

THE CONTRIBUTION OF PUBLIC FINANCES TO THE EUROPEAN GROWTH STRATEGY

Ana Lamo and Rolf Strauch***

The objective of the paper is to point out the impact of public finances in the context of the Lisbon growth strategy. Official communications from the Commission and ECOFIN Council note that public finances can contribute to achieving the goal of higher growth and employment via three mechanisms: (a) supporting a stable macro-economic environment, (b) making tax and benefit systems more employment friendly, and (c) redirecting public expenditures towards productive areas. This paper surveys the literature to investigate these channels, to quantify their impact and to identify conditions for their effectiveness. Based on empirical results in the literature, we conclude that there is substantial evidence to suggest that public finances can be considered a source of endogenous growth, but there remains considerable uncertainty regarding the size of their impact. This uncertainty emerges, among other factors, because the effectiveness of fiscal policies hinges on external conditions, such as the state of development. In addition, the link between these policy mechanisms and economic growth seems to have a non-linear functional form in the short and in the long-run.

1. Introduction – The European Growth Strategy

The European Council, meeting in March 2000 in Lisbon, set the new strategic goal for the European Union "... to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".¹ It proclaims a comprehensive strategy preparing the

* Econometric Modelling Division, ECB.

** Fiscal Policies Division, ECB.

The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank (ECB). The authors would like to thank Ludger Schuknecht, Gabriella Briotti, Christhart Bork and participants of the Banca d'Italia Workshop in Perugia for helpful comments and discussions. Any remaining errors are of course the sole responsibility of the authors.

¹ Conclusion of the Presidency, p. 2.

transition to a knowledge-based economy through better R&D, the spread of information technologies, stepping up of structural reforms for competitiveness and innovation, and by completing the internal market. Moreover, the appropriate macro-economic policy mix is considered an ingredient for a healthy economic outlook and favorable growth prospects. Many of the measures envisaged by the heads of states as part of a comprehensive strategy affect not only the regulatory setting but also public finances. If implemented, the Council considers "an average economic growth rate of around 3% [as] a realistic prospect for the coming years".²

In a follow up to the process initiated in Lisbon, the Commission and ECOFIN Council underscored that the "quality" of public finances plays a crucial role for growth and employment.³ In particular, public budgets can contribute to higher growth and employment via three mechanisms: (a) supporting a stable macro-economic environment through sustainable public finances, (b) making tax and benefit systems more employment friendly, and (c) redirecting public expenditures towards physical and human capital accumulation and encouraging technological progress.

The first mechanism builds upon and pushes further the consolidation process, which has been initiated since the start of the Maastricht process. In line with the principles set forth in the Stability and Growth Pact, fiscal policy can contribute to a stable macroeconomic environment through sustainable public finances avoiding disruptive fiscal adjustments. In addition, the cyclical fluctuation of the budget attenuates economic cycles, when governments do not replicate the errors of the past and engage in procyclical fiscal policies. In addition, it is argued that the challenges of aging populations need to be addressed to avoid excessive deficits in the future and preserve the sustainability of public finances.

The second mechanism, tax and expenditure reforms, aims at a sustainable reduction of the tax burden and more employment friendly tax and benefit systems. Any progress in reducing the tax burden however should not jeopardize the sustainability and appropriate cyclicity of public finances. In particular, the tax burden on labour as well as the marginal income tax rate should be lowered and benefit systems should be

² Conclusions of the Presidency, p. 2.

³ Report from the Commission and the (ECOFIN) Council to the European Council (Stockholm, 23/24 March 2001), The contribution of Public Finances to Growth and Employment: Improving Quality and Sustainability, (Press Release: Brussels, 12 March 2001 No. 6997/01).

reshuffled so as to make work pay and curb unemployment traps. According to the Commission and the ECOFIN Council report, reducing the tax wedge for low-paid workers and developing in-work benefits are instruments to bring labour back into work.

The third mechanism is the redirection of public spending to productive areas. Shifting public spending towards capital accumulation and technological innovation, as the Commission and the Council argue, needs to be compatible with the first and second mechanism. Therefore, it has to be based on the restructuring rather than the augmentation of public finances. In the official documents, particular emphasis is given to the areas of education and training as well as R&D. Increased investment in physical and human capital should complement and support private investment rather than substitute it. This requires the design of a comprehensive reform strategy setting incentives for private investment activities. Moreover, due consideration has to be given to the efficiency of investments, among others, by reaping the gains from public-private-partnerships for the development and implementation of projects.

The paper will discuss each of these three mechanisms in turn in the following sections. The main purpose of each section is, first, to briefly outline theoretical approaches provided in the literature, linking the respective mechanism to short-term and long-term growth. Then we survey the empirical literature in the field in order to find evidence of the quantitative impact of these mechanisms and the conditions for their effectiveness. Based on empirical results in the literature, we conclude that there is evidence indicating that public finances can be considered a source of endogenous growth, but considerable uncertainty remains regarding the size of their impact. This uncertainty emerges, among others factors, because the effectiveness of fiscal policies hinges on external conditions, such as the state of development. In addition, the link between policy mechanisms and economic growth often seems to have a non-linear functional form in the short- and in the long-run.

2. Supporting a stable macroeconomic framework via sound fiscal policies

This section focuses on the first channel. Its main purpose is to assess, by reviewing the empirical evidence and main theoretical arguments, under which conditions and to what extent sound fiscal

balances can enhance long-term growth and dampen short-term fluctuations, supporting a stable macroeconomic framework.

2.1 Public budgets and short-term macroeconomic stability

There are several demand and supply channels through which fiscal policies can affect economic activity in the short-run thus being able to contribute to a stable macroeconomic environment. Nevertheless, there is little consensus on the possibilities of fiscal policies affecting economic activity in a predictable way.

A good starting point to understand the macroeconomic implications of budget deterioration and consolidation is to contrast Keynesian and neo-classical theories about short-term macroeconomic impact. The impact on output is usually termed the fiscal multiplier. In a Keynesian framework, a tightening of fiscal policy can have temporary contractionary effects on output, and a fiscal expansion can temporarily raise output via the aggregate demand channel. The change in demand owing to a change in government expenditures or taxes affects output via private agents' reactions to the change in disposable income derived from the government's measures. The immediate fiscal multiplier of higher spending is bigger than the effect of a corresponding tax increase to finance these expenditures. Assuming no changes in investment, the multiplier would be exactly one if the rise in spending would leave the budget balance unaffected. However, if this assumption is changed the results may deviate considerably. Under these circumstances higher demand leads to an increase in interest rates, which in turn crowds out private investment. Therefore, the impact on aggregate output may be largely reduced or even reversed if supply side factors are fully taken into account.

The idea of a positive reaction of consumption to an increase in public spending strongly contrasts with the standard neo-classical view on how people react to fiscal expansions. In a neo-classical model an increase in public spending, would have a negative impact on private consumption due to the permanent income effect. In contrast to the Keynesian model, where consumption is oriented towards current income, the basic foundation of the neo-classical models is that people form forward-looking rational expectations. Individuals would anticipate that an increase in spending has to correspond to the net present value of the future tax

increases to finance it. They would therefore adjust their labour-leisure choice, reducing consumption, increasing labour supply and saving more.

In the neo-classical models of business cycles, the crucial condition is the elasticity of labour supply. If the elasticity of labour is high, labour supply increases, real wages fall and the marginal product of capital increases. If the response of labour and the positive effect on the marginal product is large enough, some households start to save more due to the high rate of return. Therefore, investment rises leading to an overall increase in output. If labour elasticity is low, the marginal product of capital, savings and investment do not change and overall output falls. On this score, as in the Keynesian theory a fiscal spending impulse may yield a positive output effect in the short-run, however, the composition of economic changes, that is the contribution of consumption or investment to the overall development, may be reversed.

The fact that neo-classical models are based on forward-looking agents implies that the multiplier depends on temporary and permanent characteristics of the fiscal expansion or consolidation balance. In general, a permanent increase in government spending should have a stronger impact on people's labour-leisure choice and therefore lead to a larger capital stock. As a consequence, output reduction as a reaction to a permanent fiscal expansion will be less than for a temporary expansion. A permanent expansion may even have a Keynesian-type multiplier larger than one (Aiyagari *et al.*, 1992). These effects are obviously very sensitive to the way spending increases are financed. They are essentially reversed if an expansion of public employment or distortionary taxation negatively affects labour supply and capital accumulation (Fatás and Mihov, 2000; Alesina and Perotti, 1997; Lane and Perotti, 1999).

However, it must be noted that the reaction of aggregate output in the Keynesian or neo-classical setting also depends on a number of other economic conditions.⁴ First, in an open economy the associated increase in the interest rate leads to capital inflow, the real exchange rate will appreciate and the external current account of the country and overall output deteriorate. This is the basis for the well-known finding that fiscal policy is unable to stimulate an open economy with a flexible exchange rate regime even in a purely Keynesian framework. Second, the crowding out of private activity would be larger if investment is rather sensitive to

⁴ On this issue see also IMF (2000) providing an excellent overview.

interest rates. Conversely, if investment is an increasing function of current income, an accelerator effect can generate sizeable fiscal multipliers, despite the crowding out effect. The same holds if excess capacity exists in the economy, which may be reduced through the fiscal expansion. Third, the impact depends on the reaction of monetary policy on the fiscal expansion. In general, the more sensitive the interest rate is to changes in income, the stronger the crowding out effect. Relaxing monetary policy could accommodate this. If this would happen as a surprise, one could indeed expect a positive output effect. If the accommodative monetary stance would be permanent, however, it would feed into inflationary expectations, and would not change output or even lead to the reversed effect in the longer run. Finally, the crowding out effect will also depend on the degree of price flexibility. If firms incur costs for changing prices, they are reluctant to do so and respond to a positive external demand shock, e.g. in the form of increased government spending, with an expansion of output. Thus, the output effect of a fiscal expansion increases in the degree of price stickiness, because it prevents an adjustment of prices from rising to an equilibrium level weakening aggregate demand. However, the same mechanism may also lead to a stronger crowding out of private investment. The increase of aggregate demand without a price adjustment implies a higher real interest rate, which in turn undermines investment activity.

Moreover, expectations about future government policies affect the risk premium on interest rates. When government debt is high and building up through an expansionary fiscal policy, interest rates will increase reflecting a higher default risk on debt and a larger inflation risk. Under these circumstances, a temporary easing should produce a larger positive multiplier than a permanent increase. The crucial aspect here is the credibility of the government to control public finances. If the government lacks this credibility, the risk premium may become sizeable and even lead to a negative multiplier. Depending on the conditions under which the fiscal expansion occurs, people's expectation about future policies can produce a non-linear reaction scheme, corresponding to Keynesian or non-Keynesian predictions. When debt is low and no quick reversal of a fiscal expansion is expected, the macro-economic reaction may be Keynesian. However, when the government eases fiscal policy, but it is widely perceived that the resulting development of the debt level is unsustainable, and that a large tax rise will be needed soon to correct this misalignment, the reaction of private demand could be non-Keynesian, because the fiscal expansion is associated with a loss of people's net wealth

(Sutherland, 1997). Alternatively, people may have the perception that government spending is continuously evolving into a direction requiring even higher levels of taxation. Under these circumstances, a fiscal contraction of cutting government spending could convince them that a certain critical state will not be achieved, and induce higher private consumption (Bertola and Drazen, 1993).

Although, explanations along these lines are often found in the literature, it should also be noted that non-linearities may also emerge from the financial market access of individuals. If the government consolidates, by lowering government spending expected future taxation decreases. The wealth and consumption of individuals not being credit constraint rise, while the disposable income of credit constraint individuals deteriorates. When the latter effect dominates, the overall effect on private consumption may be “Keynesian” and the government multiplier on private consumption is positive. Conversely, the aggregate reaction will be distinctively “non-Keynesian” when the former effect dominates. (Perotti, 1999).

Empirical evidence supports the Keynesian multipliers effects in normal circumstances. Studies on the short-term impact of fiscal policy have used a number of different approaches. Given the limitations of fiscal data below annual frequency, cross-sectional and panel data studies with annual data have been fairly widespread. Several studies on non-linear effects use extensively simple sample mean comparisons to distil the stylised facts on which the analysis is based (see Alesina and Perotti, 1995 and 1997) and a growing number of studies focusing on non-linear effects). Since this line of research often focuses on “strong fiscal consolidations”, cross sectional analyses are often supplemented by country case studies, with different degrees of detail. Model simulation is a well extended method of analysis. Traditionally international institutions use macro models e.g. the IMF’s Multimod model; but also neo-classical models have been used for simulation. More recent studies have introduced the use of time series techniques for the analysis of fiscal policy effects. In particular VAR models, which easily take account of the problem of endogeneity of fiscal policies, are present in most of the empirical analysis. (Some examples of studies using VAR are Ramey and Saphiro (1997), Edelberg *et al.* (1999) and Burnside *et al.* (1999) or Blanchard and Perotti (1999), Fatas and Mihov (2000) and Perotti (2002) for SVAR). Nevertheless, the usage of time series econometrics is relatively limited by the difficulty in finding

high frequency data, often focussing on individual countries for which fiscal data at a quarterly frequency is available.

Each of the specific methods has specific limitations. Yet, some of the problems should be enlisted: first, several authors try to overcome the problem of endogeneity with respect to the explanatory fiscal variable by using cyclically adjusted budget figures. But there is considerable controversy on how to appropriately correct fiscal variables for the impact of the cycle. Therefore empirical findings are probably subject to measurement errors and methodological qualifications. Second, the short-term perspective often does not allow us to fully capture the effect of fiscal policy measures, which may have long-run implications. This holds particularly for changes of social security payments, such as pensions. Thus it is notoriously difficult to assess the impact of fiscal policy reforms, which may have an expectational impact before they are actually implemented or may be particularly effective years after it has been approved due to (potentially unmeasured) exogenous changes. Third, the multiplier effect may be conditional on several state variables, such as the level of public debt etc, giving rise to non-linearities. Although some progress has been made in this direction a number of studies fail to account for this time-varying pattern of the multiplier to discriminate between different explanations for the effect. All this complicates the empirical analysis and certainly contributes to the fact that there is still considerable variation in empirical findings on fiscal multipliers.

In large scale macro-econometric models, a fiscal expansion is typically modelled as an increase of government purchases, without a corresponding increase in taxation. Simulations of fiscal multipliers for the G3 countries point to a positive short-term effect of fiscal expansions. The multiplier is above one in the short run and then slowly fades to ca. 0.5 or less in the medium-run. These findings are rather robust across different models. Country simulations for the G7 countries yield similar results, they point in a similar direction assuming a permanent increase of government non-wage expenditures of 1% of GDP. The sign of the multiplier is always positive. The size of short-term multipliers ranges from 0.6 to 1.1 if money supply is held constant and the exchange rate is allowed to float. When money supply is variable and the exchange rate fixed, it varies between 0.6 and 1.3 in the short run. The medium-run fiscal multiplier ranges from zero to 0.9 in the first setting and from 0.5 to 1.5 in the latter one. Moreover, there is little evidence that the monetary regime or inflation has an impact

on the size of the short-term fiscal multipliers (IMF, 2000, Koelln *et al.*, 1996).

Looking at components of domestic absorption, empirical results indicate a positive multiplier for private consumption.⁵ Simulations using the IMF multi-country model (MULTIMOD) indicate a multiplier of one in the short-run and minus one in the medium-run, potentially due to the stopping or tax rule imposed for the simulation exercise. For OECD countries, the estimated macroeconomic effect of a spending increase is 0.7 in “normal times”. However, the multiplier may become negative in difficult times of high debt levels, amounting to -0.4 . Overall, the results largely deviate from the predictions of neo-classical models (see also Fatas and Mihov, 2000, on this point). The picture is more ambiguous regarding the impact of public spending on private investment. The IMF multi-country model yields a multiplier of -0.6 in the short-run and essentially zero in the medium-run. Empirical estimates range from a sizeable positive multiplier of 0.7 to no impact in the short-run. For the medium-term horizon, they mostly indicate no impact, although one method yields a negative coefficient of -0.4 . For a sample of OECD countries, negative multipliers of -0.4 and -0.5 have been found for the short- and medium-term respectively.

Several empirical studies look at the non-linear effect of fiscal policy and its determinants. For European countries, evidence could be found that consumers behave in a non-Keynesian way when a country’s debt level is high and future taxation uncertain (Bhattacharya, 1999). Others look at the impact of the debt level on the reaction of private consumption to a fiscal expansion. Moreover the study finds some impact of credibility effects. When a fiscal consolidation seems particularly credible or persistent, it produces a larger negative multiplier (*ibidem*). For a sample of OECD countries, different constellations have been examined, producing the following results: first, fiscal contractions have a larger effect on the economy than fiscal expansions. Second, the effect of fiscal consolidations is non-linear. The otherwise Keynesian-type multiplier is strongly reduced for changes in taxes or spending, when it is associated with a large-scale contraction or expansion of the budget balance. Third, the non-linearity is not related to the debt level or growth of public debt (Giavazzi *et al.*, 2000).

⁵ This paragraph is based on Perotti (2000) if not indicated otherwise.

The implication of these findings for fiscal policy making is that fiscal policy can be conducive to smooth output and people's disposable income in normal circumstances.⁶ Therefore, the Council's recommendation to avoid pro-cyclical policies could have empirical support.

2.2 The impact of public budgets on long-term growth

Recent literature on endogenous growth theory predicts that policy changes can affect the long-term growth rate by influencing the determinants of growth (physical and human capital, technological change, employment and savings). Therefore, changes in public expenditure and taxes could boost employment, human capital accumulation or increase investment externalities that then would have effects on the growth rate of output. To enhance growth, fiscal policies should also be conducive to economic stability in the short run (see above).

The size and evolution of budget balances can have a direct effect on long-term growth via its impact on aggregate savings and investment and an indirect effect derived from the implications of deficits on inflation and economic stability. These effects are independent of the impact on growth derived from the size and composition of taxes and expenditures.

Aggregate Savings

The impact of public accounts on aggregate savings crucially depends on the prevailing relation of substitutability or complementary between public and private savings. If they are complements or imperfect substitutes a decrease in the structural deficit (increase in public savings) will lead to higher aggregate savings and therefore support long-run growth. This is in fact the finding of most of the literature.

The reaction of private saving to public dissaving is the underlying idea of the so-called Ricardian equivalence, which states that public deficits will leave aggregate savings unchanged since agents tend to see them as delayed taxes, and therefore will respond by increasing private savings to neutralise the public dissaving.

⁶ Nevertheless, the effectiveness of the positive fiscal multiplier through which fiscal policy can contribute to output stabilisation depends on a number of conditions, such as the exchange rate regime, the sensitivity of investment to interest rate changes etc.

There are some quite well known theoretical arguments both in favour and against the Ricardian equivalence (see, for example, Barro, 1974, Bailey, 1971 or Blanchard, 1985). The effects of public deficits depend on the time horizon, in infinite horizon models the Ricardian equivalence holds. The condition for it to hold when the planning horizons of agents are finite, is the existence of private transfers (bequests) between generations, so that the future burden for private agents of future generations is not ignored by the current generation. The existing empirical evidence is largely inconclusive, but tends to reject the hypothesis of a full offsetting of government deficits by private savings. Thus, fiscal policy affects the overall savings level and therefore the long-run growth prospects.

Most of the empirical work has focused on testing direct implications of the Ricardian equivalence, such as aggregate consumption or interest rates remaining unaffected by government deficits (see for example Feldstein, 1982, Kormendi, 1983, Hoelscher, 1986). Most of these studies relate to the USA, some exceptions are Bernheim (1987), and Giavazzi, Japelli and Pagano (2000). These type of studies suffer from methodological caveats that may invalidate the results, including measurement problems, simultaneity issues, treatment of non-stationarity, inappropriate treatment of expectations, etc. For a clear discussion on methodological aspects of the Ricardian equivalence tests see Seater (1993).

Some studies look directly at the correlation between private and public savings, for example Easterly and Rebelo (1993) find a negative and significant correlation, while Levine and Renelt (1992) only find a very fragile correlation. These studies also suffer from several limitations, namely, they lack statistical power due to small samples, they neglect the possibility that different shocks could offset the reaction of private saving to public dissaving and they, mainly, focus on contemporaneous behaviour to extract conclusions about the long run.

An alternative approach is to use time series techniques. Doménech, Taguas and Varela (1999) estimate the long-run response of national savings to public deficit using OECD data in the context of a structural VAR where they separate savings and deficit movements into two types of shocks associated with structural parameters of the economy. Their results indicate that private savings only offset a small fraction (less than 40%) of public dissaving.

Inputs accumulation

There are several channels through which fiscal deficit could affect inputs accumulation. High deficits could translate into *higher interest rates* therefore increasing the cost of investment in physical and also human capital with the consequent negative impact on long-term growth. This is the above-mentioned crowding out effect. If interest rates are sensitive to changes in demand expansionary fiscal policy could in a Keynesian framework of sticky prices lead to higher interest rates. Furthermore, if markets see the fiscal positions as unsustainable, the risk premium on interest rates will be high to the detriment of investment and long-term growth (See Bayoumi *et al.*, 1995, and Poterba and Reuben, 1999, 2001).⁷

Large deficits may also influence economic investment by contributing to *macro economic instability*. Most of the theoretical and empirical literature confirms the negative relationship between deficits and growth via inflation (typically seen as one of the most important indicators of macro instability). Large deficits may require monetization of the government debt and this will result in inflationary pressures undermining monetary stability. Sargent (1999) shows that under a persistent fiscal deficit, it is impossible to run a non inflationary monetary policy, while it is easy to do so if fiscal policy is tight. Similarly, the controversial fiscal theory of price determination argues that the price level is determined by the evolution of monetary aggregates only when fiscal policies are tight and solvent (see Sims, 1994, Woodford, 1994, 1995, Cochrane, 1998, and Canzoneri *et al.*, 1999).

High and volatile inflation can result in uncertainty in the markets, deteriorating the environment for private sector decisions and reducing the efficiency of the price mechanism, as absolute prices will fail to transmit the correct information on relative prices. This affects both the investment decisions and the efficiency of economic activity thus damaging long-term economic growth. Additionally, large deficits could lead economic agents to expect *a change of direction* in policies (i.e. a growing probability of higher inflation). This will also affect investment decisions.

Studies based on simple growth equations found a negative relation between *inflation* and economic *growth* (see Kormendi and Meguiri, 1985, Grier and Tullock, 1989, Barro, 1996, etc.). Similar results emerge from panel data work (e.g. Andres and Hernando, 1999). Judson and Orphanides

⁷ These authors also find that strict legal restraints on deficits lowers the risk premium.

(1996) found that inflation volatility is negatively and robustly correlated with growth at all levels of inflation.

Regarding the relationship between growth and deficits, some empirical studies show that deficit is a robust variable in growth equations, although the interpretation is not clear since as Earstely and Rebelo (1993) point out, this may be simple correlation due to automatic stabilisers.

3. Making tax and benefits more employment friendly

The current situation of the labour market in Europe is characterised by a declining trend in the employment rates, combined with some unpleasant structural features, among them an uneven distribution of unemployment across different groups in the labour market (concentrated mainly in younger and unskilled people), long-term unemployment, and geographical and skill mismatches. Well-articulated public spending could deliver the right incentives to reduce these problems.

Public expenditure affects labour demand and supply and, consequently, the determination of equilibrium employment. There is therefore a direct impact on human capital stock and economic growth. The way in which public expenditure affects employment is a complex issue, and the incentive and disincentive effects of public intervention need to be weighed carefully. For example, well-designed unemployment benefits provide important safety nets for people and allow workers to search longer for the most productive employment. However, this might lengthen the period of unemployment, which would have second-round effects on the productive potential of the economy, because long-term unemployed workers experience a depreciation of their human capital. But the drawbacks of social benefits are illustrated most clearly by their effects on labour supply, the unconditional payment of unemployment benefit or other social security benefits for a large period has been cited as an important disincentive to work and as one of the main causes of unemployment in Europe (Layard *et al.*, 1991, Blanchard and Wolfers, 2000). These kinds of benefits (even if temporarily) are subject to moral hazard problems and should be linked to active manpower policies (training, placement services, etc.) to help workers find a productive job.

Moreover little penalisation or even active encouragement of early retirement have reduced labour supply. Early retirement policies may

reduce the incentive for older people to continue to work and (as well as work-sharing policies) are counter-productive in the sense that the employment equilibrium will remain most likely unaffected. The reduction of the labour supply will result in wage pressures causing employment to fall (see for example, Layard *et al.*, 1991). Early retirement prospects also constitute a disincentive for workers to maintain professional skills and engage in lifelong learning. Furthermore, early retirement incentives can facilitate labour shedding even when dismissal is very difficult. As a result, firms needing to reduce employment would cut their older workforce. This may be the more experienced rather than the least productive staff.

Labour market policies can, when properly designed and implemented, enhance labour supply and demand and consequently the rate of employment. Training programmes can facilitate skill maintenance and upgrading, thereby reducing skill-mismatch and human capital degradation among the long-term unemployed. Another challenge is the re-integration of groups, which are difficult to employ, such as low-skilled people, the long-term unemployed and older workers. Other incentives to participate could be wage subsidies (or negative income taxes) for low paid jobs in order to make these jobs more attractive to workers.

As regards labour demand, the effect of taxes, social security contributions and minimum wage regulations on wages may be a problem for workers with low productivity (typically young and low skilled workers). In this case, wage subsidies could help these workers to find a job and become more productive. Wage subsidies can also be directed to employed by new enterprises, to help cover the initial cost of starting a business. Other active labour market policies are job search assistance and direct job creation.

The empirical evidence on the effect of these public policies comes from two different kind of studies. The macroeconometric studies, pioneered by Layard, Nickell and Jackman (1991), consist of estimating reduced forms of unemployment equations across countries. Expenditure on active labour market policies (as one of the institutional factors entering these equations) is found to be significant, and it is associated to lower unemployment. Similar results are those in Nickell and Layard (1999). Blanchard and Wolfers (2000) find that the relationship becomes insignificant when allowing for economic shocks. A number of country specific studies following a similar approach have been conducted and some of them, particularly those for Scandinavian countries, do not support the finding of most of the cross-countries analysis that active labour market

policies could contribute to lower unemployment. Macroeconomic studies typically suffer from several shortcomings, such as misspecification and omitted variables, measurement errors and simultaneity biases. Studies using microdata on specific episodes or schemes, or evaluating effects on particular industries, sectors, etc. give quite an ambiguous message depending on the data and on the empirical approach. Furthermore, it is adventurous to extract general policy implications from micro studies as they are based on specific countries, events and reforms. Overall, it could be concluded that training and subsidies are the active labour market policies that could play a role in increasing employment.⁸

All the potentially beneficial effects of public policies cannot be assessed independently of the impact of the taxes required to finance them. Labour taxes, including social contributions, which are the main source of financing for these policies, raise labour costs and drive a wedge between gross wages (paid by the employer) and net wages (received by the employee). The extent to which labour taxes translate into higher gross compensation or lower net earnings also depends on institutional factors, such as the functioning of the labour market and the wage bargaining process. As such factors differ across countries, one would expect different wages response across countries.

Under competitive conditions in the labour market, labour taxes will be mostly borne by workers, resulting then in a lower net wage.⁹ In this case decisions on labour supply will be influenced by an income and a substitution effect. According to the income effect, lower wages will increase labour supply in order to keep constant the income level. However, the substitution effect will induce a lower labour supply, as lower wages make leisure relatively cheaper in terms of labour. The net effect depends on the elasticity of labour supply to wages. This is difficult to measure due to the fact that different labour market groups have different sensitivities to wage fluctuations. Labour supply elasticities appear to be generally low for men. By contrast they are higher for women. Main household earners and single workers have an inelastic supply while secondary earners have a much more elastic supply. The empirical evidence finds very diverse estimates of labour supply elasticity. The

⁸ For an assessment of the impact of recent active labour market measures in Europe J. Morgan and Mourage (2002).

⁹ Also, wages will adjust differently depending on the type of labour taxes, evidence is that there are different adjustment speeds but not intrinsic long-run differences.

Congressional Budget Office (1996) has calculated an overall measure for the US using different estimates of between 0 and -0.3 . In Europe labour supply elasticity is likely to be higher given the lower female labour force participation.

By contrast, in the presence of rigidities, such as regulation and labour protection, partly decentralised systems of wage bargaining workers will not be willing to accept lower wages and employers will be the ones bearing the taxes, and therefore, they tend to reduce labour-demand. The extent to which producers cut employment is measured by the elasticity of labour demand with respect to real labour cost. This elasticity does not seem to be very high on average, but it is estimated to be higher for low-skill workers, who are often more easily replaced for physical capital and rationalisation than high skill workers.

Empirical work shows that generally labour-demand elasticities are much higher than overall supply elasticities, so that labour taxes tend to be more distortionary in countries where there are inflexible labour markets. Hence, most of the tax effects fall on the demand rather than on the supply of labour. Empirical evidence also shows that in most EU countries taxes have played an important role in raising wages (Cotins *et al.*, 1996).

The empirical studies on the effect of labour taxes on equilibrium employment and growth has followed three different approaches. The macroeconometric approach is the most developed. It consists of estimating reduced forms of unemployment equations, which show that labour income taxes do not significantly affect employment/unemployment level in Europe (e.g. Layard, Nickell and Jackman, 1991 and 1996, Bean, 1994, Blanchard and Wolfers, 2000). However, a similar study which accounts for countries' heterogeneity, particularly with respect to institutional features, finds that labour taxes are a major cause of unemployment in Europe (Daveri and Tabellini, 2000). These macroeconomic studies typically suffer from a number of shortcomings, such as misspecification and omitted variables, measurement errors and simultaneity biases.

An alternative approach is based on micro econometric techniques, relating to countries' specific experience (or quasi-natural experiment), as it might be in the case of Chile's pension reform or the adoption of a special insurance scheme in the US. These studies find that labour taxes are neutral in the long run (Gruber, 1997). This approach has important advantages with respect to the macroeconomic approach, as it avoids

simultaneity problems and singles out clearly the policy to be assessed and the scope to be evaluated. However, the main problem with this approach is the lack of generality of the results, as they are based on specific countries, events and reforms.

A third approach to test the effects of labour taxes on employment looks at dynamic model simulations. Pissarides (1998) simulates the impact on equilibrium employment of a linear employment tax using four alternative models of the labour market. The main conclusion is that this impact crucially depends on the unemployment benefit system. If unemployment benefits are indexed to wages, real wages absorb tax changes and therefore tax cuts will not have much impact on employment. In contrast, if unemployment benefits are fixed in real terms the employment effect of a tax cut can be large, a 10% cut in taxes could reduce equilibrium unemployment by up to 1 percentage point. Altenburg and Staub (2002) using a different model find also that the tax cuts impact depends on whether unemployment benefits are indexed to wages or to prices. In the first case, tax cuts are found to have adverse effects on employment, while if unemployment benefits are constant in real terms the effect of a tax cut is ambiguous. Daveri and Maffezzoli (2000) calibrate an infinite-horizon model with endogenous growth and unemployment on data for the largest EU countries and find that a 1% labour tax cut increases growth by about 0.2% when fiscal constraints do not bind and undo the positive effect of tax cuts.

Macromodel simulations are quite popular among national and international institutions. Some simulations using the EU Commission's Quest model (see Leibfritz *et al.*, 1997) explore the impact of a 1% of GDP cut in taxes. When labour income tax is reduced GDP goes up by 2% in the EU (vs. 3.7% in USA and 0.7% in Japan). The reduction in transfers and unemployment benefits has significant effects, according to these simulations, on employment as it lowers the reservation rate.

From the available empirical evidence it can be safely concluded that, on balance, it is often the combination of high labour taxes and generous benefit systems that results in employment disincentives. The disincentives are typically strongest for low-skilled/low-income workers.

4. Redirecting public expenditures towards physical and human capital accumulation

Redirecting public expenditures towards productive areas is the third mechanism identified by the Council and Commission communication. In principle almost all expenditures could be justified by this definition, as long as they contribute to social cohesion and well-being, and thereby have a positive impact on people's capacity to work. Nonetheless, the following sub-sections will focus on the three areas more directly linked to the production process: public infrastructure investment, education and human capital formation, and R&D investment.

4.1 Public infrastructure investment

The accumulation of physical capital is a key factor in the growth process. Governments contribute to physical capital accumulation by directly providing physical capital (public infrastructure), but government expenditures could also improve private capital productivity either directly or via the positive impact of public infrastructure on private activity.

Public infrastructure mostly consists of large capital intensive "monopolies" such as highways, some transportation facilities, water and sewerage pipes and communication systems. The conventional view is that public provision of this kind of investment contributes to growth by overcoming the problems associated with market provision. Infrastructures cannot be considered pure public goods. Therefore, the rationale for the government to get involved in their provision is their feature as natural monopolies. If private monopolists are allowed to charge prices above marginal cost, and have supranormal profits, large inefficiencies may arise in the market. In most industrialised countries, governments have directly provided a large part of the infrastructure. In recent years this role of the government has been questioned due to inefficiencies in the production of infrastructure. This disenchantment may have also contributed to the current tendency to engage in public-private partnerships or out-source infrastructure investment to the private sector entity, which is regulated by public authorities.

A large number of studies have empirically investigated the effects of public infrastructure on private sector productivity and growth. The econometric techniques, samples and data sets vary considerably. The

widely cited study of Aschauer (1989a) estimates the impact of infrastructure on output in *an aggregate production function framework* and finds an elasticity of output with respect to public capital of 0.39 for the US. This finding would give public investment a prominent role as a “growth enhancing” mechanism and it fuelled the political debate on whether the low productivity growth in the 1970’s was due to a lack of public investment.

Aschauer himself, as well as others, extended the sample to a small number of industrialised countries. These studies generally find a positive effect of public infrastructure investment on productivity growth, although it is not always robust to the choice of the econometric specification. Aschauer (1989b) finds for the sample of G7 countries an output elasticity of even 0.41. Seitz (2001) reports for a sample of 13 OECD countries, including the G7, estimates of 0.12 to 0.17. This is relatively close to the coefficient of 0.18 found by Evans and Karras (1994) for seven developed economies.¹⁰ These small samples, on the one hand, have the advantage of including a fairly homogeneous set of countries, but on the other hand, results may largely depend on individual country performance. This problem has been overcome by a series of studies, started by Barro (1991), using a worldwide sample of countries. Among others, Barro and Lee (1994) find a positive relationship between total investment and per capita growth. In addition, they cannot find any significant impact of public investment measured as a share of total investment. This implies that the return on public capital is similar to private investment and the contribution of each component is therefore not relevant.

The previously quoted work was heavily criticised on different methodological and economic grounds. First, it has been argued that the finding may be driven by “reversed causation”. Governments would then tend to invest more in periods of high growth and public investment would be a superior good to them. This argument however, could be invalidated by empirical evidence in other studies suggesting that the direction of causation indeed goes from investment to growth.¹¹ Second, Aschauer’s

¹⁰ The latter authors cannot find an effect significantly different from zero for all specifications, but it is unclear how reliable these specifications are since they produce at the same time highly unlikely values for private production factors.

¹¹ Apart from using instrumental variables, the evidence against ‘reversed causation’ essentially builds upon the differentiated pattern between public investment and output. If public investment were a superior good for governments, one would expect a broad increase in overall investment during upswings. However, the expected positive correlation can only be found for specific areas of (continues)

finding could be the result of the “spurious regressions” problem and it has been argued that the coefficient is therefore too large. As a consequence, growth equations should be estimated in first differences. Estimating the impact of public investment on output in first differences, in fact, yields much weaker and sometimes inconclusive results. But this does not apply to all countries. De la Fuente (2000) shows that estimates for the US states become contradictory, while those for Spanish regions rather robustly indicate an elasticity of close to 0.1. Therefore, it may be rather the size of the coefficient than the effect per se which seems questionable. Finally, it has been argued that the study controlled insufficiently for other possible determinants of growth. The common pattern of decline in productivity and public investment could in fact emerge from a third factor, such as the increase in energy prices. However, the Barro-type growth equations include a large amount of control variables, so that a simple omitted variables bias is rather unlikely.

The last issue can also be understood differently. An important question is whether the impact of public investment is *conditional* on other factors. For example, Demetriades and Mamuneas (2000) use a panel for 12 OECD countries and estimate the impact on output growth per capita individually for each country. The output effect of infrastructure investment varies in the range of 0.36 to 2.0. Similarly Ford and Poret (1991), replicating Aschauer’s analysis for eleven OECD countries find a consistent positive correlation between investment and productivity growth in only five cases. The implied marginal product of infrastructure ranges from 0.45 in the United States to 1.7 in Germany. We are not aware of studies analysing the complementarity or substitution between public investment and “third factors”, such as political and regulatory institutions, but two explanations for this differential impact can be put forward.

First, as mentioned above, the relationship between public investment and output or productivity growth may be non-linear, since public investment eventually may crowd-out private capital formation and become increasingly inefficient. The impact should therefore vary across countries depending on their stock of capital or public investment rate. De la Fuente (1997) investigates that issue for a sample of OECD countries. Using the investment to GDP rate, as a proxy for the public capital stock, and an interaction term of the investment rate with its log, he finds a

investment, such as productive infrastructure, or with respect to specific sectors of the economy, which heavily use these types of infrastructure. (see de la Fuente 2000).

non-linear effect, although the second term is not always statistically significant. According to these estimates, the elasticity of aggregate output with respect to the stock of public capital is around 0.20 for very low levels of investment. Then returns diminish rapidly. The point estimates of this non-linear relationship indicate that investment expenditures could only be expected to yield higher growth rates in countries which devote less than 2% of their GDP to public investment. These estimates however do not take into account the “saturation” of investment, i.e. the size and quality of the existing infrastructure stock. Therefore it may underestimate the growth effect, if the existing capital stock is small.¹²

Second, the type and sector of public investment instruments may be important. The composition of public investment could explain cross-country differences in the impact since the above evidence is generally based on aggregate investment figures. In their large-scale cross-sectional analysis, Easterly and Rebelo (1993b) distinguish the following sectors of public investment: education, health, housing and urban infrastructure, transport and communication, and industry and mining. They only find a consistently positive correlation growth for transport and communication, but no correlation with private investment. The return on investment is rather high, indicated by a coefficient of 0.6. Education and urban infrastructure investments do not yield a positive and significant estimate for all specifications.

The importance of infrastructure investment is corroborated by several studies looking at regions. In a study on the US states, Munnell (1992) finds that roads and the water supply networks have the largest positive impact on productivity. This is confirmed by a study of García-Milà and McCuire (1992) regarding public roads. Using a panel of Spanish regions, Mas *et al.* (1994) assess the impact of the stock of productive infrastructure, including transport, water supply and urban structure, on output. They find a positive and statistically significant coefficient. Similar results on the importance of core infrastructure are found by González-Páramo and Argimón (1997), and Dabán and Lamo (1999).

Finally, another group of papers more specifically looks at the effect of public investment and its complementarity with private production

¹² Interestingly, Kelly (1997) does not find diminishing returns to public investment for a sample of 56 low and middle income countries. Thus the non-linearity seems to be particular relevant for highly industrialised countries.

factors by estimating *cost functions*. The cost function approach allows us to determine the impact of public infrastructure investment on the demand for different private input factors in the production process. Thus, it answers the question of whether public investment, private investment and labour are substitutes or complements. Seitz (2001) analyses 13 OECD countries using an ERC-model. He finds a substitutive relationship between public infrastructure investment and labour, and a complementary effect on private capital. In other words, higher infrastructure investment leads to lower demand for labour and a higher demand for private capital. For both private factors the elasticity is close to 0.2, with an opposite sign however. This finding corroborates other evidence in the literature, partly based on regional panels (see Seitz, 2001 and Sturm, 1998).

In short, although the original estimate by Aschauer apparently is too large, there is reasonable evidence supporting a positive effect of public investment on growth. Still the effect does not seem to be linear. The differences in the contribution of public capital to a country's growth performance can depend on saturation with public investment and its quality. The most robust evidence for a positive effect exists for road construction and basic infrastructure provision in transportation and communication.

4.2 *Education and Human Capital*

Spending in education can be growth enhancing since it contributes to human capital accumulation and human capital provides one growth enhancing mechanism in endogenous growth theory. This is basically due to its character of non-rival and non-excludable good, which decrease the chances of encountering the diminishing returns typical of exogenous growth models.

In most industrialised countries, spending in education is typically shared by the private sector and government. The idea is that the government does not substitute private spending, but complements it. The role of the government in financing education expenditure is justified by several markets failures that will otherwise result in sub-optimal provision of education. Individuals only take into account private returns to education, when they decide on how much to invest in their human capital. The social returns on schooling, arising because educated workers are more productive, able to adapt to technological change, able to take care of

themselves, etc. are not necessarily internalised by the individual. Therefore, the socially optimal level of investment in education may be higher than the private one and individuals may be inclined to invest less than is socially optimal in education. Even if the private incentives to invest in education exist, the lack of collateral in imperfect credit markets can make it impossible for many individuals to finance their education. Similarly, firms have no incentive to provide on-the-job training if trained workers can leave the company. Government subsidisation of education and training is therefore important for an optimal provision.¹³

Several authors propose growth models where endogenous growth is associated with public provision of education (see e.g. Saint-Paul and Verdier, 1993). In these models, generally, human capital is either understood as a direct production input or as a condition for technological innovation and productivity increases. Empirical studies addressing the link between human capital and growth have followed several approaches. A first one explores the relationship between education attainment and earnings using *micro data*, usually estimating wage equations.¹⁴ The focus here is necessarily on the private returns on education. Different data sets and samples find that an additional year of schooling adds from 5 to 15% on earnings (Ahn and Hemmings, 2000 and Temple, 2000). A major problem here is the interpretation of the results, i.e. whether education itself contributes to the rate of return or whether it actually measures the impact of other variables. If more gifted individuals have relatively high earnings and also chose to invest more in education, then the two phenomena are correlated and estimates may actually overstate the impact of schooling. A plausible approach to explaining a positive correlation between schooling and individual ability argues that individual's use longer schooling to "signal" their personal capacity, since individual ability is not observable by the employer. Therefore, the above estimate on the private return on education should be taken with caution, even though some variables, such as family background and native ability, can be evaluated fairly easily.

A second approach directly investigates the contribution of human capital accumulation to economic growth by estimating cross-country regressions *à la* Barro using *macro data*. Different proxies of human

¹³ On how the public sector could provide/finance education while minimising the market distortions see Tanzi and Schuknecht (2000).

¹⁴ See Card (1999) for an overview.

capital have been tried. Often researchers have used schooling at different levels to operationalise human capital formation. In several studies, schooling appears insignificant or has the wrong sign, particularly when the equations are estimated using panel specification (see in particular Pritchett, 1997 and Benhabib and Spiegel, 1994). However, more recent evidence casts doubts on the robustness of these results for various reasons: misspecification of the equation (Topel, 1999 and De la Fuente and Domenech, 2000), unrepresentative outliers in the sample (Temple 2000), measurement error (Krueger and Lindhal, 2001 and De la Fuente and Domenech, 2000).

Correcting for some of these problems, by cleaning and adjusting data, provides more encouraging evidence on the growth enhancing impact of human capital formation. De la Fuente and Domenech (2000) consistently find a positive impact of education, measured as the average number of years of schooling of the adult population, on total factor productivity in OECD countries. This finding holds for estimates based on five-year averages of educational levels as well as first differences. In addition, specification tests indicate that the assumption of constant coefficients across countries and a linear relationship between education and growth does not fit actual data very well. Correcting for the constant coefficient problem, Krueger and Lindhal (2001) then find for a worldwide sample of countries that changes in educational attainment have a sizable positive impact on growth, whereas the initial stock of human capital does not exert a systematic influence.

These results for overall human capital formation raise the question of the specific contribution of public provision of education and the impact of different levels of schooling. Empirical studies on the contribution of public education services on growth partly corroborate the results for human capital formation in general. Among others, Mankiw *et al.* (1992), Kneller *et al.* (1999) have included public spending in education as a variable in the growth equation specification finding a small, yet positive effect of education spending on growth. Recent papers use *time series techniques* (VAR) to model the joint dynamics of output growth and different kinds of public expenditure including education. Cullison (1993) finds that government spending in education and training has statistically and numerically significant effects on future economic growth. Unfortunately, we are not aware of any study explicitly analysing potential substitution effects between public and private investment.

Most studies on the return (private and social) of the different stages of education find diminishing returns of education, primary education being the one with highest returns (Wolff and Gittleman, 1993, and Judson, 1998) Results for secondary and tertiary education are contradictory (see Barro and Sala-i-Martin, 1995, and Psachorapoulos, 1994). However, these studies face difficulties in accounting for the exact impact and externalities of education. In particular, these results are usually found for a very heterogeneous set of countries, including low income as well as high-income industrialised countries. Thus, a more homogeneous set of industrialised countries could lead to different results. Second, these findings refer to average rates of return, while marginal rates may be more relevant for individual investment decisions and technological progress. Finally, they neglect the interaction between different levels of education. Therefore it remains rather unclear whether European countries could actually expect higher rates of return by funnelling more resources into primary, as compared to secondary and tertiary education.

4.3 Technological Change – The Role of R&D

Investment in research and development (R&D) is a key factor in determining technological change and innovation and therefore promoting growth. Examples of R&D-driven endogenous growth models are Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992) and more recently Jones (1995), and Segerstrom (2000). Investment in R&D leads directly to the creation of innovation and new technologies of the investing firm. The central idea behind the endogenous growth literature, again, is that the non-rivality and less than full excludability of knowledge means that there are “technological spillovers” and the social returns of investing in R&D may diverge from private returns. As a consequence the private sector may not invest at the socially optimal level, and government involvement correcting the market failure in the production of scientific and technological knowledge may be warranted.

There are several types of spill-overs:¹⁵ a *rent spill-over* emerges if the innovation in an intermediate good cannot be fully captured by the monopoly supplier, but also goes to the user; a *knowledge spill-over* emerges when the technological know-how can be freely borrowed or

¹⁵ The following classification is based on Jones and Williams (2000) and also used in Ahn and Hemmings (2000:22).

adopted from others. Moreover, there is *creative destruction* if the invention of a new product or technology makes the old one less attractive or even obsolete. Finally, there may be congestion externalities, for example, if several firms run the same research with the hope to patent first, and they thus multiply research efforts. While the social returns tend to be higher for the first two spillovers, the reverse may hold for the latter two cases, and the overall effect of these externalities on the social rate of return of R&D activity is unclear.

What then is the empirical effect of R&D on output? There are two main measures for the contribution of R&D investment, public and private, on output growth. Using a Cobb-Douglas *production function approach*, often the effect of the stock of R&D capital and other inputs on total factor productivity has been estimated. Alternatively, the rate of return on R&D, measured as a share of sales or output, with respect to the total factor productivity has been assessed. The estimated magnitude of the elasticity of output with respect to the total stock of R&D and the rate of return vary substantially, depending on the type of data, the method of estimation, and the unit of analysis (firm, industry or country). Nonetheless, according to Nadiri (1993) the overwhelming evidence from the 1970s onward indicates a positive effect of R&D on output and productivity. The estimates of the elasticities of total factor productivity with respect to R&D, mostly gained from studies on the US, range from 8% and 30% and the estimates of the rate of return between 20% and 40%. Firm or industry studies on individual countries are less numerous for other countries and therefore provide less basis for comparison.

However, cross-sectional studies indicate that there are differences in the impact of R&D. Griffith *et al.* (2000) also provide a rationale for these differences by distinguishing the effect of R&D investment on innovation and technology transfer. They find that investment has a positive statistically significant relation with both the rate of innovation and technology transfer. Therefore they argue that R&D investment not only furthers total factor productivity through innovations, but also the *absorptive capacity* to adopt and imitate new technologies from other industries or from abroad. Adoption of technologies is an important factor, which raises the rate of return on R&D investment in catching-up countries. For example, for the United States, which maintained the frontier of total factor productivity in manufacturing throughout most of the sample period, the effect of R&D on total factor productivity consists almost entirely of its effect on the rate of innovation. By comparison, in an

economy such as Finland, where the average level of relative total factor productivity was roughly 50%, the total effect of R&D is more than twice as large as its effect on the rate of innovation. Moreover, the authors find that increases in educational attainment support innovation and technological transfers.¹⁶

The overall positive impact of R&D however does not identify the role of public finances in contributing to technological progress. Policy-makers have different instruments at their disposal to support private research activities. First, the public sector itself engages directly in research activities through public laboratories etc. The purpose here is usually to satisfy public needs and to provide the basic knowledge that can be used in the applied work of firms. Second, the public sector contracts out research activity and provides research grants or subsidies. R&D contracts are particularly important in the area of defense. Public grants and subsidies similarly allow the targetting of specific firms or projects that are either directly useful to the governments objectives or carry a high social return. Finally, the government can provide tax breaks or credits for R&D activities, which for the purpose of this survey we consider “tax expenditures”. This instrument is usually less discriminatory and does not directly intervene in the firms’ own research strategies.

The effects of these instruments on private R&D investment are not uniform and unambiguous, since they can be complements or substitutes of private R&D activities. (see David *et al.* 2000). For example, tax credits generally allow the private agent to choose the investment project and directly lower the marginal costs of that project. Therefore, one would not expect a “crowding out” effect as long as the input costs of the agent are not adversely affected. Input costs could rise if, for example, qualified labour supply is inelastic and demand increases due to tax measures. Public grants or contracts, in principle, should focus on those areas where there is a strong divergence of individual and social rates of returns, and therefore no displacement of investment should occur. However, this is not guaranteed since government projects could directly replace activities which the private sector would have undertaken anyway. Moreover, the fact that some firms receive government contracts or subsidies may lower the expected rate of return of those who did not and therefore lead to less

¹⁶ These findings on a countries absorptive capacity go in line with the result of Gittleman and Wolff (1995) who find that R&D activity contributes to the explanation of differences in per-capita output in developed economies, but not in less developed ones.

private R&D activities. The displacement effect through higher input prices may also similarly emerge using this policy instrument. Of course this would also hold for direct public R&D activities through universities etc. Summarizing these different forces, David and Hall (1999) argue it is more likely to see a complementary net effect of public involvement where the relative size of the public sector in total R&D input is small, where the elasticity of labour supply is high, and where the rate at which the private marginal yield of R&D decreases more gradually with increased public R&D expenditures.

The empirical research on R&D, according to Nadiri (1993), suggests that the rates of return on privately financed R&D are much higher than those on publicly financed R&D. This finding may be due to the fact that public research is more oriented towards basic knowledge and has no direct impact on total factor productivity. It could also emerge from a substitution effect between public and private investment, lowering the combined effect on output. However, in a review of a large number of studies on the impact of public subsidies, David *et al.* (2000) find that a minority reports a net substitution effect when they are based on an industry or higher level of aggregation. Although the authors do refrain from drawing any definite conclusions, but rather point out the methodological and theoretical problems associated with these studies, it is unlikely that the lower rate of return could be unambiguously related to the substitution effect. By comparison, "tax expenditures" seem to be more efficient in fuelling R&D. As a conclusion of a broad literature review, Hall and Van Reenen (2000:449) conclude, based on the "the current (imperfect) knowledge [...] a dollar in tax credit for R&D stimulates a dollar of additional R&D". More specifically, Bloom *et al.* (2000) find for a sample of OECD countries that the impact elasticity of tax incentives on private R&D is small in the short run, about 0.1, but close to unity in the long-run.

An OECD (1999) study empirically investigates the impact of the different policy instruments, based on a sample of 17 OECD countries from 1983 to 1996, and draws several interesting policy conclusions: first, well designed government programmes have a leverage effect on private R&D investment; second, frequently redesigning policy instruments reduces their effectiveness; third, a piecemeal approach to technology policy is detrimental to its effectiveness since different policy measures may have complementary but also substitutive effects; fourth, providing

too low but also too high levels of support is similarly inefficient;¹⁷ fifth, defence related research seems to crowd out private business activity while civilian public research is neutral for business R&D; finally, the usefulness of university research can be improved through targeted government funding enhancing the transfer of technology.

Summarising the evidence, empirical studies indicate that R&D investment in the public and the private sector can make a contribution to enhanced growth. The rate of return seems to be particularly large in countries with an intermediate level of technological advancement, which are able to absorb outside innovations and technological advancements. The evidence on the complementary or substitutive effect of different policy instruments with respect to private R&D investment is not unambiguous. However, tax breaks or deductions seem to promote rather than displace private activity.

5. Conclusion

The conclusions of the European Council Meeting in Lisbon (March 2000) on the future growth prospects leave open which growth model actually reflects best its intentions.. Exogenous and endogenous growth models have substantially different implications for the impact of a policy variable on economic growth. Exogenous neoclassical growth models confine the impact of fiscal policy and other policy instruments to permanently changing the level of per capita output, but alter growth rates only temporarily during the transition path to this new steady state. By contrast, endogenous growth models predict that policy variables cannot only permanently change the output level, but also the growth rates. If an exogenous growth pattern were the prevailing in Europe, all we could expect from the European growth strategy proclaimed in the Lisbon Meeting is output speeding up in the short and medium run, but then levelling off again. Conversely, under an endogenous growth pattern the structural changes which the European Council envisages to make Europe a more integrated, competitive and productive economy would imply that trend growth rises permanently. In reviewing the literature we found some evidence supporting the role of public finances in providing

¹⁷ According to their estimates, the threshold is about 14% of business R&D (OECD 1999:4).

growth-enhancing mechanisms, not only in the short-run but also along the lines predicted by endogenous growth theory.

In a follow up of the process initiated in Lisbon, the Commission and the ECOFIN council pointed out three mechanisms through which public finances can contribute to achieve higher growth and employment. (i) Supporting a stable macro-economic environment, (ii) making tax and benefit systems more employment friendly, and (iii) redirecting public expenditures towards productive areas. This paper has reviewed the empirical and theoretical literature to assess the impact and effectiveness of these mechanisms.

The second section discussed the role of public finances in stabilising the economy and the importance of fiscal sustainability. The stabilising impact of fiscal policies and its short-run growth effect crucially hinges upon the sign and size of the fiscal multiplier. Evidence gained through empirical studies and simulations indicates that there is a relatively wide range of estimates of the size of fiscal multipliers. Generally, in those studies fiscal multipliers operate in line with Keynesian predictions in the short-run. The sign and size of multipliers however depends on the structure of the economy, such as its openness, interest rate elasticity etc., as well as the state of public finances. Non-Keynesian effects may prevail under exceptional circumstances, when credibility effects play a strong role and misalignments of public finances are severe. Then the budgetary reaction to economic fluctuations through automatic stabilisers, for example, could be ineffective or destabilising. Sustainable budgetary positions are also important for long-run growth. When high deficits contribute to inflation dynamics and higher interest rates, they affect capital accumulation. Although not entirely conclusive, the empirical literature indicates that “Ricardian equivalence” does not hold empirically and public balances can affect aggregate savings and capital accumulation.

As discussed in the third section, tax and benefit systems affect the human capital stock available in the economy and therefore economic growth. The empirical literature in the field provides some evidence that the social security system affects unemployment rates and wages; excessively generous benefit systems can undermine labour supply. At the same time, wages and the level of unemployment are empirically positively related to the level of taxation. As a consequence, labour taxes can have a negative impact on growth. Simulation studies also indicate an inverse relationship between labour taxation and growth. The magnitude of the

growth elasticity however differs substantially, ranging from 0.2% to 2% as a reaction of a 1% cut on labour income taxation.

Finally, productive public expenditures can provide a source of endogenous growth. But the impact of these spending flows on economic growth is not linear. Empirical studies on public infrastructure investment indicate decreasing returns depending on the available stock of capital. Evidence on decreasing returns is less conclusive for education expenditures and it is non-existent for R&D. Research on R&D rather indicates that the rate of return depends on the technological state of the economy. A minimum level of human capital and technological knowledge seems to be necessary to generate innovation and growth and to imitate new technologies. Countries at the technological frontier have a lower rate of return on technological investments than others. While they benefit from their innovation, others are in addition able to absorb and imitate their technological advancement. Regarding the substitutability or complementarity of public and private investment, little is known on the public and private provision of education services. For public infrastructure investment, empirical evidence points to a complementary relationship with private capital investment, but a substitutive effect on labour input. For public R&D the impact varies somewhat with the policy instrument. However, there is less conclusive evidence on a complementary relationship for public subsidies, which is more compelling for tax incentives for private R&D investment.

REFERENCES

- Aghion, P. and P. Howitt (1992), "A Model of Growth Through Creative Destruction", *Econometrica*, Vol. 60, No. 2, pp. 232-51.
- Ahn, S. and P. Hemmings (2000), "Policy Influences on Economic Growth in OECD Countries: An Evaluation of the Evidence", Paris, OECD, Working Paper 2000/19.
- Aiyagari, R., L. Christiano and M. Eichenbaum (1992), "The Output, Employment, and Interest Rate Effects of Government Consumption", *Journal of Monetary Economics*, No. 30, pp. 73-86.
- Alesina, A. and R. Perotti (1995), "Fiscal Expansions and Adjustments in OECD Countries", *Economic Policy*, No. 21, pp. 207-48.
- (1997), "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects", IMF Staff Papers, Vol. 44, No. 2, pp. 210-48.
- Altenburg, L. and M. Staub (2002), "Taxes on Labour and Unemployment in a Shirking Model with Union Bargaining", *Labour Economics*, No. 8, pp. 721-44.
- Andres, J., F. Ballabriga and J. Valles (2000), "Monetary Policy and Exchange Rate Behaviour In The Fiscal Theory of Prices", Bank of Spain Working Paper, No. 4.
- Andres, J. and I. Hernando (1997), "Does Inflation Harm Economic Growth? Evidence from the OECD", NBER, Working Paper, No. 6062.
- Aschauer, D. (1989a), "Is Public Expenditure Productive?", *Journal of Monetary Economics*, No. 23, pp. 177-200.
- (1989b), "Public Investment and Productivity Growth in the Group of Seven", *Economic Perspectives (Federal Reserve Bank of Chicago)*, Vol. 13, No. 5, pp. 17-25.
- Barro, R.J. (1974) "Are Government Bonds Net Wealth?", *Journal of Political Economy*, Vol. 82, No. 6 pp. 1095-1117.
- (1990), "Government Spending In a Simple Model of Endogenous Growth", *Journal of Political Economy*, Vol. 98, No. 5, Part 2, pp. 103-125.

- (1991), “Economic Growth in a Cross-Section of Countries”, *Quarterly Journal of Economics*, CVI(2), pp. 407-43.
- Barro, R.J. and J.W. Lee (1994), “Sources of Economic Growth”, *Carnegie-Rochester Conference Series on Public Policy*, Vol. 40, pp. 1-46.
- Barro, R.J. and X. Sala-i-Martin (1995), *Economic Growth*, New York, San Francisco, McGraw-Hill.
- Bayoumi, T., P. Masson and H. Samiei (1996), “International Evidence on the Determinants of Saving”, CEPR Working Paper.
- Bean, C. (1994), “European Unemployment: a Survey”, *Journal of Economic Literature*, Vol. 32, pp. 573-619.
- Benhabib, J. and M. Spiegel (1994), “The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-country Data”, *Journal of Monetary Economics*, Vol. 34, No. 2, pp. 143-74.
- Bernheim, G. (1987), “Ricardian Equivalence: an Evaluation of Theory and Evidence,” in S. Fischer (ed.), *Macroeconomics Annual*, NBER, MIT Press.
- Bertola, G. and A. Drazen (1993), “Trigger Points and Budget Cuts: Explaining the Effects of Fiscal Austerity”, *American Economic Review*, Vol. 83, No. 1, pp. 11-26.
- Bhattacharya, R. (1999), “Private Sector Consumption Behavior and Non-Keynesian Effects of Fiscal Policy”, IMF Working Paper, No. 112.
- Blanchard, O. and R. Perotti (1999), “An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output”, NBER Working Paper, No. 7269.
- Blanchard, O. and J. Wolfers (2000), “The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence”, *Economic Journal*, Vol. 110, No. 462, pp. C1-33.
- Bloom, N., R. Griffith and J. van Reenen (2000), “Do R&D Tax Credits Work? Evidence from a Panel of Countries 1979-97”, Institute for Fiscal Studies and University College, London.
- Bruno, M. and J. Sach (1985), “Economics of World-Wide Stagflation”, Harvard University Press, CA. MA.

- Burnside, C., M. Eichenbaum and J. Fisher (1999), "Assessing the Effects of Fiscal Shocks", mimeo, Northwest University.
- Canzoneri, M., R. Cumby and B. Diba (1999), "Is the Price Level Determined by the Needs of Fiscal Solvency?", Working Paper, Georgetown University.
- Card, D. (1999), "The Causal Effect of Education on Earnings", in O. Aschenfelter and D. Card (eds.), *Handbook of Labour Economics*, Vol. 3, Elsevier Science, pp. 1801-62.
- Carraro, C., M. Galeotti and M. Gallo (1996), "Environmental Taxation and Unemployment: Some Evidence on the 'Double Dividend Hypothesis' in Europe", *Journal of Public Economics*, Vol. 62, No. 1-2, October, pp. 141-81.
- Cochrane, J. (1998), "Long-Term Debt and Optimal Policy in the Fiscal Theory of the Price Level", National Bureau of Economic Research Working Paper, No. 6771.
- Congressional Budget Office (1996), "Labour Supply and Taxes", CBO Memorandum.
- Cotins, J.P., R. Méary and N. Sobczak (1996), "Le Chômage d'Équilibre en France: une Évaluation", Contribution française à la session de WPI de l'OCDE sur l'analyse du NAIRU, October.
- Cullison, W.E. (1993), "Public Investment and Economic Growth", Federal Reserve Bank of Richmond Economic Quarterly, Vol. 79, No. 4, pp. 19-33.
- Dabán, T. and A. Lamo (1999), "Convergence and Public Investment Allocation", Ministerio de Economía y Hacienda, Documento de Trabajo, No. d-99001.
- Daveri, F. and Maffezzoli, M. (2000), "A Numerical Approach to Fiscal Policy, Unemployment and Growth in Europe", Università Bocconi, Istituto di Economia Politica, Studi e Quaderni di Economia Applicata, EEA 2000, No. 4, May.
- Daveri, F. and G. Tabellini G. (2000), "Unemployment, Growth and Taxation in Industrial Countries", *Economic Policy*, April, pp. 47-104.
- David, P.A. and B.H. Hall (1999), "Hear of Darkness: Public-Private Interactions inside the R&D Black Box", Oxford University, mimeo.

- David, P.A., B.H. Hall and A. Toole (2000), "Is Public R&D a Complement or Substitute for Private R&D? A Review of the Econometric Evidence", *Research Policy*, No. 29, pp. 497-529.
- De la Fuente, A. (1997), "Fiscal Policy and Growth in the OECD", CEPR, Discussion Paper, No. 1755.
- (2000), "Infrastructure and Productivity: A Survey", CSIC, mimeo.
- De la Fuente, A. and R. Doménech (2000), "Human Capital in Growth Regressions: How Much Difference Does Data Quality Make", CSIC, Universidad de Valencia, mimeo.
- Demetriades, P.O. and T.P. Mamuneas (2000), "Intertemporal Output and Employment Effects of Public Infrastructure Capital: Evidence from 12 OECD Economies", *Economic Journal*, No. 110 (July), pp. 687-712.
- Doménech, R., D. Taguas and J. Varela (2000), "The Effects of Budget Deficit on National Saving in the OECD", *Economics-Letters*, Vol. 69, No. 3, December, pp. 377-83.
- Easterly, W., M. Kremer, L. Pritchett and L.H. Summers (1993), "Good Policy or Good Luck? Country Growth Performance And Temporary Shocks", *Journal of Monetary Economics*, No. 32, pp. 459-83.
- Easterly, W. and S. Rebelo (1993a), "Marginal Income Tax Rates and Economic Growth in Developing Countries", *European Economic Review*, 37.
- (1993b), "Fiscal Policy and Economic Growth: An Empirical Investigation", *Journal of Monetary Economics*, Vol. 32, No. 3, pp. 417-58.
- Edelberg W, M. Eichenbaum and J. Fisher (1999), "Understanding the Effects of Shocks to Government Purchases", *Review of Economic Dynamics*, Vol. 2, pp. 166-206.
- Evans, P. and G. Karras (1994), "Is Government Capital Productive? Evidence from a Panel of Seven Countries", *Journal of Macroeconomics*, Vol. 16, No. 2, pp. 271-79.
- Fatás, A. and I. Mihov (2000), "The Macroeconomic Effects of Fiscal Policy", Paris, mimeo.

- (2000), “Government Size and Automatic Stabilizers: International and Intranational Evidence”, mimeo.
- Feldstein, M. (1982), “Inflation, Tax Rules and Investment: Some Econometric Evidence”, *Econometrica*, Vol. 50, No. 4, July, pp. 825-62.
- (1982), “Government Deficits and Aggregate Demand”, *Journal of Monetary Economics*, Vol. 9, No. 1, pp. 1-20.
- Ford, R. and P. Poret (1991), “Infrastructure and Private-Sector Productivity”, *Economic Studies*, No. 17, pp. 63-89.
- García-Milà, T. and T. McGuire (1992a), “The Contribution to Publicly Provided Inputs to States’ Economies”, *Regional Science and Urban Economics*, 22(2), pp. 229-41.
- Giavazzi, F., T. Jappelli and M. Pagano (2000), “Searching for Non-Linear Effects of Fiscal Policy: Evidence from Industrial and Developing Countries”, *European Economic Review*, No. 44, pp. 1259-89.
- Giavazzi, F. and M. Pagano (1995), “Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience”, NBER Working Paper Series, No. 5332, Cambridge, MA, National Bureau of Economic Research.
- Gittleman, M. and E.N. Wolff (1995), “R&D Activity and Cross-Country Growth Comparisons”, *Cambridge Journal of Economics*, No. 19, pp. 189-207.
- González-Páramo, J.M. and I. Argimón (1997), “Efectos de la Inversión en Infraestructuras sobre la Productividad y la Renta de las CC.AA.”, in E. Pérez Touriño (ed.), *Infraestructuras y desarrollo regional*, Madrid, Civitas.
- Grier, B. and G. Tullock (1989), “An Empirical Analysis of Cross-National Economic Growth, 1951-80”, *Journal of Monetary Economics*, Vol. 24, No. 2, September, pp. 259-76.
- Griffith, R., S. Redding and J. van Reenen (2000), “Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries”, The Institute for Fiscal Studies, Working Paper, No. 02/00.
- Grossman, G.M. and E. Helpman (1991), *Innovation and Growth in the Global Economy*, Cambridge, MA and London, MIT Press.

- Gruber, J. (1997), "The Incidence of Payroll Taxation: Evidence from Chile", *Journal of Labor Economics*, pp. 72-101.
- (1998), "Health Insurance and the Labor Market", NBER Working Paper, No. 6762, October.
- Hall, B. and J. van Reenen (2000), "How Effective are Fiscal Incentives for R&D? A Review of the Evidence", *Research Policy*, No. 29, pp. 449-69.
- Hoelscher, G. (1986), "New Evidence on Deficits and Interest Rates", *Journal of Money, Credit and Banking*, Vol. 18, No. 1, February, pp. 1-17.
- International Monetary Fund (IMF), (2000), "The Effectiveness of Fiscal Policy in Stimulating Economic Activity – a Review of the Literature", Washington, DC, mimeo.
- Jones, C.I. (1995), "R&D-Based Models of Economic Growth", *Journal of Political Economy*, Vol. 103, No. 4.
- Jones, C. and J.C. Williams (2000), "Too Much of a Good Thing? The Economics of Investment in R&D", *Journal of Economic Growth*, No. 5, pp. 65-85.
- Judson, R. (1998), "Economic Growth and Investment in Education: How Allocation Matters", *Journal of Economic Growth*, No. 3, pp. 337-59.
- Judson R. and A. Orphanides (1996), "Inflation, Volatility and Growth", Federal Reserve System – Board Of Governors – Finance And Economics Discussion Series, No. 19, and *International Finance*, Vol. 2, No. 1, April 1999, pp. 117-38.
- Kneller, R., M.F. Bleaney and N. Gemmell (1999), "Fiscal Policy and Growth: Evidence from OECD Countries", *Journal of Public Economics*, Vol. 74, pp. 171-90.
- Koelln, K., M. Rush and D. Waldo (1996), "Do Government Policy Multipliers Decrease with Inflation", *Journal of Monetary Economics*, No. 38, pp. 495-505.
- Kormedi, R. (1983), "Government Debt, Government Spending, and Private Sector Behavior", *American Economic Review*, Vol. 73, No. 5, December, pp. 994-1010.

- Kormedi, R. and P. Meguiri (1985), "Macroeconomic Determinants of Growth: Cross-Country Evidence", *Journal of Monetary Economics*, Vol. 16, No. 2, September, pp. 141-63.
- Krueger, A.B. and M. Lindahl (2001), "Education for Growth: Why and For Whom?", *Journal of Economic Literature*, December, pp. 1101-36.
- Lane, P. and R. Perotti (1999), "The Importance of Composition of Fiscal Policy: Evidence from Different Exchange Rate Regimes", Dublin, mimeo.
- Layard, R., S. Nickell and R. Jackman (1991), *Unemployment, Macroeconomic Performance and the Labour Market*, Oxford, Oxford University Press.
- (1994), *The Unemployment Crisis*, Oxford, Oxford University Press.
- Leibfritz, W., J. Thornton and A. Bibbe (1997), "Taxation and Economic Performance", OECD/GD(97)107.
- Levine, R. and D. Renelt (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review*, Vol. 82, No. 5, pp. 942-63.
- Mas, M., J. Maudos, F. Pérez and E. Uriel (1994), "Capital Público y Productividad en las Regiones Españolas", *Moneda y Crédito*, No. 198.
- Mankiw, G., D. Romer and D.N. Weil (1992), "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, No. 107 (May), pp. 407-37.
- Mendoza, E., A. Razin and L. Tesar (1994), "Effective Tax Rates in Macroeconomics: Cross-Country Estimates of Tax Rates On Factor Incomes and Consumption", *Journal of Monetary Economics*, No. 34, pp. 297-323.
- Mendoza, E., G. Milesi-Ferretti and P. Asea (1997), "On the Effectiveness of Tax Policy in Altering Long-Run Growth: Harberger's Superneutrality Conjecture", *Journal of Public Economics*, Vol. 66, No. 1, pp. 99-126.
- Morgan, J. and A. Mourougane (2002) "The Impact of Active Labour Market Measures in Europe", mimeo, ECB.

- Munell, A. (1992), "Infrastructure Investment and Economic Growth", *Journal of Economic Perspectives*, Vol. 6, No. 4, pp. 189-98.
- Myles, G. D. (2000). "Taxation and Economic Growth", *Fiscal Studies*, Vol. 21, No. 1, pp. 141-68.
- Nadiri, M.I. (1993), "Innovations and Technological Spillovers", NBER, Working Paper, No. 4423.
- Nickell, S. (1997), "Unemployment and Labour Market Rigidities: Europe vs. North America", *Journal of Economic Perspectives*, Vol. 11, No. 3, pp. 55-74.
- Nickell, S. and R. Layard (1999), "Labour Market Institutions and Economic Performance", in O. Ashenfelter and D. Card (eds.), *Handbook of Labour Economics*, Vol. III.
- Organisation for Economic Co-operation and Development (OECD) (1999), "The Impact of Public R&D Expenditure on Business R&D", Paris, OECD (DSTI/STP(99)34).
- Pissarides, C.A. (1998), "The impact of Employment Tax Cuts on Unemployment and Wages; The Role of Unemployment Benefits and Tax Structure", *European Economic Review*, No. 42, pp. 155-83.
- Pritchett, L. (1997), "Where Has All the Education Gone?", World Bank, Policy Research Working Paper, No. 335.
- Psacharopoulos, G. (1994), "Returns to Investment in Education: A Global Update", *World Development*, Vol. 22, No. 9, pp. 1325-43.
- Perotti, R. (1999), "Fiscal Policy When Things Are Going Badly", *Quarterly Journal of Economics*, No. 114, pp. 1399-436.
- (2000), "What Do We Know About the Effects of Fiscal Policy", New York, mimeo.
- (2002), "Estimating the Effects of Fiscal Policy in OECD Countries", mimeo.
- Poterba, J. and K. Reuben (1999), "State Fiscal Institutions and the U.S. Municipal Bond Market", in J. von Hagen (ed.), "Fiscal Institutions and Fiscal Performance", NBER Conference Report Series, Chicago and London, University of Chicago Press.

- (2001), “Fiscal News, State Budget Rules, and Tax-Exempt Bond Yields”, *Journal of Urban Economics*, Vol. 50, No. 3, November, pp. 537-62.
- Ramey, V. and M. Saphiro (1997), “Costly Capital Reallocation and the Effects of Government Spending”, Carnegie Rochester Conference on Public Policy.
- Saint Paul, G. and T. Verdier (1993), “Education, Democracy and Growth”, *Journal of Development Economics*, No. 42, pp. 399-407.
- Sargent, T. (1999), “A Primer On Monetary And Fiscal Policy”, *Journal of Banking and Finance*, 23, pp. 1463-82.
- Seater, J. (1993), “Ricardian Equivalence”, *Journal of Economic Literature*, Vol. 31, No. 1, March, pp. 142-90.
- Segerstrom, P.S. (2000), “Long-Run Growth Effects of R&D Subsidies”, *Journal of Economic Growth*, Vol. 5, No. 3, pp. 277-305.
- Seitz, H. (2001), “Infrastructure Investment and Economic Activity: Theoretical Issues and International Evidence”, in Deutsche Bundesbank (ed.), *Investing Today for the World of Tomorrow: Studies on the Investment Process in Europe*, Berlin, Heidelberg, Springer, pp. 85-124.
- Sims, C. (1994), “A Simple Model For The Determination of The Price Level And The Interactions of Monetary and Fiscal Policies”, *Economic Theory*, No. 4, pp. 345-80.
- Sturm, J.E. (1998), *Public Capital Expenditure in OECD Countries: The Causes and Impact of the Decline in Public Capital Spending*, Cheltenham, Northampton, Edward Elgar.
- Sutherland, A. (1997), “Fiscal Crises and Aggregate Demand: Can High Public Debt Reverse the Effects of Fiscal Policy?”, *Journal of Public Economics*, 65(2), pp. 147-62.
- Tanzi, V. and L. Schuknecht (2000), *Public Spending in the 20th Century: A Global Perspective*, Cambridge, New York, Cambridge University Press.
- Temple, J. (2000), “Growth Effects of Education and Social Capital in the OECD”, Nuffield College, Oxford, mimeo.
- Wolff, E.N. and M. Gittleman (1993), “The Role of Education in Productivity Convergence: Does Higher Education Matter?”, in A.

Szirmai, B. van Ark and D. Pilat (eds.), *Explaining Economic Growth*, Elsevier Science.

Woodford, M. (1994), "Monetary Policy and Price Level Determinacy in a Cash in Advance Economy", *Economic Theory*, 4, pp. 345-80.

————— (1995), "Price Level Determinacy without Control of a Monetary Aggregate", *Carnegie-Rochester Conference Series on Public Policy*, 53, pp. 1-46.

