quantitative analysis of taxation can yield important insights for formulating policies. Computable general equilibrium (CGE) models have proven useful tools for policy analysis, when considered as such and when complemented with econometric evidence.

In **WP 1** on employment, two CGE models were built along similar lines for an EU-15 country (Finland) and a new member state (NMS) (Estonia). This approach enabled comparisons of the effectiveness of tax/benefit policies, and an evaluation of the role of labour market institutions (through wage formation) and their interaction with policies. An innovative model, based on search theory and linked to endogenous productivity as provided by on-the-job training, facilitated analysis of the effectiveness and extent of social welfare created by French labour market policies and their comparison with those in the UK.

In **WP 2** on tax competition and corporate taxation, a methodological contribution was made by the first use of an applied general equilibrium model to investigate tax base consolidation with formula apportionment in the EU.

A scientific contribution was also made by building a multi-country tax model, which goes one step further than earlier literature in that notably the savings decision is derived from dynamic utility maximisation. Not only does this do justice to the inherently dynamic nature of saving, it also enriches the welfare analysis.

The project additionally carried out a new econometric evaluation of intra-EU foreign direct investment (FDI), focusing on the comparison between old and new EU member states.

In **WP 3** on EU convergence and productivity growth, an econometric evaluation was undertaken of the tax/benefit systems and their effects on EU convergence in terms of GDP per capita. The originality of the approach was to decompose GDP per capita into productivity and labour market factors.

The search model built in WP 3 on R&D activity and the labour market structure is a novel theoretical tool. The vector autoregressive model (VAR) modelling with the elaboration of taxes is an extension of the literature analysing the relationship between productivity and employment.

In **WP 4** on the macroeconomics of the tax systems under economic and monetary union (EMU), a new form of theoretical modelling was carried out on tax policy under the single currency, and with respect to structural reforms in the EU. The extensive econometric evidence produced on the spillovers of fiscal policy under EMU is a further new contribution.

In **WP 5** on tax systems and climate policy designs, it proved useful to combine in a unique way various types of modelling approaches to tackle the long horizon of policies needed in the analysis of up to 100 years, and to be able to produce the sectoral breakdown of the optimal policies simultaneously.

## 1.5 Summary of the key policy findings

The orientation of the project was, in accordance with the research task specified in the concerned SSP priority, to produce policy-relevant research for the EU level and that of the member countries. Below are the key results and conclusions for policy. These are elaborated in more detail in the respective parts of section 3.

### WP 1 (Employment)

- 1) The CGE models that were built in the project imply that wage formation is essential in determining the outcome of the tax/benefit policies and their overall effectiveness. The apparent efficacy of certain policies reached under fixed wages may be quite misleading, because the ensuing reaction of wages may neutralise much of the positive policy effects. At the same time, there are also policy measures whose positive effects are strengthened by the reaction of wage formation. The former measures include those affecting labour demand, such as cutting the indirect labour costs of firms. The effects of measures of the latter type, which reduce wage claims, like benefit reductions, are magnified under bargaining while with fixed wages their positive effects are only marginal.
- 2) Under decentralised bargaining, wage–wage competition among trade unions may undermine efforts to reduce the non-wage labour costs of low-skilled workers. That being stated, under a nationwide income policy the effectiveness of this policy is restored.
- 3) CGE model analysis of different wage formations for the Estonian and Finnish economies (market-determined wages and bargained wages, respectively) implies that there is a need for different labour market and tax/benefit policies in different EU member states. A comparison of the policy scenarios for Estonia suggests that market-determined wages outperform bargained wages, with the latter representing the more common type of wage formation in the EU. Thus, it is not advisable for the NMS to adopt EU-15 approaches to their labour market policies.
- 4) The labour supply of low-skilled workers in the NMS under all types of wage formation is best increased by lowering the marginal income tax rate. Combining this step with strategies for improving employment in general, e.g. lowering employers' social security contributions, could potentially improve the labour market position of those with lower skills.

- 5) Statistical analysis reveals that the quantitative impact of tax/benefit systems on employment in the NMS is more vigorous than in the EU-15.
- 6) The French system of a minimum wage and payroll tax reductions for low-wage earners is near the social welfare optimum, if endogenous productivity related to on-the-job training is taken into account.
- 7) With its fixed benefits, the UK unemployment benefit system is preferable in terms of employment to the French and Continental systems, whose benefits are linked to prior income.

## **WP 2 (Tax competition and corporate taxes)**

- 8) CGE model analysis reveals that even a unilateral reduction of the corporate income tax rate is not beneficial for all EU countries if they have to finance the tax reduction through an increase in the tax rates on labour or consumption. The reduction in the corporate tax rate attracts FDI and foreign profits. But the increase in the taxes on labour or consumption dampens the impact on employment, GDP and welfare, and might even offset it.
- 9) Econometric analysis of FDI reveals that competition in social policies has a more powerful effect on FDI than tax competition. This conclusion is based on the observation that FDI depends more on differences in employment protection and union bargaining coverage than on differences in statutory or effective corporate tax rates.
- 10) The largest gains from a common, consolidated, corporate tax base (CCCTB) might be expected if all enterprises, domestic and multinational, are treated equally. Proposals for consolidation that exclude some of the firms, such as domestic ones, introduce uneven competition. This approach might induce extensive restructuring both within and among EU member states.
- 11) CGE model analysis underscores that the full benefits from tax base consolidation can only be reaped if all firms participate in a common tax base that applies to them all. If domestic firms are excluded, the EU average gains in terms of GDP and welfare from CCCTB equal respectively 0.08% and 0.03% of GDP in the long run, with the most favourable apportionment formula. The gains would be much larger, with additional gains for both GDP and welfare of about 0.10%, if not only multinational enterprises, but all firms were to participate.
- 12) Formula apportionment distorts the investment and labour demand behaviour of multinational enterprises. The incentives for reallocating production or the production factors are minimised if apportionment depends on the share of production by multinationals in each EU member country. The largest distortions are introduced if apportionment is based on a single production factor, for example employment or capital.
- 13) A CCCTB to which only multinationals may apply creates GDP and welfare gains in EU member states with a broad tax base, but harms countries with narrow bases.
- 14) The economic and welfare effects of a CCCTB are unevenly distributed. Simulation of the CCCTB, in which apportionment is based on employment, capital and production in equal proportions, gives the result that the change in welfare ranges from a reduction of 0.4% of GDP to an increase of 0.6% of GDP. The change in GDP also ranges from a reduction to an increase, both of which are 0.7%.

**WP 3 (Productivity and catching up)**

- 15) According to pooled panel data estimations and cross-country comparisons of the OECD countries, the growth rate of labour productivity has been affected positively by the following factors: higher fixed investment, lower inflation, higher R&D investment and ICT investment as a percentage of GDP, a higher share of young adults with at least upper secondary education, reduced product market regulation and increased exports. In most specifications, taxes and gross replacement rates have no statistically significant effect on productivity growth rates. We found a negative effect from taxes and a positive one from gross replacement rates when they appear together with fixed investment or inflation. Nevertheless, with this evidence we conclude that taxes and gross replacement rates are unlikely to have had an effect on productivity growth.
- 16) At the same time, the taxes-to-GDP ratio has had a significant negative effect on the number of hours worked by the working-age population. Furthermore, we find a negative correlation between the average number of hours worked, on the one hand, and product market regulation and gross replacement rates, on the other. Income inequality and trade union density do not correlate with the number of hours worked, but collective bargaining coverage has a negative correlation. There is also a negative correlation between the ratio of collective bargaining coverage and trade union density on one side, and the average number of hours worked, on the other.
- 17) Theoretical analysis shows that powerful trade unions or higher labour costs associated with increases in, e.g. unemployment compensation, the payroll taxes paid by employers, the taxes paid by workers or the cost of employment protection, cause more unemployment and a slowdown of economic growth. A coordinated bargaining process increases employment at the price of a lower growth rate.
- 18) These theoretical predictions are consistent with the empirical analysis on convergence using data on regions in the EU-15. The tax wedge and unemployment benefits are found to reduce the growth rate and increase the unemployment rate. Employment protection increases unemployment rates, without a significant effect on the growth rate of GDP per capita. The coordination of wage bargaining reduces the growth rate and the unemployment rate. The growth rate of total factor productivity (TFP) increases the growth of GDP per capita and decreases the unemployment rate.
- 19) Econometric evidence shows that the faster productivity growth rates in the new EU member states owe more to catching up from their lower initial levels of output per worker than to policy choices regarding the design of labour market institutions.
- 20) Theoretical modelling of an open economy shows that the equilibrium unemployment rate depends negatively on labour taxes, but not on the capital income tax, as a higher rate of it only leads to a lower level of productivity and income. On the other hand, a permanent change in labour taxes only has a long-term negative impact on employment, but not on productivity.
- 21) VAR analysis for the EU-15 shows that labour taxes have a marked and statistically significant negative effect on employment, while the effects of corporate taxes are more neutral with respect to productivity and employment. The results also show that in the short term there is a trade-off in the EU between the two key economic goals of productivity rises and employment. This tension is less severe in the long run, and while it does not fully disappear, over time it becomes statistically insignificant. By contrast, this trade-off does not hold for the US, where there is price flexibility. This situation calls for more flexibility in the EU labour markets to adjust smoothly to technological changes and



possible negative supply shocks. Simulation of an econometric model for the Finnish labour market shows that in the medium term, there may be important employment gains from the acceleration of productivity, while in the long run there is no connection between them.

#### **WP 4 (Macroeconomics of tax systems)**

- 22) Theoretical modelling of the EMU shows that if the economies are mainly hurt by demand shocks, then flatter tax systems tend to destabilise output whereas the indexation of taxes on prices tend to stabilise it. If the economies are mainly hurt by supply shocks, then the progressiveness of taxation has little impact on output stability. On the whole, the move towards flatter tax systems would likely lead to more unstable output in the euro area.
- 23) Given that i) the European Central Bank smoothes the interest rate, ii) net tax shocks do have supply-side effects, and iii) spending shocks may have a declining impact on aggregate demand owing to financial liberalisation, we conclude that the positive spillovers produced in the euro area today by public spending expansions may be decreasing compared with the past, while tax cuts may now be producing negative spillovers.
- 24) Estimation of a dynamic stochastic general equilibrium model shows that a positive spending shock in Germany has a positive, Keynesian impact on German GDP and a positive but small spillover on French GDP. A positive spending shock in France has symmetrical effects. Spillovers among EMU countries are small because of a significant reaction of the common interest rate to spending shocks in any of the countries.
- 25) VAR analysis of the EU countries shows that both the domestic and cross-border effects of German tax shocks have tended to weaken over time. Even so, they have remained positive, i.e. an expansionary shock in Germany has a positive impact on partner countries, especially neighbouring ones. The impact on the interest rate was found to be weak, however. In empirical research, tax shocks were found to be generally more effective in spurring domestic output than government spending shocks in the euro area. This result might stem from the fact that tax policies may give rise to potential growth in the long run, especially when distortionary taxes are removed, thus increasing economic efficiency and competitiveness. When the VAR estimation is performed recursively over samples of 17 years of data, it emerges that GDP multipliers drop drastically from the early 1990s onwards, especially in Germany (tax shocks) and in the US (both tax and government spending shocks). Furthermore, the conduct of fiscal policy seems to have become less erratic, as documented by a lower variance of fiscal shocks over time. Fiscal ‘surprises’ – in the form of unexpected reductions in taxation and expansions in government consumption and investment – have become progressively less successful in stimulating economic activity at the domestic level. This finding indicates that in the framework of the EMU, policy-makers can only marginally rely on these discretionary instruments as a substitute for national monetary policy.
- 26) Political myopia has a negative impact on the willingness to reduce labour taxes, and the stability and growth pact (SGP) reinforces this pattern since excessive deficits lead to sanctions. Political myopia also reduces the willingness to reduce the welfare state, but this time the SGP has a positive impact on the willingness to reform. Myopia has little impact on the readiness of governments to reform labour and goods markets, but the SGP produces the missing incentive. Given that all reforms but those to the goods markets have a negative impact on neighbouring countries, EU countries should continue to

coordinate product market reforms but leave the reforms of the welfare state and of the labour markets to peer pressure, with the SGP acting as a positive catalyst.

#### **WP 5 (Climate change and energy taxation)**

- 27) An extension of the Californian initiative of curbing emissions to the whole of the US shows that the US would tend to gain from free permit trading with the EU.
- 28) Implicit in the policy goal to limit the rise in temperature to 2°C up to 2100 is that delayed action may induce large excess costs of transitional climate policies and the burden-sharing debate may become substantially more critical over time owing to ‘foregone action’.
- 29) In global climate change policies, there is a non-negligible trade-off between limited and global coverage from a perspective of 20 core countries taking the lead in moving forward with stringent, unilateral emissions-reduction commitments, if the leadership is assumed to last forever. If, however, leadership is restricted to a transitional phase – until 2030 – the welfare implications might be reduced substantially.
- 30) Using two large-scale models of the global economy in combination shows that in an optimal emissions policy over the next 100 years, developing countries reduce their emissions considerably more than industrialised countries do. This result is mainly driven by the share of coal in the baseline fuel-use mix. The reduction in production differs between sectors, with a similar pattern in all regions. Plausibly, the fossil fuel sectors are most affected, whereas the non-energy sectors hardly decline at all.
- 31) A unilateral energy tax will not affect EU-wide emissions and always increases abatement costs in general, but especially in the country that introduces the tax; thus, it cannot be justified from the view of climate change policy. The implication of the analysis is that existing energy taxes for installations covered by the EU emissions trading system are better removed from the standpoint of abatement efficiency.
- 32) The conversion of existing energy taxes to uniform carbon taxes is a powerful instrument in terms of both emissions reduction and economic welfare relative to cap-and-trade. The position of the NMS deserves special attention when considering changes to energy taxes. Existing energy taxes are highly distortionary, but by the same token, new arrangements may provide potentially very powerful instruments within the context of climate change policies.
- 33) Revenue recycling is beneficial relative to recycling in a lump-sum fashion. There is accordingly a double dividend in climate policies.
- 34) In the endogenous technology case, R&D on less-polluting energy technologies is fostered by high permit prices, but it nonetheless requires a large initial subsidy for technology. Carbon leakage may entail a substantial extra cost to the EU in terms of economic growth.

Further details on the output of the project, the seminars organised and the related material, along with the participants of the research consortium can be found on the project website ([www.taxben.org](http://www.taxben.org)) and the website of the ENEPRI network ([www.enepri.org](http://www.enepri.org)).

## 2. Background and Objectives of the Project

The overarching aim of the 26-month project “Tax/benefit systems and growth potential of the EU – TAXBEN” (SCS8-CT-2004-502639), financed by the European Commission under Framework 6 of Research, was to contribute, in line with the issues specified in SSP Priority 8, Topic 3.1, Task 4, to a better knowledge of the functioning and need for reform of the tax/benefit systems in the EU and thereby contribute to the Lisbon process. The project studied current problems related to the slow economic growth of the EU and the role of tax/benefit systems in this process.

### 2.1 Objectives

Among the specific goals of the project was to provide policy options to improve the potential growth of the EU and the attainment of high levels of employment, taking into account the challenges of enlargement and the EU’s environmental aspirations. The extensive use of numerical general equilibrium models and econometric estimations permitted the evaluation of the impact of various existing tax/benefit systems. Moreover, these approaches yielded knowledge about policy options, which is primarily quantitative but to some extent theoretical as well, and which should be useful in actual policy-making under different political constraints.

The project had the objective of analysing five areas relevant to the tax/benefit systems in the EU:

- 1) the link between tax/benefit systems and employment;
- 2) the EU tax systems under tax competition and enlargement;
- 3) the growth potential of the EU and its relation to the tax/benefit systems;
- 4) the macroeconomic role of tax systems and promotion of reforms under the single monetary policy; and
- 5) the achievement of sustainable growth in conjunction with high environmental quality, and the role of green taxes and emissions trading in the energy sector.

The project was organised along this division of objectives into five work packages (WPs). The sixth WP consisted of project management, organising the final conference and drafting this final report.

In **WP 1**, the objective was to consider tax/benefit systems and the functioning of EU labour markets using several novel approaches. First, two similar, numerical, general equilibrium models of the labour market were built that distinguish among workers with various skill levels, working as distinctive and cooperative labour inputs from the firms’ standpoint, as well as together with capital stock. We separated two situations: wage formation and the fixation of relative wages in a monopolistic labour market and wage formation in a fully decentralised labour market. We then contrasted the results concerning reforms of tax/benefit systems, as to their extent and distribution, in these two cases from the viewpoint of employment and the equality of the income distribution. We were thus able to analyse the magnitude of the consequent wage and non-wage labour cost adjustment and the interaction and trade-off between reforms of the tax/benefit system, on the one hand, and wage flexibility in the labour market, on the other. We adapted the model to an EU-15 country (Finland) and a new member state (NMS) (Estonia) to enable us to determine the optimal course of reform in tax/benefit systems. There was also an objective to combine some information on small and medium-sized enterprises into this analysis. Yet, this aspect was found to be outside the core line of the

approach – firms were not divided into several sectors or firm size categories owing to the extensive modelling work already adopted. Nor was this aspect considered vital to the policy conclusions.

A further objective was to analyse the basic role of investment in firm-specific skills and its relation to the labour market policies. The goal was to build a numerical equilibrium model where wage, productivity and unemployment were endogenous.

In addition, the project sought to consider whether the EU accession countries should adopt similar kinds of tax/benefit systems as those presently operating in EU-15 countries. We gave an overview of the current situation and trends in the NMS, identifying the main differences with the systems in place in the old member countries of the EU.

**WP 2** had two related objectives. First, a gravity approach was applied to foreign direct investment (FDI), using as key explanatory variables the unit labour cost and indicators of corporate taxation. The goal was to provide quantitative insights on the scope for tax competition and tax harmonisation. The analysis relied on econometric estimations of the semi-elasticity of bilateral FDI flows to various measures of tax differentials and labour market institutions. It was subsequently possible to provide equivalencies between tax differentials, differences in unit labour costs (including labour taxes) and distances to the centre of the EU. The recent evolution of corporate taxation in the EU as well as the existing level of taxes in new member countries was further evaluated from this perspective. Finally, several scenarios of tax coordination were studied, following the developments of EU discussions on this issue.

Second, we sought to develop a computable general equilibrium (CGE) model for the EU to describe the allocation of international capital flows. This was combined with information about institutional details on European tax systems. The model was used to explore the economic implications of i) competition and harmonisation in EU corporate income tax rates and ii) reforms of tax bases in the EU. We included some of the new member countries in our model. In calibrating the model, we could make use of the empirical information from the first leg of this part of the project. We considered in this connection a reform that shifts the tax burden from corporate to energy taxation, which highlights an important relationship between this part of the project and WP 5 on environmental policies.

In **WP 3**, the goal was to contribute to the Lisbon process by evaluating the various types of tax/benefit systems and EU convergence (or the lack of it) with respect to the US and the operation of the labour market. We used, inter alia, the identity decomposing the growth of per capita incomes into changes in productivity, hours worked, unemployment, participation and age structure. We tried to discern the quantitative effects of reforms to tax/benefit systems, ranging from reduced unemployment and enhanced total factor productivity (TFP) growth, to acceleration in the catching-up of the EU. We also considered the role of labour institutions in the NMS with regard to their convergence on the EU. As high rates of unemployment prevail in many of the NMS, this issue is also highly relevant in their convergence towards the EU-15 in terms of income levels, and tackling it is essential for future EU coherence.

The second approach used here to evaluate the quantitative effects of labour market policies – especially changes in the tax/benefit systems – on the growth potential of the EU involved using VAR models and an econometric model of the labour market. In this context, we simulated the effects of an acceleration of productivity growth in the EU on the unemployment rate. Our intention was to analyse this reaction using a model built to derive an estimate of the equilibrium rate of unemployment in the case of Finland, but the overall pattern should emerge in other EU countries as well. All these analyses reinforced the link between WP 1 and WP 3.

In **WP 4**, we strived to obtain a coherent view of reforms to tax systems and macroeconomic balance in the EU. We started from the essential dual role of taxes, i.e. that of a demand factor and a supply factor through, inter alia, wage-setting. We considered the working of the economic and monetary union (EMU) against this background of reforming EU tax policies. We also considered the coordination of structural policies aimed at increasing the supply and growth potential of the EU in combination with the spur in this direction from the single monetary policy, under the constraints of the stability and growth pact (SGP). The purpose was to describe the spillovers of fiscal policies within the EMU. The various types of spillovers (through trade, imported inflation, monetary policy and FDI) were integrated in a simple, theoretical model. Econometric estimations were performed to try to figure out the sign of the overall spillovers.

We also sought to analyse the coordination of structural policies in the EU with the aid of a theoretical model. In a third step, vector autoregression (VAR) models were estimated for the key euro member countries with four endogenous variables: output growth and inflation in the specific country, and eurozone-wide growth and inflation. It was subsequently possible to look at the cross-over effects of tax cuts and spending rises among euro countries.

Finally, we had thought to supplement the results of the theoretical model and the econometric analysis with a survey of the existing research on the effects of fiscal and structural policies in the EMU countries, paying attention to both country and cross-country effects. The survey was to concentrate on the results of large multi-country macro-econometric models and as such would have been a natural complement to the theoretical and empirical contribution of the three preceding steps. But owing to the current reduced role of existing large-scale econometric models in policy analysis, a decision was taken to substitute this effort with the construction of a dynamic stochastic general equilibrium model for the euro area and to estimate it to determine the spillovers of fiscal policies and the single monetary policy between Germany and France.

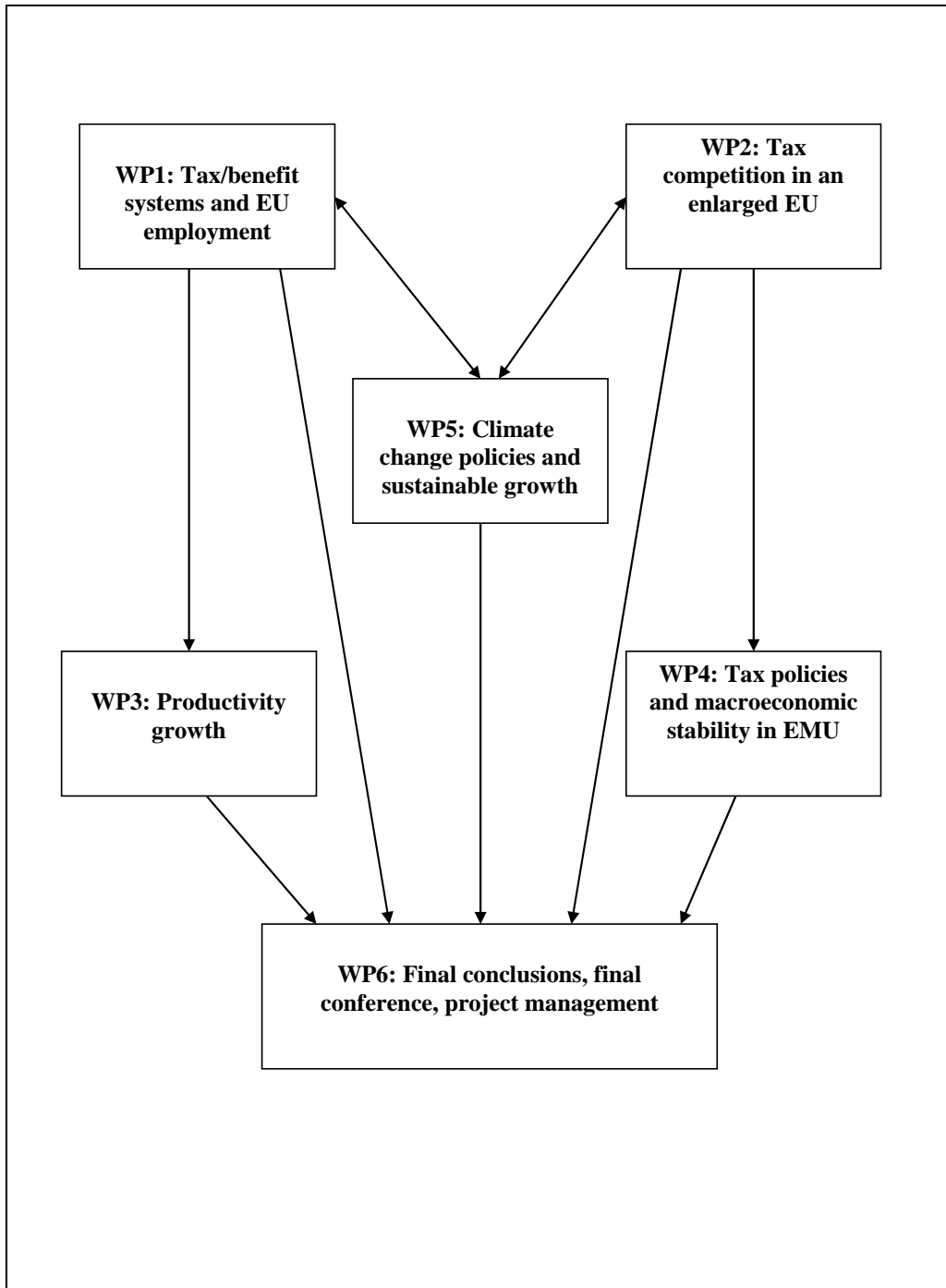
In **WP 5**, the intention was to investigate the impacts of alternative climate change policies, with an emphasis on current practices of energy taxation in EU member states. The goals were to analyse the optimal timing of the abatement of global warming, to assess the post-Kyoto policy options and to analyse the scope of emissions trading in the EU vis-à-vis existing energy taxes. The analysis compared the economic and environmental effects of different environmental instruments and explicitly addressed the revenue raising and revenue recycling aspects of climate change policies.

An integrated assessment model (PACE-IAM) was used to determine optimal responses to exogenous long-term targets for temperature (or likewise atmospheric concentrations of greenhouse gases). The integrated assessment model combines an intertemporal multi-sector, multi-region CGE model of global trade and energy use with a reduced form description of the climate system. In order to cope with computational constraints and data limitations (in particular with respect to long-term country-specific projections of economic growth and energy use), PACE-IAM is aggregated to a few world regions and energy-intensive sectors that are key to the greenhouse gas problem. To gain insights that are more detailed on the adjustment process triggered by long-term climate policies, the policy (design) output of the intertemporal PACE-IAM model as an exogenous input was linked to the more disaggregated dynamic-recursive WorldScan CGE model. The combination of both models enabled information to be gathered for EU policy-makers on the economic implications of climate policies at a sufficiently detailed level while keeping an overall coherent view of long-term and cost-effective climate policy design. In addition, the combined model system can be used in a 'pure' simulation setting in which the climate sub-module simply accounts for the climate impacts of exogenous climate-change mitigation strategies. Thus, various climate policy proposals could be benchmarked

against a cost-efficient strategy. The project also sought to carry out a concise analysis using an aggregative production function to demonstrate the link between economic growth and climate policies.

The interdependencies of the project are depicted in Figure 1.

Figure 1. Project interdependencies



## 2.2 Organisation of the project

The project consortium was composed of the following organisations: the Centre for European Policy Studies (CEPS), Brussels, as the coordinator; the Research Institute of the Finnish Economy (ETLA), Helsinki, as the scientific coordinator; the Centre d'Etudes Prospectives et d'Information Internationales (CEPII), Paris; the Centre d'Etudes Prospectives d'Economie Mathématique (CEPREMAP), Paris; the Netherlands Bureau for Economic Policy Analysis (CPB), The Hague; the PRAXIS Centre for Policy Studies, Tallinn; and the Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim.

The Coordinator of the project was **Daniel Gros**, Director of CEPS, and the Scientific Coordinator was **Kari E.O. Alho**, Research Director at ETLA. The work package leaders were **Kari E.O. Alho**, ETLA for WP 1 (employment), **Albert van der Horst**, Research Fellow at CPB, for WP 2 (tax competition), **François Langot**, Research Fellow at CEPREMAP, for WP 3 (productivity), **Agnès Bénassy-Quéré**, Director of CEPII, for WP 4 (macroeconomics of tax systems) and **Paul J.J. Veenendaal**, Programme Leader at CPB, for WP 5 (environment). The Steering Committee of the project consisted of the above persons, along with **Christoph Böhringer**, Professor at ZEW and **Sten Anspal**, Research Fellow at PRAXIS. Administration was taken care of by **Sally Scott**, Head of Finance and Administration at CEPS, and **Olivier Millard** from October 2006 onwards.

The Scientific Officer for the project at the European Commission was Dr **Ian Perry**, Principal Administrator at DG Research. The key Commission representative who closely followed and commented upon the work was **Katri Kosonen**, Principal Administrator at DG Taxud. In addition, at various stages the representatives of these and other Commission DGs, i.e. DG ECFIN and DG Employment, Social Affairs and Equal Opportunities, commented on the work performed and scheduled in the project.

## 2.3 Overall output of the project

The original plan of the project was to produce 16 working papers, and to organise 5 seminars and a final conference. During the work, the research effort widened so that altogether 24 working papers were produced (see appendix 1). The planned 5 seminars on the different WPs were held (see section 5 below). All the material was submitted to Commission representatives and disseminated through the website of the project (see section 5). The number of working papers that were produced within each of the WPs is indicated below in connection with the presentation of the respective WP.

In addition to the seminars for each of the WPs, a kick-off meeting and 2 joint workshops for the entire project were held. The final conference was held in Brussels on 27 November 2006 (see section 5).

## 3. Description of the Project Results

### 3.1 Tax/benefit systems and employment in the EU (WP 1)

#### 3.1.1 Summary of WP 1

##### Introduction

Against a background of globalisation and population ageing, a key target of the EU is to reach full employment by increasing the demand for and supply of labour, and by reducing

unemployment and inactivity. Other targets are to enhance job quality, productivity, and social and territorial cohesion. There have been positive trends in the EU labour market such that employment has risen, as has productivity, and in the current revival the rate of unemployment has gone down. Yet, there is still some way to go towards a satisfactory balance, with room for further policy interventions at the EU and national levels to improve the functioning of the EU labour markets.

The bulk of the approaches of TAXBEN in WP 1 concern the functioning of the labour market. The EU and the OECD want to encourage the social partners to set the right framework for wage bargaining in order to reflect productivity and labour market challenges. The member countries are advised to review the impact of non-wage labour costs and to reduce the burden associated with low-paid workers. The goals are to make the labour market more flexible, to make work pay by using in-work benefits and to reduce non-wage labour costs, especially for low-wage earners.

Policy interventions have recently focused more on taxation than on benefits, while some changes have targeted labour market institutions to make them more decentralised. Nevertheless, it should be noted that social benefits contribute more to redistribution than taxes do. One key task of policy is to consider them jointly.

### **Research tasks**

In WP 1, the TAXBEN project adopted three broad research tasks:

- i) to identify the interaction between the labour market institutions with respect to wage formation and the tax/benefit system, in order to help assess the effectiveness of labour market and economic policies;
- ii) to determine the interaction between endogenous productivity (through on-the-job training) and labour market policies related to minimum wage and payroll taxes; and
- iii) to evaluate the impact of tax/benefit policies on employment, especially in the NMS.

The second task (ii) is closely linked to the research carried out in WP 3.

### **Methodological approaches used**

The methodological approaches used in the five papers under this work package can be divided into three methods. First, to shed light on task (i), CGE models were built for the Finnish and Estonian labour markets, based to some extent on a similar idea and approach, but with some modifications and differences. The models also have broader EU relevance, as they enable the evaluation of several kinds of institutional settings in terms of wage formation and observation of their interaction with policies.

Both models place workers into three categories based on their level of educational attainment: basic, secondary and tertiary. The wage formation hypotheses analysed are fixed real wages, market-determined wages with a fixed unemployment rate, and wage bargaining (at either a union or national level), with the latter also being called an ‘income policy’. The Finnish model in addition draws a line between the short and long term, identifying these alternatives in such a way that the short term – or rather, medium term – is determined by a fixed capital stock, while the long term is determined by endogenous capital stock, taken from a given (international) required rate of return on capital.

The second approach in task (ii) built a search-theoretical model identifying the search among three labour market positions – employment, short-term and long-term unemployment – and deriving the respective reservation wages. The model makes labour productivity endogenous



through on-the-job training, so that the training decisions made by firms are negatively based on the turnover of labour. A firm has a low incentive to train an employee if there is a high risk that s/he will leave the firm. Thus, the analysis tackled the question of the impact of labour market policies with respect to minimum wage and targeted, indirect labour-cost reductions in the French labour market, which extended to a comparison with the UK's labour market and policies.

The third methodological approach in (iii) involved building an econometric model for the labour market performance of the NMS and contrasting the performance with that of the EU-15.

### **Key results and policy conclusions**

The CGE models for Finland and Estonia in broad terms confirm the hypothesis specified at the outset that there is an important interaction between wage formation and the impacts and effectiveness of tax/benefit policies. The results are also dependent on the time span. It may be that some policies will lose and some gain in effectiveness over time.

The study concludes that with respect to wage bargaining, measures (that apply asymmetric treatment of various groups in the labour market such as low-skilled workers and others) can completely lose their effectiveness owing to wage–wage competition links. On the other hand, under bargaining the curtailment of benefit levels may produce incentives for labour supply and labour demand, such that labour supply rises simultaneously with a fall in the unemployment rate.

Based on the French search model for the labour market, the analysis concludes that labour market policy may have important repercussions through endogenous productivity. The structure of benefit systems, whether linked to past income or a fixed sum independent of past income, can also have significant implications for the labour market. When endogenous productivity is taken into account, the current French employment policy of minimum wages and payroll tax relief for low-skilled workers is quite near the social optimum.

The EU should pay attention to the interaction between tax and benefit policies so that contradictory policies are not carried out in the sense that policy measures in one domain neutralise those in the other. Furthermore, in the NMS, the tax/benefit systems have a greater impact in quantitative terms on employment than in the EU-15. The study concludes that the NMS of the EU should not follow the pattern of the majority of the EU-15 in adopting more monopolistic labour market institutions.

### **3.1.2 Summaries of the deliverables**

Altogether, five working papers were prepared in this WP.

#### **3.1.2.1 Labour Market Institutions and the Effectiveness of Tax and Benefit Policies in Enhancing Employment: A General Equilibrium Analysis**

**Author: Kari E.O. Alho (ETLA) (Deliverable No. 4)**

#### **Introduction**

Taxes and benefits are key policy instruments that affect the functioning of the labour market and employment. Thus, these and other instruments of economic and labour market policies should be analysed in conjunction with wage formation, the role of which is often neglected when considering policies affecting the demand or supply side of the labour market, despite the potentially large impact wage formation can have on the effects of these policies. Although Finland has been able to markedly improve the imbalance in its labour market since the deep recession in the early 1990s, the country still suffers from fairly high unemployment. So there is

room for adjustment and further policy measures. There are wide and persistent differences in the balance in terms of employment of the various skill categories, not only in Finland, but also in other EU countries as well.

### **Research task**

In this paper, we distinguish among four types of wage formation to shed light on its role in the effectiveness of diverse policies for enhancing employment. The first type assumes fixed wages. The second assumes market-determined wage formation, where wages correspond to the marginal revenue product of labour at the given level of unemployment. The third type assumes wage bargaining, where wages are negotiated between the employer and employee trade union organisations in an uncoordinated way. The fourth type is that of coordinated wage bargaining under a nationwide income policy. The second type, i.e. market-based wages, allows us to consider the hypothetical case of a fully flexible labour market and contrast this with the effects of various labour market policies. The CGE model built in this study is static, but also makes a distinction between short- and long-term equilibria in the labour market, so that in the long term the capital stock of firms changes in response to shifts in profitability in the short term. This also gives us an estimate of the change in the equilibrium rate of unemployment.

The motivation behind this extensive modelling is that we wanted to shed light on the relationship between policies and the wage formation structures, which, to our knowledge, has not yet been studied so thoroughly. In this way, the paper strives to be of wider relevance given that EU countries differ in their labour market institutions and wage formation, and the current intensive debate in the EU about how to reform the tax/benefit systems and improve labour market functioning in order to enhance employment.

### **Methodological approach used**

To obtain empirical results, an aggregative, numerical general equilibrium model is constructed for the Finnish economy. The approach taken here is to use this single-country model to illuminate the effects of policies and how these effects depend on the various possible labour market institutions. Of course, data limitations and differences – for example, in tax and benefit structures among the EU countries – also justify this kind of approach.

We distinguish among workers with varying skill levels because they have a different position in the labour market and they may be differently affected by a variety of policies. The model comprises blocks for labour demand and labour supply, in combination with job flows for the recruitment of new workers, assorted approaches to wage formation and a goods market with aggregate production. We also identify the key government policy instruments affecting the economy and the labour market and the government budget constraint.

Our model has some features similar to the CGE model of the Dutch labour market by Bovenberg et al. (2000), but other elements are quite different. The latter are basically related to the importance given to the various assumptions about wage formation and the cooperative structure of production combining the different components of labour, allowing for the case of subsidised labour recruited under an employment support scheme and the specification adopted on how to combine the job flow market with recruitment costs in the model. In the spirit of the recent literature on behavioural economics, under bargaining we introduce the wage–wage links between the worker categories in such a way that the marginal utility of a trade union also depends on the relative wage in relation to that of the other unions.

We analyse several policy measures, such as reductions in average and marginal income taxes, in the indirect labour costs of firms (both uniform and those solely targeted at low-skilled

employees) and in unemployment benefits, along with an increase in the employment subsidy scheme – all of which, in principle, boost the economy. The *ex ante* size of the measures is 0.5% of GDP.

### **Key results and policy conclusions**

Wage formation is found to be essential in determining the outcome of tax/benefit policies and their overall effectiveness. The apparent effectiveness of certain policies attained under fixed wages may be quite misleading, because the ensuing reaction of wages may neutralise much of the positive impact of the policies. Yet, there are also policy measures whose positive impacts are strengthened by the reaction of wage formation. These measures include those affecting labour demand, such as cutting the indirect labour costs of firms. The effects of such measures (which reduce wage claims directly or indirectly) are magnified by wage reactions, however, while with fixed wages their positive effects are only marginal.

Among the more specific results, the role of tax policies is problematic under wage bargaining. Typically, a reduction of marginal tax rates does not work in a satisfactory manner, as it will lead to a rise in wage claims by the labour unions. Under wage bargaining, the tax reduction should be targeted at low-income earners. Still, the interaction between a reform aimed at a more competitive labour market and tax policy leads to another kind of result. In a flexible labour market, the incentives to work created by a reduction of the marginal tax rates, as channelled to in-work labour perform best. The situation surrounding the wage negotiations, such as the intensity of wage–wage competition among the trade unions, also plays a key role with respect to the outcome of some policies. This is especially so if the policy concerned affects the negotiation positions of the various worker groups in an asymmetric way, as does a lowering of the indirect labour costs of firms targeted at only one group of workers. On the other hand, the role of benefit policies merits more attention than perhaps that of tax policies because, under bargaining, a very clear expansion in the economy occurs if benefit levels are curtailed. Of course, this is quite a harsh policy in social terms. But, combined with tax reductions, the policy tool is effective under bargaining and it is more neutral in terms of its social consequences.

Overall, we have found that wage formation has a strong impact on the outcomes of various policies aimed at enhancing employment. The case of fixed wages and those instances in which wages react to policies yield the most contrasting results. In some cases, the expansionary effect on the economy and employment can be even stronger under wage bargaining than under market-determined wages, which is important with respect to policy-making in a European context and to consideration of labour market institutions.

The diverse wage reactions and their relationship with the effects of policies should be recognised when planning actual policies, e.g. by taking into account that policies may have quite different outcomes depending on the labour market institutions and the respective type of wage formation prevailing in the EU country. The other angle is that the reactions of wages are also different over time, and thus cause variations in the results of economic policies during the course of that time.

As expected, a lowering of firms' indirect labour costs is not effective under flexible wages. In many instances, the effects of policies achieved under fixed wages in directly enhancing labour demand are fully neutralised through wage changes over time. One conclusion from the results concerning policies seeking to boost labour demand is that, when formulating them, the short-term gains in employment reached under fixed wages have to be weighed against the long-term neutrality of such measures.

As is plausible in connection with the tool built here, policies that boost the supply side of the labour market, including wage moderation stemming from these measures, work better and the activity of the economy will expand as a result of them. The welfare system, described here by the size of the replacement rate, seems to play a rather substantial role in labour market outcomes. On the other hand, it is also important to note that these measures lead to a large enough degree of wage moderation that the economy and employment expand to an extent that the increase in labour supply (induced by changes in incentives) could be absorbed, and thus there could be a fall in the unemployment rate, too.

Wage bargaining turns out to yield quite small impacts – and not always as positive – which is notably the case with respect to lowering the marginal tax rates. Nevertheless, centralised bargaining could deliver a positive result with respect to the unemployment rate of the targeted group of workers, when their indirect labour costs are reduced, which uncoordinated bargaining cannot do. It is, of course, a totally different matter whether it is at all likely that a centralised wage agreement can be reached in such a situation, where the labour market partners are treated in such a mutually asymmetric way by economic policies.

The best policy is to liberalise wage formation, although it polarises society. We suggest that under bargaining there should be a combination of tax policies, namely that of reducing average taxes while at the same time curtailing social security benefits by an equivalent amount, which is an effective policy under a bargained labour market structure. The results call for the coordination of measures in tax and benefit policies, so that incentives to seek employment and to stay out of work are not simultaneously generated.

### **3.1.2.2 A Comparative General Equilibrium Analysis of the Estonian Labour Market**

**Authors: Alari Paulus, Andres Võrk (PRAXIS) and Kari E.O. Alho (ETLA)  
(Deliverable No. 7B)**

#### **Introduction**

The EU member countries are increasingly concerned about their competitiveness in the global market. One of the central issues is related to the functioning of the labour market and social protection systems. In comparisons of the US and the EU labour markets, the latter has been considered more regulated and rigid, which again has been associated with higher unemployment rates. On the other hand, labour in Europe enjoys higher social protection standards.

Under the pressure of global processes, current trends are towards adjustments in tax/benefit systems that could increase work incentives and improve the flexibility of the labour market without scaling back social protection too much (Carone and Salomäki, 2001). Also, the re-launched Lisbon strategy and the underpinning integrated guidelines advocate more employment-friendly tax/benefit systems.

The enlargement of the EU in 2004 introduced new member countries, which, having relatively decentralised labour markets, also contrast with the EU-15 countries. There are some concerns that this could lead to social dumping. In this context, the NMS have a dilemma as to which way to proceed – continuing the market-oriented flexible approach or shifting to a more centralised bargaining and protective system. There is some empirical evidence that a bell-shaped relationship exists between the centralisation of wage bargaining and the unemployment level (Calmfors and Driffill, 1988), possibly making the choice of an intermediate position between the polar cases relatively unfavourable.

## Research task

In this paper, we take Estonia as one example of the new EU member states and try to answer whether it would be beneficial to implement a tax/benefit system more akin to those found in the old EU countries. Estonia is a small open economy conducting a liberal economic and tax policy. Recent and current tax/benefit reforms aimed at lowering the income tax burden and at increasing unemployment and subsistence benefits represent a good opportunity to model the outcome under various wage formation hypotheses.

## Methodological approach used

We adopt a CGE model initially developed for the Finnish economy as part of the TAXBEN project (see Alho, 2006), but with elements from the models of Bovenberg et al. (2000) for the Dutch economy and Hinnosaar (2004a and 2004b) for the Estonian economy.

The main features of the model are as follows. There are two production factors, capital and labour, with the latter divided further into three skill groups based on educational attainment. Firms are symmetric and produce one homogeneous good. The goods market is characterised by monopolistic competition, implying positive profits for firms. The foreign sector is not explicitly modelled, domestic firms compete with foreign firms in the international market and it is assumed that the domestic price level of goods equals the international price level. Households earn labour income, receive distributed profits and unemployment benefits. Their utility depends on leisure, private consumption (on which all the income is spent) and public consumption. The government has a passive role of spending all tax income on unemployment benefits and public consumption. Tax revenue is generated by income taxes on labour and capital along with employers' social security contributions.

Three different structures of wage formation are modelled. The first is fixed wages, which in the case of a tax/benefit policy change would reflect the first reaction in the (very) short run. The second is market-determined wages, which may correspond to the Estonian case under current circumstances in the medium term. (We do not consider the long run, as capital is held fixed.) The third is wage bargaining by each skill group, representing a more EU-oriented hypothetical case.

Overall, labour supply and wage bargaining are modelled in the manner of Bovenberg et al. (2000) and Hinnosaar (2004a and 2004b), while the production side and other wage formation schemes (fixed and market-determined) are modelled as in Alho (2006).

The general equilibrium effects of the Estonian tax/benefit system have not been extensively researched. To our knowledge, there are no previous studies apart from Hinnosaar (2004a and 2004b). Compared with the latter, we consider several alternative wage formation systems. We also introduce capital as a production factor, although fixed, and employ data that are more recent. Additionally, having available a similar model to the Finnish case allows us to compare tax/benefit effects on employment in an old and a new member state, where the coverage of wage bargaining differs notably: 90% and 20-30%, respectively, in 2003 (European Industrial Relations Observatory, 2005). Modelling several skill groups also enables us to separately analyse the situation of low-skilled labour, whose employment rate is particularly low.

## Key results and policy conclusions

There are four policy scenarios evaluated under all three wage systems, altogether up to nine different simulations. The following policy changes are considered: 1) lowering the marginal income tax rate, 2) increasing the income tax allowance, 3) lowering employers' social security contributions, and 4) increasing the replacement rate. All policy simulations are financed by an *ex ante* reduction in the level of public consumption by 0.5%.

The policy simulations considered show that alternative ways to affect the labour market can lead to very different outcomes, e.g. on labour supply and unemployment. An initial improvement in terms of households' disposable income might even turn out to be welfare-reducing in the new equilibrium. The effects of policy changes also vary under different wage formation schemes – lowering the marginal income tax rate is for example most effective in enhancing private consumption and social welfare under market-determined wages, while a reduction in the social tax rate works most successfully under fixed wages. A combination of cutting the marginal income tax rate and increasing tax allowances (essentially the 2005 tax reform in Estonia) has the potential to increase production and social welfare without increasing unemployment rates under market-determined wages.

Assuming that different wage formations are relevant for Estonian and Finnish economies (market-determined wages and bargained wages, respectively), we can stress the need for different labour market and tax/benefit policies in different EU member states. Comparing the policy scenarios for Estonia under market-determined wages and wage bargaining implies that market-determined wages outperform bargained wages, with the latter more closely representing the type of wage formation predominant in the EU-15.

Although no policy scenarios targeted at specific skill groups were carried out, some implications could be still noted. The labour supply of the low-skilled is most effectively increased by lowering the marginal income tax rate, which is valid under every wage scheme. Combining this in turn with strategies to improve employment in general, e.g. reducing employers' social security contributions, could potentially enhance the labour market position of those with lower skills.

### **3.1.2.3 A Quantitative Evaluation of Payroll Tax Subsidies: A Structural Approach, a Reform of the French Tax/Benefit System**

**Authors: Arnaud Chéron (PSE-Jourdan, Cepremap and GAINS (Université du Maine)), Jean-Olivier Hairault (Cepremap, EUREQua (Université de Paris 1), IUF and IZA) and François Langot (PSE-Jourdan, Cepremap and GAINS (Université du Maine)) (Deliverable No. 6A)<sup>1</sup>**

#### **Introduction**

High labour costs are typically considered the primary cause of high unemployment levels in Continental European countries (see Blanchard and Wolfers, 2000). During the 1990s, these countries used a large set of policy tools to decrease the unemployment rate, in particular that for low-skilled workers. France experimented with an original strategy that consisted of a high minimum-wage level compensated by large and permanent payroll tax subsidies for low-wage employment.

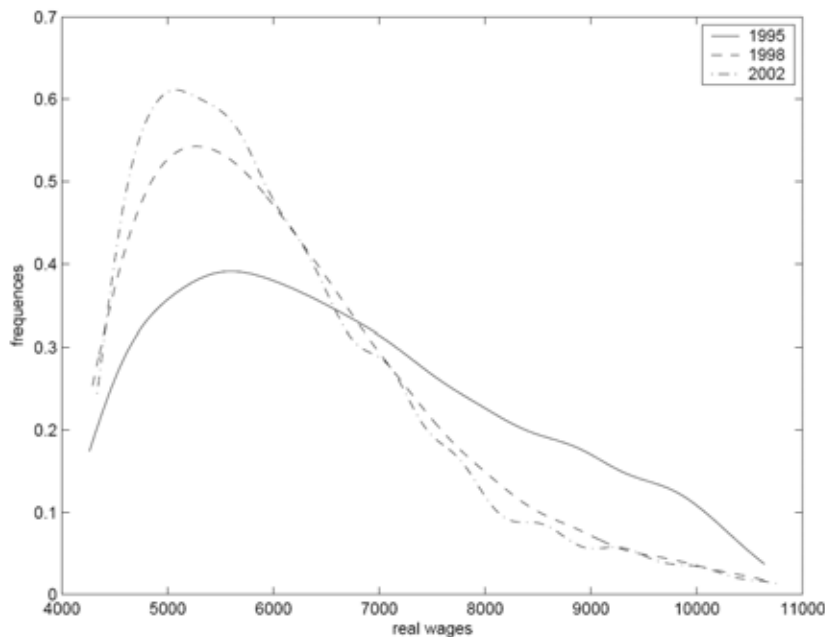
Research on the French labour market has extensively pointed out the negative role played by the minimum wage legislation in increasing labour costs. In the mid-1990s, the introduction of payroll tax subsidies for low-wage workers was meant to compensate for the negative impact of the minimum wage on employment without exacerbating wage inequality. The policy is specifically designed to avoid a significant job reallocation towards poorly paid jobs. Subsidies are not concentrated at the minimum wage level and, instead, consist of a maximum reduction of 18.2 points at the minimum wage level and a decreasing reduction in payroll taxes of up to 1.33 times the minimum wage. Several econometric papers have already highlighted the

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<sup>1</sup> This paper has been accepted for publication in the *Journal of Public Economics* in 2008 under the title “A Quantitative Evaluation of Payroll Tax Subsidies for Low-Wage Workers: An Equilibrium Search Approach”.

positive impact of this policy on employment. Malinvaud (1998), however, underscores a potential negative impact on productivity, owing to a bias in job creation at the bottom of the wage distribution. When the wage distribution is strongly interrelated with the productivity distribution, payroll tax subsidies that are concentrated at the bottom of the wage distribution could shrink productivity, which in turn could dampen the output. Figure 2 shows the downward shift and flattening of the wage distribution of manual workers since the 1990s. The change in labour cost units during the period 1997–2002 supports this observation: at the minimum wage level, unit labour cost increased despite the negative impact of payroll tax subsidies.

*Figure 2. Observed wage distributions of manual workers (France)*



Source: Chéron, Hairault and Langot (2005).

## Research task

In this paper, we evaluate the payroll-tax exemption policy and its impact on employment when we take into account the productivity channel.

## Methodological approach used

We build a structural model of the labour market for French low-skilled workers, which enables us to quantitatively evaluate the employment-plus-productivity effects of the French labour cost-reducing policy. This structural strategy differs from recent econometric exercises and allows us to examine several policy experiments.

We propose a wage posting model with specific human capital investments and a bilateral endogenous search, similar to Mortensen (2000), to consistently generate wage and productivity distributions and an unemployment equilibrium rate. In this framework, the expected job duration determines the extent to which firms invest in firm-specific human capital. In addition, we hold that the wage posting strategies of firms and their training investments are strongly related, as suggested in Manning (2003). As such, the negative relationship between wage and labour turnover creates incentives for training employees. In equilibrium, firms choose different

levels of training and wage offers, which result in endogenous within-market productivity differences and, consequently, a dispersed equilibrium wage-offer distribution. Moreover, the wage posting approach is incorporated into the search equilibria in order to determine unemployment and vacancy rates in a consistent manner. This method leads to a joint theory of wage (as well as productivity) and employment, where the effects of labour market institutions are not determined *a priori* by job creation disincentives or the reduction of the monopsony power of firms.

This study also incorporates realistic features to analyse the efficiency of French labour market policies. First, we take into account the existence of a minimum wage, which influences the cost of labour and the recruiting efforts of firms. Second, we assume the existence of transition periods between short-term and long-term unemployment as well as some heterogeneity in the search intensity of employees and of the short- and long-term unemployed. As such, we obtain a time-varying unemployment benefit system and differences in offer arrival rates as per the status of individuals (in employment, short- or long-term unemployment). These features generate an endogenous distribution of the unemployed workers' reservation wage, which enhances the evaluation of the minimum wage legislation.

Our strategy relies on at least two key points: the wage posting hypothesis and the fact that productivity is governed by specific human capital investments. The former seems consistent with empirical findings for low-wage workers and the assumption that firms have monopsony power is not rejected for these workers in the French panel dataset. Regarding the second point, Postel-Vinay and Robin (2002) show that the productivity differential across firms explains about half of the French low-skilled wage variance. The remaining part is entirely owing to search friction, leaving no room for individual fixed effects. We interpret this as general human capital, which increases with the skill of workers. We estimate key parameters of the model on French data using the simulated method of moments. Based on statistical tests, we cannot reject the hypothesis that the theoretical wage distribution is generated by the same law as the observed one. In particular, because the productivity distribution plays a central role in the replication of the observed unimodal wage density, it provides a powerful identification strategy to estimate the elasticity of productivity relative to human capital investment.

### **Key results and policy conclusions**

We investigate the various implications of a minimum wage on output. The optimal level for a minimum wage seems to be slightly lower than the observed one: a decrease in the minimum wage leads to an employment boost, but is not totally compensated by a decline in labour productivity. The opposite occurs when considering values below the optimal minimum wage level. If we remove the productivity channel, we obtain a very different conclusion and find that short-term unemployment benefits are binding as to employment. Despite the existence of long-term unemployed workers who would be willing to work for a lower wage, we show that no firms would propose a wage below the reservation wage of the short-term unemployed workers. In that sense, the minimum wage legislation is unnecessary. Alternatively, including the productivity channel emphasises the importance of a minimum wage. Given that the payroll tax subsidies are implemented to reduce labour costs without removing the minimum wage legislation, we show that this policy is welfare-improving. It is implemented relatively well because it allocates subsidies over a wide range of wages, not only at the minimum wage level. Existing exemptions lead to an employment boost, which is offset in part by a deterioration of the productivity level. Here again, removing the productivity channel from the analysis leads to an opposite recommendation, namely the concentration of exemptions at the minimum wage level.



### 3.1.2.4 Why is Unemployment Higher in France than in the UK? A Wage Posting Answer

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#### Introduction

The French and the UK economies have access to the same technology and use the same organisational process of production. In these two economies, there is a high minimum wage. Nevertheless, the level of unemployment, and more specifically the unemployment of low-skilled workers, is higher in France. How can we explain this difference?

The taxes or the average rate of the unemployment benefits are not the same but the key difference is the calculation of the unemployment benefits for an unemployed worker. Indeed, in France, there is a system wherein the calculation of the unemployment benefit depends on the preceding wage. This approach leads to a large dispersion of unemployment benefits. At the opposite end, in the UK, there is an unemployment insurance system à la Beveridge: unemployment benefits do not depend on the preceding wage. In the latter case, the distribution of the unemployment compensation is a mass point. The French system allows the smoothing of consumption by workers, whereas in the UK, one can observe a large decrease in consumption over the life-cycle of the unemployed.

#### Research task

In this contribution, we focus on the costs of the unemployment benefit system based on the logic of consumption-smoothing. This difference in the dispersion of the unemployment benefit can lead to large differences in the equilibrium, if one focuses on the unemployment rate, aggregate production or welfare. Indeed, a large dispersion of the unemployment benefit leads those firms that have wage offers that are lower than the higher unemployment benefit to encounter unemployed workers who reject the job proposal. Hence, by introducing heterogeneity among the workers, the French unemployment benefit system can lead to a large inefficient mismatch. This mismatch increases the delays for a firm (worker) to find a worker (firm) and thus extends unemployment.

Without any dispersion of the unemployment benefit, there is no job refusal in the UK and hence the unemployment rate is lower. One can introduce a minimum wage in order to reduce the number of job refusals. Without any dispersion of the unemployment benefit, the impact of the minimum wage on unemployment is trivial in the UK: if the minimum wage is higher than the level of the unemployment benefits, then labour costs are higher, the number of vacant jobs is lower and the unemployment rate is higher.

At the other end of the spectrum, in France, the minimum wage has more complex impacts: an increase of the minimum wage leads to a reduction of the number of vacant jobs, as in the UK, but this policy implies that the number of job rejections decreases. This latter effect can reduce the equilibrium rate of unemployment. Nevertheless, in France the minimum wage does not ensure that all the wage offers will be accepted in the equilibrium, because any individual has access to high unemployment benefits.

Beyond its impact on unemployment, the minimum wage introduces arbitration between employment and productivity: a higher minimum wage leads to reduced turnover and provides some incentives to invest in job-specific capital. Thus, in the UK, the decrease in employment can be compensated by the increase in productivity and hence it leads to greater welfare. In

France, if the minimum wage increases employment, its positive impact on productivity magnifies its first positive effect on welfare.

### **Methodological approach used**

The methodology used in the paper involves building a search model for the labour market, distinguishing the various labour market positions and thereby being able to derive the reservation wages of the workers and to identify the frictional and inefficient unemployment.

### **Key results and policy conclusions**

The simulation results for the French economy are as follows. The introduction of a minimum wage leads to a decrease in the vacancy rate and then to the frictional unemployment ( $u_f$ ). This increase of the labour costs reduces the number of job offers but also largely reduces the number of job refusals. Then the aggregate unemployment falls because there is a large decline in the inefficient unemployment ( $u_{in}$ ). This decrease of the inefficient unemployment can be decomposed into two parts. The decrease of  $u_{in}$  due solely to the reduction of job refusals is from 12.1% to 10%. Indeed, in this simulation, the firms cannot adjust the number of vacant jobs after the introduction of the minimum wage: the rate of meeting is the same as in an economy without a minimum wage. When the number of vacant jobs is endogenous, it also leads to a reduction in the number of job refusals and subsequently the level of inefficient unemployment (from 10% to 7.1%).

In the UK, unemployment benefits do not depend on the previous wage. We assume that the distribution of the unemployment benefit is restricted to one point in the UK for the level of unemployment benefit, which corresponds to 0.34 of the average wage rate. Given these assumptions about the tax/benefit system in the UK economy, the level of inefficient unemployment is equal to zero because the lower wage offer is equal to the unemployment benefit, which is the same for all the workers. In the case of the UK, the equilibrium rate of unemployment is equal to the frictional unemployment. Because we assume that the creation/destruction process is the same in the two economies, the equilibrium rate of unemployment in the UK is equal to the frictional unemployment rate in France.

When the minimum wage is fixed at the same level as in the French economy, the introduction of a minimum wage leads to a decrease in the vacancies and therefore explains the increase in unemployment. With this unemployment benefit system, the aggregate unemployment is largely lower in the UK. But the two unemployment benefit systems are different in two respects: the level of the replacement rate and the existence of an unemployment benefit distribution. If the level of the unemployment benefit in France is reduced in order to have on average the same replacement ratio, then the equilibrium rate of unemployment is lower, but the impact of the dispersion of the unemployment benefit implies that the unemployment rate is more than two times larger than in the UK. In general equilibrium, i.e. when the number of vacant jobs is endogenous and is reduced by the increase in the wage costs, the increase in the frictional unemployment offsets the large decrease in the inefficient unemployment. This leads to a small decrease in aggregate unemployment.

Moreover, simulations of the model also show that the minimum wage increases production and welfare in these two economies. Finally, we show that the minimum wage fosters a significant reduction in income inequalities. These results give some support to the adoption of the UK unemployment benefit system by European countries. They also underline that there is in each economy an optimal minimum wage. Its level depends on the arbitration between productivity and employment.

### **3.1.2.5 Tax/Benefit Systems in the New Member States and their Impact on Labour Supply and Employment**

**Authors: Andres Võrk, Reelika Leetmaa, Alari Paulus and Sten Anspal (PRAXIS Centre for Policy Studies) (Deliverable No. 7A)**

#### **Introduction**

The level and structure of taxes and benefits have been the subject of much attention and discussion in recent years in EU countries. The existing research suggests that labour market institutions matter for labour market outcomes and that disincentives generated by the structure of tax/benefit systems are one cause of low employment and slow economic growth in the EU (European Commission, 2000). Tax/benefit systems create incentives that influence the behaviour of both employees and firms. On the demand side, high tax burdens can increase the cost of labour. On the supply side, generous out-of-work benefit payments may lead to reduced efforts to seek employment and high marginal tax rates reduce the reward for additional work efforts (Carone and Salomäki, 2001).

The eight new EU member states (formerly planned economies from Central and Eastern Europe –NMS-8) that entered the EU in 2004 have had rapid economic reforms since the 1990s, but in several NMS the unemployment rates have remained high and the employment rates low. Meanwhile, there are considerable differences in labour taxation and disincentives created by the tax/benefit systems. The extent to which these differences in the tax/benefit systems can explain differences in labour market outcomes is the issue we address.

A few studies have analysed the labour market institutions, including tax/benefit systems, and their impact on labour market outcomes in the NMS or transition countries. For the most part, the cross-country studies have covered the four NMS that belong to the OECD countries. The dominant conclusion from previous studies is that labour market institutions are less rigid and labour markets are more flexible in the NMS than in the EU-15, but still they find that taxes and benefits influence employment and unemployment rates.

#### **Research task**

In this paper, we analyse whether cross-country differences in labour market outcomes, especially in activity rates and employment rates, in the NMS-8 can be explained by the characteristics of the tax and benefit systems.

#### **Methodological approach used**

We use macro-level panel data from the NMS-8 over the years 1998–2004. We apply graphical analysis and panel-data regression models to investigate whether the variation in the incentives created by the tax/benefit systems, measured by the tax wedge and marginal effective tax rates, can explain variations in the labour market outcomes. We analyse the impact on activity rates, employment rates, unemployment rates, the share of part-time workers and weekly work hours. We use pooled OLS and country-specific fixed effects regression models. In our regression models, we also control for other macroeconomic variables that may influence labour market developments: GDP growth, inflation and openness (trade-volume-to-GDP ratio).

#### **Key results and policy conclusions**

The NMS from Central and Eastern Europe are characterised by lower overall tax burdens. Still, they display relatively high taxes on labour and in all the countries, the tax wedge on labour is higher than the average of the EU-15 countries. On the other hand, social expenditures (including those on unemployment benefits) are low, which increases incentives to work.

In our econometric analysis, despite the small sample period, we find statistically significant effects of the tax/benefit indicators on the labour market outcomes in several of our regression models. As tax/benefit systems do not change very rapidly and we have a relatively short time period, it is not surprising that there are more significant results in pooled OLS regressions than in the models with country-specific fixed effects.

Our statistical and econometric analysis shows that a higher tax wedge has a significant negative impact on labour force participation and the employment rate in the NMS-8. Our estimates suggest that an increase of the tax wedge by 1 percentage point reduces the employment rate by 0.2 to 0.7 percentage points, depending on whether we include country-specific effects in the model. A negative relationship exists for both men and women, for older workers (the strongest effect) and for those with low levels of education.

Concerning high marginal effective tax rates, when moving from unemployment to work (an unemployment trap indicator), we find that they decrease the activity rate and the employment rate of older workers and increase the unemployment rate. We also find some effects of the low-wage traps on the activity rate of older persons and those with low levels of education.

Our estimation results suggest that the progressivity of the tax/benefit system, at least at the low-wage level and as measured by the size of the trap indicators, is positively related to the average of usual weekly working hours and negatively so to the share of part-time workers. These results suggest that in the countries where the system is more progressive, those persons who work prefer to work tend to do so more hours and not take up part-time employment.

As both the time series and number of countries in our analysis is small, and in several models we have encountered statistically significant coefficients with unexpected signs, the results should be interpreted with caution. Still, given that other labour market institutions (e.g. employment protection legislation, unions and active labour market policies) are less important in the NMS and we observe a high tax wedge and large variations in unemployment traps, our general results do not conflict with our expectations.

In recent years, several NMS have reduced or plan to reduce the tax burden of low-paid workers by increasing income tax allowances or decreasing marginal income-tax rates, or both (e.g. Estonia, Lithuania, the Czech Republic and Slovenia). Given our results that lower taxes are associated with higher activity rates and employment, these policies should lead to increased employment rates. In the NMS, where wages are more flexible, a simple reduction of the marginal income-tax rate and an increase in the tax allowance might encourage the employment of low-wage earners. The tax/benefit systems in the EU under tax competition (WP 2)

### **3.1.3 Summary of WP 2**

#### **Introduction**

The Lisbon process also implies that the European social model, which is relatively generous, should be preserved through its modernisation. This goal could possibly be endangered by the rising mobility of capital and highly skilled labour, which could lead to some tax competition among EU member states. The outcome would be either reduced resources for the benefit systems or higher levels of inequality for the financing among the various kinds of taxpayers.

The free movement of capital in the single market is hampered by the existence of separate systems of corporate taxation. Consolidating the tax base for multinational firms would reduce these tax obstacles enormously. Yet consolidation might also overrule the primacy of member states in fiscal policy. Is there a way out of this dilemma?

## Research tasks

The focus of WP 2 is on the economic impact of corporate tax policy. Two kinds of policy scenarios concerning corporate taxation are studied. The first analyses the implications of competition and coordination in statutory tax rates. Specifically, the impact of cross-country discrepancies in corporate taxes and in unit labour costs on FDI, gross domestic product (GDP) and welfare are investigated. The second focuses on tax base harmonisation and is inspired by proposals in the 2002 Tax Communication of the European Commission to consolidate taxable profits across member states. Together with consolidation, we study the impact of formula apportionment, which is needed to allocate the tax base over the member states.

## Methodological approaches used

The analysis relies on econometric estimates and model simulations. Semi-elasticities of bilateral FDI flows to various measures of corporate tax differentials and of differences in unit labour costs are estimated. The economic and welfare implications of both tax rate reforms and consolidation of the tax base are simulated with a CGE model.

## Key results and policy conclusions

The main policy implications of WP 2 are as follows.

Tax differentials are important determinants of FDI in the EU-15, but not in the new EU member states. This conclusion is based on econometric estimates for 22 EU countries between 1990 and 2002.

Even a unilateral reduction of the tax rate is not beneficial for all countries if they have to finance the tax rate reduction by an increase in the tax rates on labour or consumption. The reduction in the corporate tax rate attracts FDI and foreign profits. But the increase in taxes on labour or consumption dampens the impact on employment, GDP and welfare, and may even offset it.

Social competition is more powerful than tax competition. This conclusion is based on the observation that FDI depends more on differences in employment protection and union bargaining coverage than on differences in (statutory or effective) corporate tax rates.

This conclusion is confirmed by model simulations showing that policies to remedy tax competition, such as setting a minimum tax rate or even harmonising the corporate income tax, hardly enhance growth and welfare in the EU: the winners just gain enough to compensate the losers.

The largest gains from consolidating the corporate income tax base might be expected if all enterprises, domestic and multinational, are treated equally. Proposals for consolidation that exclude some of the firms, such as domestic firms, create an uneven playing field. This approach might induce significant restructuring both within and among member states.

Formula apportionment distorts the investment and labour demand behaviour of multinational enterprises (MNEs), which are minimised if the apportionment formula reflects the distribution of the corporate income of MNEs. The largest distortions are introduced if apportionment is based on a single production factor, such as employment or capital. The incentives for reallocating production or the production factors are minimised in the simulations if apportionment depends on the share of production by multinationals in each member state.

The economic effects of consolidation with formula apportionment are unevenly distributed. Owing to formula apportionment, low-tax countries are attractive for the location of production, whereas GDP and welfare in high-tax countries decline. In addition, a common consolidated tax

base to which only multinationals may apply creates GDP and welfare gains in member states with a broad tax base, but harms countries with narrow bases.

Tax competition is intensified with common consolidated base taxation. All member states, but in particular those with relatively open economies, have stronger incentives to reduce their tax rate with a consolidated tax base than with separate accounting. If formula apportionment is based on an internationally mobile production factor, like capital, tax competition might even result in a race to the bottom. If apportionment is based on an internationally less mobile factor, like employment, tax rates are likely to be cut, but not to the bottom.

### **3.1.4 Summaries of the deliverables**

There are four working papers prepared under this work package.

#### **3.1.4.1 Who's Afraid of Tax Competition?**

**Author: Amina Lahrèche-Révil (CEPII) (Deliverable No. 9A)**

##### **Introduction**

The tax competition literature has long stated that increasing international integration might impose growing pressure on tax policies, as raising taxes creates incentives for mobile taxpayers to relocate abroad. Because tax base relocation is proportionally more important in small countries than in large ones, this literature further shows that small countries have stronger incentives than large ones to cut taxes, which could eventually lead tax rates on mobile income to converge towards zero. Such a conclusion has, however, been challenged by a number of alternative approaches, pointing for instance to the fact that higher taxes can be the counterpart of higher attractiveness, or to the fact that taxation is a second-order determinant of location decisions, well behind e.g. proximity to the market.

As far as corporate taxation is concerned, most existing empirical studies focus on the sensitivity of FDI or firms' location decision to taxation. These show that multinational firms do react to tax incentives, be they embedded in tax rules or tax rates.

While most existing studies focus on the OECD, tax competition may be tighter within the EU owing to the single market. In this context, the low rates observed in the NMS are raising fears of a race to the bottom.

##### **Research task**

This paper investigates the impact of tax incentives on FDI within the enlarged EU, using bilateral FDI flows from the EU-15 countries to 18 to 22 EU-25 countries (depending on tax measures), from 1990 to 2002.

##### **Methodological approach used**

The empirical investigation relies on two alternative specifications of a gravitational model of FDI flows, where the impact of various definitions of corporate taxation (namely, implicit tax rates, statutory tax rates and effective average tax rates) is investigated, together with the impact of unit labour costs.

##### **Key results and policy conclusions**

The main result of the study is that, over the period considered, FDI reacts to tax differentials only within the EU-15. By contrast, FDI flowing from the EU-15 to the NMS seems to be

unrelated to tax differentials. Other factors, such as the real exchange rate and unit labour costs, also fail to explain to a significant extent the FDI inflows into the NMS.

#### **3.1.4.2 Do EU Member States Compete on Social Systems?**

**Authors: Vincent Delbecque and Amina Lahrèche-Révil (CEPII) (Deliverable No. 9B)**

##### **Introduction**

Deepening integration within the EU increases the mobility of firms. While tax competition is a well-documented tool for attracting FDI (see, for instance, de Mooij and Ederveen, 2003), room for tax competition is progressively vanishing as tax rates converge downwards. The case for social competition has been less scrutinised so far, partly because of measurement problems and partly because social systems are multidimensional. For instance, a reduction in employment protection can be partially offset by an increase in the bargaining power of trade unions, which was observed in the OECD during the period 1992–2004.

##### **Research task**

This paper seeks to measure the impact of social factors on FDI across EU member states within a gravity framework from 1992 to 2004. To the extent that they affect labour costs, market regulation and the bargaining power of unions may influence location decisions.

##### **Methodological approach used**

Labour market regulation and employment protection legislation are related to fixed costs, whereas centralised bargaining and coordination have an impact on variable costs. Both types of indicators are used here through a Heckman methodology that allows us to highlight the impact of social systems on the probability of investing in a given country (which should be related to fixed costs) based on the amount invested (which should be linked to variable costs).

##### **Key results and policy conclusions**

We find that both labour market institutions and trade union strength affect the probability of attracting FDI and the amount of FDI received. For instance, an increase of the mean employment-protection legislation index by one standard deviation reduces the amount of investment by 30%, while an increase by 10 percentage points of collective bargaining coverage reduces inward investment by 32%, *ceteris paribus*. Hence, we find no evidence of a positive impact of labour protection or unionisation on investment through gains in productivity.

#### **3.1.4.3 Who Benefits from Tax Competition in the European Union?**

**Authors: Leon Bettendorf, Joeri Gorter and Albert van der Horst (CPB) (Deliverable No. 19)**

##### **Introduction**

Capital market integration within the EU has been successful. It brings about a superior allocation of capital across member states by linking capital markets. But capital market integration also links national capital income taxes. Member states have indeed reduced their statutory corporate income tax (CIT) rates in order to attract the highly mobile paper profits of multinational firms. Yet effective CIT rates have remained relatively stable. The evidence thus suggests that there is more to tax competition than the canonical tax race to the bottom.

The theoretical tax competition literature provides an abundance of often contrastive tenets. The CIT rates of one member state lead to capital flight to other member states, and thus entail a positive spillover as capital flight increases foreign CIT bases and labour productivities. The domestic CIT bill, however, is picked up by foreigners insofar as they own stocks of domestic firms, and thus entails a negative spillover. Moreover, if a member state decides to engage in tax competition and reduces its CIT rate, then it must mend the resulting budgetary hole, either by cutting public expenditure or by increasing the burden of alternative taxes. In particular, the labour income tax carries heavy domestic distortions that make it unattractive to go down this route, even in the face of the high capital mobility within the EU.

### **Research task**

Economists still grope in the dark regarding the empirical relevance of the contrastive tenets. Does the downward pressure on CIT rates dominate the upward pressure, and if so, to what extent? And what is the welfare cost of tax competition, or similarly, the potential welfare gain of tax coordination?

### **Methodological approach used**

Investigating these questions requires an integrated framework, allowing for numerical assessments of the economic outcomes of CIT reforms. CORTAX is an applied general equilibrium model of the EU tailor-made for the problem at hand. The model captures the main features of corporate income taxation in 17 EU member states. It distinguishes between domestic and multinational firms in order to simulate the simultaneous impact of capital income taxation on FDI, profit-shifting and tax-exporting.

Moreover, the model allows for a welfare analysis by considering the optimal response of households to changes in taxes and factor rewards. This welfare analysis will answer questions on the efficiency of the CIT system in the EU and on the distribution of the gains and losses of consolidation.

CORTAX builds on a model presented by Sørensen (2004). Yet CORTAX goes one step further in some directions. Notably, the savings decision is derived from dynamic utility maximisation. Not only does this do justice to the inherently dynamic nature of saving, it also enriches the welfare analysis. With CORTAX, we investigate a wider array of tax coordination proposals, starting with unilateral tax rate reductions and then proceed with multilateral and coordinated tax reforms.

Our contribution to this literature is a thorough investigation of the economic and welfare effects of unilateral and multilateral tax reforms in Europe, by developing and simulating the applied general equilibrium model CORTAX for corporate taxation in Europe. This provides insight on how individual member states might be affected by CIT reductions either in the home country or in other member states. In addition, we show which countries gain from imposing a European minimum tax rate or, similar to Sørensen (2004), from even harmonising their tax rates.

### **Key results and policy conclusions**

In an integrated Union, member states respond to each other's changes in corporate income taxation – and for good reasons: a CIT rate reduction in one country harms other member states, which they offset by reducing their CIT rates, too.

That is not to say that all countries benefit from playing at leapfrog. Even a unilateral reduction of the tax rate is not beneficial for all countries if they have to finance the tax rate reduction by a more distortive tax on labour or consumption. A central result of the simulations is that a typical



member state has only a small incentive to unilaterally reduce its CIT rate. Consequently, the welfare cost of tax competition is relatively small, and may even be negative for some member states. The main reason for this outcome is that if alternative tax instruments are used as balancing items, the benefits of a lower CIT are outweighed partly or entirely by the costs of a higher labour income or consumption tax.

If member states take into account that other states may respond, the potential gains from a CIT reform are significantly reduced. In this case, the inability to attract foreign profit income reduces the benefits from favourable tax planning by multinational firms. A reduction in the tax rate is still beneficial for countries with a highly distortionary CIT tax, but not for countries with already small tax bases or low tax rates. Therefore, the latter countries will not participate in a race to the bottom.

Even countries that benefit from a tax rate reduction will not completely abandon the tax on corporate income. At lower CIT rates, the distortions in the alternative taxes on consumption and labour exceed the distortionary effects of the CIT on investment and profit shifting. We show that a further integration of European capital markets aggravates the CIT distortions, but still will not trigger an abolition of the CIT.

From an economic point of view, competition in tax rates is hardly worth pursuing at current levels of corporate income taxation, and even less so at a lower level of taxation. Policies to remedy tax competition, such as setting a minimum tax rate or even harmonising the CIT rates, barely enhance growth and welfare in the EU: the winners just gain enough to compensate the losers.

#### **3.1.4.4 Will Corporate Tax Consolidation Improve Efficiency in the EU?**

**Authors: Albert van der Horst, Leon Bettendorf and Hugo Rojas-Romagosa (CPB) (Deliverable No. 26)**

##### **Introduction**

Companies operating across the internal market are hampered by tax obstacles such as high compliance costs for cross-border operations, transfer pricing and the lack of cross-border loss compensation. These obstacles are inherent in the current system of separate accounting, whereby the corporate income of foreign subsidiaries of multinational firms is treated separately for tax purposes.

In its 2002 Tax Communication, the European Commission proposed consolidation of the tax base as an answer to the inherent difficulties of separate accounting and the large compliance costs. The consolidated base has to be apportioned to the member states to guarantee their ability to tax corporate income.

##### **Research task**

The aim of the paper is to assess numerically the economic effects of consolidation and apportionment formula. Does this approach contribute to employment and GDP in the EU and does it improve economic efficiency by reducing tax distortions? How are the gains and losses distributed within member states, between say, domestic firms and multinationals, or between firms and households, and how are they distributed among member states?

##### **Methodological approach used**

Investigating these questions requires an integrated framework, allowing for numerical assessments of the economic outcomes under different formula apportionment proposals in comparison with the current separate accounting system. We have developed a CGE model –

CORTAX – that is designed to investigate these issues. The model captures the main features of corporate income taxation in 17 EU member states and in the US. It includes the investment and labour-demand decisions of both MNEs and domestic firms. Moreover, the model allows for a welfare analysis by considering the optimal response of households to changes in taxes and factor rewards. This welfare analysis will answer questions on the efficiency of the CIT system in the EU and on the distribution of the gains and losses of consolidation.

Our paper is the first simulation study on consolidation and formula apportionment in the EU. It is most closely related to Sørensen (2004), who applies a similar CGE model to the harmonisation of both the tax base and the tax rate in the EU. In fact, our model builds on Sørensen's OECDTAX model. The crucial extension in CORTAX is the inclusion of consolidation and formula apportionment. Sørensen points at the potential welfare gain from tax harmonisation, which we confirm in our simulations, but does not investigate the distortions introduced by formula apportionment.

The study by Edminston (2002) is the sole application of a CGE model to formula apportionment. He focuses on both the strategic behaviour of the fiscal authorities in the US and the tax planning by firms. Yet, the situation in the US, with state-specific formulas and relatively small tax-rate differentials, differs substantially from the European environment with large tax-rate differentials and presumably uniform apportionment formulae. The contribution of our paper is to investigate consolidation and formula apportionment in the EU.

### **Key results and policy conclusions**

The economic effects of consolidating the CIT base by applying formula apportionment depend crucially on its design. The largest gains from consolidation might be expected if all enterprises, domestic and multinational, are treated equally. Proposals for consolidation that exclude some of the firms introduce uneven competition and induce significant restructuring both within and among member states. Formula apportionment distorts the investment and labour demand behaviours of MNEs, which are minimised if the apportionment formula reflects the distribution of the corporate income of MNEs.

The main benefits from the abolition of separate accounting by consolidating the tax base are the elimination of paper profit-shifting, the introduction of automatic loss compensation for cross-border activities and the reduction of compliance costs. At the same time, consolidation also has its costs, as it may create unequal opportunities for different firms. With a common, consolidated, corporate tax base (CCCTB), domestic firms might face a different definition of the tax base than MNEs.

We first consider the introduction of a common base at the EU average to which only multinationals may apply. In countries with a broad tax base, this consolidation benefits multinationals relative to domestic firms, as the latter still have to adhere to the domestic rules.

In the alternative proposal of home state taxation, where firms have to make their tax declaration according to the rules of their home country, domestic firms and multinational headquarters are treated equally. Unevenness is now introduced, however, between subsidiaries of foreign MNEs. Home state taxation gives preferential treatment to subsidiaries originating from member states with a narrow tax base.

The full benefits from consolidation can only be reaped if all firms participate and adhere to a common tax base. If domestic firms are excluded, the EU average gains in terms of GDP and welfare from CCCTB equal respectively 0.08% and 0.03% of GDP in the long run, with the most favourable apportionment formula. The gains would be much larger, with additional gains for both GDP and welfare of about 0.10%, if not only MNEs but all firms participate.

Apportioning the consolidated base to the member states leaves them the autonomy to tax corporate income at their own desired rate. Nevertheless, the way in which the tax base is distributed is likely to distort the investment and production decisions of MNEs. The largest distortions are introduced if apportionment is based on a single production factor, such as employment or capital. The incentives for reallocating production are minimised if the apportionment formula resembles the distribution of the corporate income of MNEs. In the simulations with CORTAX, this is achieved if apportionment depends solely on production shares.

The economic effects of CCCTB with formula apportionment are unevenly distributed, both among and within countries. With separate accounting, low-tax countries are attractive for the location of paper profits. With formula apportionment, however, low-tax countries are attractive for the location of production (and production factors): higher production in low-tax countries enlarges the apportioned share of the tax base in these jurisdictions and thus reduces the average tax payments of MNEs. This expansion of MNEs implies an increase in GDP, employment and capital in low-tax countries. In contrast, production in high-tax countries declines. This uneven distribution of gains and losses owing to formula apportionment adds up to the unbalanced impact of the common consolidated base. In our basic simulation of CCCTB, where apportionment is based on employment, capital and production in equal proportions, the change in welfare ranges from a reduction of 0.4% of GDP to an increase of 0.6% of GDP, whereas the change in GDP ranges from a reduction to an increase of 0.7% in both directions.

Tax competition is intensified with CCCTB. Relatively open economies and those with low tax rates have stronger incentives to reduce their tax rates with a consolidated tax base than with separate accounting. If formula apportionment is based on an internationally mobile production factor, like capital, tax competition might even result in a race to the bottom: for several member states, it is optimal to leave their proportioned share of the common tax base untaxed. If apportionment is based on an internationally less mobile factor, like employment, tax rates are likely to be cut, but not to the bottom.

## **3.2 Tax/benefit systems and the potential growth (productivity) of the EU (WP 3)**

### **3.2.1 Summary of WP 3**

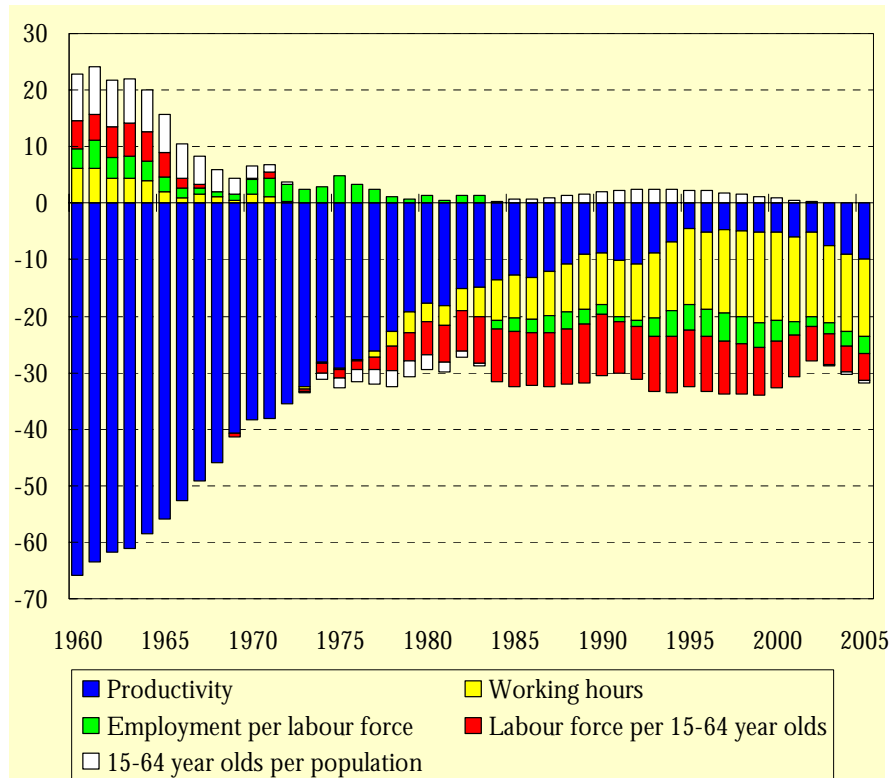
#### **Introduction**

If we focus on productivity dynamics, the EU countries caught up with the US between 1960 and 1995. Since this period, Europe has been lagging behind the US. On the other hand, relative to the US and during the same period, there was a decline in the total number of hours worked in the EU. This decrease is explained by a reduction in the average number of hours worked by each employed person, a lower participation rate and a higher unemployment rate. In this context, is it reasonable for the EU to expect to catch up with the US?

What are the dynamics of this decomposition of the GDP per capita? Why does the EU remain poorer than the US? At the beginning of the 1960s, the low level of GDP per capita in Europe was mainly owing to a lag in productivity (65%), but was partially compensated by a larger effort at work in Europe (20%) (see Figure 3). In the 1970s, the catch-up in productivity continued, with the effort at work the same in Europe as in the US. During the 1980s and 1990s, the catch-up in productivity seemed at an end, but the effort at work by Europeans largely declined relative to that of Americans. This last fact primarily stems from a large fall in both the hours worked and the participation rate. Finally, since the end of the 1990s, we have observed

an increase in the gap between American and European productivity. Europeans work less and are progressively less efficient than their American counterparts are; hence, they are poorer.

Figure 3. Decomposition of the income gap between the EU-15 and the US



Source: Kaitila (2006).

### Research tasks

During the past few decades, we have observed high rates of unemployment and a slowdown in the economic growth of European countries. Are these two phenomena related? There is no consensus regarding the sign of the correlation between growth and unemployment, either across countries or across time. Yet, theory suggests that the distortions arising from fiscal instruments lead to lower growth (endogenous growth theory) or to higher unemployment (equilibrium unemployment theory) or both.

The link between growth and unemployment can be viewed through the simultaneous link between growth, unemployment and the labour market institutions present in the EU-15, other key OECD countries and the NMS.

### Methodological approaches used

First, we develop a Schumpeterian endogenous growth model (two sectors, a competitive final goods sector and a monopolistic innovation sector) with trade unions. This model explains the effects of labour market institutions on growth and unemployment.

We empirically estimate the model for disaggregated data that comes from the Eurostat's European Regional Database (2005). The statistical regions of Europe correspond to the second level of the Nomenclature of Units Territorial for Statistics (NUTS 2). The related countries

considered are Austria, Belgium, Germany, Denmark, Spain, Finland, France, Ireland, Italy, the Netherlands, Portugal, Sweden and the UK for the period 1980–95. The originality of the approach is to take into account the large heterogeneity between regions within a country. The specificity of each European region is measured by the growth rate of its Solow residual. This indicator can be viewed as the closest measure of the specific technology available in a particular region.

The second approach is as follows. In the preceding analysis, we focused on the link between unemployment and productivity – we neglected the hours worked and the participation margins. Next, we investigate the links between all labour margins and productivity. Thus, GDP per capita ( $Y/P$ ) is decomposed into four labour market components and productivity:

$$\frac{Y}{P} = \frac{Y}{H} \left[ \frac{H}{E} \frac{E}{L} \frac{L}{N} \right] \frac{N}{P},$$

where  $Y/H$  denotes productivity per hour worked,  $H/E$  hours worked per employee,  $E/L$  the employment rate,  $L/N$  the participation rate and  $N/P$  the dependency ratio.

We analyse this decomposition using a second dataset, based on a long time series of the OECD countries. The countries are Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, the Netherlands, Austria, Portugal, Finland, Sweden, the UK, the US, Japan, Canada, Switzerland, Norway, Australia and New Zealand. The time period is 1960–2004. The originality of the approach is to decompose the catch-up with the US between the long-term productivity dynamics and the long-term adjustments of the labour markets.

The overall joint starting point in WPs 1 and 3, and in the entire TAXBEN project is illustrated in Figure 3 above, which decomposes the gap in the income levels between the EU and the US into the five components just mentioned.

Finally, as a fourth research task, the last objective of WP 3 is to analyse the short and medium-term relationship between employment and growth. It should be recalled that in the long term, our results suggest that we can have more growth in Europe with more employment. Still, the short-term analysis is important for political leaders. Indeed, the impact of reforms must improve welfare before the next election. Today, European political leaders are committed to the Lisbon process. This process has two goals: an increase in economic growth and in the employment rate. Is there a conflict between the two objectives of the Lisbon process? From the viewpoint of traditional theory, summarised by the Okun law, there is no conflict between growth and employment in the short term. This traditional view is acceptable if the economy is hit by a demand shock. But there is now broad consensus about the large size of the supply shock in the explanation of the business cycle. Hence, a conflict between growth and employment can arise in the short run. We propose to test this assumption in this last part of WP 3. We use the approach of the structural vector autoregression (SVAR) methodology and a simulation of an econometric model built for the Finnish labour market.

### Key results and policy conclusions

Using the theoretical endogenous growth model, we show that 1) high labour costs or powerful trade unions (or both) lead to higher unemployment and a slowdown of economic growth; and 2) efficient bargaining implies more employment but less growth. The empirical results, using regional data, show that

- 1) Technological progress increases the growth rate of GDP per capita and decreases the unemployment rate.

- 2) Conversely, the tax wedge and unemployment benefits decrease the growth rate of GDP per capita and increase the unemployment rate.
- 3) A more cooperative bargaining process, measured by the index of the coordination of wage bargaining, decreases both growth and unemployment.

These initial results are in accordance with the theoretical investigation. Contrary to the theoretical predictions, bargaining power (measured by the collective bargaining coverage) is not statistically significant. Even so, this variable has the sign predicted by the theory. Finally, employment protection is not a significant variable in explaining the growth rate of GDP per capita, but noticeably reduces the unemployment rate.

Using the second approach mentioned above, we first present a thorough decomposition of the income gap as discussed. After these descriptive statistics, we estimate the conditional convergence of productivity using pooled least squares panel data analysis. Empirical results suggest that there is convergence. Thus, countries with lower initial levels of productivity have had faster productivity growth than countries closer to the technological frontier. Moreover, taxes and gross replacement rates slow the convergence of productivity. But this last result is not robust. With other explanatory variables, the impact of the tax/benefit system on productivity growth becomes insignificant.

If we turn now to the average hours worked by the population of working age, it is clear that the tax rate has a negative impact. Therefore, the higher tax rate in Europe than in the US is the first candidate for explaining the low performance of Europe. Yet taxes are used to finance the ‘welfare state’. Taxes and social insurance can be correlated. Other regressions show that if the tax rate is not included in the vector of the explanatory variables, unemployment benefits and employment protection become significant. This indicates that these labour market institutions, which reduce flexibility, also explain the decline in hours worked.

In the preceding empirical analysis, we focus on ‘old’ Europe. What about the NMS? For these countries, we are able to reach the following conclusions.

- 1) First, from a brief look at the data it can be seen that these countries are catching up with old Europe. Indeed, a higher initial gap in the NMS productivity rate implies a higher speed of convergence on productivity.
- 2) Do the labour market institutions in the NMS facilitate catching-up with old Europe? *A priori*, the answer is yes, because in relation to the EU-15, the NMS have lower levels of expenditures on passive labour market policies, less employment protection and lower union density. But the NMS have the same levels of taxes as the EU-15, which have slowed down their catching-up process.

Empirical results in the fourth part of the WP show that a positive technology shock increases productivity but decreases employment in the short run. These results are in accordance with the New Keynesian view: indeed, with preset prices, demand is constrained in the short run. Consequently, fewer hours are needed to satisfy the demand for goods if efficiency rises. By contrast, a demand shock does not have a significant impact on productivity, but increases the number of hours worked. This empirical analysis also supports the view that taxes have a negative impact on hours worked in the long run. To summarise, the empirical results show that there is conflict between the two Lisbon objectives in the short run. This occurs because an impulse in the R&D sector that directly increases productivity can lead to a fall in the hours worked.

The core policy conclusions of the WP are as follows. The size of the state, measured by the tax-to-GDP ratio reduces the hours worked per employee, the employment rate and productivity growth. For policy-makers this conclusion confirms the essential need to cut taxes. But a large

share of taxes cannot be cut because they are the counterparts of social insurance programmes (welfare state) or public sector R&D. The costs of transition towards an economy with only individual insurance and an exclusively competitive R&D sector overstate the costs of steady-state tax distortions. Therefore, the essential problem is the use of taxes. Non-productive expenditures by governments should be redirected towards R&D by the public sector (more growth and more employment in the high-tech sector). The second essential problem is the profile of taxes: reforms to the tax/benefit systems should give more value to employment for medium- and low-skilled workers (payroll tax subsidies and sanctions in the unemployment insurance system). See also WP 1.

### **3.2.2 Summary of the deliverables**

Altogether, there are four working papers prepared under this WP.

#### **3.3.2.1 Growth, Unemployment and Tax/Benefit Systems in European Countries: Theoretical and Empirical Investigations**

**Authors: Stephane Adjemian (Cepremap and GAINS (Université du Maine)), François Langot (PSE-Jourdan, Cepremap and GAINS) and Coralia A. Quintero Rojas (GAINS (Université du Maine)) (Deliverable No. 16 B)**

#### **Introduction**

The observed high unemployment rate in Continental Europe and the slowdown in economic growth in recent decades naturally raise the question of whether these two phenomena are related. On the empirical side, there is no consensus regarding the sign of the correlation between growth and unemployment, either across countries or across longer periods in the same country. The same is true on the theoretical side. Nevertheless, endogenous growth theory and equilibrium unemployment theory suggest that the distortions from fiscal instruments lead to lower growth or a higher unemployment rate. This conclusion suggests that the link between growth and unemployment can be viewed through the simultaneous link between growth, unemployment and labour market institutions.

#### **Research task**

In this contribution, we construct a theoretical model to analyse the effects of labour market institutions on growth and equilibrium unemployment and estimate it using regional data on EU-15 countries.

#### **Methodological approach used**

The main hypotheses of our model built in the study are as follows: i) innovations are the engine of growth, which implies a creative destruction process generating jobs reallocation; ii) agents have the choice of being employed in production or being engaged in R&D activities; and iii) there is no full employment because trade unions representing workers' interests set the wage rate above the competitive level.

#### **Key results and policy conclusions**

In the theoretical model, we show that,

- i) Powerful trade unions or higher labour costs associated with one or more of the labour-market variables (e.g. unemployment compensation, payroll taxes paid by employers, the taxes paid by workers or the costs of employment protection) cause more unemployment and slow economic growth.

- ii) A coordinated bargaining process increases employment, but at the price of a lower growth rate. These theoretical predictions are consistent with our empirical analysis.

On passive labour market policies, we reach the following key theoretical results. First, we analyse the consequences for growth and unemployment of a more generous unemployment insurance system, then higher taxes on labour incomes and finally a higher level of employment protection.

The first result is that an increase in unemployment compensation or in payroll taxes, or in the taxes paid by workers or in employment protection leads to an increase in unemployment and to a decrease in the rate of growth.

This finding is very intuitive: a higher labour cost implies a higher wage and so a decline in labour demand. The total outcome is a contraction of monopolistic profits with the subsequent reduction in the expected value of an innovation. This effect, together with the fact that higher wages make production more attractive with respect to R&D, tends to reduce the number of workers engaged in research. Thus, the growth rate falls, too. Concerning the impact on unemployment, since neither wage rates nor labour demands change, the only effect is a contraction of profits. This discourages workers from engaging in R&D activities, with the consequent fall in the growth rate and rise in unemployment.

The impact of the unions can be analysed in two steps. For an uncoordinated wage bargaining process, one can derive the implications of higher bargaining power. Subsequently, we can compare the outcome of an efficient bargaining process with the inefficient outcome computed above.

Thus, the second key result is that an increase in unions' bargaining power leads to an increase in the unemployment rate and to a decrease in economic growth.

The economic intuition is that greater bargaining power implies higher wages. Then, as the labour demand for production declines, monopolistic profits contract, as does the expected value of an innovation. This situation discourages workers from R&D. The total outcome again is more unemployment and a lower rate of economic growth.

If in each sector the monopolistic firm and the trade union bargain jointly over both labour demand and the wage rate, the outcome is an efficient one. The third key result is that under efficient bargaining, employment levels are higher but economic growth is also lower than under uncoordinated bargaining. Yet, the comparison is ambiguous for unemployment.

Because there are fewer researchers but more workers employed in production, we do not know the total effect on unemployment. The gain in employment at the same labour cost is due to the coordination in wage-setting and the labour demand for production. But the decreasing returns to research induce a contraction of the monopolistic profits while the opportunity cost of R&D is unchanged. Consequently, there are fewer researchers under efficient bargaining.

The empirical analysis produced some key results. The observed high unemployment rate in Continental Europe and the slowdown in economic growth in recent decades have naturally given rise to the question of whether these two phenomena are related. Our theoretical framework clearly shows that labour market institutions may imply high unemployment and slow growth. Equipped with these results, we then explore if the heterogeneity of growth and unemployment experiences across European countries prevails at a regional level and, if that is the case, how much of this is accounted for by labour market institutions.

The disaggregated data we use comes from Eurostat's European Regional Database (2005). The statistical regions of Europe correspond to NUTS 2 regions. The average population size of the regions in this category is between 800,000 and 3 million. The corresponding countries to the



regions considered are Austria, Belgium, Germany, Denmark, Spain, Finland, France, Ireland, Italy, the Netherlands, Portugal, Sweden and the UK, for the period 1980–95.

In summary, these empirical results confirm our theoretical approach:

- 1) The tax wedge and unemployment benefits reduce the growth rate and increase the unemployment rate.
- 2) Employment protection increases unemployment rates, without a significant effect on the growth rate of GDP per capita.
- 3) Coordinated wage bargaining reduces the growth rate and the unemployment rate. More than a validation, this last result indicates the link between unemployment and coordination, which is ambiguous in our theoretical model.
- 4) The growth rate of TFP increases (decreases) the growth of the GDP per capita (the unemployment rate). In our model, a higher TFP stems from a more efficient R&D sector.

Nevertheless, the links between bargaining power and the endogenous variables are not significant, whereas our theoretical model suggests unambiguous relationships. These results can be explained by the poor approximation of the bargaining power by our statistical measure (collective bargaining coverage).

### **3.3.2.2 Productivity, Hours Worked and Tax/Benefit Systems in Europe and Beyond**

**Author: Ville Kaitila (ETLA) (Deliverable No. 16A)**

#### **Introduction**

The EU-15 countries were catching up with the US in terms of labour productivity up until 1995, but since the Europe has on average been losing ground. There are, however, considerable differences among the European countries in this respect. Meanwhile, the average number of hours worked by the working-age population declined in the EU-15 countries relative to the US up until the mid-1990s, but started recovering shortly thereafter. As a result of the developments in productivity and hours worked, there has been very little change in relative GDP per capita between the EU-15 and the US since 1970. Even so, owing to Europe's slower population growth, total GDP reached a peak relative to the US in the mid-1970s and has been falling behind ever since.

#### **Research task**

We put special emphasis on tax and benefit variables when we analyse factors that may have affected the relative performance of the EU-25 and other OECD countries in 1960–2004. We decompose GDP per capita into two parts (see above): i) how much value added in purchasing power terms is produced on average in one hour worked (labour productivity) and ii) how many hours the working-age population (aged 15-64) work on average. The latter variable merges three labour market indicators into one – the number of hours worked by each employed person, the participation rate and unemployment. Yet, from our point of view the important issue is the total number of hours worked. We do not discuss whether the different factors influence the supply of or the demand for labour.

To the extent that the analysis is also based on the developments preceding the early 1990s, the new EU member countries that joined the Union in 2004 are not included. At the same time, some industrialised countries outside the EU-15 are included because they can give us further insight into the factors that may affect productivity and the number of hours worked.

### **Methodological approach used**

We approach the research task from several angles. On the one hand, we use panel data econometrics for 21 OECD countries in 1960–2004 to explain the growth rate of labour productivity and the number of hours worked. The data are in non-overlapping five-year averages. This should largely remove the influence of business cycles. The estimation method is pooled least squares estimations with White heteroskedasticity-consistent covariances for the cross-sections, corrected for the degrees of freedom. We use both country- and time-period fixed effects. In addition to this, we use cross-sections to analyse the 1995–2004 period. We concentrate on different kinds of tax and benefit variables but also take into account variables as diverse as investment into R&D and inflation. Productivity and hours worked are mostly analysed separately. Even so, their possible interaction is also discussed.

### **Key results and policy conclusions**

The first key finding is that the development of productivity does not seem to be influenced by tax/benefit variables. While there surely is a problem with productivity growth in the EU-15 countries, there are some points that need to be taken into account before criticising the EU countries too harshly. Although slower productivity growth is true on average, there are several EU-15 countries with growth rates in 1995–2004 more or less equal to those in the US. Meanwhile, Spain and Italy, and to a lesser extent the Netherlands, suffered from low productivity growth during this period. In fact, the average growth rate of productivity in 1995–2000 in the EU-15, excluding Spain and Italy, was the same as in the US. Whereas Spain experienced negative productivity growth, employment grew very rapidly and GDP growth has equalled that in the US. Simultaneously, Italy and to a lesser extent the Netherlands saw a loss of competitiveness owing to a rise in unit labour costs that was far too rapid.

In the cross-section analyses for the averages of 1995–2004, we concentrated on ‘high-productivity countries’ with productivity exceeding 70% of the US level in 2004. This is because the growth strategy of the least wealthy countries can be based on very different foundations than in countries that are closer to the technological frontier. We found that there is a statistically significant positive correlation between the growth rate of productivity, on the one hand, and higher R&D and ICT investment as a percentage of GDP, a higher share of young adults with at least upper secondary education and lower levels of product market regulation, on the other. Often this result requires that we exclude Ireland, which has had a very high productivity growth rate with little investment in ICT or R&D. No correlation was found between productivity growth and the taxes-to-GDP ratio or the degree of unionisation.

The results from our pooled least squares regression analysis show that productivity convergence has occurred. The results also largely confirm those from the cross-section data analyses. The growth rate of labour productivity has been positively affected by higher fixed investment, lower inflation, higher R&D investment and increased exports. In most specifications, taxes and gross replacement rates had no statistically significant effect on productivity growth. We found a negative effect from taxes and a positive one from gross replacement rates when they appeared together with fixed investment or inflation. With this evidence, however, we conclude that taxes and gross replacement rates are unlikely to have had an effect on productivity growth.

The second key finding is that tax/benefit variables do affect the development of the number of hours worked. The average number of hours worked by a person of working age was the same in the EU-15 area as in the US in 1970 but declined thereafter to just 73% of the US level by 1997. After that, it recovered and rose to 79% by 2004. The faster ageing of the European

population increases healthcare and other costs to these societies. The costs would be easier to finance from a larger GDP, and GDP would be larger if Europeans were to participate more in production.

In many studies, the lower number of working hours in Europe has been attributed to higher taxes and social benefits or to a relatively stronger influence of trade unions (or to all of these factors). Higher taxes mean that the opportunity cost of leisure time increases and it becomes less profitable to work. According to our cross-section analyses, there was a strong negative correlation in the OECD countries between the average number of hours worked by the working-age population and the taxes-to-GDP ratio in 2000–04, although this requires the exclusion of Denmark, Finland and Sweden from the analysis. Also, looking at historical time series the rise and then stabilisation of taxes at some new higher level seems to have often resulted first in a decline in the number of hours worked and then their stabilisation at some new lower level.

We further find a negative correlation between the average number of hours worked and product market regulation, gross replacement rates and the strictness of overall employment protection legislation. Income inequality and trade union density do not correlate with the number of hours worked, but collective bargaining coverage has a negative correlation. There is also a negative correlation between the ratio of collective bargaining coverage and trade union density, on the one hand, and the average number of hours worked, on the other. This ratio can be thought of as a proxy of how ‘democratic’ the trade unions are. If the ratio is very high, a relatively small number of trade union members or their representatives negotiate wages for almost every employed person. At least in principle, it is possible that this leads to a radicalisation of trade union policies.

According to our pooled least squares panel data estimations for the 1960–2004 period, the average number of hours worked by the working-age population seems to depend negatively on the taxes-to-GDP ratio. Also, as the only independent variable, gross replacement rates have had a negative effect, collective bargaining coverage has had a positive effect, and the ratio of collective bargaining coverage and trade union density has had a negative effect on the number of hours worked. At the same time, trade union density and our measure of employment protection, which is different from the one used in the cross-section analysis, fail to explain the number of working hours.

It has to be noted that leisure time is valuable in itself. If we work less, however, GDP will be lower because higher productivity growth can no longer compensate for less working time as had been possible in the past. And here we do find evidence that higher taxes with respect to GDP have had a negative impact on the number of hours worked. This can of course arise either through lower demand for labour or lower supply of labour, or both. Taxation, benefits and income transfers potentially have a significant impact on the labour market through incentives.

The key policy conclusion is that more emphasis should be put on education, investment and incentives to work.

### **3.3.2.3 Labour Market Institutions and Productivity in the New EU Member States**

**Authors: Sten Anspal and Andres Võrk (PRAXIS) (Deliverable No. 18)**

#### **Introduction**

Prior to accession to the EU, the Central and Eastern European candidate countries adopted a range of labour market institutions similar to those in the Western European countries (Riboud et al., 2002). Since the period of transition from planned to market economies, many of these institutions have been in a continuous process of reform and adaptation. In some cases, policy-

makers have justified the changes by the need for greater flexibility in the economy, in order to accommodate a dynamic process of growth and catching-up with Western European income levels, in relation to which the NMS levels are just a little more than half. In this study, we consider the possible role of labour market institutions in fostering or hindering growth and convergence towards Western European income levels.

When speaking of the influence of labour market institutions on growth and output convergence, a relevant question is also whether and to what extent the institutions themselves are subject to convergence in the process of integration into the EU. There are several channels through which labour market institutions may be influenced in this process. Directives and transnational agreements may directly help to shape national institutions of social protection or employment regulation. Labour unions in the NMS collaborate with and receive assistance from their EU counterparts and EU-level organisations. Another channel through which convergence might occur is imitation, whereby a country adopts institutions similar to those of a neighbouring Western country.

### **Research task**

The two questions posed in our paper are, first, how the labour market institutions in the NMS have developed in comparison with those of the EU-15, and second, whether these developments have contributed to their productivity growth. In other words, we ask whether there is evidence of convergence in labour market institutions between the new and old member states, and whether these institutions have had an effect on convergence in their levels of output per worker.

### **Methodological approach used**

In outlining the trends in the development of the labour market institutions in the NMS, we try to compare these with those in Western European countries. As for the time period, we consider the period from 1995 to the latest period for which data is available, thus concentrating less on specifically transition-related reforms than on more recent trends in the decade prior to EU accession. Using indicators from Eurostat, the OECD and other sources, we try to identify which labour market institutions converge and which diverge with respect to the EU-15 average. As labour market institutions, we consider the taxation of labour (implicit tax rates on labour), unemployment benefits (expenditure on passive labour market policies), union density and coverage of collective bargaining, employment protection (employment-protection legislation indexes) and expenditure on active labour market policies.

After giving background data on the developments of labour market institutions in the NMS, we then estimate the relationship between labour market institutions and productivity growth based on a panel of OECD countries over the period 1970–99 (using averaged data over non-overlapping five-year periods). We also try to examine the effects of these institutions empirically in a dataset for 1975–2004, which also includes the NMS. The data on labour market institutions are from the dataset by Belot and van Ours (2004), supplemented with data on the NMS as much as possible.

### **Key results and policy conclusions**

Examining the developments of the labour market institutions in the Central and Eastern European NMS during the decade prior to accession, we find that the trends shared among the countries in this group are declining rates of unionisation and coverage of collective bargaining. In most countries, the taxation of labour also declined. In the majority of countries, expenditure on active labour market policies did not keep up with GDP growth. The relative decline of spending on active labour market policies appears especially pronounced when viewed against

the background of substantially increased unemployment rates in some countries. Spending on passive measures was also lower in most countries towards the end of the period under review in comparison with the mid-1990s.

The situation is more varied concerning indicators of the strictness of employment protection legislation. Regulations were relaxed in Slovenia and Slovakia; employers' assessments of hiring and firing procedures also became more favourable in the Baltic States. The more flexible countries, Hungary and Poland, on the other hand, tightened their regulations somewhat with regard to temporary work.

Some of these trends were in the same direction in the NMS and Western European countries. Trade unions weakened in both groups of countries, although the NMS moved more rapidly towards lower unionisation and less decentralised bargaining systems, such that divergence occurred in this regard. Taxation of labour remained mostly stable in the EU-15, whereas it fell in most NMS; however, the latter development has to be viewed in light of fairly high levels of labour taxation in Central and Eastern European countries. There was also divergence in spending on both active and passive labour market policies. One can perhaps speak of institutional convergence on the EU in the sense that largely similar institutions have been adopted in the NMS, but the parameters of the systems differ in important ways.

When estimating a regression using panel data on OECD countries for the period 1970–99 with labour market institutions as explanatory variables, the results confirm the negative effect of taxes on productivity growth. Still, the variable becomes insignificant when hourly productivity is used as the dependent variable, indicating that taxes may affect productivity through the effects on hours worked. In the cases of employment protection, union density and the centralisation of bargaining, the effects seem to depend on the particular combinations of these institutions analysed and their interactions. For active labour market policies, positive effects on productivity growth were not found.

In a sample that also included the NMS, the convergence term explained most of the differences in growth rates. Labour market institutions were generally insignificant, with the exception of the negative effects of active labour market policies, union density and centralised bargaining in some specifications. The results indicate that the faster productivity growth rates in the NMS stem more from catching up from their lower initial levels of output per worker, than from their policy choices in the design of labour market institutions.

### **3.3.2.4 Productivity, Employment and Taxes – Evidence on the Potential Trade-offs and Impacts in the EU**

**Authors: Kari E.O. Alho and Nuutti Nikula (ETLA) (Deliverable No. 16C)**

#### **Introduction**

A quick look at the cross-section data for the EU countries in relation to the US suggests that two goals – productivity, being the key determinant of long-term economic growth, and employment – would be in sharp conflict with each other (see Kaitila, 2006). If the objective is to employ more of the EU labour force, it can only be met through a lower level of productivity and vice versa. This is an important policy issue and therefore information on this link, illuminating either a trade-off or a mutually positive relationship between these two key goals in the short and long run, can deliver essential insight on the internal consistency of the Lisbon reform process in the EU.

## Research task

The relationship between productivity and employment is a long-standing issue in macroeconomics, with a fierce debate between the New Keynesian and Real Business Cycle schools, focusing on whether productivity and employment are negatively or positively linked in the short run. Aside from the theoretical and empirical controversy of a proper business cycle model, there is an important policy question connected with this dispute. Accordingly, our main interest here lies mostly in the question of the long-term effect of productivity gains on employment and thereby we shift the focus to consider the possible long-term structural rigidity in this connection. We also analyse the role of tax policies, which can have an essential impact, and which has so far received only limited attention in the related SVAR literature.

## Methodological approaches used

The basis for the SVAR analysis is a theoretical model describing technical change, average hours worked per employee and the aggregate unemployment rate. We identify technology, demand and tax shocks. Positive demand shocks lead to an expansion in employment, but have no long-term effect on productivity. In the long run, we also allow for the possibility of structural rigidity so that a positive technology shock may possibly lead to a cut in employment.

We also allow for nominal price rigidity vs. flexibility. In the former case, the wage rate is bargained and the price set before the shocks are realised and the firms supply all the output demanded. If there is a positive productivity shock, the demand for labour is reduced as the firms can meet the output demanded by fewer production factors (i.e. labour), and thus there is a negative short-term effect on employment from the shock. If there is price and wage flexibility in the economy, output is determined by equilibrium between aggregate supply and demand. In the event of a positive technology shock, the real wage rate and labour demand will rise in the short term as a result of the shock. This issue of diversity of short-term effects of technology shocks can only be settled in an empirical analysis. In the long term, there can be neutrality from productivity shocks with respect to employment, but not necessarily if the labour market is rigid.

In the empirical part of the paper, we use two approaches. Both are based on a similar theoretical methodology describing the equilibrium in the labour market, but diverge in the method of empirical application. We first build a theoretical open economy model and identify within it a technology, non-technology and tax shock along with their effects. In the empirical part, the first approach is to build structural VAR models and empirically determine the impacts of the structural shocks in the short and long term for all the EU-15 and some OECD countries. Second, we use an aggregative econometric model built by Alho (2002) for the Finnish labour market, based on the idea of the equilibrium rate of unemployment, and simulate it under two types of productivity gains that differ in their origin. This allows us to provide a complementary view on the nature of the productivity shocks and their effects. In addition, we also consider a change in the tax/benefit system.

## Key results and policy conclusions

The theoretical model shows that the equilibrium unemployment rate depends negatively on labour taxes, but not on the real interest rate, as a higher rate only leads to lower levels of productivity and income. This means that a permanent shift in the capital income tax rate does not have an effect on employment in the long run. On the other hand, we come to the conclusion that a permanent change in labour taxes only has a long-term negative impact on employment, but not on productivity, which is determined by the capital–labour ratio.

The SVAR model analysis shows that in the short term (but less so in the long term), there is a negative trade-off between employment and productivity in most EU countries (although not in all of them), unlike in the case of the US. The results of the simulations of the econometric model show that, while not in the short term, in the medium term there may be important employment gains from the acceleration of productivity; that being stated, in the long term there is no connection between them.

The results underline that in the short term there is indeed a trade-off in the EU between the two key economic goals of productivity rises and employment. This trade-off is less severe in the long run, and while it does not fully disappear, over time it becomes statistically insignificant. In the short term, a positive non-technology shock has a positive effect on productivity.

The results by country clearly differ in some important respects. Quite uniformly, there is a short-term trade-off between employment and productivity, such that a positive productivity shock leads to an immediate reduction in employment in the EU countries. We can interpret this as productivity gains having largely been linked in the short term to simultaneous labour shedding, i.e. we have the basic case of price stickiness in the short term. In the long term, this trade-off occurs in some cases, but is of a smaller magnitude and is not so significant in statistical terms. Nor is the effect as uniform as it is in the short term. Thus, most of the EU-15 countries do not reveal a long-term trade-off between productivity and employment, with the exception of the Netherlands and Italy. What is interesting is that, by contrast, the US economy does not reveal this characteristic – there is virtually no trade-off of this kind, even in the short term, which confirms the situation of price flexibility there.

As to the effects of aggregate tax shocks, the pattern of impulse responses is less uniform among the countries than between employment and productivity, and the majority of the effects are not statistically significant. Overall, it seems that the negative impact of aggregate taxes is stronger on productivity than on hours, which is a somewhat unexpected result.

In order to analyse the effects of taxes more accurately we modified the VAR model so that it includes two different kinds of taxes (corporate taxes and employee taxes) in relation to GDP. We carried out this analysis solely for the aggregate EU-15 countries. The results show that the labour tax shock has a statistically significant negative effect on employment and not on productivity, which is line with the theoretical model. Corporate taxes are fairly neutral with respect to employment, which is also in line with the reasoning above. Nevertheless, they also have a negative effect on productivity, as should be, although the impulse response is not statistically significant in the long term (see also Alho and Nikula, 2007).

Finally, we use the econometric model for the labour market that was built and estimated for the Finnish economy by Alho (2002). The general policy conclusion of these simulations is that, irrespective of the fact that in the long term employment and productivity are not correlated, over the medium term important gains in employment can be achieved through productivity-boosting measures if the real wage is capable of adjusting to and assisting in the absorption of the shocks. In this sense, we could take a positive position as to the widespread public conception among policy-makers about the positive relationship between productivity and employment, as exemplified here at least with respect to the case of a single EU country.

Another broad policy conclusion is that EU countries should make their labour markets more flexible to enable them to adjust smoothly to negative supply shocks and to the introduction of new technologies.

### 3.3 Macroeconomics of the EU tax systems under EMU (WP 4)

#### 3.3.1 Summary of WP 4

##### Introduction

Since the launch of the common currency, the euro area has experimented with a number of uncoordinated tax reforms, mainly tax cuts for personal and corporate income, changes in VAT rates and a reduced number of income tax brackets. In addition, governments have been striving to reform their benefit systems. Although tax policy has been the core business of governments for decades, the new monetary regime and the scheme chosen for economic governance in the eurozone have given rise to new questions:

- The stability and growth pact leads to a higher reliance on automatic stabilisers, as opposed to discretionary fiscal policies. If euro-area countries are to move towards flatter tax systems, what can be expected in terms of automatic stabilisers?
- Monetary union changes the short-term impact of tax policies, both at home and in other EMU countries. Yet several other evolutions, such as real integration and financial liberalisation, may have also affected tax multipliers. What is the impact of a tax cut on the domestic economy as well as on euro-area partners nowadays? Cross-border multipliers are especially important as they define the needs for fiscal coordination in the euro area.
- The very existence of the SGP changes the incentives of euro-area countries to reform tax/benefit systems. The question is thus whether the SGP has been powerful in countervailing political myopia and fostering structural reforms, or whether it has reduced the incentive to cut taxes.

##### Research tasks

WP 4 addresses these three issues through five research papers, three of which are theoretical and two empirical. These papers aim at 1) studying the impact of tax progressiveness on automatic stabilisers, 2) analysing tax and spending direct and cross-border multipliers in the monetary union, and 3) evaluating the impact of the SGP on the incentives of governments to reform tax/benefit systems.

##### Methodological approaches used

The first theoretical paper, addressing the first policy issue (1), considers the stabilising properties of the tax systems with respect to various shocks hitting the economy. The paper uses a Mundell-Fleming type of model with a supply curve and a Taylor rule. Taxation can be regressive, proportional or progressive. Taxation and public spending can be fully indexed on prices, partially indexed or unindexed. Three kinds of macroeconomic shocks are successively scrutinised: a demand shock, a tax shock and a supply shock.

The second theoretical model addressing issue (2) involves two identical EMU countries in a static setting. Each economy is described by an IS curve and a Phillips curve. The single central bank sets the single nominal interest rate through explicit optimisation of a loss function that depends on aggregate inflation and on the aggregate output gap of the 'area'. Hence, it reacts endogenously to public spending and net tax shocks that are exogenous.



In the first version of the model, the central bank does not accommodate fiscal shocks: in the case of an expansionary shock in one country, it raises the interest rate until the aggregate inflation rate and output gap of the area are stabilised. This means that output declines in the other country, unless the shock has large supply-side effects, in which case perfect stabilisation by the central bank is unattainable.

In the second version, the central bank smoothes the interest rate, i.e. it is reluctant to move the interest rate too suddenly after a shock. In this case, a fiscal expansion in one country has a positive impact on the other country's output gap, unless the shock has large supply-side effects.

The empirical analysis addressing issue (2) above involves two distinct methodologies leading to mostly convergent results.

In the first of these papers, a two-country, dynamic stochastic general equilibrium (DSGE) model is estimated in order to evaluate the impact of a public spending shock occurring in one economy. The two countries chosen are Germany and France. Like the theoretical model described above, the setting includes a Phillips curve and an IS curve in each country, and a single Taylor rule. Fiscal policy is exogenous. The model is estimated through a Bayesian methodology (using priors from related studies) with quarterly data covering the period from 1991 to 2005.

In turn, the second empirical paper provides a factor-augmented VAR (FAVAR) analysis of fiscal multipliers and fiscal spillovers. First, domestic multipliers are analysed through the estimation of a FAVAR model of net taxes, public spending, output, inflation and interest rates for Germany, the UK and the US, successively, based on quarterly data from 1971 to 2004. The world business cycle is controlled for by the inclusion of factors representing developments in the world economy. Fiscal shocks are identified using an identification scheme à la Blanchard and Perotti (2002) and Perotti (2005). In order to see whether fiscal multipliers have evolved over time, each model is then re-estimated on a rolling window of 17 years.

In a second step, the cross-border effects of fiscal policies are analysed by adding the GDP and real effective exchange rate of seven EU countries in the German FAVAR model. This extended model is estimated across the whole period as well as on 17-year rolling windows.

The last question above (3) is addressed by building a dynamic, two-country model where the two periods are linked by investment. Imperfect competition and distortions materialise through mark-ups in goods markets and in the labour market, influenced by capital and income taxes. Several kinds of governments are successively studied: a social planner, a myopic government and an unelected body. The sanctions incurred by violations of the SGP are introduced in the model. Finally, four types of reforms are studied: a reduction in labour taxes, a reduction in the welfare state, a reform of the labour market and a reform of product markets.

### **Key results and policy conclusions**

The main results of the first theoretical study are that,

- If the economies are primarily hurt by demand shocks, then flatter tax systems tend to destabilise output, whereas the indexation of taxes on prices tends to stabilise it.
- If the economies are principally hurt by supply shocks, then the progressiveness of taxation has little impact on output stability.

On the whole, the move towards flatter tax systems would likely lead to more unstable output in the euro area.

The key results of the second theoretical study on issue (1) are as follows. Considering that a) the European Central Bank (ECB) does smooth the interest rate, b) net tax shocks do have supply-side effects and c) spending shocks may have a declining impact on aggregate demand owing to financial liberalisation, the positive spillovers produced in the euro area today from public spending expansions may be decreasing compared with the past, and tax cuts may now be producing negative spillovers.

The first empirical paper, addressing issue (2) above, finds that a positive spending shock in Germany has a positive Keynesian impact on German GDP and a positive but small spillover on French GDP. A positive spending shock in France has symmetrical effects. The main finding of the paper is that spillovers are small because of a significant reaction of the common interest rate to spending shocks in either country.

The central conclusion of the second empirical paper on issue (2) is that both the domestic and cross-border effects of German tax shocks have tended to weaken over time. But they have remained positive, i.e. an expansionary shock in Germany has a positive impact on partner countries, especially neighbouring ones. Still, the impact on the interest rate is found to be weak.

The main results of the last study, addressing issue (3), can be summarised in that political myopia has a negative impact on the willingness to reduce labour taxes, a pattern reinforced by the SGP because excessive deficits lead to sanctions. Political myopia also reduces the willingness to reduce the welfare state, but this time the SGP has a positive impact on the willingness to reform. Finally, while myopia has little effect on the willingness of governments to reform labour and goods markets, the SGP provides the missing incentive.

Given that all reforms but those of goods markets have a negative impact on neighbouring countries, the paper concludes that EU countries should continue to coordinate product market reforms but leave the reforms of the welfare state and the labour markets to peer pressure, with the SGP acting as a positive catalyst.

### **3.3.2 Summary of the deliverables**

There are five working papers prepared in this work package.

#### **3.3.2.1 Economic Shocks, Progressiveness of Taxation, and Indexation of Taxes and Public Expenditure in the EMU**

**Author: Markku Kotilainen (ETLA) (Deliverable No. 11A)**

##### **Introduction**

Progressive income taxation is common practice in the old member states of the EU. The NMS, however, have challenged this practice. Lithuania, Latvia, Estonia and Slovakia currently have proportional income tax systems, as does Romania.

Proportional income taxation has microeconomic advantages, which are related to incentives to work. Also, arguments are often made that inefficiencies can arise from differences between proportional capital income taxes and high marginal income taxes. Furthermore, there is some evidence of positive growth effects from proportional taxation. The counterarguments to proportional income taxation are usually based on income distribution. In addition to the above-mentioned viewpoints, there is a macroeconomic aspect that also deserves attention. This aspect is how different tax systems affect the stabilisation of an economy facing diverse kinds of shocks, which is the topic of this study.

## Research task

We study the properties of various kinds of income tax systems in the context of the EMU countries. The emphasis is on the progressiveness of taxation and on the indexation of taxes and public expenditure.

We examine economies facing three unanticipated shocks: demand, tax and supply shocks. Demand shocks can be exogenous changes in foreign demand, consumer preferences, etc. Policy-related demand shocks are typically changes in public expenditure. Changes in taxes have both a demand and a supply component. A typical supply shock is an exogenous change in productivity, oil prices or other factors affecting producer prices. If supply shocks are temporary, automatic stabilisers to cushion the effects can easily be justified. If, however, the shocks are permanent, it can be argued that the stabilisers delay the necessary adjustment. When the (temporary) shocks originate in the market, we would like to stabilise them to some extent. In the case of policy-induced shocks, the focus is usually on the effectiveness of the policy tool in question. In this situation, automatic stabilisers reduce some of the effects of the measure.

## Methodological approach used

We use a Mundell-Fleming-based, two-country, theoretical macroeconomic model with a rather rich supply side. The bilateral exchange rate between the countries is fixed. The model tries to depict the situation in the larger EMU countries. We also use a single-country model, which is more relevant in the case of small EMU countries.

In addition to the extent of tax progressiveness, the authorities have to decide on the inflationary adjustments to be made on taxation and public expenditure. In extreme cases, inflation can be totally neglected, or taxes and public expenditure can be fully indexed to changes in prices.

The tax shock is a mixed shock including demand as well as supply effects (through wages and prices). All shocks are assumed to occur in country 1 ('Germany'). But they have effects on country 2 ('France') through output and price spillovers as well as through changes in competitiveness. Because the model is too complicated for obtaining *a priori* results, we calculate the solution by using realistic estimates for the parameters. In the single-country model, however, *a priori* results are obtained.

## Key results and policy conclusions

We first present the effects without any monetary policy reactions. A positive demand shock in country 1 increases the output and prices of both countries, although more so in the country where the shock originates. In the event of a tax cut, the output effect in the country where the shock originates is clearly positive, whereas in the foreign country it is relatively smaller than in the case of a demand shock, because that country's competitiveness deteriorates. Prices change only marginally because the effects through lower costs and through increasing economic activity work in opposite directions. A pure supply shock has, in the short run, a 'beggar-thy-neighbour' nature.

When studying Taylor-type monetary policy rules, we notice that in the case of a demand shock, following a price or output target tends to stabilise both union-wide output and prices. In relation to a tax shock, strict adherence to a price target does not tend to stabilise output, because prices change only marginally. After a positive supply shock, prices decline in both countries, whereas union-wide output remains rather stable because of opposing effects in the two countries. Following the price target would thus destabilise the output.

When studying the effects of progressive taxation in the single-country model, we notice that progressive taxation tends to stabilise output in the cases of demand and tax shocks. Concerning

a supply shock, progressiveness tends to stabilise output if taxes are fully indexed. If they are not, the outcome depends on the relative magnitudes of the parameters of the model. In particular, the smaller the demand effect of taxes, the more likely it is that progressiveness will tend to stabilise output even with a low indexation of taxes.

Progressive taxation definitely stabilises prices only with respect to a tax shock. In the case of a demand shock, progressiveness tends to stabilise prices when the supply effect is weak, and in the case of a supply shock when the demand effect is weak.

In the two-country investigation, we use the model version without monetary policy reactions. The motivation for this is that we want to keep the effects of the tax parameters transparent. Monetary policy often takes time, and we do not know the policy rules very well. Because the monetary policy of the central bank is based on discrete decisions, the reaction can also vary over time. We research two scenarios: 1) where the reaction of wages and accordingly of prices to taxes is rather weak, and 2) where wages and prices respond strongly to changes in taxes. The first assumption may be founded on the short-term nature of the model (wages are sticky owing to contracts that are often for one or two years) and by the supposition that employees value the public expenditures financed by taxes. The second scenario is relevant in countries whose citizens strongly dislike taxes and where wages are flexibly determined at short notice.

When prices react strongly to changes in taxes, the output stabilisation property of increasing progressiveness holds in both countries in relation to a demand shock. But now the deviation of prices in both countries tends to rise. This is because increasing taxes tends to raise prices. Here we have a clear case for restrictive monetary policy. In the instance of a tax shock, increasing progressiveness tends to stabilise the output of both countries by dampening some of the shock's effect. When prices react strongly and quickly to changes in taxation, higher progressiveness tends to dampen the original decline in taxes, and accordingly the decline in prices in country 1. In country 2, taxes increase more with progressive taxation and the decline in prices in this country is also smaller. In the situation of a supply shock, output and prices are, again, not very sensitive to progressiveness. Output in both countries tends to deviate slightly less with higher progressiveness. Also, prices in country 1 deviate slightly less with progressive taxation. Prices in country 2, however, deviate somewhat more. When taxes are less than fully indexed, the effects of progressiveness on output deviations are about the same as in the case of a weaker supply reaction to taxes. Nevertheless, prices become more sensitive to progressiveness. Price deviations are enhanced when progressiveness increases.

About the role of progressiveness in economic stabilisation after various shocks, in the two-country model it can be concluded that progressive taxation tends to increase the stability of output in both countries in the face of a demand shock. Progressiveness stabilises prices if wages and prices react only modestly to changes in taxes, but destabilises them when these reactions are strong. In the event of a tax shock, progressive taxation tends to stabilise the output and prices of both countries in both cases. From a policy point of view, progressive taxation partly offsets the output effects of a tax cut. Following a supply shock, output and prices are not very sensitive to progressiveness. This result is consistent with studies using the INTERLINK, QUEST, NiGEM and FRB/US models (where, however, the full operation of all types of automatic stabilisers is assumed). Sensitivity increases when taxes are less than fully indexed to prices. In this circumstance, output deviations are slightly greater than with proportional taxation in the country where the shock originates, but slightly smaller in the other country.

We can roughly summarise the results obtained in the single- and two-country models by saying that progressive taxation tends to stabilise output or has a neutral effect in most cases. The

effects on price stabilisation are more controversial, however, since they can be stabilising, rather neutral or destabilising depending on the situation at hand.

In the event of a positive demand shock occurring in one country, the deviation of output and prices in both countries increases when the indexation of taxes or public expenditure increases. This is because deflating the effect of rising prices tends to enhance the real effect. After a tax shock, the price effect is so small, owing to the conflicting demand and supply effects of taxes, that indexation does not matter much. Following a supply shock, taking into account the effect of declining prices in one country tends to lead to heavier taxation, which in turn is likely to stabilise the output of that country. The effect is similar in the other country up to some medium degree of indexation. The effects of tax indexation on prices are small. Yet increasing the indexation of public expenditure tends to destabilise prices.

### **3.3.2.2 Short-term Fiscal Spillovers in a Monetary Union**

**Author: Agnès Bénassy-Quéré (CEPII) (Deliverable No. 11 B)**

#### **Introduction**

One popular view concerning macroeconomic policy in the EMU is that the ECB should deal with aggregate shocks whereas national governments should concentrate on idiosyncratic shocks. Still, this simple division of labour encounters several difficulties. First, the ECB will react to aggregate shocks only to the extent that this does not contradict the objective of keeping inflation close to 2%. Second, monetary policy is not a perfect substitute for fiscal policy. Third, a fiscal impulse in one country may impact on output and prices in another country, owing to higher imports (the trade channel), reduced price competitiveness (the relative-price channel) or a rise in the common interest rate (the interest-rate channel). Whatever their net sign, the very existence of a fiscal spillover asks for some form of coordination among member states. Finally yet importantly, the effectiveness of fiscal policy is a much-debated issue. This raises the question of the need to coordinate tax and benefit reforms in the eurozone in relation to business cycles.

#### **Research task**

This study seeks to analyse the sign of short-term fiscal spillovers in a monetary union depending on i) the way in which fiscal policy is implemented (expenditures versus taxes), ii) the strength of the supply-side channel of tax policies, and iii) the extent of central bank accommodation. The recent evolution of prices in the eurozone has been shown to be very sensitive to tax policies in the large economies of the area, which have not resulted from fiscal cooperation. Simultaneously, the ECB has proven relatively flexible concerning short-term movements of aggregate inflation, especially with respect to one-off variations stemming from oil hikes or tax shocks. Hence, it is necessary to reconsider fiscal spillovers in the context in which a tax increase in country 1 may impact positively on country 2 just because price competitiveness is improved in country 2 as a result of higher prices in country 1, while the central bank reacts smoothly to higher inflation.

#### **Methodological approach used**

A simple, two-country, static model is developed. It relies on two IS curves, two Phillips curves and an optimisation behaviour by the central bank. Fiscal policy consists of either a spending shock, which impacts on demand, or a tax shock, which impacts on both demand and prices. Fiscal shocks are assumed to be exogenously implemented in country 1, and their effect on output gaps and prices in both countries is analysed.

## Key results and policy conclusions

The analysis shows that both a spending expansion and a tax cut produce positive spillovers on foreign output, provided the central bank accommodates the shock, unless tax cuts have large supply-side effects. In this case, the foreign country does not benefit from a fall in the interest rate (because of interest-rate smoothing), whereas it suffers from a loss in price competitiveness.

If the central bank does not accommodate the shock, the spillovers of a fiscal expansion are generally negative: the common interest rate rises until aggregate demand is perfectly stabilised, which entails an output loss in the foreign country. But fiscal spillovers can be positive in the case of a tax cut, because induced disinflation reduces or even reverses the reaction of the central bank.

Owing to financial liberalisation, it is possible that demand-side channels of fiscal policy have become less powerful compared with supply-side channels, because of the increased ability of households to disconnect consumption from current disposable income. This has important implications for fiscal spillovers. For a spending expansion, the spillover effect is likely to become less positive. In turn, the rising importance of supply-side effects relative to demand-side effects is likely to turn positive spillovers into negative ones after a tax cut, at least if the central bank adopts interest-smoothing behaviour.

### 3.3.2.3 Changing Patterns of Domestic and Cross-Border Fiscal Policy Multipliers in Europe and the US

**Authors: Agnès Bénassy-Quéré and Jacopo Cimadomo (CEPII) (Deliverable No. 24)**

#### Introduction

The way in which fiscal policy influences domestic and foreign economies depends on several factors. In particular, the presence of factors such as excess capacity, an accommodating monetary policy, distortionary taxation and liquidity-constrained consumers play a prominent role in determining how fiscal policies affect economic activity in the home country. The impact on foreign output depends crucially on the importance of trade links, on real exchange rates and, in a monetary union, on the sensitivity of private investment and consumption to the interest rate. The last 30 years have witnessed frequent changes in the economic environment. For instance, in most OECD countries during the 1980s, the monetary policy stance was less accommodating compared with the 1970s, and more accommodating again in the late 1990s and early 2000s. Moreover, financial markets have been heavily deregulated. Hence, fiscal policy might have lost (or gained) power as a stimulating tool in the hands of policy-makers.

#### Research task

This study attempts to shed more light on the time evolution of domestic and cross-border tax and spending multipliers. We analyse the domestic impact of fiscal shocks in Germany, the UK and the US and cross-border fiscal spillovers from Germany to the seven largest EU economies.

#### Methodological approach used

The study combines a FAVAR approach with the identification strategy proposed by Blanchard and Perotti (2002) and Perotti (2005) to provide new evidence of the domestic impact of fiscal policy in three OECD countries: Germany, the UK and the US. In the two former cases, three ‘global common factors’ (representing worldwide co-movement in business cycles, credit conditions and fiscal policies) are included in a baseline VAR model to control for a possible bias in multipliers estimation owing to the fact that worldwide phenomena may affect fluctuations of domestic output, especially in relatively small countries, rather than domestic

fiscal shocks. We then extend our workhorse FAVAR model to study fiscal spillovers from the largest euro-area economy (Germany) to five neighbouring countries (France, Italy, the Netherlands, Belgium and Austria) and to two more remote countries (Spain and the UK).

After analysing a period ranging between 1971 and 2004, we perform recursive estimations and shocks identification for single-country and two-country models based on rolling windows of data to assess whether, and if so how, spending and tax multipliers have changed in the last 34 years.

### **Key results and policy conclusions**

The analysis finds that tax shocks are generally more effective in spurring domestic output than government spending shocks. This outcome might be owing to the fact that tax policies may increase potential growth in the long run, especially when distortionary taxes are removed, thus increasing economic efficiency and competitiveness. Government spending shocks, on the other hand, are more likely to crowd out the private sector. When the estimation is performed recursively over samples of 17 years of data, it emerges that GDP multipliers have dropped drastically since the early 1990s, especially in Germany (tax shocks) and in the US (both tax and government spending shocks). Moreover, the conduct of fiscal policy seems to have become less erratic, as documented by a lower variance of fiscal shocks over time. This trend might help to explain the diminishing volatility in business cycles in the countries under examination.

Expansionary fiscal policies in Germany do not generally have beggar-thy-neighbour effects on other European countries. In particular, when shorter subsamples are analysed, our results suggest that tax multipliers have been positive but diminishing for neighbouring countries (France, Italy, the Netherlands, Belgium and Austria). They have been weak and mostly insignificant for the more remote neighbours (the UK and Spain). Cross-border government spending multipliers are found to be monotonically weak for all the subsamples considered. Yet foreign output seems to react positively in the short run and when the 1970s are dropped, but that is just the case for the Netherlands, Belgium and Austria.

Overall, these findings suggest that fiscal ‘surprises’ – in the form of unexpected reductions in taxation and expansions in government consumption and investment – have become progressively less successful in stimulating economic activity at the domestic level. This finding indicates that, in the framework of the EMU, policy-makers can only marginally rely on these discretionary instruments as a substitute for national monetary policy. Furthermore, the positive sign of cross-border multipliers suggests that the interest-rate channel of transmission of fiscal policy is offset by the trade one.

#### **3.3.2.4 Assessing Spillover Effects from Fiscal Policy in Europe: A DSGE Approach**

**Author: Charlotte Möser (CEPS) (Deliverable No. 25)**

##### **Introduction**

The introduction of the euro in 1999 has led to debate about new challenges for monetary and fiscal policy in Europe. In a currency union, countries share a common central bank, which responds to union-wide developments. Consequently, macroeconomic policy at the national level shifts towards fiscal policy. Whether countries belonging to the euro area should coordinate their fiscal policies depends among other things on the existence of spillover effects from fiscal policy. Spillover effects of fiscal policy can occur through the common interest rate in an integrated capital market and through international trade. In the latter case, fiscal expansions lead to increased economic activity, which in turn may also increase imports from trading partners. Spillover effects arising through the interest-rate channel are more problematic,

however. An expansionary fiscal policy in a few countries may put upward pressure on domestic inflation, forcing the ECB to raise interest rates and thereby affecting all countries in the euro area.

### **Research task**

This study aims at providing evidence on spillover effects based on a structural modelling framework that can be applied for policy analysis. To this end, we develop and estimate a DSGE model to analyse the sign and extent of spillover effects of fiscal policy both within and among countries. To keep the analysis tractable, we set up a two-country model and estimate it with French and German time series data. We therefore employ a theoretical and an empirical approach at the same time, which is a novelty in the literature on fiscal spillover effects. We view our approach as a starting point for a comprehensive analysis of spillover effects of fiscal policy in a multi-country DSGE framework covering the entire euro area.

In contrast with our approach, most of the literature analysing fiscal spillover effects uses empirical VAR models. A potential caveat – which we address by developing a structural model – is that VAR models are based on a non-structural modelling framework, which is not applicable for policy experiments and forecasting exercises.

### **Methodological approach used**

We suggest a micro theoretically-founded model consisting of two countries of equal size constituting a currency union. In our model, monetary policy is conducted by a common central bank, which sets the interest rate for the union. Fiscal policy is implemented at the country level through government spending financed by lump-sum taxes. The model includes nominal rigidities and both country-specific and union-wide shocks.

We estimate the model with Bayesian inference techniques using French and German time series data. Estimating instead of calibrating the model allows us to make direct use of time series data. The Bayesian estimation method also allows us to formalise the use of prior information obtained from earlier studies. Including prior information improves the estimation of the parameters of a DSGE model when data have a short sample period, as is the case for the euro area. In presenting our results, we discuss the parameter estimates and the transmission of a fiscal policy shock through impulse response functions.

Our modelling approach belongs to a new research agenda that has been adopted by various policy institutions in recent years. In this research programme, DSGE models building on explicit micro foundations with optimising agents are developed to conduct policy analysis and forecasting experiments. While the focus of this literature has been on the analysis of monetary policy, there have been contributions recently that discuss the role of fiscal policy in models similar to the present one. Micro-founded, expectation-based DSGE models provide a framework that is more suited to the analysis of macroeconomic policies, because DSGE models are able to deliver a structural interpretation of the obtained results. In addition, major advances in estimation methodology in recent years allow the estimation of DSGE models that are able to compete with time series models, such as VAR models.

### **Key results and policy conclusions**

Our results show that a positive shock in government spending increases economic activity in France and Germany. Examining the propagation of government spending shocks across borders, we find the effect on economic activity to be very small. Moreover, the sign of transmission is ambiguous: while a government spending shock in Germany is found to raise output in France, a shock to government spending in France results in a negative output



response in Germany. The effect arising from the interest-rate channel is clearly negative, however – a fiscal expansion in France and in Germany results in a union-wide interest rate increase. The results suggest that the spillover effects stemming from the trade channel are negligible, whereas the effect from the interest-rate channel is negative. In summary, expansionary fiscal policy triggers a tight monetary policy response and thereby spreads over the entire euro area. Policy-makers should therefore strictly support the case for consequent adherence to the rules of fiscal discipline laid down in the Maastricht criteria.

### **3.3.2.5 Structural Reforms in the EU and Political Myopia in Economic Policies**

**Author: Kari E.O. Alho (ETLA) (Deliverable No. 21)**

#### **Introduction**

Structural reform has been a longstanding issue in European policy-making and on the agenda of the European and worldwide economic research community. Recently, there have been three main lines of research in this field. First, research has been conducted on the current situation in the EU with respect to reforms, along with their consequences and spillovers within the Union. A second line of enquiry has been whether reforms, being beneficial in principle for the EU economies as such, are politically and socially viable. Third, consideration has been given to how the reforms are indirectly affected by EU policies, notably by the coordination of economic policies implied by the monetary union and the SGP with limits on budget balances.

#### **Research task**

The links between the SGP and economic reforms have been analysed by Beetsma and Debrun (2004) using a two-period, political-economic model. In this study, we use a somewhat similar approach as Beetsma and Debrun, but seek to discuss economic reforms in a more explicit way in terms of their benefits and costs. We evaluate these by building a small model with monopolistic goods and labour markets, and distinguish the tax/benefit system. The key factor, the effect of which is influenced by political myopia and which creates intertemporal spillovers, is the investment behaviour of firms. Here, this factor can be affected positively by reform policies. We consider the political bias in economic policies and whether the bias can be corrected with an SGP.

We omit from the study the short-term demand and inflationary effects of policies, in order to keep the analysis manageable, but extend the time span to the medium term with supply-side dominance.

#### **Methodological approaches used**

We build a two-period model with imperfections in the goods and labour markets, aimed at a medium-term analysis of policies and, consequently, we concentrate on the supply side of the economy. The consumers allocate consumption over two periods with the goal of smoothing consumption. The monopoly trade union sets its wage so that the after-tax real wage is based on the mark-up over the social benefit. The government budget is allocated on social transfers and public consumption; the government collects taxes from labour income and uses borrowing.

Similar to the study by Beetsma and Debrun (2004), at the beginning of the second period there is an election and the present government has the probability ( $p$ ) of winning it and staying in power for a further term. We assume that the outcome of the election solely depends on the present after-tax real labour income of the median voter and assume that s/he is an employed person. We classify the government under four possible types, with variable degrees of myopia and farsightedness in policies.

The government has a number of options through which it can carry out economic reforms:

- i) cutting taxes, with taxes on labour solely being considered here;
- ii) curtailing the welfare system by lowering benefits,
- iii) driving down the mark-up in the labour market and reforming it from a monopolistic to a more competitive market; and
- iv) reforming the product market to become more competitive by driving down the mark-up factor in this case.

Taxes on capital income are kept fixed. We use a numerical calibration and solution of the policy optimum in the model as a function of the probability ( $p$ ). In addition, we present econometric evidence based on Alho (2002).

### Key results and policy conclusions

Our general conclusion is that structural reforms are negatively affected by myopia in economic policies. So, taxes are higher and the welfare state is larger under myopia than the social optimum. Yet, the case for product market reform is quite strong, irrespective of the political set-up. On the other hand, it may easily be that political considerations block reform of the labour market. Our econometric evidence confirms these findings. The SGP hinders and limits the magnitude of a tax reform, but is conducive to a reform of the welfare state and the labour and product markets. Even so, given the degree of rigidity of the actual SGP, these effects are not likely to be large.

We reach the following four key conclusions for policy. The optimal tax policy depends negatively on farsightedness. This finding implies that the socially optimal tax rate, with  $p$  being unity, is lower than that chosen by a myopic government and that the international non-elected body emphasises a tax reform more than the national decision-makers do. In addition, the optimal tax depends negatively on the stringency of the SGP. The intuition is that the SGP makes borrowing more costly and therefore calls for higher current taxes. It turns out that while in principle the SGP may have a large impact in this respect, the impact is not very large when we consider the magnitude of the sanctions stipulated by the SGP.

The analysis furthermore finds that for the optimal welfare benefit, the more farsighted the government is, the lower the level of social spending. This outcome suggests that the socially optimum welfare benefit, with  $p$  being unity, is less than that chosen by a myopic government and that the international non-elected body emphasises a reform of the welfare state more than the national decision-makers do. The optimal social benefit level depends negatively on the stringency of the SGP, because a reduction of the benefit level leads to a savings in government finances.

As the replacement ratio here is fixed, there is no uniformly 'best' (inner point optimum) wage level, as is plausible. In empirical terms, considering the political cost and economic benefits of reforming the labour market, we are inclined to conclude that in reality the case for a labour market reform is not very strong. It is also interesting that the effects of the economic factors on the required reaction in the political domain to lead to a status quo do not depend much on existing political myopia in economic policies.

A decrease of the mark-up in the goods market is unambiguously beneficial for both private income (and thereby for consumption) and the finances of the public sector. The gain from the reform of the goods market is magnified by the larger capital stock in the second period. It seems that in general we can find the following dividing line. National decision-makers are the least likely to carry out a reform, which the public would favour, while the international bodies

are in general pursuing the right cause, as they continue to call for reforms to the economy. Their argument, however, may be even stronger than the social optimum.

The role of the SGP is not very large, if we take into account its stringency with respect to sanctions. Its impact is negative in the case of a tax reform but positive in terms of other economic reforms. Thus, we could qualify the result of a negative impact of the SGP on reform activity, as reached by Beetsma and Debrun (2004), to apply only to tax policy, but in the case of reforming the welfare state, the labour and the product markets, we reach the opposite result. This conclusion stems from the fact that these latter reforms lead to an improvement in government finances and thereby to a lower effective cost of borrowing.

The numerical values reached in the solutions are, of course, only indicative. Among the various reforms considered in the paper, it turns out that reforming the goods market would have the strongest rationale in political and economic terms, and not be hampered much at all by considerations of myopia. It also appears that in reality reforms in the EU have been more predominant in the goods than in the labour market.

This medium-term emphasis is likely to lead to the situation in which the reforms of the tax system and the welfare state are of the beggar-thy-neighbour type, because they can give rise to inward FDI in the reforming country at the cost of the neighbouring EU countries. Therefore, there is not that much scope for active coordination, because the prospects for these reforms are already limited in a single EU country and the existing bias is towards the status quo. The situation in the goods market, however, is the opposite, and thus there is justification for coordinating product market policies in the EU.

We show that overall the political bias in economic policies can have quite a substantial effect. A key step would be to reduce the extent of myopia in the political process, and in this regard, international organisations such as the OECD and the peer review by the European Commission and member states may do a good job.

### **3.4 Climate change policies and taxation – The abatement of global warming, the emissions trade and the need for European coordination (WP 5)**

#### **3.4.1 Summary of WP 5**

##### **Introduction**

The major EU policy challenge in the field of global warming is how to launch global greenhouse gas (GHG) emission-abatement activities that would offer a chance of meeting the EU objective of limiting during this century the rise in temperature to 2°C compared with pre-industrial levels. In this respect, both the timing of abatement efforts and the road towards the establishment of a global abatement coalition are major and critical policy features.

The instalment of cap-and-trade schemes is one of the key policy solutions to the abatement problem. Yet, other policy measures are being undertaken simultaneously. Such efforts raise important policy questions about the interactions among the different instruments deployed. Examples of these are the fostering of R&D on cleaner energy technologies, the subsidisation of renewable energy and energy taxation.

##### **Research tasks**

In view of the policy challenges and questions in the field of climate change and taxation, the following research questions have been addressed, in six research papers.

On post-2012 climate policy development, several issues have been studied:

- i) Assessments have been made of the timing of global abatement efforts that would be optimal in view of the EU's temperature objective and of the additional costs of late action.
- ii) The road towards a global coalition has been explored as well – in two separate papers. The first paper assesses – under various permit allocation rules – the impacts of broadening the abatement coalition from the platform of G8 to a relatively small group of 20 countries that really matter (called the 'L20') because they are leading in terms of GDP *and* population *and* emissions. The second paper explores the impacts of an extension of the Californian initiative to the whole of the US.

Concerning the interactions of policy instruments, two questions have been addressed:

- iii) In a theoretical paper using an endogenous growth model, the effects of an emissions cap on induced R&D are assessed with numerical model calculations.
- iv) The interactions of the EU emissions trading scheme (EU ETS) with energy taxes have been investigated as well, in two separate papers. The first paper analyses, in a partial equilibrium framework, the consequences of introducing a unilateral carbon tax within the EU ETS. The second one assesses the ramifications of energy tax reforms with the EU ETS in place in the context of a general equilibrium model. In particular, this paper assesses the benefits of converting existing energy taxes to carbon taxes relative to cap-and-trade, the overall abatement efficiency of the EU system (delineation of the regulated sector) given existing taxes and the benefits of revenue recycling if permits are auctioned.

### **Methodological approaches used**

Within WP 5, a variety of methodologies has been deployed. These range from numerical calculations with concise theoretical models and detailed partial equilibrium models for the EU-27 to applied general equilibrium models of a dynamic nature with global coverage. The study on the optimal timing of global emission abatement efforts conducts various counterfactual policy scenarios using two different applied general equilibrium models. One of these, PACE-IAM, is of an aggregate nature, yet dynamic in a forward-looking sense and capable of generating an integrated assessment of the temperature increase that will go with accumulated GHG emissions. The other, WorldScan, is recursively dynamic yet much more disaggregated; it is used to show the impacts of the emission profiles generated by the other model in much more detail. PACE-IAM is also used to assess the effects of broadening the abatement coalition to the group of countries that really matter. WorldScan is additionally used to assess the interactions between the EU ETS and energy taxation.

### **Key results and policy conclusions**

Because delayed action may induce large excess costs of transitional climate policies, the burden-sharing debate may become substantially more critical over time owing to 'foregone action'.

The simulations concerning coalitions of leading countries suggest that leaders prefer leadership under an egalitarian allocation rule. For ability-to-pay and polluter-pays rules, leadership is costly to the leaders but these costs can be reduced if unilateral action is limited to a transitional phase.

The impact analysis of an extension of the Californian initiative to the whole of the US shows that the US would tend to gain from free permit trading with the EU.

In the endogenous technology case, research and development in less-polluting energy technologies is fostered by high permit prices.

Introduction of a unilateral carbon tax within the EU ETS will not affect EU emissions; it always raises abatement costs (in general especially in the country that introduces the tax) and cannot be justified from the standpoint of climate change policy. The implication of the analysis is that existing energy taxes for installations covered by the EU ETS are better removed from the perspective of abatement efficiency. This finding is also confirmed by the following experiment in a general equilibrium context: when permits are auctioned, using the permit revenue to slash existing energy taxes within the sectors covered by the EU ETS is welfare-improving (over and above revenue recycling in a lump-sum fashion). Moreover, the conversion of existing energy taxes to uniform carbon taxes is a powerful instrument in terms of both emissions reduction and economic welfare relative to cap-and-trade. Nevertheless, the position of the NMS deserves special attention in the event that energy taxes are rearranged in this way. Given existing energy taxes, the inefficiencies involved in delineating the regulated sector turn out to be relatively minor. Revenue recycling is beneficial, relative to recycling in a lump-sum fashion. Hence, from this viewpoint, the auctioning of permits is to be preferred to grandfathering.

### **3.4.2 Summary of the deliverables**

There are altogether six working papers prepared in this work package.

#### **3.4.2.1 Post-2012 Climate Policies: A Simulation Study with WorldScan**

**Authors: Stefan Boeters and Gerard Verweij (CPB) (Deliverable No. 23B)**

##### **Introduction**

After the decision of the US and Australia not to ratify the Kyoto Protocol, the process of an internationally coordinated climate policy seems to be deeply stuck. The Kyoto Protocol commits a group of industrialised countries – the Annex-B countries – to reduce their emissions of GHGs in 2008–12 by approximately 5% below their 1990 levels. This is a small step towards a stabilisation of the concentration of GHGs in the atmosphere. A focal point in the discussion about climate change is a limit on the rise in global temperature of 2°C, which is commonly seen as a ‘safe’ temperature level limiting the possible catastrophic consequences of more severe changes. With such a target in mind, stricter emission ceilings for individual countries and an extension of the group of contributing countries are indispensable, which makes the non-participation of the US even more worrisome.

##### **Research task**

In this situation, climate policy research can contribute by pointing out possible further steps and analysing their consequences. The discussion can be stimulated by contrasting potential paths of the future development, and singling out those that have the highest probability of gaining broad support. In this study, we seek to contribute to this discussion by sketching a climate policy scenario for the period 2012–20, building on the CPB-RIVM study of Bollen et al. (2005). We take the existing climate change policies as a starting point and extend them where we consider this politically feasible. There are three important building blocks of our post-2012 scenario: the Annex-B countries, excluding the US, form an abatement coalition in the form of a cap-and-trade system; the US commits to moderate emission targets, but does not partake in the trading system; and non-Annex-B regions contribute in the form of a system of clean development mechanism (CDM) projects.

### Methodological approach used

WorldScan (Lejour et al., 2006) is a multi-sector, multi-region applied general equilibrium model. It is developed to study long-term global issues, such as globalisation and climate change policy. The model builds upon neoclassical theory, has strong micro-foundations and solves for the equilibrium that maximises welfare across the entire economy, subject to technological constraints, GHG limitations, etc. The model is calibrated on input–output tables and trade data from the GTAP 6 database (Dimaranan and McDougall, 2005). The base year for the model is 2001. The model version used in this study distinguishes 13 sectors and 19 regions.

The impacts of policy interference are measured with respect to a baseline, which is a reference scenario usually termed business-as-usual (BaU), where no policy changes apply. In order to simulate the economic and environmental implications of our post-2012 scenario, information on the future BaU development of the global economy is required. The BaU projections forced upon the models determine how policy interference, such as carbon emission constraints under post-2012 climate policies, will bind the respective economies in the future. The compilation of the BaU projections is a key challenge for long-term climate policy analysis. For our simulations, we adopt the WEC/IIASA “Middle Course” Scenario B as our reference case. Scenario B is based on a cautious approach to technological change and energy availability as well as modest economic growth.

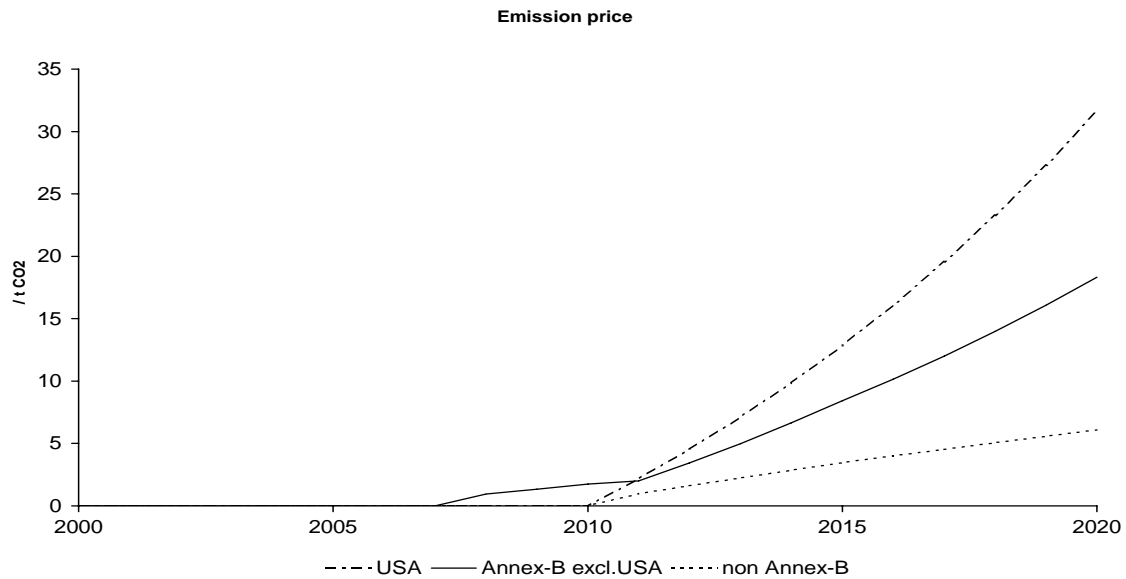
### Key results and policy conclusions

The baseline emissions are relatively stable for the Annex-B regions and rise steadily at 2.7% per year for the non-Annex-B regions. Non-Annex-B countries like China and India will therefore become large emitters in the next decades.

In the non-Annex-B regions, the post-2012 scenario only generates a modest reduction of the CO<sub>2</sub> emissions: –1% in 2020. There is a small reduction, although the commitment of these countries is less strict than the benchmark emissions, because CDM is taking place. Yet, the volume of CDM is small compared with the total emissions in the non-Annex-B area. Furthermore, some leakage of CO<sub>2</sub>-emitting activities to the rest of the world takes place; here the emissions increase by 1% in 2020.

For the Annex-B regions, there is a more substantial reduction in CO<sub>2</sub> emissions compared with the baseline: –24% for the US and –16% for the rest of the Annex-B are in 2020. Differences in CO<sub>2</sub> reduction among the regions exist according to their emissions target and level of permit trade.

Three markets for emission permits exist: the internal market of the US, the common Annex-B market and the regional markets for CDM credits. Figure 4 shows the pattern of prices that lead to market clearing for these different types of permits. The emission price in 2020 for the US is the highest: €32/tCO<sub>2</sub>. The rest of the Annex-B group has a lower emissions price: €18/tCO<sub>2</sub>. This higher price in the US can be explained when we have a second look at the formation of the emission targets. If expressed as a relative reduction compared with the 1990 emissions, it seems that the reduction target in the US is considerably less strict than in the rest of the Annex-B countries (no change vs. –26%). But if this is translated into changes compared with the baseline emissions, the order is reversed. The US then ends up with a stricter target (–24% vs. –20%), which results from the steeper increase in baseline emissions in the US. In addition, the US does not participate in CDM, and hence the difference in domestic emission reductions is even enlarged to –24% vs. –16%. This translates into the permit price difference of €14/tCO<sub>2</sub>. Joining the Annex-B permit market would thus be beneficial for the US by lowering its emissions price.

Figure 4. Carbon emission price in €/t CO<sub>2</sub>

Source: Boeters and Verweij (2006).

For the Annex-B group, Figure 4 shows the positive permit price already present in the Kyoto period (2008–10). The price remains below €3/tCO<sub>2</sub>, however.

### 3.4.2.2 Post-2012 Climate Policies: From G8 to L20

**Authors: Christoph Böhringer (ZEW and University of Heidelberg) and Ulf Moslener (ZEW) (Deliverable 23A)**

#### Introduction

Since spring 2005, the Kyoto Protocol – the first international agreement on climate protection – has been in force. It contains legally binding emission targets for industrialised countries to be achieved during the commitment period 2008–12. Proponents of the Protocol celebrate it as a breakthrough in international climate policy. Yet opponents criticise that its approach, namely negotiating targets and timetables for emission reductions within a comprehensive process of the United Nations Framework Convention on Climate Change, is seriously flawed and ultimately doomed to fail. In the debate on climate policy architectures beyond 2012, there is concern about the effectiveness of the inclusive negotiation procedure associated with a 160-nation bureaucracy, which underlies the negotiations towards the Kyoto Protocol. The (anticipated) minor environmental effectiveness of the Protocol seems to support this perception: acknowledging the vast heterogeneity of the 160 nations' political priorities, the veto power of every single nation compromises any ambitious, common reduction target. Substantial leverage on negotiation outcomes may be achieved by working with a small number of countries representing the major emitters as well as economic and political powers. Such a group (perhaps along the lines of the Leaders 20 Summit – L20 – suggested by Canadian Prime Minister Paul Martin) may move forward with stringent unilateral emission reduction commitments, while the rest of the world does not necessarily have to be part of any legally binding international agreement.

## Research task

We compare the economic impacts of this leadership against a global commitment that maintains the same worldwide emission budget. We investigate the incentives for leadership by a limited number of countries under alternative allocation rules for the global carbon emissions budget.

## Methodological approach used

We describe the trade-off between limited and global coverage from an L20-leaders perspective: given some worldwide emission limit over the next decades, the pay-off to include other countries in a potentially cumbersome UN debate on global burden sharing declines with the degree to which the participation of countries outside the L20 reduces the compliance costs of the leaders.

As a cost-effectiveness framework for numerical analysis, we use an intertemporal multi-sector, multi-region CGE model of global trade and energy use (PACE-IAM). Beyond the consistent representation of market interactions as well as income and expenditure flows, the dynamic model setting accommodates an assessment of the adjustment path of economies to exogenous policy constraints over time.

To determine the key players (leaders) in the field of international climate policy there are several criteria. Three fairly self-evident and rather prominent criteria are a country's i) CO<sub>2</sub> emissions, ii) GDP and iii) population. These criteria also serve as a basis for central equity rules referred to in the policy debate. Among the most commonly quoted equity rules, the sovereignty and the polluter-pays principle are based on (historical or projected) emissions. The egalitarian principle calls for identical per capita emissions, thereby emphasising the role of population. Finally, the ability-to-pay rule is based on the economic wealth of a country, which is generally linked to GDP. The countries identified as potential members of a leaders group consist of four industrialised regions (EUR-30, the US, Japan and Russia) and five non-industrialised regions (Brazil, Mexico, China, India and Indonesia).

## Key results and policy conclusions

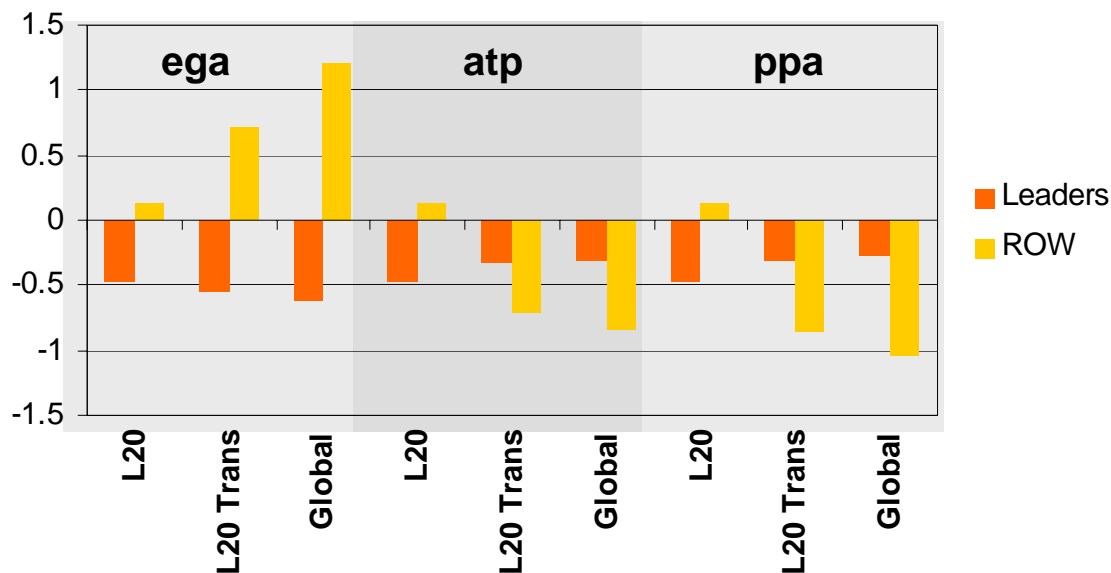
Our simulations suggest that leaders prefer leadership under an egalitarian allocation (ega) rule. For ability-to-pay (atp) and polluter-pays (ppa) rules, leadership is costly to the leaders but these costs can be reduced if unilateral action is limited to a transitional phase. Figure 5 displays welfare implications in percentage terms of the different regimes for both the leaders moving forward with ambitious climate policy targets and the rest of the world (ROW).

We have identified a non-negligible trade-off between limited and global coverage from an L20 perspective if leadership is assumed to last forever. If, however, leadership is restricted to a transitional phase – until 2030 – the welfare implications might be reduced substantially. The main driver of the welfare implications turns out to be the income transfer through the carbon endowments. While for an egalitarian allocation rule, leaders would prefer an L20 scenario to global coverage, for all the other analysed allocation rules the potential leaders would be better off if global coverage of reduction commitment is assumed. Additional work on the burden-sharing debate among the (relatively inhomogeneous) group of leaders would be one interesting area of further research.

Our findings suggest that leadership might be preferred in the case of the egalitarian rule, but costly under polluter-pays or ability-to-pay regimes. The cost burden of the leaders might be substantially lower if leadership were restricted to a transitional phase.



Figure 5. Welfare implications of a group of leaders moving forward with CO<sub>2</sub> abatement commitments



Notes: L20 = leadership forever; L20 Tran = leadership restricted to a transitional phase; global = global coverage of reduction commitments

Source: Böhringer and Moslener (2006).

### 3.5.2.3 Efficient and Transitional Climate Policies – A Combined Analysis using PACE and WorldScan

Authors: Christoph Böhringer (ZEW and University of Heidelberg), Stefan Boeters (CPB) and Ulf Moslener (ZEW) (Deliverable 14)

#### Introduction

The analysis of long-term scenarios of climate policy poses ambitious requirements for the scope of the economic models used. On the one hand, they must cover a long time span, and there must be a dynamic coupling of all periods to account for the forward-looking adjustment of economic agents to future policies. On the other hand, regional and sectoral detail is necessary to capture the distributional consequences of such policies, both between and within countries. These differential consequences determine the incentives for countries and for particular groups within countries to participate in a coordinated international approach to emission reduction.

#### Research task

The required detail in several dimensions goes beyond what is currently handled in standard CGE models. In this study, we therefore combine information from two models, PACE-IAM and WorldScan, to obtain a comprehensive picture of future options of climate policy.

The strength of PACE-IAM is its intertemporal optimisation set-up, which allows us to construct a full time-path of optimal reduction targets. As a tool specifically tuned for this task, PACE-IAM uses a relatively coarse disaggregation with respect to regions, time periods and sectors. This is the point at which the second model, WorldScan, comes in. It is set up as a

dynamic recursive model, so that the economic equilibrium in each period can be calculated independently of later periods. This makes a more detailed coverage of regions and sectors possible. As the single periods can be individually tuned, the match with the exogenous baseline scenario is closer in WorldScan as well.

We illustrate the complementarities of the two models in an investigation of different optimal and conditionally optimal policies. As a background, we start with a policy that establishes global where-and-when efficiency for a given temperature target over the entire period until 2100, derived by PACE-IAM. The consequences of this policy are then broken down by region and sector on a year-by-year basis using WorldScan. This overall efficient policy is finally compared with different conditional scenarios that follow a politically feasible path until 2030, and are then complemented by an efficient path until the end of the period of interest. We assess the efficiency loss that these concessions to political feasibility generate.

### **Methodological approach used**

In order to investigate the long-term effects and efficiency costs of transitional climate policies we make use of both the integrated assessment model PACE-IAM and WorldScan. PACE-IAM combines economic aspects of climate change with scientific knowledge of the dynamics of climate change. WorldScan complements this with a model set-up that adds regional, sectoral and temporal detail, while lacking the climate and intertemporal optimisation aspects.

PACE-IAM links a dynamic macroeconomic model with a simple geophysical module of climate change. The latter corresponds to the climate component of the RICE-99 model. The macroeconomic module is formulated as an intertemporal multi-sector, multi-region CGE model of global trade and energy use. PACE-IAM in its current version does not attempt to translate global warming into market impacts and non-market impacts. The model is, however, well suited to derive cost-efficient climate policies given long-term temperature or concentration targets and to compare the efficiency costs of alternative policy scenarios. As is customary in applied general equilibrium analysis, base-year quantities and prices – together with exogenous elasticities – determine the parameters of functional forms that describe technological options in production and consumer preferences in consumption. For the base-year calibration, PACE-IAM builds on the most recent GTAP 6 database.

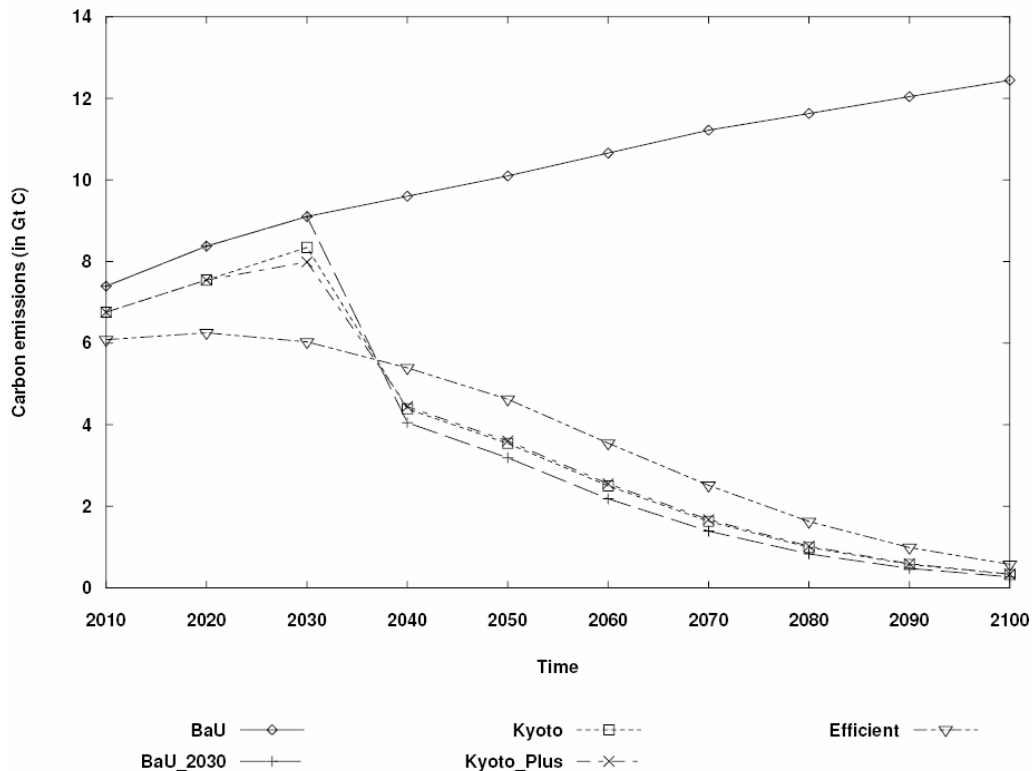
WorldScan shares many general features of CGE models with PACE-IAM. The differences are in the dynamic set-up of the model and in the aggregation structure. In its temporal structure, WorldScan is dynamic-recursive. This does not allow for intertemporal optimisation, which is why the time profile of optimal emissions is taken over from PACE-IAM. On the other hand, the independence of the periods and the yearly structure allow for a more precise calibration to the exogenous time path of GDP and energy use. Regarding regional and sectoral disaggregation, WorldScan accommodates much more detail than PACE-IAM. The world is broken down into 21 regions. In each of the regions, we distinguish 31 production sectors.

### **Key results and policy conclusions**

Figure 6 depicts the carbon emission trajectories across the different scenarios. Under global efficiency considerations for a long-term temperature target of 2°C, substantial emission cutbacks vis-à-vis the BaU are already required in the transition phase between 2010 and 2030 accounting for long-term climate dynamics. In our assessment of efficiency costs for transitional climate strategies, we consider pragmatic formulations of climate policies up to the year 2030. To provide a meaningful cross-comparison of different policy scenarios up to 2030, we presuppose that the ‘residual’ policy between 2030 and 2100 will use an efficient intertemporal strategy that meets the same exogenous long-term temperature target (+2°C) as the ‘efficient’ scenario. ‘BaU\_2030’ reflects a situation without effective abatement policies until 2030;

afterwards, an efficient climate policy applies to meet the temperature target in 2100. ‘Kyoto’ requires industrialised countries (as listed in Annex B of the Kyoto Protocol) to maintain their Kyoto targets from 2010 onwards, whereas no explicit emission constraints apply to developing countries. ‘Kyoto\_Plus’ assumes that industrialised countries stick to the Kyoto targets until 2020 and then decrease these emission limits by 1% per year between 2020 and 2030.

Figure 6. Global carbon emissions (Gt of C)



Source: Böhringer, Boeters and Moslener (2006).

Table 1 summarises gross adjustment costs at the world level: adjustment costs are measured as Hicksian equivalent variation in lifetime income.

Table 1. Adjustment costs (% change in Hicksian equivalent variation)

	BaU	BaU_2030	Efficient	Kyoto	Kyoto_Plus
World	0.0	-0.89	-0.66	-0.78	-0.77

Source: Böhringer, Boeters and Moslener (2006).

WorldScan is used to break down the results of the efficient scenario into regional and sectoral effects.

The efficient carbon reduction scenario is characterised by a relatively mild emissions cutback in the beginning and, by contrast, a steep decline towards the end of the simulation period. The emissions price is steadily rising, reaching levels in the second half of the century that suggest an almost complete switch to some backstop technology. The relative emissions reduction level differs among countries, with developing countries reducing considerably more than industrialised countries.

With respect to the composite scenarios that take political feasibility into account, we can observe the following general pattern: low emission targets until 2030 (especially in the BaU\_2030 scenario) must be compensated by higher reduction achievements towards the end of the period. This leads to an emissions price profile that increases even more steeply than in the efficient scenario. The overall welfare loss is roughly driven by the looseness of the abatement targets in the initial period. The more the path deviates from the efficient one until 2030, the higher are the welfare costs to be borne later.

### **3.4.2.3 Efficiency Losses from Overlapping Economic Instruments in European Carbon Emissions Regulation**

**Authors: Christoph Böhringer (ZEW and University of Heidelberg), Henrike Koschel (ZEW), Ulf Moslener (ZEW) (Deliverable No. 20A)**

#### **Introduction**

To reduce their carbon dioxide emissions, in addition to the CO<sub>2</sub> EU ETS, EU member states must apply complementary regulatory measures in those sectors that are not covered by the EU ETS. This segmented carbon regulation runs the risk of producing substantial excess costs since marginal abatement costs are not equalised across emission sources, which would lead to inefficiencies. In many member countries, the allocation to energy-intensive industries has been perceived as rather generous at the expense of sectors outside the EU ETS. The burden has been shifted from energy-intensive industries with rather low marginal abatement costs to sectors with potentially high abatement costs.

In several EU countries, industrial installations that have to hold emission permits are also affected by national energy tax regimes. In contrast to the EU emissions trading directive that clearly prescribes which installations are affected by the ETS, the EU energy tax directive allows the member states great latitude as to whether EU ETS sectors are taxed or not. Even though from a purely theoretical standpoint the use of a mix of policies in order to pursue a single policy objective is not useful, it is in the nature of policy design within a federal system such as the EU that instruments introduced at the European level are complemented by instruments of the member states.

From a more subtle theoretical point, there are several reasons why a mix of policy instruments might even be preferable to a single instrument. Differentiated instruments can be justified if there are multiple policy objectives, such as social or technology-related criteria. Second-best regimes, which are characterised by initial market distortions or imperfections, provide a general argument for differentiated regulation. Such regimes include situations with uncertainty, external knowledge spillovers, initial tax distortions, market power or transaction costs. In climate policy design, sector-specific differences in transaction costs have been used as an argument for, e.g. applying different climate policy instruments to different economic sectors.

#### **Research task**

We analyse the potential efficiency losses arising from the co-existence of emission taxes and emissions trading. The following analysis abstracts to a large extent from market distortions and focuses on the static efficiency implications of additional emission taxes imposed on energy-intensive sectors that are in addition subject to the EU ETS. We show that in this case overlapping regulation may induce substantial excess costs: firms under the EU ETS that are simultaneously confronted with additional domestic energy or carbon taxes will abate inefficiently while other firms within the EU ETS will benefit from lower international emission permit prices. In essence, unilateral emission taxes within the EU ETS are ecologically ineffective and subsidise net permit buyers.

### Methodological approach used

We illustrate the effects of possible overlaps of existing CO<sub>2</sub> emissions regulations with the EU ETS using a simple emission market model. Each member state is characterised by an (aggregate) marginal abatement cost function of the sectors that are subject to the EU ETS, including the power sector, oil refining, several energy-intensive industries, and by an (aggregate) marginal abatement cost function for the rest of the economy (covering all sectors outside the scope of the EU ETS including private households, transport, trade). The ETS sectors in each member state receive an emissions budget according to the national allocation plans and can trade the permits thereafter. In contrast, the rest of the economy does not participate in trade. The member states, however, are required to take complementary action. We assume that the emission reductions in the rest of the economy are prescribed by the national allocation plans and implemented cost-efficiently by carbon taxes.

### Key results and policy conclusions

The EU ETS implements any given EU-wide target for the ETS sectors at minimum costs – independent of whether the country-specific national allocation plan implies an over-allocation or not. An additional tax within the trading scheme cannot change the distribution between the ETS and non-ETS sectors *ex post*. Owing to the segmentation of the economy into ETS and non-ETS sectors, however, taxes do not act as an instrument to implement a second-best solution: a unilateral emissions tax drives apart the marginal abatement costs within the ETS sectors of the different regions and leads to efficiency losses. It increases the EU's overall implementation costs of the emissions target and has no ecological effect. Furthermore, it is costly for the (taxing) member state.

There is an exception to this. The taxing country may gain at the expense of overall cost effectiveness only if rather restrictive conditions are met: the country has a large share in the permit market, it features comparatively flat marginal abatement costs in the sectors subject to emissions trading and is at the same time a net permit importer. In this case, the reduced domestic permit demand may lower the EU-wide market price for permits and thereby cause an extra reduction of the country's expenditures for permit imports. Therefore, energy or carbon taxes within the segment of the EU economy that is regulated by the ETS should be handled with great care and justified by reasons other than implementing the commitments under the burden-sharing agreement in a cost-efficient manner.

#### 3.5.2.5 The EU ETS and Existing Energy Taxes

Author: Paul J.J. Veenendaal (CPB) (Deliverable No. 20B)

#### Introduction

Under the Kyoto Protocol, the EU has committed itself to reducing GHG emissions over the period 2008–12 by 8% below 1990 levels. One of the major tools that have been put in place to achieve this commitment is the EU ETS. This cap-and-trade system is currently in its first start-up phase of 2005–07. It puts a cap on CO<sub>2</sub> emissions from large combustion installations with a capacity exceeding 20 MW. Together these installations account for nearly half of EU-25 fossil fuel CO<sub>2</sub> emissions. Emission permits are allocated to firms by national governments (subject to approval by the European Commission) and are freely tradable. Most of the permits have been grandfathered but the directive allows for permit auctions as well, albeit subject to a maximum of 10% in the second phase that coincides with the Kyoto period of 2008–12. The EU ETS establishes a uniform emissions price for all installations that it covers throughout the member states. Hence, in principle emissions abatement will be efficient and undertaken at the lowest

possible costs. Yet, existing energy taxes may jeopardise this conclusion if they are applied non-uniformly to the installations covered by the EU ETS.

### **Research task**

The aim of this study is to analyse the interactions between the EU ETS and EU energy taxation and to assess the importance of these interactions. We distinguish three relationships between cap-and-trade systems and taxation.

First, the cap would alternatively materialise if CO<sub>2</sub> emissions were taxed at exactly the level of the permit price. Thus, the claim that a cap-and-trade system is cost-effective presumes that energy use is not taxed in additional non-uniform ways. Energy taxes are abundantly present, however, especially in the EU-15 member states, and vary widely by energy carrier, by user and by member state, with the relative magnitude of energy taxes bearing no relation whatsoever to CO<sub>2</sub> emissions. Hence, the cost-effectiveness of an additional cap-and-trade system is not guaranteed.

Second, although the coverage of the EU ETS (large combustion installations) may be extended in its second phase, there is no doubt that the cap will continue to be imposed on only part of the economy (henceforth, the ‘regulated’ sectors). Given that according to the EU’s burden-sharing arrangement each member state has agreed to a cap on total emissions, permit allocation to the regulated sectors implicitly puts a complementary, national cap on emissions from the other (henceforth, ‘non-regulated’) sectors. In general, marginal abatement costs of the regulated sectors under the EU-wide cap will differ from the marginal costs incurred by the non-regulated sectors, while the latter will also differ among member states owing to the burden-sharing arrangement. Compliance costs of the non-regulated sectors depend directly on the amount of permits allocated to the regulated sectors. The separation of emissions reductions within the EU-25 into many different components thus raises questions concerning the efficiency of the overall abatement effort. The over- or underallocation of permits to the regulated sectors and extension of the sectoral coverage of the EU ETS may have important impacts on marginal abatement costs in the non-regulated sectors. Moreover, diverging levels of existing energy taxes may drive abatement costs even farther apart.

The third connection between cap-and-trade and taxation is rather more direct. When emission permits are auctioned, the auction receipts can be recycled back into the economy. Although the possibilities to do so are numerous, the economic literature suggests that using these receipts to slash existing tax distortions improves economic welfare more than a lump-sum transfer to the economic agents does. According to the weak double dividend hypothesis, revenue recycling through cuts in distortionary taxes improves economic welfare relative to recycling through lump-sum payments. The strong double dividend hypothesis suggests that substitution of an environmental tax for a distortionary tax will improve economic welfare. Hence, the introduction of an environmental tax would not only enhance environmental quality but also non-environmental welfare (double dividend). Obviously, verification of the double dividend hypotheses requires model simulations in a particular empirical setting.

### **Methodological approach used**

In this study, we use a recursively dynamic global applied general equilibrium model, WorldScan, as a tool to analyse and assess the importance of the interactions of EU cap-and-trade systems and EU energy taxes. One should bear in mind that the outcomes from the model are of a long-term nature and do not reflect the costs of structural adjustments. As a baseline, we adopt the WEC/IIASA “Middle Course” Scenario B. This scenario is characterised by a cautious approach to technological change and energy availability as well as modest economic growth. It does not include climate change policies or carbon taxation.

## Key results and policy conclusions

The possible interaction between existing taxes and cap-and-trade systems raises the question of how tax harmonisation in terms of carbon taxation would fare as a device to curb CO<sub>2</sub> emissions vis-à-vis cap-and-trade. For the assessment, we first install a full cap-and-trade system in the EU, which caps the EU fossil CO<sub>2</sub> emissions of all sectors and households. Subsequently, we convert existing energy taxes to carbon taxes in four different ways: separately by member state and for consumers and producers; separately by member state for all agents; EU-wide, yet separately for producers and consumers; and EU-wide for all agents. In all these cases, we maintain energy tax revenues at baseline levels as a percentage of GDP. It thus turns out that the conversion of existing energy taxes to more uniform carbon taxes would outperform the cap-and-trade system for the next decade in terms of emissions reduction. Second, the conversion would also generally outperform the cap-and-trade system in terms of (smaller) welfare losses. Moreover, if the energy taxes were converted to a uniform carbon tax for all agents, strong double dividends would arise at the levels of the EU-15 and the EU-25. EU-wide harmonisation, however, would have adverse impacts on economic welfare in the NMS, as it would raise the energy tax burden in these countries over and above baseline levels. Finally, the conversion would strongly discourage the use of coal and natural gas and promote the use of petroleum, relative to the baseline.

Although tax harmonisation therefore seems to be a strong alternative to cap-and-trade, the political viability of a tax harmonisation strategy may be limited. The distributional impacts on welfare in the NMS and on employment in the coal industry may be politically sensitive. Tax harmonisation is a difficult process and the fostered use of petroleum seems to be at odds with energy conservation and energy security concerns. Hence, the main lesson is that existing energy taxes are very distortive, and by the same token, rearranging them may provide potentially very powerful instruments within the context of climate change policies.

As the EU ETS covers only part of the economy, other policy measures must ensure that the non-regulated sector reduces emissions as well. This raises the question of the extent to which overall abatement efficiency in the EU is sensitive to extension of the EU ETS to all other production sectors with the exception of the transport sector. Given existing energy taxes, the general conclusion is that extension would not increase economic welfare. Extension of the EU ETS to other production sectors will lower the permit price and raise the carbon tax for the non-regulated sectors.

The reasons are twofold. First, more reduction opportunities would become available in the regulated sector while fewer options would be left in the non-regulated sector. Second, existing energy taxes would become even more concentrated in the non-regulated sector. This implies that the carbon tax must rise considerably to have an impact on emissions because abatement is the result of relative price changes. Hence, the carbon tax must be relatively high when pre-existing taxes are high and carbon taxation becomes more costly. As a result, the overall welfare impacts of extending the EU ETS are slightly negative. This assessment does not take into account possible differences in administrative costs. These costs may be lower for an extended system. If permits can be efficiently auctioned (and the cumbersome grandfathering process skipped), it may be less costly to include a large number of firms in the EU ETS than monitoring them separately to check compliance with a large variety of other policy measures.

The analysis shows – again – that existing energy taxes interact in important ways with cap-and-trade systems. The higher these taxes are, the higher will be the costs of further emission reductions. As the distribution of existing taxes is skewed over sectors and households and quite divergent across member states, it seems sensible to limit the EU-wide cap-and-trade system to those sectors that are taxed rather mildly. This limited coverage characterises the EU ETS in its current form. Extension of the EU ETS to other sectors that are also mildly taxed may not

enhance overall economic welfare. This welfare assessment, however, does not take into account possible differences in administrative costs.

When permits are auctioned, recycling permit revenue in such a way that existing tax distortions are reduced generally increases welfare over and above revenue recycling in a lump-sum fashion. Two cases are considered. First, we use the permit revenue to reduce taxes on labour. As these are borne by employers in WorldScan, reducing taxes on labour will lower producer prices, raise the real net wage and foster labour supply. Second, we use permit revenue to reduce both taxes on electricity and existing energy taxation for the regulated sector. Given the cap, the decreased taxation of energy carriers in the regulated sector as well as the increased demand for electricity will raise the price of permits. The rise, when large enough, might facilitate the adoption of cleaner technologies, e.g. in power generation.

The general conclusion that can be drawn from these revenue recycling policies is that they yield a double dividend. The impacts of reduced labour taxation appear to be most beneficial. The welfare effects of reduced taxation of energy use by the regulated sector are relatively minor, but they are not negligible, especially in the NMS.

### **3.5.2.6 Climate Policies and Economic Growth**

**Author: Kari E.O. Alho (ETLA) (Deliverable No. 13)**

#### **Introduction**

Climate policies can have important economic effects, while they endeavour to reach a path of lower emissions. Of course, giving up climate policies also has important ramifications in comparison with the present situation. It is often heard from the environmentalists that strict climate policies give rise to such high incentives for R&D in less-polluting technology that the burden of environmental policies turns into a surplus.

This starting point of this analysis is that because of environmental concerns, a country or region of countries sign a climate agreement that cuts their emissions stemming from the use of one essential factor of production – energy. The aim of the study is to undertake a simple analysis of the effects of climate policies on the growth rate of the economy, using numerical calibrations.

#### **Research task**

We start from the basic premise of no international factor mobility and then enlarge it to allow for factor mobility, where domestic factors of production can relocate abroad as a result of the reduced real reward caused by the scarcity of the energy factor. The main part of the analysis is devoted to the matter of endogenous growth, where the rate of innovation in the energy sector is endogenous and can react to the climate policies. We study how essential the factors of endogenous technical change and R&D in clean energy are from the viewpoint of overall economic growth. Our objective is to give more numerical substance to this field of study on endogenous growth and energy policies and to explicitly consider the case of an open economy.

#### **Methodological approach used**

Throughout the study, we take an aggregative view of a single economy, which is so small that its policies with regard to the environment and use of energy do not have any effects on the world financial or energy markets. GDP is produced by domestic resources and energy. The use of the latter is limited by international climate policies.



In the first part of the analysis, we simply plug this constraint into an aggregative production function under fixed domestic resources and where there is ‘carbon leakage’, caused by a lower reward for domestic resources as a result of less available energy.

The main part of the analysis studies endogenous economic growth, such that the less-polluting technical change is endogenous, i.e. the relation between emissions and energy input in production depends on economic incentives. We first analyse optimal economic growth in a command-type of open economy and thereafter formulate the case of a market economy and consider environmental policies to reach the social optimum in R&D in energy technology.

### **Key results and policy conclusions**

From the basic calculations in the first part of the analysis, under exogenous technology we see that the Kyoto target of limiting emissions (0.25% p.a., altogether 6.3% over 30 years) reduces the level of output by 0.6-0.7% in the end-point steady state. The adverse effect grows almost linearly with the ambition of the climate target, so that a reduction of emissions by 30% would roughly cut 3.5% from the long-term level of real GDP.

Under mobile factors, however, we reach the conclusion that the reduction in domestic output would be around 2% from reductions of a ‘double-Kyoto’ size, while with fixed factors it is less, at 1.3%. By contrast, the price of energy, i.e. the domestic tax on energy, will behave in such a way that its rise is slower, the higher the carbon leakage. This is because as output is reduced, the need to cut emissions will dwindle as well.

The results of the analysis illuminate the extent to which the energy constraint bites into economic growth. Under endogenous growth, we are able to illustrate how the position adopted by the environmentalists that strict environmental policies lead to a boost in the economy holds qualitatively, but in quantitative terms is only a minor remedy. On the other hand, the international price of tradable emissions permits has a significant influence on R&D activity towards introducing more energy-saving technology. We also derive the optimal subsidy rate for R&D and find it to be quite large, but diminishing over time, as the cost of new technological inventions decreases over time.

The environmentalists often claim that strict environmental regulation creates incentives for R&D, which outweigh the adverse effects of these environmental policies. This claim does not hold empirically here. It is true that R&D activity carried out in the optimal growth path increases somewhat under climate policies compared with the absence of such policies, but the difference is very marginal. For instance, after 30 years, the share of total labour devoted to R&D in energy technology is only 0.07 percentage points higher under the scenario of climate policies than under the baseline, and therefore the two R&D allocation paths are almost identical. There are two basic reasons for this. The share of energy in output is not so vital and the energy constraint considered here is not so binding after all.

As noted earlier, however, the results show that the international price of tradable permits has quite substantial effects. If the tradable permits have a low price, there are, of course, a higher number of purchases and accordingly domestic production is clearly higher. In both cases, the path of purchases of pollution rights is declining, because the domestic build-up of energy technology is a substitute for imported permits. There is less incentive to carry out own R&D in clean energy technology when the pollution right has a low value.

From the results, we first observe that the optimal rate of subsidy is quite high indeed, on the order of 90% of the wage cost of R&D activity. Second, the subsidy is higher in the beginning than it is later on, as the cost of new technology declines. We also infer that the need to subsidise R&D is the lower, the higher the price of tradable emissions permits. This reflects the fact that a tighter market for pollution rights in itself leads to more profitable R&D activity and

thereby to a greater allocation of resources to R&D and, consequently, to a smaller need for government intervention in promoting R&D activity.

## 4. Conclusions and Policy Implications

The orientation of the project has been, in line with the research task specified in the concerned SSP priority, to produce policy-relevant research at the EU level and the level of the member countries. The following key results and policy conclusions have been found. These are elaborated in more detail in the respective parts of section 3.

### WP 1 (Employment)

- 1) The CGE models that were built in the project imply that wage formation is essential in determining the outcome of the tax/benefit policies and their overall effectiveness. The apparent efficacy of certain policies reached under fixed wages may be quite misleading, because the ensuing reaction of wages may neutralise much of the positive policy effects. At the same time, there are also policy measures whose positive effects are strengthened by the reaction of wage formation. The former measures include those affecting labour demand, such as cutting the indirect labour costs of firms. The effects of measures of the latter type, which reduce wage claims, like benefit reductions, are magnified under bargaining while with fixed wages their positive effects are only marginal.
- 2) Under decentralised bargaining, wage–wage competition among trade unions may undermine efforts to reduce the non-wage labour costs of low-skilled workers. That being stated, under a nationwide income policy the effectiveness of this policy is restored.
- 3) CGE model analysis of different wage formations for the Estonian and Finnish economies (market-determined wages and bargained wages, respectively) implies that there is a need for different labour market and tax/benefit policies in different EU member states. A comparison of the policy scenarios for Estonia suggests that market-determined wages outperform bargained wages, with the latter representing the more common type of wage formation in the EU. Thus, it is not advisable for the NMS to adopt EU-15 approaches to their labour market policies.
- 4) The labour supply of low-skilled workers in the NMS under all types of wage formation is best increased by lowering the marginal income tax rate. Combining this step with strategies for improving employment in general, e.g. lowering employers' social security contributions, could potentially improve the labour market position of those with lower skills.
- 5) Statistical analysis reveals that the quantitative impact of tax/benefit systems on employment in the NMS is more vigorous than in the EU-15.
- 6) The French system of a minimum wage and payroll tax reductions for low-wage earners is near the social welfare optimum, if endogenous productivity related to on-the-job training is taken into account.
- 7) With its fixed benefits, the UK unemployment benefit system is preferable in terms of employment to the French and Continental systems, whose benefits are linked to prior income.

### WP 2 (Tax competition and corporate taxes)

- 8) CGE model analysis reveals that even a unilateral reduction of the corporate income tax rate is not beneficial for all EU countries if they have to finance the tax reduction through

an increase in the tax rates on labour or consumption. The reduction in the corporate tax rate attracts FDI and foreign profits. But the increase in the taxes on labour or consumption dampens the impact on employment, GDP and welfare, and might even offset it.

- 9) Econometric analysis of FDI reveals that competition in social policies has a more powerful effect on FDI than tax competition. This conclusion is based on the observation that FDI depends more on differences in employment protection and union bargaining coverage than on differences in statutory or effective corporate tax rates.
- 10) The largest gains from a common, consolidated, corporate tax base (CCCTB) might be expected if all enterprises, domestic and multinational, are treated equally. Proposals for consolidation that exclude some of the firms, such as domestic ones, introduce uneven competition. This approach might induce extensive restructuring both within and among EU member states.
- 11) CGE model analysis underscores that the full benefits from tax base consolidation can only be reaped if all firms participate in a common tax base that applies to them all. If domestic firms are excluded, the EU average gains in terms of GDP and welfare from CCCTB equal respectively 0.08% and 0.03% of GDP in the long run, with the most favourable apportionment formula. The gains would be much larger, with additional gains for both GDP and welfare of about 0.10%, if not only multinational enterprises, but all firms were to participate.
- 12) Formula apportionment distorts the investment and labour demand behaviour of multinational enterprises. The incentives for reallocating production or the production factors are minimised if apportionment depends on the share of production by multinationals in each EU member country. The largest distortions are introduced if apportionment is based on a single production factor, for example employment or capital.
- 13) A CCCTB to which only multinationals may apply creates GDP and welfare gains in EU member states with a broad tax base, but harms countries with narrow bases.
- 14) The economic and welfare effects of a CCCTB are unevenly distributed. Simulation of the CCCTB, in which apportionment is based on employment, capital and production in equal proportions, gives the result that the change in welfare ranges from a reduction of 0.4% of GDP to an increase of 0.6% of GDP. The change in GDP also ranges from a reduction to an increase, both of which are 0.7%.

### **WP 3 (Productivity and catching up)**

- 15) According to pooled panel data estimations and cross-country comparisons of the OECD countries, the growth rate of labour productivity has been affected positively by the following factors: higher fixed investment, lower inflation, higher R&D investment and ICT investment as a percentage of GDP, a higher share of young adults with at least upper secondary education, reduced product market regulation and increased exports. In most specifications, taxes and gross replacement rates have no statistically significant effect on productivity growth rates. We found a negative effect from taxes and a positive one from gross replacement rates when they appear together with fixed investment or inflation. Nevertheless, with this evidence we conclude that taxes and gross replacement rates are unlikely to have had an effect on productivity growth.
- 16) At the same time, the taxes-to-GDP ratio has had a significant negative effect on the number of hours worked by the working-age population. Furthermore, we find a negative correlation between the average number of hours worked, on the one hand, and product

market regulation and gross replacement rates, on the other. Income inequality and trade union density do not correlate with the number of hours worked, but collective bargaining coverage has a negative correlation. There is also a negative correlation between the ratio of collective bargaining coverage and trade union density on one side, and the average number of hours worked, on the other.

- 17) Theoretical analysis shows that powerful trade unions or higher labour costs associated with increases in, e.g. unemployment compensation, the payroll taxes paid by employers, the taxes paid by workers or the cost of employment protection, cause more unemployment and a slowdown of economic growth. A coordinated bargaining process increases employment at the price of a lower growth rate.
- 18) These theoretical predictions are consistent with the empirical analysis on convergence using data on regions in the EU-15. The tax wedge and unemployment benefits are found to reduce the growth rate and increase the unemployment rate. Employment protection increases unemployment rates, without a significant effect on the growth rate of GDP per capita. The coordination of wage bargaining reduces the growth rate and the unemployment rate. The growth rate of total factor productivity (TFP) increases the growth of GDP per capita and decreases the unemployment rate.
- 19) Econometric evidence shows that the faster productivity growth rates in the new EU member states owe more to catching up from their lower initial levels of output per worker than to policy choices regarding the design of labour market institutions.
- 20) Theoretical modelling of an open economy shows that the equilibrium unemployment rate depends negatively on labour taxes, but not on the capital income tax, as a higher rate of it only leads to a lower level of productivity and income. On the other hand, a permanent change in labour taxes only has a long-term negative impact on employment, but not on productivity.
- 21) VAR analysis for the EU-15 shows that labour taxes have a marked and statistically significant negative effect on employment, while the effects of corporate taxes are more neutral with respect to productivity and employment. The results also show that in the short term there is a trade-off in the EU between the two key economic goals of productivity rises and employment. This tension is less severe in the long run, and while it does not fully disappear, over time it becomes statistically insignificant. By contrast, this trade-off does not hold for the US, where there is price flexibility. This situation calls for more flexibility in the EU labour markets to adjust smoothly to technological changes and possible negative supply shocks. Simulation of an econometric model for the Finnish labour market shows that in the medium term, there may be important employment gains from the acceleration of productivity, while in the long run there is no connection between them.

#### **WP 4 (Macroeconomics of tax systems)**

- 22) Theoretical modelling of the EMU shows that if the economies are mainly hurt by demand shocks, then flatter tax systems tend to destabilise output whereas the indexation of taxes on prices tend to stabilise it. If the economies are mainly hurt by supply shocks, then the progressiveness of taxation has little impact on output stability. On the whole, the move towards flatter tax systems would likely lead to more unstable output in the euro area.
- 23) Given that i) the European Central Bank smoothes the interest rate, ii) net tax shocks do have supply-side effects, and iii) spending shocks may have a declining impact on aggregate demand owing to financial liberalisation, we conclude that the positive

spillovers produced in the euro area today by public spending expansions may be decreasing compared with the past, while tax cuts may now be producing negative spillovers.

- 24) Estimation of a dynamic stochastic general equilibrium model shows that a positive spending shock in Germany has a positive, Keynesian impact on German GDP and a positive but small spillover on French GDP. A positive spending shock in France has symmetrical effects. Spillovers among EMU countries are small because of a significant reaction of the common interest rate to spending shocks in any of the countries.
- 25) VAR analysis of the EU countries shows that both the domestic and cross-border effects of German tax shocks have tended to weaken over time. Even so, they have remained positive, i.e. an expansionary shock in Germany has a positive impact on partner countries, especially neighbouring ones. The impact on the interest rate was found to be weak, however. In empirical research, tax shocks were found to be generally more effective in spurring domestic output than government spending shocks in the euro area. This result might stem from the fact that tax policies may give rise to potential growth in the long run, especially when distortionary taxes are removed, thus increasing economic efficiency and competitiveness. When the VAR estimation is performed recursively over samples of 17 years of data, it emerges that GDP multipliers drop drastically from the early 1990s onwards, especially in Germany (tax shocks) and in the US (both tax and government spending shocks). Furthermore, the conduct of fiscal policy seems to have become less erratic, as documented by a lower variance of fiscal shocks over time. Fiscal ‘surprises’ – in the form of unexpected reductions in taxation and expansions in government consumption and investment – have become progressively less successful in stimulating economic activity at the domestic level. This finding indicates that in the framework of the EMU, policy-makers can only marginally rely on these discretionary instruments as a substitute for national monetary policy.
- 26) Political myopia has a negative impact on the willingness to reduce labour taxes, and the stability and growth pact (SGP) reinforces this pattern since excessive deficits lead to sanctions. Political myopia also reduces the willingness to reduce the welfare state, but this time the SGP has a positive impact on the willingness to reform. Myopia has little impact on the readiness of governments to reform labour and goods markets, but the SGP produces the missing incentive. Given that all reforms but those to the goods markets have a negative impact on neighbouring countries, EU countries should continue to coordinate product market reforms but leave the reforms of the welfare state and of the labour markets to peer pressure, with the SGP acting as a positive catalyst.

#### **WP 5 (Climate change and energy taxation)**

- 27) An extension of the Californian initiative of curbing emissions to the whole of the US shows that the US would tend to gain from free permit trading with the EU.
- 28) Implicit in the policy goal to limit the rise in temperature to 2°C up to 2100 is that delayed action may induce large excess costs of transitional climate policies and the burden-sharing debate may become substantially more critical over time owing to ‘foregone action’.
- 29) In global climate change policies, there is a non-negligible trade-off between limited and global coverage from a perspective of 20 core countries taking the lead in moving forward with stringent, unilateral emissions-reduction commitments, if the leadership is assumed to last forever. If, however, leadership is restricted to a transitional phase – until 2030 – the welfare implications might be reduced substantially.

- 30) Using two large-scale models of the global economy in combination shows that in an optimal emissions policy over the next 100 years, developing countries reduce their emissions considerably more than industrialised countries do. This result is mainly driven by the share of coal in the baseline fuel-use mix. The reduction in production differs between sectors, with a similar pattern in all regions. Plausibly, the fossil fuel sectors are most affected, whereas the non-energy sectors hardly decline at all.
- 31) A unilateral energy tax will not affect EU-wide emissions and always increases abatement costs in general, but especially in the country that introduces the tax; thus, it cannot be justified from the view of climate change policy. The implication of the analysis is that existing energy taxes for installations covered by the EU emissions trading system are better removed from the standpoint of abatement efficiency.
- 32) The conversion of existing energy taxes to uniform carbon taxes is a powerful instrument in terms of both emissions reduction and economic welfare relative to cap-and-trade. The position of the NMS deserves special attention when considering changes to energy taxes. Existing energy taxes are highly distortionary, but by the same token, new arrangements may provide potentially very powerful instruments within the context of climate change policies.
- 33) Revenue recycling is beneficial relative to recycling in a lump-sum fashion. There is accordingly a double dividend in climate policies.
- 34) In the endogenous technology case, R&D on less-polluting energy technologies is fostered by high permit prices, but it nonetheless requires a large initial subsidy for technology. Carbon leakage may entail a substantial extra cost to the EU in terms of economic growth.

## 5. Dissemination of the Results

The strategy for disseminating the project findings involved the elements presented below.

- 1) The project's website (<http://www.taxben.org>) was created and updated, onto which all the deliverables and the key presentations at the project seminars have been uploaded. In addition, the research documents have been made available on the websites of the respective partner institutes.
- 2) A policy-oriented final conference was arranged and held on 27 November 2006 at CEPS in Brussels with around 100 participants. The presentations by the work package leaders of the TAXBEN project stimulated comments and discussion by key EU officials in the field among others.
- 3) Other seminars were organised that also involved the presence of key representatives of the European Commission:
  - A seminar on WP 2 (tax competition) was held on 17-18 December 2004 in Prague. The seminar was also devoted to policy issues. There was a view of taxation in the EU-15 and in the new member states. Then, the pros and cons of the EU proposal concerning the harmonisation and consolidation of tax bases were discussed. The workshop ended with a roundtable on tax coordination;
  - A kick-off meeting of the project was held on 21 January 2005 in Brussels;
  - A seminar on WP 1 (employment) was held on 29 June 2005 in Tallinn;
  - The first full project workshop was held on 9 September 2005 in Helsinki;

- A seminar on WP 4 (macroeconomics of tax systems) was held on 19 January 2006 in Paris;
  - A seminar on WP 3 (EU convergence) was held on 20 January 2006 in Paris;
  - The second full project workshop was held on 15-16 June 2006 in The Hague; and
  - A seminar on WP 5 (climate change and energy taxation) was held on 9 October 2006 in Brussels.
- 4) Related publications and articles were produced. In addition to the deliverables (see appendix 1), other publications were produced by the project team:
- Based in part on the results reached in WP 1 and WP 3, the team at ETLA also published the study by K. Alho, V. Kaitila and M. Kotilainen, *Employment and Productivity – An Assessment of the Effects of Economic and Labour Market Policies* (in Finnish), Employment Studies No. 317, Finnish Ministry of Labour, 2006.
  - A report was presented to the Estonian Ministry of Social Affairs by A. Võrk and A. Paulus, *Eesti sotsiaaltoetuste ja maksude mõju inimeste töödõupakkumise stiimulitele* [Analysis of labour supply incentives in the Estonian tax/benefit system], PRAXIS, Tallinn, 2006 (available at [http://www.praxis.ee/data/VorkPaulus\\_PRAXIS\\_Stiimuliteanalyy.pdf](http://www.praxis.ee/data/VorkPaulus_PRAXIS_Stiimuliteanalyy.pdf)). It included the presentation of the preliminary results of Deliverable No. 7A.
  - L.J.H. Bettendorf, J. Gorter and A. van der Horst published the report, *Who benefits from tax competition in the European Union?*, as CPB Document 125, CPB, The Hague, 2006.
  - L.J.H. Bettendorf and A. van der Horst wrote the report, *Documentation of CORTAX*, as CPB Memorandum 161, CPB, The Hague, 2006.
  - Deliverable No. 11B, “Short-term fiscal spillovers in a monetary union” by A. Bénassy-Quéré, was presented in “Focus”, *CEPII Newsletter*, No. 31, 4<sup>th</sup> Quarter, 2006 (available at [www.cepii.fr](http://www.cepii.fr)).
  - Deliverable No. 24, “Changing Patterns of Domestic and Cross-Border Fiscal Policy Multipliers in Europe and the US” by A. Bénassy-Quéré and J. Cimadomo, was also presented in “Focus”, *CEPII Newsletter* No. 31, 4<sup>th</sup> Quarter 2006 (available at [www.cepii.fr](http://www.cepii.fr)).
  - K. Alho and V. Kaitila wrote two articles on the preliminary results of the project for the *Prima* magazine of the Confederation of Finnish Employers (Nos. 4 and 7, 2005).
- 5) Other conference and seminar presentations were organised, as listed below.
- The results of the project were presented by K.E.O. Alho from ETLA at a conference organised by the Finnish Ministry for Labour in September 2005 and at a seminar of Finnish economists working in employer organisations in October 2005, in Helsinki. Results of Deliverable No. 4 were presented by K.E.O. Alho at ETLA seminars in May 2006 and November 2006.
  - The work by PRAXIS was presented in the public lecture by A. Võrk, “Töötamise stiimulid Eesti maksu- ja sotsiaaltoetuste süsteemis” [Incentives to work in the Estonian tax/benefit system], at the Estonian Ministry of Finance on 13 September

2005. The lecture referred to the TAXBEN project and presented the preliminary results of Deliverable No. 7A (available at [http://www.praxis.ee/data/PRAXIS\\_taxben\\_employment.pdf](http://www.praxis.ee/data/PRAXIS_taxben_employment.pdf)).

- Horst from CPB gave the presentation, “Corporate income taxation in Europe”, to the Dutch Ministry of Finance on 23 May 2006, in The Hague. He also gave the presentation of the same title at the “Conference on Subsidiarity in Europe”, on 9 November 2006 in Brussels.
  - J. Gorter from CPB gave the presentation, “Mondialisering en vennootschapsbelasting” [Globalisation and the corporate income tax] on 28 September 2006 at the University of Groningen.
  - S. Boeters from CPB presented his work, “Autonomous energy efficiency increases and marginal abatement costs in long-term energy-economy scenarios”, which elaborates on some methodological aspects of WP 5, at the “Workshop on Economic Policy Modelling”, on 22-24 January 2007 in Oslo.
  - Deliverable No. 24, Changing Patterns of Domestic and Cross-Border Fiscal Policy Multipliers in Europe and the US by A. Bénassy-Quéré and J. Cimadomo (also available at [www.cepii.fr](http://www.cepii.fr)), was presented at a seminar at ECARES – Free University of Brussels, in February 2006 in Brussels. It was later presented at a seminar at the Centre for European Integration Studies (ZEI), in June 2006 in Bonn and at the “Annual Conference of the French Economic Association”, in September 2006 in Paris.
  - In addition, A. Bénassy-Quéré has used the various outcomes of TAXBEN (not only those derived by CEPII) in her speeches at the French Ministry of Finance, in the media and elsewhere.
- 6) After completion of the project, there is an aim to further disseminate the project’s results through various working paper series, if not yet published in this form, and in journal articles. In particular, so far, the following submissions have been made:

Adjemian, S., F. Langot and C.A. Quintero Rojas (2006), “Growth, Unemployment and Tax/Benefit Systems in European Countries: Theoretical and Empirical Investigations” (Deliverable No. 16B), CEPREMAP, Paris, to the *Journal of Evolutionary Economics*.

Chéron, A., J.-O. Hairault and F. Langot (2005), “A Quantitative Evaluation of Payroll Tax Subsidies: A Structural Approach, a Reform of the French Tax/Benefit System” (Deliverable No. 6A), CEPREMAP, Paris. This paper has been accepted for publication in the *Journal of Public Economics* in 2008 under the title “A Quantitative Evaluation of Payroll Tax Subsidies for Low-Wage Workers: An Equilibrium Search Approach”.

————— (2006), “Labor Market Institutions and Unemployment in France vs. in the UK: A Wage Posting Investigation” (Deliverable No. 6B), CEPREMAP, Paris, to *Labour Economics*.

Boeters, B. “Autonomous Energy Efficiency Increases and Marginal Abatement Costs in Long-Term Energy–Economy Scenarios” (which elaborates on some methodological aspects of WP 5), to be submitted to the *Energy Journal*.



Bénassy-Quéré, A. “Short-term Fiscal Spillovers in a Monetary Union” (Deliverable No 11B), to be submitted to the *Journal of Policy Modelling*.

Delbecq, A. and A. Lahrière-Révil (2007), “Do EU Member States Compete on Social Systems?” (Deliverable No. 9B), submitted to the Spring Meeting for Young Economists (SMYE) in Hamburg in May 2007 and to the “Annual Conference of the Research in International Economics and Finance (RIEF)” Network in Rome, June 2007.

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- Alho, K.E.O. and N. Nikula (2007), *Productivity, Employment and Taxes – A SVAR Analysis of the Trade-offs and Impacts*, ETLA Discussion Paper No. 1074, ETLA, Helsinki.
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## Appendix 1. List of the Project Working Papers

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- Adjemian, S., F. Langot and C.A. Quintero Rojas (2006), *Growth, Unemployment and Tax/Benefit Systems in European Countries: Theoretical and Empirical Investigations* (Deliverable No. 16B), CEPREMAP, Paris (available at <http://www.taxben.org>).
- Alho, K.E.O. (2006), *Labour Market Institutions and the Effectiveness of Tax and Benefit Policies in Enhancing Employment: A General Equilibrium Analysis* (Deliverable No. 4), Discussion Paper No. 1008, ETLA, Helsinki (available at <http://www.taxben.org>).
- (2006), *Climate Policies and Economic Growth* (Deliverable No. 13), Discussion Paper No. 1024, ETLA, Helsinki (available at <http://www.taxben.org>).
- (2006), *Structural Reforms in the EU and Political Myopia in Economic Policies* (Deliverable No. 21), Discussion Paper No. 1050, ETLA, Helsinki (available at <http://www.taxben.org>).
- Alho, K.E.O. and N. Nikula (2006), *Productivity, Employment and Taxes – Evidence on the Potential Trade-offs and Impacts in the EU* (Deliverable No. 16C), Discussion Paper No. 1054, ETLA, Helsinki (available at <http://www.taxben.org>).
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- Bettendorf, L., J. Gorter and A. van der Horst (2006), *Who Benefits from Tax Competition in the European Union?* (Deliverable No. 19), CPB Document No. 125, CPB, The Hague (available at <http://www.taxben.org>).
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- (2006), *Labor Market Institutions and Unemployment in France vs. in the UK: A Wage Posting Investigation* (Deliverable No. 6B), CEPREMAP, Paris (available at <http://www.taxben.org>).

- Delbecque, V. and A. Lahréche-Révil (2006), *Do EU Member States Compete on Social Systems?* (Deliverable No. 9B), CEPII, Paris (available at <http://www.taxben.org>).
- Kaitila, V. (2006), *Productivity, Hours Worked, and Tax/Benefit Systems in Europe and Beyond* (Deliverable No. 16A), Discussion Paper No. 1015, ETLA, Helsinki (available at <http://www.taxben.org>).
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## Appendix 2. Status of the Agreed Deliverables

All the agreed deliverables have been completed. The list of the original deliverables is presented in the Table A2.1. The additions and modifications made during the project are reported above.

*Table A2.1 Deliverables list*

<b>Del. No. *</b>	<b>Deliverable name</b>	<b>WP No.</b>	<b>Status</b>
1	Project presentation	1-6	Completed
2	Final plan for using and disseminating knowledge	1-6	Completed
3	Workshop on employment and tax/benefit systems	1	Held
4	Working paper: Reforms in tax/benefit systems and EU labour markets	1	Completed
5	First project workshop	6	Held
6	Working paper: European labour market performances	1	Completed
7	Working paper: Tax/benefit systems and employment in the accession countries	1	Completed
8	Workshop on tax competition in the EU	2	Held
9	Working paper: The tax/benefit systems in the EU under tax competition	2	Completed
10	Workshop on macroeconomic modelling of tax policies	4	Held
11	Working paper: Macroeconomics of the EU tax systems under EMU – Theory	4	Completed
12	Workshop on climate change policies and taxation in the EU	5	Held
13	Working paper: Potential growth of the EU and climate policies	5	Completed
14	Working paper: Optimal timing of GHG emissions reductions	5	Completed

*Table A2.1 continued*

<b>Del. No. *</b>	<b>Deliverable name</b>	<b>WP No.</b>	<b>Status</b>
15	Workshop on productivity growth and tax/benefit systems	3	Held
16	Working paper: EU catching up and reforms in tax/benefit systems	3	Completed
17	Deleted as NIER departed from the consortium	–	Deleted
18	Working paper: Labour market institutions and convergence in the accession countries	3	Completed
19	Working paper: Welfare effects of various forms of tax harmonisation	2	Completed
20	Working paper: Taxes and tradable permits in the EU to curb CO <sub>2</sub> emissions	5	Completed
21	Working paper: Structural reforms in the tax systems and their coordination in EMU	4	Completed
22	Second project workshop	6	Held
23	Working paper: Post-Kyoto policy options	5	Completed
24	Working paper: Results of the macroeconomic model on tax policies in the EU	4	Completed
25	Working paper: Survey of existing macroeconomic model results concerning spillovers	4	Completed
26	Working paper: Tax reform in EU countries	2	Completed
27	Final report of the project	1-5	Completed
28	Final conference on the results of the project	1-5	Held

\* Deliverable numbers are in order of delivery dates.

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CERGE-EI	Centre for Economic Research and Graduated Education, Charles University, Prague, Czech Republic
CPB	Netherlands Bureau for Economic Policy Analysis, The Hague, The Netherlands
DIW	Deutsches Institut für Wirtschaftsforschung, Berlin, Germany
ESRI	Economic and Social Research Institute, Dublin, Ireland
ETLA	Research Institute for the Finnish Economy, Helsinki, Finland
FEDEA	Fundación de Estudios de Economía Aplicada, Madrid, Spain
FPB	Federal Planning Bureau, Brussels, Belgium
IE-BAS	Institute of Economics, Bulgarian Academy of Sciences, Sofia, Bulgaria
IER	Institute for Economic Research, Bratislava, Slovakia
IER	Institute for Economic Research, Ljubljana, Slovenia
IHS	Institute for Advanced Studies, Vienna, Austria
ISAE	Istituto di Studi e Analisi Economica, Rome, Italy
NIER	National Institute of Economic Research, Stockholm, Sweden
NIESR	National Institute of Economic and Social Research, London, UK
NOBE	Niezalezny Osrodek Bana Ekonomicznych, Lodz, Poland
PRAXIS	Center for Policy Studies, Tallinn, Estonia
RCEP	Romanian Centre for Economic Policies, Bucharest, Romania
SSB	Research Department, Statistics Norway, Oslo, Norway
SFI	Danish National Institute of Social Research, Copenhagen, Denmark
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