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**QUALITY OF  
PUBLIC FINANCES  
AND GROWTH**

by António Afonso,  
Werner Ebert,  
Ludger Schuknecht  
and Michael Thöne

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### QUALITY OF PUBLIC FINANCES AND GROWTH <sup>1</sup>

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## **Abstract**

In this paper we review the linkages between the quality of public finances, that is, the level and composition of public expenditure and its financing via revenue and deficits, and economic growth. We review the various channels through which public finances affect growth and its underlying determinants (institutional framework, employment, savings and investment, innovation). The paper addresses the approaches used to assess the performance and efficiency of public spending, and surveys the empirical findings on the impact of fiscal variables on sustained economic growth.

**Keywords:** quality of public finances, efficiency, growth.

**JEL classification:** H50, O40.

## Non-technical summary

In this paper we review the linkages between the quality of public finances, that is the level and composition of public expenditure and its financing via revenue and deficits, and economic growth. The importance of high-quality fiscal policies for economic growth has been brought to the forefront by a number of developments over the past decades. Member States of the European Union are bound to fiscal discipline through the Stability and Growth Pact which limits their scope to conduct unfinanced spending. Globalisation makes capital and even tax payers more mobile and exerts pressure on governments' revenue base.

The study provides arguments and quantitative evidence that fiscal policies are of high quality and support growth if they fulfil the following requirements: (i) provide for an institutional environment that is supportive to growth and sound public finances, (ii) limit commitments to the essential role of government in providing goods and services, (iii) set growth promoting incentives for the private sector and make efficient use of public resources, (iv) finance government activities and where appropriate private sector activities with an efficient and stable tax system, and (v) support macroeconomic stability through stable and sustainable public accounts.

Some of the main conclusions of the paper are as follows:

A well-defined institutional framework is important to support the long-run growth of the economy and 'high quality' public finances play an important role for its functioning; Fiscal policy can contribute to macroeconomic stability and a sound policy mix and create expectations that foster economic growth;

The evidence on size effects of fiscal variables supports the case for quantitative consolidation with a view to reducing total spending, thus enabling reductions of deficits and taxation. The empirical findings on growth effects of the composition of government activities clarify that not all kinds of government spending should be treated alike when it comes to reforming public finances;

On the spending side, certain core spending items are essential for the economy to function and to grow. However, these services also must be delivered in a cost-effective way;

A main growth element is public investment, especially in human capital and – under certain conditions - in R&D. The growth effects of physical capital investment are less clear-cut;

Redistributive spending can undermine growth. However, a certain basic level of redistribution and social spending is probably necessary as a social infrastructure.

Taxes should be not distorting and should display low marginal rates while avoiding tax uncertainty and time inconsistency;

The survey of different empirical studies shows that an objective and unambiguous overall catalogue of “high quality”-expenditure items is not feasible. There is no cookbook for growth. Economics gives an idea of the major ingredients, but it does not clearly tell the recipe;

The quality-indicators for public finances developed in the meantime can only be illustrative. Within their methodical limits, indicator-concepts may offer orientation on their respective aspects of quality. But no indicator can in fact *measure* the comprehensive quality of public finances;

In spite of all efforts to identify the sources of growth, we still have a simplistic growth concept that ignores many interdependencies and synergies of this process. From this perspective, the use of comprehensive case studies could give valuable additional insight, and this can be an avenue for further work on the topic.

## 1. Introduction

This study reviews the linkages between the quality of public finances, that is the level and composition of public expenditure and its financing via revenue and deficits, and economic growth. The importance of high-quality fiscal policies for economic growth has been brought to the forefront by a number of developments over the past decades. Member States of the European Union are bound to fiscal discipline through the Stability and Growth Pact which limits their scope to conduct unfinanced spending. Globalisation makes capital and even tax payers more mobile and exerts pressure on governments' revenue base. At the same time, expenditure pressures do not abate, and countries will soon have to face up to the fiscal consequences of ageing population.

The study reviews the literature and, thereby, provides arguments and quantitative evidence that fiscal policies are of high quality and support growth if they fulfil the following requirements: (i) maintain an institutional environment that is supportive to growth and sound public finances, (ii) limit commitments to the essential role of government in providing goods and services, (iii) set growth promoting incentives for the private sector and make efficient use of public resources, (iv) finance government activities and (regulate) private sector activities with an efficient and stable tax system, and (v) support macroeconomic stability through stable and sustainable public accounts. If these conditions are fulfilled, fiscal policies boost growth via positive effects directly on employment, savings/investment and innovation and, indirectly, via the institutional framework.<sup>6</sup>

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<sup>6</sup> It is also worth recalling that there is an important policy debate that discusses the same issue in a more operationally minded manner and terminology. The European Commission in its Public Finance Report (2004), for example, proposes a broad definition of the quality of public finances, which concerns the allocation and the most effective and efficient use of resources in relation to identified strategic priorities. This definition does not identify the policy objectives *ex ante* given that it does not single out the expenditure categories that are more "productive" and consequently more quality improving. It leaves to the political process the role of setting those priorities which could include general social targets, economic growth as well as redistribution and economic stabilization, being therefore a technical definition. Additionally, productive expenditure is generically defined as expenditure with a positive effect on the growth potential of an economy by means of increasing the marginal productivity of capital and/or labour or the total factor productivity respectively.



The direct transmission channels to growth are derived from the growth literature whereby fiscal policies can affect “exogenous” growth through its effect on labour, capital accumulation and technological progress and it can create “endogenous” growth effects, for example, when it boosts learning-by-doing effects or contributes to the development of a “knowledge-producing” sector.

By contrast, the measurement of public sector efficiency is a difficult empirical issue and the literature on it, particularly when it comes to aggregate and international data is rather scarce. Recently, progress has been made in this regard by shifting the focus of the analysis from the amount of resources used by a ministry or a programme to the services delivered or outcomes achieved.

The paper is organised as follows. Section two addresses the various channels through which taxes and spending affect growth. Section three assesses public finance quality and its growth impact by discussing measurement issues and empirical findings. Section four presents the summary and the conclusions of the paper.

## **2. Public finances affect growth**

Public finances affect growth in several ways. In the understanding developed here, growth is primarily defined as long-term growth potential, and not short term or cyclical growth. This section briefly reviews the economic linkages between spending, tax policies and growth, as well as the relevance of the institutional framework, and the contribution of public finances to macroeconomic stability. There is by now a considerable literature of which we provide some general references in the footnote below and more specific references in the text.<sup>7</sup>

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<sup>7</sup> See also European Commission (2001, 2004), ECB (2001), Hemming et al. (2002), OECD (2003a, b), Romero de Avila and Strauch (2003), Tanzi and Schuknecht (2000, 2003), Tanzi and Zee (2000), and Zagler and Durnecker (2003).

## 2.1. Institutional framework

The institutional framework, that is, the environment within which fiscal policies operate, matters for growth via two main channels. First, the existence of a well-defined institutional framework is key to growth. Public finances, indirectly, play an important role for its proper functioning. Legal constraints and rules, such as well-established property rights or the existence of efficient markets minimise institutional uncertainty, and enhance the control over and security of returns on investment. Rules promoting market exchange (e.g. via contract law, freedom to set prices) are a prerequisite for a market economy. Functioning markets generate information via the price mechanism, which, in turn, induces agents to work, save, invest, specialise and innovate so as to make a profit. Rules must promote competition, secure adequate information and allow efficient risk management. They should also guarantee that government actions do not undermine but rather support the functioning of markets. In that way a well functioning institutional framework minimizes transaction costs for the private economy and helps to internalize externalities and spillovers. This view of the role of government has been advocated by classical economists such as Adam Smith and advocates of the modern institutional and constitutional economics literature (including e.g. F. Hayek, D. North and J. Buchanan).

High quality public finances can indirectly support growth by supporting the broader institutional framework. With sufficient funds for internal and external security and public administration, well-trained and non-corrupt civil servants, judges, etc secure that the wheels of the economy are well greased. Underfunded, overstaffed administrations by contrast are prone to less well-functioning institutions (see e.g., van Rijckeghem and Weder (2002)). Prohibitive taxation undermines property rights and subsidised public services can destroy private markets.

Second, the institutional framework that governs fiscal policy making plays an important role for the quality of public finances and growth via well established and enforceable fiscal rules and institutions (see e.g. von Hagen, Hallerberg and Strauch (2004)). These can prevent an expenditure and deficit bias in the political process that creates inefficient

and overly large public sectors and undermines the sustainability of public finances. Rules can also secure the stability of fiscal policies by preventing erratic changes in deficits, tax laws and expenditure programmes. Furthermore, rules can enhance the efficiency of fiscal policies and reduce the scope for rent seeking.

Budgets rules are particularly important because they determine the aggregation of spending demands and the solution of distributional conflicts. A number of techniques, such as performance budgeting, human resource management tools, market-like mechanisms of pricing, have been developed to provide the necessary information for a technically sound allocation of resources and enhance the efficiency of the implementation process.<sup>8</sup> Other examples of important institutional elements include audit rules, public procurement rules and cost-benefit analysis in the context of deciding on public activities and regulation as well as expenditure targets or sunset clauses.

## **2.2. Government spending**

In the theoretical literature that links public finances with growth, three expenditure variables have been considered: public investment spending, public consumption spending and social welfare or redistributive spending. Some of this literature has also considered public spending that increases human capital and spending that contributes to innovation such as that for research and development as core spending as it enhances the human capital base (investment) and technological progress. Total government spending average about 45% of GDP in industrialised countries but the range from little over 30% of GDP to around 60% suggests enormous differences across countries (European Commission, AMECO, as quoted in Tanzi and Schuknecht (2003)).

There is some governmental activity and related public spending that is essential for the performance of the economy. This “core”, or “essential”, or “productive” spending may be as important to growth as private capital and labour. This core spending can directly raise the human and physical capital stock and technical progress in the economy but it can also do so indirectly by creating synergies for private activities. Without it the

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<sup>8</sup> See, for example, OECD (1995).

economy will not function well and will not grow. The level of this spending depends on how efficient the government is in using the resources available. The more efficient is the government, the lower needs to be the spending level. But government spending depends also on a number of “exogenous” factors: geography, the level of development of the country and on the sophistication of its markets (Tanzi (2004)).

Core spending includes spending for essential administrative services and justice (see also the impact on growth via institutions as discussed above), basic research, *basic* education and health, public infrastructure, internal and external security and so on. Spending on these categories in industrialised countries are hard to assess precisely. However, if approximated by public consumption they average about 20 percent of GDP or 45% of total public expenditure (cfr. European Commission, AMECO database).

Public spending on education (via human capital) and research and development (innovation/technical progress) enhances growth. As the new growth theory suggests, public activity is needed as it can compensate for market failure due to network-externalities, non-linearities and monopolistic competition. Public spending (e.g. in the areas of education and R&D) can drive education and R&D to a more efficient level than would prevail in a pure market scenario.

Redistributive spending by contrast can undermine growth by reducing incentives to work, invest in human capital or exercise entrepreneurial talents. Early retirement incentives or generous social assistance reduce labour supply and the incentive to maintain one’s human capital. On the other hand, spending on basic social safety nets reduces the need for precautionary savings and enhances the ability for risk taking and insofar could serve as a growth-promoting institutional factor. All in all, an increase in efficiently executed core spending can promote growth while an increase in non-core spending beyond basic safety nets can be assumed to retard growth. Redistributive spending, nevertheless, is the second most or even most significant expenditure category in many industrialised countries and averages about 40% of public spending (though this depends very much on the definition of redistributive spending and the country).



Public investment is a narrower concept than productive or core spending. It is more specifically directed to the creation of physical infrastructure. Normally gross fixed capital formation is limited to around 2–3% of GDP (or about 5 percent of total spending) (see also European Commission (2004)).<sup>9</sup>

There is no question that public investment may contribute to growth. Apart from directly raising an economy's capital stock, it is often argued that public investment on infrastructure is necessary to crowd in private investment and to reduce some private costs. However, in the theoretical as well as the empirical literature the impact is not clear-cut (see Pfähler et al. (1996)). First, the definition of what is an investment is somewhat arbitrary and could lend itself to manipulation. Second, the use of strictly objective cost-benefit analysis has yet to enter investment decisions. Inefficient projects, often called “white elephants” can have very significant fiscal costs but with little impact on growth. Third, the increase in public investment could replace/discourage private investment. Still, in spite of these reservations, it must be maintained that properly defined public investment and efficiently executed public projects would contribute to growth.

### **2.3. Tax systems**

Industrialised countries typically have well developed revenue collection system to finance the above-mentioned spending levels. As revenue must remain on average close to spending, the revenue ration also averages nearly 45% industrialised countries with roughly one third of this falling on indirect taxes on consumption, six tenths on direct taxes on incomes, and the remainder on other revenue.

The level of taxation is important because (a) taxes are generally distortive, and (b) taxes transfer resources from the private to the public sector and there is often the presumption that the private sector is more efficient in their use. A high level of taxation is likely, *ceteris paribus*, to reduce the growth potential of a country because of the negative impact that it might have on work incentives, investment, saving decisions, and on the allocation

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<sup>9</sup> The remaining 5-10% of total expenditure are interest expenditure on public debt.

of resources in general. In a global environment high taxes in one country may also reduce growth in that country by inducing capital flight towards lower taxed countries.

While taxes may reduce growth by being too high, they might also reduce it by being too low. This will happen if the level of taxation is too low to give the public sector of a country the resources necessary to provide essential government services. At least in theory, there must be a level and structure of taxation that could be considered “optimal” from a growth point of view because it would be just sufficient to finance the *essential* public services in an *efficient* way. When the tax level of a country exceeds this optimal level, a lowering of it could lead to faster growth. For instance, typical examples of tax-induced distortions are labour-leisure decisions, savings-consumption decisions or the alternative allocation of consumption among various commodities and investment among various economic sectors.

Over the years, public finance experts have analysed the impact of different taxes and tax structure on economic variables, and have generally concluded that not all taxes have the same impact on the economy. Taxes that are imposed with high marginal rates (for example on the factor labour) are more damaging because economic theory teaches that the dead-weight cost of taxes grows with the square of the marginal tax rate. For this reason, on efficiency grounds, value added taxes (that are basically *proportional* taxes on *consumed* income) are preferred by many tax experts to personal income taxes that are often applied with high marginal tax rates on both consumption *and* saving. In general, reforms that broaden the base of income taxes and reduce the marginal rates; or that replace income taxes with proportional sales taxes improve the efficiency of an economy.

While there are tax changes that improve the efficiency of the economy, it is also true that when tax systems are changed frequently in their structural and level aspects, these changes introduce “tax uncertainty”, and this could have negative effects on growth. Uncertainty makes economic decisions involving the future more difficult. This can happen especially when tax uncertainty is likely to create *time consistency problems*. For example a tax reform may introduce tax incentives to stimulate investment but, because

the incentive will cost revenue to the government, the investors may fear that they may be removed or reduced after the investments have been made.

In structural terms, taxes and subsidies can serve as one possible tool to internalise network-externalities and spillovers in (new growth) models where market price signals are not able to lead to a social optimal level of economic activity, e.g. in research and development (R&D), development of human capital or production of social and physical infrastructure.

#### **2.4. Public finances and macroeconomic stability**

Fiscal policies are one factor that can contribute to macroeconomic stability and a sound policy mix and, thereby, also support monetary policy in maintaining stable prices at low interest rates. Low deficits and debt ratios create expectations that public finances are sustainable so that expenditure policies and tax systems and rates will be predictable. This is conducive to economic growth because it creates an environment conducive to long-term-oriented savings and investment decisions (Sargent (1999)). By contrast, if, over a sustained period of time, government revenue is much lower than total public spending, (thus, creating unsustainable macroeconomic imbalances and public debt accumulation) growth may be reduced because the private sector might come to see the fiscal situation as unsustainable and reduces investment in anticipation of future higher taxes. Moreover, uncertainty about the future tax changes and, thereby, the tax structure may exacerbate the negative effects and, in particular, reduce immobile capital investment that is vulnerable to tax increases.<sup>10</sup>

Moreover, low deficits prevent the absorption of a large share of savings to finance the public sector (crowding out) which, in turn, benefits investors via lower interest rates and raises the capital stock (see Detken, Gaspar and Winkler (2004)). This argument is based on the presumption that Ricardian equivalence (i.e., lower public saving as reflected in

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<sup>10</sup> For the channels from taxation via deficits and debt to growth see Tanzi and Chalk (2000). For an overview of the political economy literature explaining deficit and debt biases see Alesina and Perotti (1995) and Schuknecht (2004).

higher deficits is fully offset by higher private savings) does not hold. However, here a number of arguments and empirical evidence that suggests that at least some crowding out of private investment due to public imbalances should be expected (Blanchard (1985), Easterly and Rebelo (1993), Domenech, Taguas and Varela (1999)).

### **3. Assessing public finance quality and its growth impact**

The impact of fiscal policies can be measured in two ways: First, indirectly, by looking at the outcome of public spending that might have a bearing on growth and, thereby, assessing the productivity and efficiency of the public sector; and second directly via statistical/econometric analysis or case studies.

#### **3.1. Measuring the quality of public finances indirectly**

##### **3.1.1. Expenditure policies**

The adequate measurement of public sector efficiency, particularly when it concerns services provision, is a difficult empirical issue and the literature on it, particularly when it comes to aggregate and international data is rather scarce (for a survey see Afonso, Schuknecht and Tanzi (2003)). Recently, academics and international organisations have made progress in this regard by shifting the focus of the analysis from the amount of resources used by a ministry or a programme (inputs) to the services delivered or outcomes achieved (see OECD (2003a)).

There have been a number of attempts to measure public sector performance and efficiency by setting output/outcome measures in relation to inputs.<sup>11</sup> Afonso, Schuknecht and Tanzi (2003) compute a composite indicator of public sector performance using several sub-indicators. One group seeks to measure the functioning of the markets and the

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<sup>11</sup> See Afonso et al. (2003) for public expenditure performance and efficiency in OECD countries, Afonso and St. Aubyn (2004) for health and education in OECD countries, and Clements (2002) for education in Europe. The Social and Cultural Planning Office of the Netherlands (2004) also provides a useful cross-country and cross-sector assessment of the public sector performance while Her Majesty's Stationery Office (2004) addresses the measurement of government output and productivity.

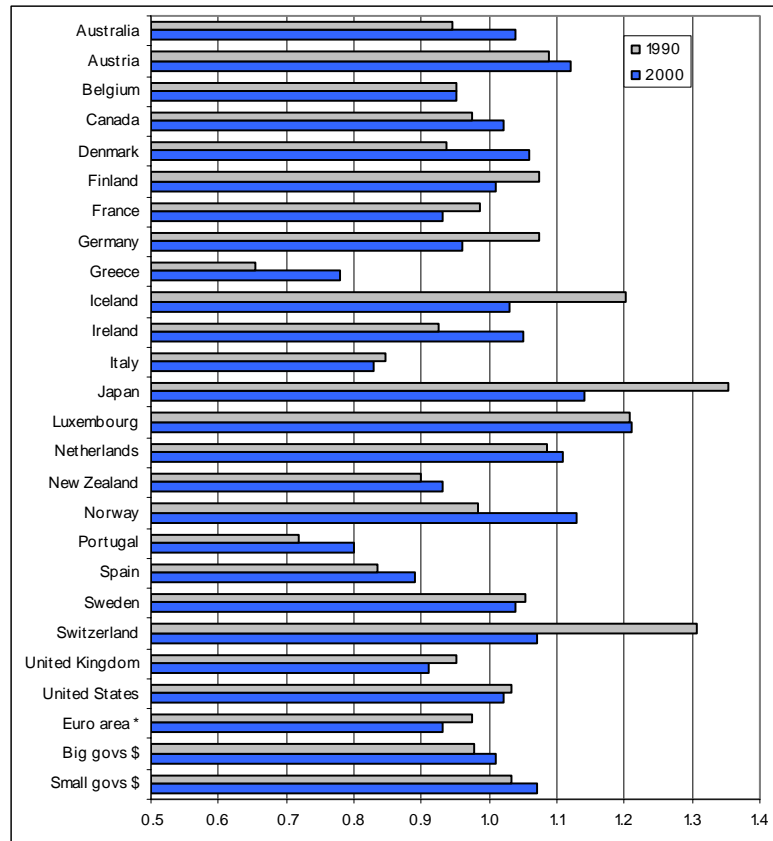


equality of opportunity for people by taking into account administrative/institutional, education, health and public infrastructure outcomes. They also look at several other indicators to incorporate information on the “Musgravian” functions of the government: stabilisation, redistribution and allocation. Although such structural indicators can give some first indication on the performance, they can only serve as an illustrative tool for assessment because the development of composite indicators that show an adequate weighting of the different aspects of the performance and sufficient comparability faces data and methodological obstacles.

A general pattern that emerges is that countries with lower public spending-to-GDP ratios show a better performance of their administration/institutions and more growth while large public sectors are correlated with more equal income distribution. Spending on and performance of education and health systems seem to be less correlated. Naturally, trying to determine the “optimal” composition and size of public spending has to be seen in perspective, given the policy options and priorities of each country.

Figure 1 is based on the results presented by the authors for overall public sector performance in 1990 and 2000. First, there are marked but not huge difference across industrialised countries in 2000. Second, performance seems to have converged between 1990 and 2000. The chart clearly shows the catching up of Greece, Portugal, Spain and Ireland over this decade. However, note that progress in public sector performance made by the different countries over time is measured relative to other countries and not relative to its own past performance.

**Figure 1** – Index of public sector performance (average=1.0)



Source: Compiled from Afonso (2004) and partially arranged from Afonso, Schuknecht and Tanzi (2003).

\* Weighted average according to the share of each country GDP.

\$ Small governments: public spending <40% of GDP.

Big governments: public spending >50% of GDP.

Subsequently, in the aforementioned study public sector performance is set in relation to resources used, i.e. public expenditure. Differences in efficiency turned out to be very significant and in particular the costs of more equal income distribution in terms of higher spending (and taxes) and less favourable economic performance were found to be rather high.

The analysis of public sector productivity and efficiency is usually done by applying non-parametric approaches such as the Free Disposable Hull or the Data Envelopment Analysis.<sup>12</sup> With this sort of non-parametric analysis Afonso et al. (2003) show that

<sup>12</sup> For instance, Clements (2002) and Afonso and St. Aubyn (2004) review efficiency studies using non-parametric analysis. In the context of the so-called non-parametric techniques (FDH or DEA), of estimating a theoretical efficiency frontier, one assumes that under efficient conditions, for instance,

European countries spend on average 30% more than the most efficient OECD country would have used to attain the same performance. Overall, the results of the study also seem to indicate declining marginal productivity of public spending.

A study of education and health expenditures by Afonso and St. Aubyn (2004) further illustrates these non-parametric approaches and also sheds some light on the shortcomings. The study assesses the efficiency in secondary education and health in OECD countries in 2000 by looking at quantity measures of inputs. For education, the OECD PISA indicator is the output measure and two quantity measures are used as inputs: the number of hours per year spent in school and the number of teachers per student.<sup>13</sup> For health, the quantitatively measured inputs are the number of doctors, nurses and hospital beds, while the outcomes are infant mortality and life expectancy.

### 3.1.2. Tax policies

Assessing the quality of public finances, one also needs to look at the way governments use taxation to finance their borrowing requirements. Naturally, tax systems play a relevant role in determining not only the efficiency of the public sector but also of the overall economy.

When evaluating the tax policies of particular countries it is necessary to go beyond statutory rates and to develop indicators, which bear a stronger and sounder relation with the taxes actually paid, and assess effective taxation. Since there are quite a few elements of tax-benefit systems that have to be accounted for when making cross-country comparisons, the so-called “effective tax rates” show relative tax burdens resulting from

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public sector performance of country  $i$ , measured by an indicator  $y_i$ , the output, which depends on a set of factors,  $x_i$ , the inputs:  $y_i = F(x_i)$ . If  $y_i < F(x_i)$ , it is said that country  $i$  exhibits inefficiency. For the observed input level, the actual output is smaller than the best attainable one and inefficiency can then be measured by computing the distance to the theoretical efficiency frontier.

<sup>13</sup> Education expenditure is predominantly public particularly in European countries (92.4% of total educational expenditure is public in the European Union in 2000). Public expenditure in health is usually more than half of total expenditure, and it averaged 72.2% of total expenditure in the OECD in 2000.

the joint operation of taxes, social security contributions and benefits, in a comprehensive fashion.

Therefore, indicators frequently used in this context are “effective” tax rates and “effective” marginal tax rate. For instance, Mendoza, Razin and Tesar (1994) compute aggregate effective tax rates on consumption, capital income and labour income for the G-7 countries, arguing that these tax rates are the appropriate ones to help transform theoretical insights into policy-making. “Effective” marginal tax rates are calculated by taking into account statutory tax rates and tax rules defining the taxable basis. They represent also by now a well-established approach to analyse the influence of taxes on key macroeconomic variables such as saving, investment and employment.

Studies from the European Commission show that the tax burden on labour in the EU has been steadily increasing over the last thirty years.<sup>14</sup> The “effective tax rate on labour” in the EU, defined as non-wage labour cost (employers’ and employees’ social security contributions) and personal labour income tax as a percentage of labour costs, was about 30% in 1970 and increased to reach a peak of 38% in 1996. These figures compare to a tax burden on labour of only 24% in the USA, and some 20% in Japan. Since mid-1990s, the EU average tax burden on labour has started to decline in a number of EU countries, although only very slightly.

Marginal tax rates are useful indicators in investigating whether Member States face a “poverty trap” problem. According to an OECD (2001) study, over the period 1997-2000 most Member States succeeded in reducing the tax wedge on the low and medium earnings (see Table 1, copied from European Commission (2001, pp. 88)). The so-called poverty trap is due to the existence (and its rapid withdrawal) of income-tested tax allowances and/or a steep progressiveness built into the tax system that leads to

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<sup>14</sup> See, Commission Issues Paper, ECOFIN of 17 October 2000, EC (2000), and Martinez-Mongay and Fernandez (2001). Additionally, Carey and Tchilinguirian (2000) also compute average effective tax rates for the OECD countries. As a result a joint European Commission-OECD project, Carone et al. (2003) also report marginal effective tax rates in the context of the EU.

particularly high marginal rates at the lower end of the wage distribution.<sup>15</sup> With little disposable income from additional work effort, labour supply is reduced.

**Table 1** – Marginal tax rates in the EU 1997–2000  
(income tax plus employees contributions less cash benefit, as % of gross wage)

	Single individual (no children, earning 67% of APW)		Single individual (2 children, earning 67% of APW)		Married couple (2 children, single earner on APW)		Married couple (2 children, 2 earners — APW + 33 %)	
	Marginal tax rate in 2000	Change 1997 to 2000	Marginal tax rate in 2000	Change 1997 to 2000	Marginal tax rate in 2000	Change 1997 to 2000	Marginal tax rate in 2000	Change 1997 to 2000
B	54.1	-0.7	54.1	-0.7	51.4	-0.3	45.5	1.0
D	51.0	-0.9	48.8	-0.8	51.8	3.6	39.5	-2.4
EL	20.1	0.0	15.9	0.0	28.5	0.0	35.5	-0.3
E	26.4	-4.8	6.4	-17.7	23.2	-0.9	34.9	-1.8
F	48.6	-0.8	21.0	-0.4	21.0	-0.4	39.0	-0.5
IRL	22.0	-8.5	22.0	-68.5	28.5	-4.2	20.3	-4.6
I	32.8	-1.6	32.8	-1.6	40.1	-0.6	40.5	-6.5
L	34.1	0.0	14.7	2.1	14.7	2.1	14.2	-1.3
A	37.1	-14.4	52.1	30.5	42.0	-0.5	32.3	-2.0
P	25.0	-1.0	11.0	0.0	25.0	-1.0	27.5	-0.5
FIN	42.7	-2.3	42.7	-2.3	48.4	-2.3	38.9	-1.0
<b>EUR-12 (*)</b>	<b>48.5</b>	<b>-2.8</b>	<b>33.7</b>	<b>-2.1</b>	<b>46.3</b>	<b>-0.8</b>	<b>44.5</b>	<b>-2.2</b>
DK	50.7	-1.4	50.7	-1.4	45.2	-1.3	36.3	-0.5
S	38.3	-0.6	38.3	-0.6	35.2	-0.5	43.6	-2.5
UK	32.0	-1.0	69.4	36.4	69.4	36.4	20.8	-1.3
<b>EU-15 (*)</b>	<b>41.9</b>	<b>-1.7</b>	<b>39.7</b>	<b>3.0</b>	<b>42.6</b>	<b>5.3</b>	<b>36.2</b>	<b>-1.9</b>
US	29.6	-0.3	35.6	-15.4	29.6	-21.4	24.8	-2.4
JP	17.3	0.8	17.3	0.9	18.6	0.6	21.7	4.1

(\*) Weighted average (real GDP).

Source: OECD, Taxing wages 1999–2000.

The measurement of the tax burden and public expenditure is complicated in particular by the use of so-called tax expenditure. By “spending” via reducing the taxable base or by granting a tax break, they make average taxation and public spending look smaller than they would be if “open” expenditure and taxation were used instead. Brixi, Valencuc and Swift (2004) provide some results for the “forgone” revenues for some countries which can reach up to 4% of GDP.

The EC (2000) shows in simulations that tax distortions would be reduced and growth increased by shifting from direct to indirect taxation since consumption taxes are less distortionary than labour income taxes. Additionally, a tax shift from labour income to indirect taxes is under certain circumstances, a valid alternative to expenditure reduction

<sup>15</sup> Tax wedges – the difference between labour costs to the employer and the corresponding net take-home pay of the employee – express the sum of personal income tax and all social security contributions minus cash benefits as a percentage of labour costs.

in terms of fiscal consolidation since by fostering employment and growth such tax shift may also reduce unemployment transfers (see also EC (2000) for further empirical references)).

### **3.1.3. Fiscal institutional framework**

Budgetary institutions also play a key role in the quality of public finances. The measurement of the quality of fiscal institutions is a difficult task. Some progress has been made to measure the quality of institutions to maintain fiscal discipline. The relevant literature has identified two commitment technologies to achieve aggregate fiscal discipline: the delegation of power to a strong minister of finance and the creation of a fiscal contract (see Hallerberg, Strauch and von Hagen (2004)). In the delegation approach, the minister of finance receives strong agenda setting powers in the planning and approval stage, and the necessary discretionary authority to keep the budget on track during the implementation stage. In the contract approach, leading policy makers agree on the overall budget target before the actual budgeting process starts. During the approval and implementation stage, legislative authorities and the minister of finance need monitoring tools to ensure that the initial contract is kept. The quality of institutions under these approaches has then been assessed via surveys on the relevant parameters.

Empirical work with the resulting measures on the quality of budget institutions have shown that the quality of budgetary institutions differs considerably in Europe and matters for maintaining fiscal discipline. On average, however, institutions have improved over the last decade. Moreover, more stringent multi-annual budgetary targets have helped to contain deficits almost across all countries.

## **3.2. Empirical findings on the growth impact**

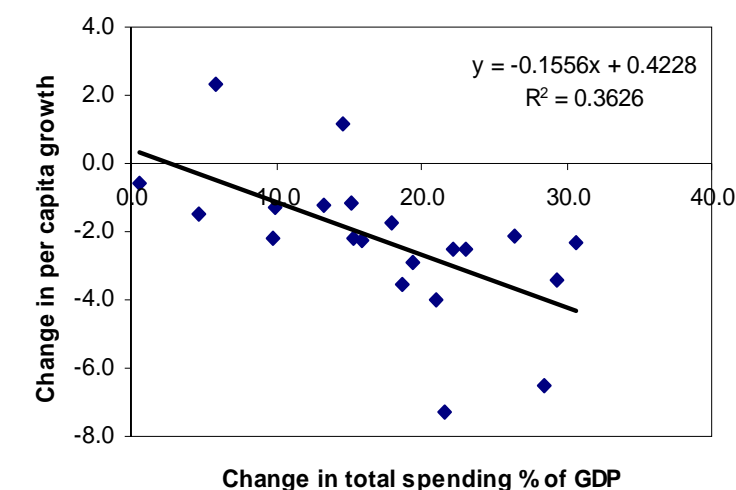
For a first orientation, the empirical findings on the impacts of fiscal variables on sustained economic growth can be divided into two broad groups. The first group studies the impact of the most aggregate fiscal variables, like total expenditure, total taxation and government debt or deficit. These variables primarily give an impression how govern-

ment size and its financing affects growth. In the centre of the analysis presented here are the growth effects of the composition of government activities. While still on the aggregate level, this investigation necessarily takes place one level below the “size effects”. The second and relatively small groups looks at case studies and, thereby, emphasize more the analysis of the policy process in the broader context that reforms take time and concern different policy domains.

### 3.2.1. Growth effects of government size

Before reviewing the econometric evidence on the growth enhancing (or reducing) consequences of general government’s total expenditures, a few stylised facts may give a good first impression. For 24 OECD countries, Tanzi and Schuknecht (2003) plot the changes in total government spending in the last 40 years of the 20<sup>th</sup> century against the changes in per capita GDP growth (Figure 2).

**Figure 2** – Change in total spending 1960 –2000 versus change in per capita growth, 1960s –1990s



The illustration of the growth-spending dynamics in the very long run shows a strong correlation between total spending increases and growth declines. The same applies for a similar plot of gross fixed capital formation (one of the main growth determinants) and public spending ratios in the 1990s, i.e. in the medium term. Economy-wide capital

formation is strongly and negatively correlated with total government expenditure. Moreover, when looking at the financing side, the strongly negative correlation between direct taxes and employment ratios is noteworthy (see also Prescott (2004)).

These stylised facts lay no claim to statistical significance. Yet, they are supported by most econometric studies in this field. Table 2 gives a brief overview of recent papers.<sup>16</sup>

**Table 2 – Growth effects of total government expenditure**

<b>Author(s)/date</b>	<b>Regional Basis</b>	<b>Independent Variable</b>	<b>Effect on Growth</b>
Agell/Lindh/Ohlsson (1997)	23 OECD countries	General government spending (among others)	neither positive, nor negative
Barro/Sala-i-Martin (1995)	90 countries worldwide	Government pending ratio	significantly negative
Bassanini/Scarpetta/Hemmings (2001)	21 OECD countries	General government spending (among others)	significantly negative
De Gregorio (1996)	21 OECD countries	General government spending (among others)	negative, yet not significant
Fölster/Henrekson (1999)	23 OECD countries	General government spending	significantly negative
Heitger (2001)	21 OECD countries	General government spending (among others)	significantly negative
Lee (1995)	16 OECD countries	General government spending (among others)	negative, yet not significant

The “size effect” of government spending on growth is mostly negative. No study has found a positive relationship between growth and aggregate expenditure. Agell, Lindh and Ohlsson (1997) did not find clear evidence on the nature of the relation between the two variables. De Gregorio (1996) and Lee (1995) could not confirm the significance of the negative spending effects on growth. However, all other studies reviewed assert the significance of these effects.

This negative correlation is not a linear function. The review of composition-effects of public spending below will show that, at the core level, the productive effects of a certain

<sup>16</sup> This and further literature reviews below were compiled with additional reference to surveys of empirical research, namely: Agell, Lindh and Ohlsson (1997), Temple (1999), Ahn and Hemmings (2000), David, Hall and Toole (2000), European Commission (2002), Florax, de Groot and Heijungs (2002), Nijkamp and Poot (2003), Lamo and Strauch, R. (2002), OECD (2003), Tanzi and Schuknecht (2003), Thöne (2004), Kirchgässner (2004), and Schuknecht and Tanzi (2005).



level and some components of public expenditure are very high, because government activities set the indispensable framework in which economic growth takes place. But the evidence in Table 2 gives reason to believe, that the governments in OECD countries have outgrown these “purely productive” spending dimensions and now crowd out more productive private sector activities.

### **3.2.2. Growth effects of taxation and the spending composition**

Before analysing further the effect of expenditure components on growth, we look at taxation. The econometric evidence on the growth effects of the means employed to finance the size of government spending supports the argument that a high level of taxation impairs the allocation of resources, mainly by depressing incentives to work, to invest and/or to save. Moreover, if taxation leads to high and sustained government deficits and growing debt, growth is harmed through many channels as discussed above (see Tanzi and Chalk (2000)).

For taxation in OECD countries, quite a few studies find significant negative effects on growth (see Cashin (1995), de la Fuente (1997), Fölster and Henrekson (1999), and Kneller, Bleaney and Gemmell (1998)). Yet other studies cannot find a relationship, be it positive or negative. Again, no study so far has shown positive growth effects of high taxation. The empirical literature also supports the general view on government deficits. Where budget deficits have been tested econometrically, they have often displayed significant negative growth effects (see Martin and Fardmanesh (1990), Easterly and Rebelo (1993), Miller and Russek (1997), de la Fuente (1997), Kneller et al. (1998) and Bleaney et al. (2001)). For aggregate government debt, analogous arguments apply (see European Commission (2004)).

The evidence on size effects of fiscal variables supports the case for quantitative consolidation with a view to reducing total spending, thus in turn enabling reductions of deficits and lower levels of taxation. The review of empirical findings on growth effects

of the composition of government activities clarifies that not all kinds of government spending should be treated alike when consolidating public finances.<sup>17</sup>

The evidence on differentiated growth effects of “qualitative” spending aspects crucially depends on the quality of the available data. Econometric studies on the macroeconomic level often face the necessity to use highly aggregated components of public spending. This sometimes leads to empirical endeavours that produce seemingly tautological results like: “Specifically we find that (1) distortionary taxation reduces growth, whilst non-distortionary taxation does not; and (2) productive government expenditure enhances growth, whilst non-productive expenditure does not” (Kneller et al. (1998)). When instead looking at the more disaggregated spending level, empirical analyses often must resign themselves to the use of intermediate impact indicators which display a plausible relation to growth, but do not facilitate direct evidence.

The foremost component of government spending traditionally associated with positive growth effects is investment expenditure. Following Aschauer’s (1989) seminal paper many studies have found positive growth effects of the acquisition or the accumulation of physical capital goods by governments (see for OECD countries, e.g., Cashin (1995), Nourzad and Vrieze (1995), Sanchez-Robles (1998), Shioji (2001) and Kamps (2004)). Yet, the size of the effects differs considerably. A large number of authors present evidence that public investment expenditure has no significant impact on growth (see for OECD countries, e.g., Barth and Bradley (1988), Ford and Poret (1991), Holtz-Eakin (1994), Yi and Kocherlakota (1996) and Cassou and Lansing (1999)).<sup>18</sup> Moreover, investment can be productive or unproductive for growth depending on the institutional context in which it is undertaken. Keefer and Knack (2002) show that secure property

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<sup>17</sup> For brevity’s sake, the evidence on growth effects of different tax regimes cannot be reproduced here. By and large, empirical studies reconfirm the theoretical assertions that (1) indirect taxes harm growth less than direct taxes and that (2) high tax *rates* of direct taxes are especially damaging for incentives and general allocation.

<sup>18</sup> Vanhoudt, Mathä and Smid (2000) even find evidence for “reverse causality” in the EU-countries. Public investment often encompasses more than pure spending on infrastructures. According to their findings, it is economic growth which has a significant impact on public investment (not the other way around).

rights and the rule of law significantly affect the growth-enhancing impact of public investment.

But there is less polarity in the discussion than it may seem from these contrasting results. A certain consensus has emerged that public investment still is important for growth, but less important than it used to be (European Commission (2003)). In economic theory, public expenditure on physical capital can enhance growth only, if it is spent on infrastructures that serve as inputs to private investment. This notion is affirmed by empirical evidence, mainly for investments in transport, communication and public utilities (see e.g. Easterly and Rebelo (1993), Devarajan, Swaroop and Zou (1996)).

For infrastructure spending, there is also evidence that the law of diminishing returns holds. De la Fuente (1997), for example, has shown that public investment is beneficial only up to a level of two percent of GDP. This perspective is endorsed by Kalyvitis and Kalaitzidakis (2002) in their case study for Canada: In this “mature” economy equipped with a high level of infrastructure, its maintenance promises high productivity effects, whereas newly added infrastructure yields low or even negative marginal returns. As a conclusion from the mixed empirical findings, Thöne (2004) advocates to dismiss the “classical” focus on investment spending in favour of a direct focus on spending for infrastructure services.

In contrast, the empirical literature on the significant positive growth effects of public activities in the production of human capital is almost unequivocal (see for OECD countries, e.g. Englander and Gurney (1994), De Gregorio (1996), Keefer and Knack (1997), De la Fuente and Domenech (2000), Bassanini and Scarpetta (2001), Gemmill and Kneller (2001), Heitger (2001), Buysse (2002) and OECD (2003b)). Due to limited data availability, all empirical studies are restricted to formal school education. Thus, the human capital effect of vocational training is not reflected in the findings. A second restriction directly relates to public finances. Most empirical studies do not use public spending on schooling as their independent variable, but school attendance rates, schooling years or graduation rates. Wößmann (2002, pp. 58) even states a “missing link between expenditure and schooling quality”. This is a good reminder that the focus on

growth enhancing public expenditures can only be sustained with a strong link to efficiency issues.

In modern industrial or “post-industrial” economies, research and development is undoubtedly one of the major causes of economic growth. But the growth impacts of *public* R&D-activities are treated controversially in the empirical literature: are public and private R&D substitutes, or do they complement one another? Only in the latter case public R&D spending can bring about positive effects on economic growth, because it does not crowd out private R&D. The studies of Robson (1993), Park (1995), Busom (1999), Diamond (1999), Guellec and van Pottelsberghe de la Potterie (2000) give evidence for complementarity, while the studies of Toivanen and Niininen (1998), Wallsten (1999), Bassanini, Scarpetta and Hemmings (2001) indicate crowding out. As only a slight majority of econometric research supports the notion of complementarity, the empirical question should be treated as unsolved.<sup>19</sup>

Health policy has long been counted among the growth-enhancing government activities, because good health improves human capital and thereby growth. Bleaney, Kneller and Gemmell (2001) find a significant positive impact of health expenditures on growth in OECD countries. Bloom, Canning and Sevilla (2001) support this view in a worldwide study. Yet with respect to the OECD, Rivera and Currais (1999) see evidence for reverse causality: economic growth has created high real incomes which enable people to spend more on the consumption good ‘health’.

There are also other policies that may help to mobilise human capital. In many countries women still have insufficient chances and incentives to combine family life with a long-term professional career. The ensuing low labour utilisation is an important obstacle to satisfactory growth dynamics. As far as government expenditure is concerned, particularly early childcare measures significantly increase female labour market participation. This is supported the empirical evidence on the high negative elasticity of female labour supply with respect the individual costs of out-of-home childcare (see e.g.

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<sup>19</sup> David, Hall, and Toole (2000) survey 30 empirical studies and come to a comparable conclusion.

Ribar (1992), Averett et al. (1997), Anderson and Levine (1999), Kimmel (1999), Han and Waldfogel (2001)).<sup>20</sup>

### **3.2.3. Institutional linkages**

Finally, we should look at the transmission from fiscal policies to growth via the institutional framework. There is little modern empirical literature on this issue so far but important work has looked at this dimension from a case study perspective (see also below for the use of case studies to discuss the impact of broader fiscal and institutional reform programs).

North (1990, 1998) provides fascinating accounts of how fiscal policies, institutions and growth interact. North explores how England and Spain from similar starting points went very different ways in their economic development. Both countries needed more money to finance their wars. In England, decentralized decision making with independent courts, secure property rights and a well developed mercantile law including patent law gave rise to a law-based market economy, with much investment and innovation and rapidly developing capital markets. This also filled the government's coffers via moderate taxation. In Spain by contrast, the government stifled economic exchanges/trade with over-regulation, the sale of monopoly rights and price controls. Over-taxation and confiscation undermined property rights. The two basic rules supporting investment, innovation and growth could hence not develop. Fiscal revenue, though perhaps initially buoyant, suffered.

### **3.2.4. Making use of the evidence**

How do we interpret the evidence on the growth impact of diverse fiscal instruments and objectives? An ideal econometric study on the growth impact of fiscal variables might come to a conclusion like: "For our panel of 20 OECD countries, an x percent increase of

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<sup>20</sup> The empirical literature mentioned above refers to the United States. Recently, the OECD has started a series of country studies, which now covers the relationship of "Babies and Bosses" in Australia, Denmark, the Netherlands (see OECD (2002)), Austria, Ireland and Japan (see OECD (2004)).

general government spending on the y-item in 1975-1995 increased GDP growth rates by z percent on average.” Of course, this is not a cookbook recipe for future growth. One of those OECD countries *now* increasing spending on the “y-item” by “x percent” would almost certainly *not* experience an increase of growth rates by “z percent”.

It goes without saying that, by its very nature, econometric analysis can give *ex post* evidence on “average” impacts only. Furthermore, the analysis of rather recent developments in OECD or EU countries cannot make allowances for non-linearities that especially become evident for core spending (protection of property rights, internal and external security).

Finally, the econometric foundation of the new growth literature itself is subject to controversial debate. When interpreting the evidence with a view to the quality of public finance, we should bear in mind that, despite its popularity, the “(...) new empirical growth literature remains in its infancy” (Durlauf and Quah (1999, pp. 295)). So far, in standard growth regressions a range of methodological problems are not sufficiently controlled for. On an elementary level, many of the empirical studies on the sources of growth are plagued with measurement error and specification problems (Schulz (1999, pp. 71)). Many variables of growth are endogenous, which raises identification problems. Endogeneity, if not properly dealt with, can easily give rise to the notorious *post hoc ergo propter hoc* fallacy, i.e. wrongly concluding causality from correlation. Yet, the obvious answer to simultaneity – using exogenous instrumental variables to proxy for the regressors – requires very strong, in many cases implausible assumptions for the omitted growth determinants (Durlauf (2000, pp. 252)). The multiplicity of proposed variables which offer plausible partial explanations of growth also calls for procedures of variable selection, or, at least, for tests of robustness (see e.g. Levine and Renelt (1992) and Sala-i-Martin (1997)).

These and other problems of the empirical growth literature demonstrate that the above mentioned *ideal* econometric study on the growth impact of fiscal variables does not

exist.<sup>21</sup> Nevertheless, there is no need to discard the empirical evidence surveyed in this paper. Growth regressions may not always live up to the very high expectations they once raised. But still they give a good idea of the driving forces of growth. Some of the methodological problems mentioned can be overcome with the use of modern statistical methods.

Other problems of growth econometrics cannot be overcome because they do not reflect statistical or mathematical complications, but our limited understanding of the mechanics of growth. In spite of the major efforts to identify the sources of growth, we still have a simplistic growth concept that ignores many interdependencies and synergies of this process. From this perspective, “greater eclecticism in empirical work” with a stronger reliance on qualitative case/country studies promises valuable additional insight (see Durlauf (2000)). Tanzi and Schuknecht (2000), for example, examine the fiscal reform in a number of countries in the 1980s and 1990s. They argue that comprehensive (“radical”) rather than piecemeal reforms, which improve the institutional framework and curb the rent seeking incentives of special interests, have been most successful in reducing public expenditure, changing the expectations and outlook of economic actors and re-invigorating economic growth. They provide a detailed account for the experiences of New Zealand and Chile but also make reference to the reforms in OECD countries such as Australia, Ireland, the Netherlands or the UK.

The interdependencies and synergies of all-in-one reforms give a good illustration why the same partial policies may lead to different growth results in different countries. Of course, institutional and political preconditions for radical reform are not alike in all countries. But be it comprehensive reforms, be it piecemeal reforms, a few issues stand out despite all methodological complications: it is certainly wise to treat policies that are positively associated with current economic growth differently than other policies which are not. And the returns for these “wisely spent” expenditures do not necessarily come tomorrow, but in the medium and – mainly – in the long-term.

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<sup>21</sup> E.g. model specification and heterogeneity. For further discussion see Pack (1994), Freedman (1997), and Brock and Durlauf (2001).

#### 4. Summary and conclusions

The present survey has addressed the fact that the “quality of public finances” indeed might have a potential impact on long-term economic growth. One key problem in the whole debate, however, is that the issue of “quality” is very difficult to capture. Moreover, theoretical limitations (economic theory, econometric studies) and data and methodological problems (construction of indicators) prevent exact quantifications handoff the impact of fiscal policies on growth. Some concluding points can now be summarised building on the previous sections.

- A well-defined institutional framework is important to support the long-run growth of the economy and ‘high quality’ public finances play an important role for its functioning;
- Fiscal policy can contribute to macroeconomic stability and a sound policy mix and create expectations that foster economic growth;
- The evidence on size effects of fiscal variables supports the case for quantitative consolidation with a view to reducing total spending, thus enabling reductions of deficits and taxation. The empirical findings on growth effects of the composition of government activities clarify that not all kinds of government spending should be treated alike when it comes to reforming public finances;
- On the spending side, certain core spending items are essential for the economy to function and to grow. However, these services also must be delivered in a cost-effective way;
- A main growth element is public investment, especially in human capital and – under certain conditions - in R&D. The growth effects of physical capital investment are less clear-cut;
- Redistributive spending can undermine growth. However, a certain basic level of redistribution and social spending is probably necessary as a social infrastructure.
- Taxes should be not distorting and should display low marginal rates while avoiding tax uncertainty and time inconsistency;



- The survey of different empirical studies shows that an objective and unambiguous overall catalogue of “high quality”-expenditure items is not feasible. There is no cookbook for growth. Economics gives an idea of the major ingredients, but it does not clearly tell the recipe;
- The quality-indicators for public finances developed in the meantime can only be illustrative. Within their methodical limits, indicator-concepts may offer orientation on their respective aspects of quality. But no indicator can in fact *measure* the comprehensive quality of public finances;
- In spite of all efforts to identify the sources of growth, we still have a simplistic growth concept that ignores many interdependencies and synergies of this process. From this perspective, the use of comprehensive case studies could give valuable additional insight, and this can be an avenue for further work on the topic.

## Appendix - Long-term growth theoretical framework<sup>22</sup>

Exogenous growth models first appeared in the 1950s, pioneered by Solow (1956) and Swan (1956). Set within the neo-classical framework, these models include a production function and a capital accumulation equation. The production function in its simpler version has two inputs, capital and labour, exhibit constant returns to scale in production and diminishing marginal productivity of both inputs. Assuming a Cobb-Douglas technology, it the production function can be written as follows

$$Y = F(K, L) = K^\alpha L^{1-\alpha}, \quad (\text{A1})$$

where  $Y$  is output,  $K$  is capital,  $L$  is the labour force,  $0 < \alpha < 1$ . An alternative way of expressing the production function is:  $y = k^\alpha$ , where  $k = K/L$  and  $y = Y/L$  are capital and output per unit of labour.

Capital accumulation obeys the following process:

$$K_t = sY - \delta K_{t-1}, \quad (\text{A2})$$

where  $s$  is the aggregate saving rate and  $\delta$  the depreciation rate of capital, both constant and exogenous.

These models emphasise the role of physical capital accumulation as the cause of growth, but due to their feature of decreasing returns to capital, the growth process is non-sustainable. For fixed labour, each additional unit of capital gives a lower return than the previous one, and gradually the economy moves to a point where savings provide investment only to cover depreciation.

Sustainable growth requires “technological progress” which augments capital (and labour) productivity. An index of technical efficiency,  $A$ , which captures technical progress, is then introduced in the production function:

$$Y = A K^\alpha L^{1-\alpha}. \quad (\text{A3})$$

With such a production function specification, economies exhibit a long-run per-capita growth rate at the rate of technological change.

Technological change is not explained within the model, but taken as exogenous, and the model does not explain the determinants of long-term growth. According to the exogenous growth models policy changes only have impact on determining the level of output, they do not affect long-run growth rates, and they can raise the output growth but only during a transition period to a new steady state level of output.

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<sup>22</sup> Adapted from Lamo and Strauch (2001).

Endogenous growth models, which were first pioneered in the 1980s by Romer (1986) and Lucas (1988), account for the introduction of endogenous mechanisms of technological change. These models constitute a useful framework to study the effects of fiscal policy on long-term growth. They allow sustained growth and policy changes have effects not only on the level of output but also on the growth rates. Perpetual growth of output is possible as capital has externality effects and or is defined in a broader way, i.e. diminishing returns do not apply. Accordingly, growth can permanently be raised by increasing aggregate savings, by inputs accumulation (labour, human and physical capital), by higher efficiency in the production process and by supporting technological progress and research and development (R&D) investment.

A basic framework is to assume that the capital is the only input in the production function and that output varies proportionally with capital, i.e. the production function exhibits constant returns to capital instead of diminishing. In this setting, as long as net investment is positive, output grows. This model is known as the AK model because of its production function is written as  $Y=AK$ .

Another approach is to define capital broadly including human capital (skills and knowledge in the labour force). There may be two investment processes in the model, investment in physical capital and in human capital with a production function which has constant returns to both capitals jointly.

An alternative way to reach sustained growth and to give a role to policies consists in introducing a knowledge-producing sector. Additionally, Romer (1990) formalises the relationship between ideas and growth. Technology progress is endogenous via the introduction of the search for new ideas, and technology then is driven by R&D. For a given level of technology the production function has constant returns to scale, and increasing returns to scale when recognising ideas as inputs of the production function.

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