Growth Effects of Fiscal Policies

A Comparative Analysis in a Multi-Country Context

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Abstract

The potential interactions among fiscal policies, investments and economic growth are complex and manifold. In this paper, we will perform a systematic comparative analysis of the various economic insights that are currently available on these complex relationships, both theoretically (by a selective literature review) and empirically (by investigating available data from various countries). Despite the wide variety of potential theoretical relationships between government expenditures, taxation and growth, most empirical analyses are restricted to simple linear regressions of growth on some measure of government expenditures. Based on empirical experiments, we will indicate directions for future empirical research that may enrich our knowledge on the complex relationship between fiscal policies and economic growth, not only nationally but also regionally.

Key words: fiscal policy, government spending, taxation, economic growth, comparative analysis

JEL-codes: O11, O23, O47, O57

May 1999

1. Introduction

Growth theory is a focal point of modern economics. It does not only address the causes of economic growth (see, e.g., Solow, 1956; Denison, 1985), but also the implications of growth for the relative wealth of nations (as is illustrated by, for example, the convergence debate and discussions on poverty traps). There are at least two central issues in this debate. First, several authors (e.g., Arrow, 1962, and Arthur, 1994) have emphasised the critical importance of learning-by-doing mechanisms through which an economic system might be stimulated to achieve self-sustaining growth. But do learning mechanisms emerge as an automatic 'manna from heaven' or should there be an explicit act of government to induce such a mechanism (e.g., through training facilities, R&D etc.)? Against this background, the discussion on endogenous growth mechanisms and the central role of knowledge and (fostering) knowledge accumulation and dissemination is of great importance. Secondly, endogenous growth theory is relevant since it may provide answers to questions on the phenomenon of winners and losers and on the role the public sector has to play in this context (e.g., by providing education and infrastructure) in a competitive system of different - territorially demarcated - economies (e.g., countries, regions). Also the role of institutions (e.g., labour unions) comes increasingly into play. The crucial question is then whether increasing returns and free factor mobility in an open economic system might lead to spatial-economic convergence or whether spatial-economic disparities in a growth context would have to be tackled by explicit policy initiatives of governments and institutions (*cf*. Fujita and Mori, 1998). This issue has gained special importance with the advent of unification in Europe.

Thus, the ultimate 'drivers' of economic growth and the associated spatial-economic disparities need to be given due analytical attention (*cf*. Nijkamp and Poot, 1998). The integration of temporal and spatial dynamics in economics is, however, fraught with many difficulties and requires often the use of non-linear dynamic models for complex spatial systems (see for a review and illustrations Nijkamp and Reggiani, 1998). Since the path-breaking contributions of Romer (1986) and Lucas (1988) a wealth of scientific contributions has emerged on the integration of increasing returns and imperfect competition in general equilibrium models. But the spatial openness and interactive feedbacks of such systems were not properly investigated, nor was the role of governments and institutions. This has also clearly been expressed in the 'new economic geography' (see, e.g., Krugman, 1991). Especially since the publication of Krugman (1993) on the similarity between theories of international trade and of transport and locations, a new wave of interest in spatial growth theory has emerged, perhaps instigated by his challenging remark: "*Who produces what, where? It is not surprising that there should be a field of economics concerned with that question. What is surprising is that there are two such fields. The two fields were both born in the early 19th*

century; but since their birth they have diverged, and until recently have seemed to be totally distinct. I refer to the fields of international trade theory and location theory. (…) International trade theory, descended in its essence from Ricardo's 1819 analysis of comparative advantage, has grown into a massive intellectual structure. Location theory, descended in a less linear fashion from Von Thünen's 1842 analysis of land rent, has an almost equally long pedigree and a core of important ideas, but has never achieved either the same degree of integration or the same status. And the two fields hardly communicate".

Fortunately, the history of regional economic research has not made a standstill, as was implicitly assumed in several of Krugman's writings. Interesting recent examples showing the progress in spatial-economic analysis can inter alia be found in Ottaviano (1999) - who developed a general equilibrium model incorporating trade and migration in order to investigate the consequences of changes in the cost structure of trade and migration for regional- and sectoral-economic inequalities - and in Magrini (1999) - who employed a Markov chain approach based on a neo-classical model for an open regional economic system in order to empirically study regional convergence in Europe. Other good illustrations of solid growth theory can be found in Barro and Sala-i-Martin (1995) and Aghion and Howitt (1998).

A quick glance at the current literature on modern growth theory reveals also severe weaknesses. First, although the availability of extensive data sets like those of Summers and Heston (1991), Maddison (1982 and 1995), and Barro and Lee (1994), have spurred research on the empirics of economic growth, the empirical nature and quality of the analysis is in most cases extremely feeble (see Temple, 1999, for an excellent overview of what has been achieved as well as for a research agenda for the coming decades). Second, many theoretical and empirical contributions assume an essentially space-less economy, so that transactions and flows of goods and ideas across regions are neglected. And finally, the steering role of government bodies and institutions (e.g., unions, employers' associations) is mostly left out of consideration. This paper tries to fill at least some of the above mentioned gaps. It emphasizes in particular the impact of governmental agencies on growth and seeks to pinpoint the associated opportunities for public intervention in development policy. Finally, an attempt is made to offer some empirical evidence of the role of governments by a comparative study on growth paths of several countries.

The present paper proceeds as follows. In section 2 and 3, we will shortly review the available theoretical insights on the relationship between the activities and behavior of governments and economic growth. We will argue that this literature has not yielded many clear, testable implications. Despite the lack of clear testable implications following from economic theory, much empirical research has tried to shed some light on the relation between

fiscal policy and economic growth, which will be selectively reviewed in section 4.[1] These studies try to explain average growth rates over long periods by possibly explanatory variables like initial income (to test the convergence hypothesis; see, for example, Barro and Sala-i-Martin, 1995), investment ratios (to test for the effect of capital accumulation), or various kinds of policy variables like government expenditure, taxation, black market premiums on foreign exchange, tariff rates, schooling variables, etc. (see, e.g., Barro and Sala-i-Martin 1995). These types of regression equations have become popular due to Barro (1991) and are by now known as 'Barro-equations'. We will present some evidence on the role of fiscal policy that has resulted from these studies, and also pay some attention to the problems that they face. Next, in section 5 some empirical findings resulting from an applied analysis executed within the framework of this paper will be presented, while section 6 will discuss some potential ways for improving our empirical knowledge on the complex relationship between growth and the role of governments and offer some concluding remarks.

2. Government spending, taxation and economic growth; the theory

In neoclassical growth models (as developed by Solow, 1956, and Swan, 1956), growth in income per capita in the steady state is exogenously given and depends only on the exogenous rate of technological progress that falls like 'manna from heaven'. Economic growth is invariant to any kind of policy (although policy will affect the steady state *level* at which the economy operates). Only during the transition of economies to their steady state can economic policy have an effect on *rates* of growth. For decades, this model was the standard reference which formed the basis for policy views on government spending and taxation. It is therefore not surprising that most research on the role of the government focused on the 'division and stabilization of the cake' instead of its 'enlargement'. With the advent of the new, endogenous, growth theory that was initiated by the pioneering work of Romer (1986) and Lucas (1988), the perspective on the role of the government has drastically changed. In this class of model, not only transition growth rates are endogenous, but also the steady state growth rates. Factors that have been proposed as being important for determining long run growth are, among others, preferences, trade-intensity (for example, Grossman and Helpman, 1991), Research and Development (for example, Grossman and Helpman, 1991), income inequality (Persson and Tabellini, 1991) and also fiscal policy (Barro, 1990 and Glomm and Ravikumar, 1994a and 1994b). In all endogenous growth models that have been developed in the past

[1] We deliberately restrict our attention to cross-section studies. Note however, that also time series evidence has been obtained (e.g., Easterly and Rebelo, 1993, and Persson and Tabellini, 1991). Furthermore, there is some evidence from growth accounting studies (see, e.g., Maddison, 1982), as well as evidence from the estimation of production functions including some kind of public capital (see Glomm and Ravikumar, 1994a for an overview).

decade, the government can influence growth, either directly or indirectly. Thereby, it can have major consequences for standards of living. A crucial distinguishing characteristic of the endogenous growth theory is its perception of the nature of knowledge. In contrast to the neoclassical theory of growth, knowledge is not considered to be a public good and need not be characterized by diminishing returns to scale. The former characteristic implies that the government may have to play an active role in providing subsidies to overcome under-investment due to non-appropriability, or in defining property rights. The latter implies that a once and for all increase in investments in, for example, education may permanently foster economic growth (which is in contrast with the neoclassical growth theory). In the present section, we will describe the potential (theoretical) effects of government spending and taxation on economic growth. In section 3, attention will be shifted towards other government 'activities' and their relationship with economic growth. In section 4, we will review the available empirical evidence.

As a first step toward studying the relationship between government spending, taxation and economic growth, it is of crucial importance to divide government activities in several categories. The broadest division is into spending and revenue raising. Spending can be subdivided into government consumption (which includes government subsidies) and investment. These investments may further be divided into investments in infrastructure, education, defense, etc. Also the ways in which revenues are being raised need further classification. The first distinction is between distortionary and non-distortionary (lump-sum) taxation. Distortionary taxation can further be classified along capital- and labor-income taxation, their degree of progressivity, etc. Finally, government spending and revenue raising cannot be considered in isolation. The difference between the two is the government deficit which accumulates into government debt.

The *partial* effects of these variables on economic growth have been well investigated in the literature. Stated generally, government investments have a growth enhancing effect, as have, for example, subsidies aimed at enhancing private investments (in physical, human and knowledge capital). Government consumption can, as far as economic growth is concerned, be considered as 'throwing money in the sea' and will thus have no direct effect on economic growth. A first issue that we need to address in the context of revenue raising is concerned with the question whether the government finances its expenditures by issuing debts or by levying lump-sum taxes. According to the Ricardian Equivalence Theorem (RET), the government's financing decisions should be irrelevant. In this view, we only need to be concerned with the size and composition of government spending to establish the growth effects of government activities. There are however, several flaws to this argument (see for example Romer, 1996, for a discussion). Among these are that (i) the logic of the RET only applies for infinite-lived households (for finitely lived households the issuing of debts

represents net wealth for people living at the time the debt is issued and will thus affect their behavior), (ii) liquidity constraints may affect the borrowing capacity of people (issuing debts instead of levying taxes then relieves this constraint and may again affect people's behavior), and (iii) taxes may be distortionary. Distortionary taxation may reduce incentives to save and/or invest and will thereby have a depressing effect on economic growth. As to the effects of the stock of government debt, there is no accordance in the literature on its effects on growth. It is however likely that a huge debt will tend to have a growth-depressing effect as expectations on profitability of investments and savings will tend to be lower.

Although these partial effects can relatively easily be (and have been) demonstrated, the fact that government spending will have to be backed with revenues is likely to result in complex and non-linear relationships between government spending and growth. This has neatly been demonstrated in the seminal theoretical work on endogenous growth and the role of the government by Barro (1990). In his basic model, he assumes that services provided by the government are of productive use in the private sector (think of, for example, investments in infrastructure). However, government expenditures should be financed and this is done by a proportional tax on income (which is assumed to be such that the government runs a balanced budget). It turns out that in this fairly simple model of endogenous growth, the effect of increased government spending on economic growth is non-monotonic. With a small size of the government, the productivity effect dominates and there is a positive relation between growth and the size of the government. As the government becomes larger, the distortionary effect of the taxes that have to be raised to finance the expenditures becomes more important and beyond a certain size of the government, the relation between growth and the size of the government becomes negative. There is, in other words, a hump-shaped relation between the size of the government and the rate of economic growth, implying some optimal size of the government. Clearly, it is not obvious beforehand from this model whether one should empirically expect a positive or negative relationship between growth and taxes. The answer on this question depends on whether governments in the countries under consideration are on, below or above their optimal size. This relationship is in any case non-linear.

This basic result has been reestablished in various other studies in some way or another. For example, Glomm and Ravikumar (1994a and 1994b) consider the relationship between government spending on infrastructure or education and economic growth. The implications their models yield depend, in general, on how the expenditures are being conceived (i.e., being productive or just as throwing money into the sea), and how they look at the effects of taxes that have to be raised in order to finance the expenditures. The general empirical implications that seem to follow from these models are that one expects a positive (partial) correlation of growth with productive expenditures (on, for example, education and infrastructure) and a negative (partial) correlation with government consumption and

distortionary taxes. However, it is important to note that there is no uniformity in these models and that there are not many clear, testable implications that follow from the literature. Most agreement exists probably on the fact that the relation between fiscal policy and economic growth is non-linear and depends on various partial effects that are difficult to disentangle[2]. Despite this fact, much empirical work has been done in the field of the relationship between fiscal policy and economic growth and we will discuss some of the evidence that follows from this work in the next section.

In conclusion, theoretical studies have described various channels through which fiscal policy might affect economic growth. The relation seems to be rather complex and to depend on various partial effects, implying many complex trade-offs between the potentially beneficial effects of government services provided and the negative effects of distortionary taxes on economic growth and development.

3. Systemic governmental effects on economic growth

So far, attention has been restricted to the government as an economic agent that collects money via taxation and spends it on education, provision of subsidies, infrastructure, government consumption, etc. And we saw in the previous section that these activities may affect economic growth along various channels. One may, however, also identify other mechanisms through which governments may influence economic growth which may be referred to as non-financial conditions or prevailing domestic, political or institutional arrangements through which the government may, directly or indirectly, affect economic growth (see for example the work by North, 1991, and Olson, 1982) for rich and extensive discussions on these issues). In a way, these conditions with flanking policies to match them may be regarded as public goods in that they have indivisible consequences for whole nations at the least. As far as policy is concerned, the main issue appears to be not only that of a possibly positive outcome in quantitative measures of the accumulation of expenditure effects and fiscal effects, but also that of a possible outweigh of the efficiency-reducing forms of government intervention (e.g. public sector enterprises, price and quantitative controls) by efficiency-enhancing roles of the government (e.g., addressing market failures, providing social and economic infrastructure), resulting in a net positive impact on overall economic performance and hence on growth. The following contribution will shortly describe some of the channels that have attained a distinct position with regard to the frequency in which they,

[2] This point is forcefully made by Levine and Renelt (1992) when they discuss the problems that arise when performing *linear* cross-section growth regressions (as is done in most of the empirical studies, see section 3).

more or less successfully, have been implemented empirically.

Although possible distortion effects of government taxation have been pointed out in the previous section, it was not yet dealt with exhaustively. Government taxation is not only a means of raising revenues to back up expenditures, but it is also an instrument through which income (in) equality and labour markets may be affected. An obvious result of an increase in effective taxes on labour would be that of an increase in labour costs. According to Daveri and Tabellini (1997), an excessively high cost of labour is the main cause of an increasing rate of unemployment as well as the slowdown in economic growth in Europe nowadays. Given a non-competitive nature of labour markets, an exogenous and permanent increase of labour costs will force firms to substitute capital for labour, which results in a decrease of the marginal product of capital over long periods of time; this in turn will diminish the incentive to accumulate and thus to grow.

Governments also play an important role in influencing the distribution of income over various agents in the economy. The importance of income distribution has, for example, been underlined by Persson and Tabellini (1991). They show that inequality is harmful to growth, the reason being that a society with more inequality, where distributional conflicts are important, is characterised by political decisions that allow private individuals to appropriate less of the returns on accumulation of physical and human capital. These societies are consequently faced with lower rates of capital accumulation, leading to lower growth rates. In an indirect way, fiscal policies aimed at reducing inequality can thus be said to be favorable to growth. On the other hand, by providing generous social benefits, governments may foster unemployment which in turn may be bad for economic growth (e.g., Daveri and Tabellini, 1998, and de Groot, 1998)

Governments are also important in providing a stable and legal framework in which property rights are clearly defined (now and in the future), and also a monetary environment with stable prices. An interesting point of view regarding this matter has been offered by Olson (1982). He argues that the longer a society enjoys political stability, the more likely it is to develop powerful special-interest organisations that in turn make it economically less efficient. They will have both an incentive to make the society in which they operate more prosperous, and an incentive to redistribute income to their members with as little excess burden as possible. In practice, these distributional organisations are bound to slow down a society's capacity to adopt new technologies and to reallocate resources in response to changing conditions, and thereby will reduce the rate of economic growth. The accumulation of distributional institutions and agencies will, due to an increasing complexity of regulation, bureaucracy, and political intervention in markets, cause an increasing importance of an active role of the government.

Another factor by which the government may affect economic growth in an immaterial

manner is the degree to which people within a political system have (political) freedom. Friedman (1962) and Hayek (1944) among others, have argued that freedom should facilitate economic performance and hence growth. Others (proponents of a planned economy) have argued that a country requires autocratic control and reduced freedom in order to grow rapidly. Olson (1990), for example, argues that countries which have had democratic freedom of organization without any upheaval or invasion for relatively long periods, will suffer most from growth-repressing organizations and combinations. Moreover, countries whose distributional coalitions, emerged as described above, have been emasculated or abolished by totalitarian government or foreign occupation should grow relatively quickly after a free and stable legal order is established.

Finally, a factor in which government involvement meets regional perspectives is the degree of openness of an economic system. With respect to economic growth, attention may be focused on the manner in which openness affects convergence across countries (*cf*. Puga, 1999). The importance of trade, capital flows, the diffusion of product and process innovations and net migration at the interregional and international levels suggest that spatial interactions need to be considered, both in terms of their direct effects on growth and their effects on technological change. In the neo-classical growth model, trade is not necessary for income convergence to take place, though a free flow of capital may speed up the process (*cf*. Barro, Mankiw and Sala-i-Martin, 1995). In its essence, endogenous growth theory predicts - in the absence of cross-country knowledge spillovers - divergence, by relaxing the assumption of diminishing returns to capital, due to which the ratio of saving or investment to GDP also matters for long-run growth (Baldwin, 1999). The introduction of endogenous technological change may be a disequilibrating factor in a trade model. Although Romer (1991) showed an increased average growth rate resulting from an integration of regional economies, it is possible that a specialization based on comparative advantage leads to sub-optimal investment in R&D activities by resource rich economies (Grossman and Helpman, 1994). From a policy perspective, the question which region has a comparative advantage in the R&D sector is relevant here since it may be the level of activity in this specific sector that provides a learning by doing spillover benefit for all regions. Hence, an increase in the supply of the resource used intensively in the knowledge generating sector will obviously speed up growth. Despite all this, the disequilibrium issue here comes down to the fact that the regions that produce the good which enjoys a faster technological change will, in the absence of knowledge spill-overs (!), continue to have a higher growth rate, resulting in a continuing change in the terms of trade.

4. The empirical evidence: a comparative review

Inspired by the theoretical studies on the relationship between fiscal policies and economic growth and the appearance of data sets from, for example, Summers and Heston (Penn World Table; 1991) and Barro and Lee (1994), in recent years much research has been performed, trying to find evidence for such a relation. We refer to Temple (1999) for an excellent overview of this 'new growth evidence', as well as for an overview of the problems of this literature and the resulting research agenda which will probably occupy researchers for the next decades. In this section, attention will be restricted to a discussion of cross-section evidence on the relationship between government activities and economic growth.[3] This empirical literature was initiated by Barro (1991).[4] His study covered 98 countries over the period 1960-1985, and looked at the relationship in a cross section of countries between the growth rate of real GDP per capita in that period and proxies for human capital, initial real GDP, investment in physical capital, measures of political stability, proxies for market distortions, the share of government consumption in GDP and the share of public investment. A distinction is made between government consumption (excluding spending on education and defense, as these spending categories are more likely to add to private sector productivity) and public investment. As one would expect theoretically, a negative correlation between growth and government consumption is found. The argument being that government consumption has no direct effect on private sector productivity, but lowers savings and growth through the distorting effects of taxes (see also section 2). No significant relation was found between public investment and growth. Especially regarding endogenous growth however, it is important to bear in mind that, given its underlying assumptions on the absence of diminishing returns to capital, public investment may affect growth in an indirect, rather than in a direct manner. This holds for human capital as well as for normal capital. This kind of study has been done and redone in various, slightly different, ways. Most extensive in this were Easterly and Rebelo (1993) and Levine and Renelt (1992). The most important findings from the former study were that (i) measures of fiscal policies tend to be insignificantly related with growth, (ii) these measures often cause the coefficient on initial income to become insignificant, pointing

[3] For some time-series evidence we refer to, for example, Easterly and Rebelo (1993) and Persson and Tabellini (1991). In the context of growth accounting studies, some material on the effect of fiscal policy can be found in, for example, Maddison (1982). Another type of evidence comes from studies, aiming at estimating aggregate production functions that include some measures of public capital (see Glomm and Ravikumar 1994a for a brief review).

[4] An update and extension of these results can be found in Barro and Sala-i-Martin (1995). The general conclusions in these two studies are not essentially different.

at a strong correlation between initial income and fiscal policy measures[5], (iii) growth and public investments in transport and communication are consistently positively related, while investments in transport and communication are not related with the investment rate, implying that the effect of public investment does not run via capital accumulation but via the efficiency of resource allocation.

In an extensive overview of the empirical growth literature, Levine and Renelt (1992) address the question of the robustness of the relations that have been found. They do so by employing the Extreme Bounds Analysis (EBA), developed by Leamer.[6] They call a relationship between economic growth and a particular variable robust, if (i) it remains statistically significant, and (ii) it is of the theoretically predicted sign, when the conditioning set of variables in the regression equation changes. The main conclusion of their paper is that there is a positive and robust relation between economic growth and the investment share of GDP. Furthermore, the investment share is robustly correlated with the share of trade in GDP. Finally, they find qualified support for the hypothesis of conditional convergence: including a measure of human capital, there is a robust negative correlation between growth and initial income. As far as government activities are concerned, they show that there are no robust relationships between growth and government consumption expenditures, total government expenditures, government expenditures net of spending on education and defense, central government surpluses, government capital formation as a ratio of GDP, government education expenditure as a ratio of GDP, government defense expenditure as a ratio of GDP and various tax measures[7]. Also, there turns out to be no robust relation of the above mentioned variables with the investment share in GDP. A final remark on this robustness analysis is that fiscal indicators enter with the predicted sign for many specifications when investment is included, while the indicators are insignificantly correlated with the investment ratio itself. The general conclusion should thus be that, if there is any relation between growth and fiscal policy at all,

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5 Another troublesome conclusion is that the significance of relations of the 'standard' variables like assassinations, revolutions and war casualties with growth depends on the type of tax measure that is included (see Table 3 in the paper). This points to robustness problems in these results (see section 3.5 for a more extensive discussion on this issue).

6 For an intuitive overview of the EBA-methodology we refer to Levine and Renelt (1992). The essence of the methodology is that one tests whether a certain relationship between two variables remains significant and is of the theoretically predicted sign, if one changes the conditioning set of variables that is used in the regression. Note that there has been some discussion on the usefulness of the EBA-methodology (e.g., McAleer, 1994, and McAleer and Veall, 1989). Nevertheless, Levine and Renelt make an important point in their study and it is important to refer to their results in the context of the subject under consideration in the present paper.

7 An update of this part of the analysis by Levine and Renelt is found in Levine and Zervos (1993). In this study, the initial analysis is extended by using, for example, data from Easterly and Rebelo (1993). The conclusion of no robust relation between growth and fiscal policies remains to stand upright, however.

it runs via efficiency of resource allocation and not via the accumulation of physical capital as implied by many of the existing theories.

Another source that casts some doubt on the potential of policy variables to explain variations in economic growth is a study by Easterly et al (1993). They start with the notion that much of the existing growth literature explains differences in growth performances by focusing on differences in country characteristics such as savings rates, education levels and also various kinds of policy measures (this holds for all studies described in the previous sections). Starting from this point, it is convincingly shown in the paper that growth rates show little persistence over time. This conclusion holds independent of whether one determines persistence by means of simple or rank correlations or a cross plot of growth rates in two different periods for various countries. It also holds independent of the length of the period that is chosen. Having noted this, the persistence of country characteristics should be low as well in the case in which these characteristics should be able to explain the differences in growth performance of these countries over time. It is shown, however, that the persistence over time of various country characteristics like inflation, government consumption, assassinations, the trade share, the black market premium, initial income, enrollment rates, investment shares, etc. is large relative to the persistence of growth rates. The implication of this point is clear. Country characteristics are not well suited to explain the observed differences in growth performance of countries over time. In the remainder of the paper, it is shown that shock variables like terms of trade, external transfers, the change in the number of war-related casualties per capita on the national territory and the presence of a debt crisis can explain much of the low persistence in growth rates over time. Especially the importance of the terms of trade is stressed. The effect of these shocks is partly direct but also partly indirect, as the shocks influence policy variables. Fiscal policies are thus probably partly endogenous. The conclusion of the paper, therefore, is that given the high persistence of country characteristics (among which are policy characteristics) and the low persistence of growth rates over time, one should be cautious in concluding that good growth performances can be attributed to good policy. This casts some doubt on the importance of fiscal policy for explaining growth performance.

Another driving force for growth (which may be influenced by policy) may be trade. Although theoretical discussions frequently focus on the relationship between international trade, knowledge spill-overs and growth, empirical research has typically examined the relationship between just exports and growth. As already mentioned in section 3, endogenous growth theory differs from neo-classical growth theory by the fact that it predicts, in the absence of knowledge spill-overs, divergence (or only conditional convergence) among countries. One of the first convergence studies regressing per capita income growth on initial level of per capita income was the one done by Barro (1991). The sign on the initial per capita

income only turned negative after adding school enrolment rates in the equation. This kind of result has been a typical feature in subsequent large sample studies by Mankiw et al. (1992), Knight et al. (1993) and Barro and Lee (1994). All these studies showed no evidence of unconditional convergence, but evidence of conditional convergence when other factors affecting the growth of income per capita are allowed for, such as political instability, government activity, market distortions and trade variables (Thirlwall and Sanna, 1996). One of the best examples where free trade and factor mobility are associated with a narrowing down of regional differences in economic welfare can be found in the United States. Here, a regional per capita income convergence process is, according to Barro and Sala-i-Martin (1992), taking place over the last hundred years.

An important empirical issue is the fact that, while traditional trade theory tends to emphasise that it is increased openness - and not necessarily the actual volume of trade - that should lead to an equalisation of incomes, the evidence from that earlier work points to a very strong relationship between the two. A conclusion might be then that the level of trade may be seen as an appropriate proxy for the degree of openness of a country. Indeed, a variety of empirical studies has provided evidence that income convergence among countries seems to be a prevailing feature among countries that trade extensively with one another. Evidence, though weak, that countries that become increasingly open experience higher economic growth (rather than "just" convergence) was found by Kormendi and Meguire (1985). More recently, Hansen (1994) found an insignificant relation between exports and economic growth for individual country estimates.[8] For the pooled sample the coefficient was positive and highly significant when using gross investment data, but insignificant when utilised net capital stock data were used. One of Hansen's conclusions is that the results reported in the literature regarding the positive effect of exports on economic growth are not robust.

This issue of lack of robustness once again leads to the 'Levine and Renelt critique'. They examined the robustness of export indicators used in past studies, while in addition they examined the relationship between growth and import indicators, total-trade indicators, and more direct estimates of trade policy and the distortion between domestic and international prices. In their extreme bound analysis Levine and Renelt hardly found a regression in which the ratio of exports to GDP enters positively and significantly when investment is used as a conditioning variable (see the earlier discussion above on the EBA-method). However, as soon as investment is dropped from the list of conditioning variables the ratio of export proves to be robustly positively related with economic growth. Also, a robustly positive correlation between the share of trade in GDP and the share of investment in GDP was found. These

[8] Hansen used a rather small country set consisting of Canada, West-Germany, Japan, United Kingdom and United States.

results suggest an important two-link chain between trade and growth through investment and were taken by Levine and Renelt as an indication that, in contrast to standard theory, the relationship between trade and growth may be based on enhanced resource accumulation and not necessarily on the improved allocation of resources.

Levine and Renelt also examined more direct measures like the measure of openness, constructed by Leamer (1988) by using the Hekscher-Ohlin-Vanek trade model. This index represents the difference between the actual and predicted level of trade, a higher value of this index representing more openness. Levine and Renelt did not find this index to be robustly correlated with GDP per capita growth. They did, however, find a robust, positive correlation between the index and the investment share.

From the above discussion, it will be evident that the empirical literature on the effects of government spending, taxation, trade and openness is fraught with problems. The problems increase further when attention is shifted to the effects of non-financial conditions and prevalent political circumstances. In the literature concerned with these issues, the discrepancy between theoretical coverage and their respective empirical implementations are even wider, the main problem often being the search for a variable which can be taken as an appropriate proxy for the political circumstance under consideration and which can also be represented by a quantifiable measure. The discussion that has enrolled on these issues is extensive.

We take, as an for example, the measurement of the degree of stability of the political system. In order to define this degree, Barro (1991) included two variables from Bank's (1979) data set, i.e., the number of revolutions and coups per year and the number per million population of political assassinations per year. The idea behind the inclusion of these variables is evident. Given an increase in the chance of being replaced within a sufficiently small period of time, a political leader is likely to be more inclined to carry on expropriatory actions, since the costs can be passed over to successors. When one bears in mind that mechanisms for protecting property and contractual rights are already fragile in a period of political instability, especially when instability is cause by non-constitutional events, it is straightforward that high numbers of revolutions, coups and assassinations will cause a reduction and reallocation of investment and will thus prove to have a negative influence on economic growth. Barro empirically tested his predictions and actually did find a negative relation between his proxies for political instability and economic growth, though the coefficients still proved to be negative when the investment/income ratio was held constant (see the previous discussion on these issues). Barro's approach has been heavily criticized by, for example, Knack and Keefer (1995). First, Barro's proxies for political instability are restricted to non-constitutional political disturbances. This limits the coverage of his predictions, since the actions of those leaders who face a higher risk of losing power in a constitutional way are not captured by these proxies. Second, the proxy itself may be a misleading one. The correlation between

revolutions, coups and assassinations and the security of property rights might be not as high as expected. Several examples of countries contradict such a strong relation. Some western European countries like Germany and France score at least as poorly on Barro's measures of political violence as, for example, Malawi and Zambia. However, this does by no means point to an equal security of property rights. Third, the possible manner in which government and institutions affect property rights is not restricted to political instability. The latter is a relatively crude indicator and is not covering much of the relevant influences. Fourth, there is a simultaneity problem. Economic performance on its turn seems to have an important part in the appearance of political violence. Barro himself already mentioned this possibility in an attempt to explain high correlation in the absence of decreasing investment ratios.

Another example is related to the measurement of political rights and civil liberties. Gastil (1979) has constructed indices of these indicators for most countries in the world. These indices are ordinal measures which run from 1 (most free) to 7 (least free). Political rights are rights to participate meaningfully in the political process. In a democracy this means the right of all adults to vote and compete for public office, and for elected representatives to have a decisive vote on public policies. Civil liberties are rights to free expression, to organize or demonstrate, as well as a degree of autonomy such as provided by freedom of religion, education, travel, and other personal rights. From these two indices Gastil derives the status of political freedom for a country as either free, partially free, or not free. Empirically, Gastil's contribution has been used and interpreted different ways. Authors like Kormendi and Meguire (1985) treat the index of civil liberties as an additional explanatory variable for economic growth (finding a positive relation between the degree of civil liberty and economic growth, while the effect on growth operates mainly through the investment channel). In a more recent paper, Guseh (1997) uses Gastil's classifications to transform them into dummy variables to compensate for extreme capitalist and socialist economies. Again, Knack and Keefer have adopted a more skeptic attitude to the explanatory value of the indices. They argue that they concern aggregate measures which have been compiled without the explicit aim of measuring the security of property rights. For many purposes, these variables are of great importance. However, many of the dimensions are not closely related to property rights. Further critical remarks by Knack and Keefer concern the possibility of considerable measurement error in evaluating the particular institutions thought to affect property rights, contracting rights, and the efficiency with which public goods are allocated, since the indices are not dis-aggregated and the implicit weights attached to the various dimensions may vary over time and between countries.

As a means to resolve the problems with measuring 'political circumstances', Knack and Keefer (1995) come up with an alternative set of institutional indicators compiled by two private international investment risk services, viz. International Country Risk Guide (ICRG)

and Business Environment Risk Intelligence (BERI). The ICRG variables they use consist of expropriation risk, rule of law, repudiation of contracts by government, corruption in government and quality of bureaucracy. Expropriation risk, rule of law and repudiation are interpreted by Knack and Keefer as proxies for the security of property and contract rights. A low score on one or more of these variables means that countries are likely to suffer a reduction in the quantity and efficiency of physical and perhaps even human capital investment. Corruption in government and quality of bureaucracy are taken as proxies for the general efficiency with which government services are provided, and for the extent and damage of rent-seeking behavior. A low score on these variables implies a situation in which other than efficiency criteria are likely to prevail with respect to the determination of government policies and the allocation of public goods. Moreover, the fact that a corrupt government and a low quality bureaucracy will negatively affect security of property rights may result in a diminishing quantity and efficiency of capital investment. The BERI variables used by Knack and Keefer consist of contract enforceability, infrastructure quality, nationalization potential and bureaucratic delays with the latter two paralleling the ICRG variables expropriation risk and quality of bureaucracy. Contract enforceability could be taken as a proxy for the security of contract rights with investment consequences as already mentioned above. The variable of infrastructure quality reflects the efficiency with which governments allocate public goods. One of the conclusions of Knack and Keefer is that the correlation between the ICRG and BERI variables on one hand and Barro's political violence variables and Gastil's political and civil liberties indices on the other hand are relatively low. This indicates (at least) that the ICRG and BERI variables contain a substantial amount of information not being found in the other variables.

In this section we have reviewed some of the central studies yielding insights into the empirical relationships between fiscal policy, trade, institutions and economic growth. Some general remarks on this type of cross-sectional empirical studies are in place. First, all studies face serious measurement problems. There are neither data available on *marginal* tax rates and subsidies, nor are there reliable data on the levels of public investment.[9] Secondly, the studies face a potential problem of reverse causation. We already noted the correlation between initial income and fiscal policy measures as implied by the Barro-type of equations. More extensive studies indeed show a statistically significant relationship between initial income (as a measure for the level of development) and fiscal policy measures (e.g., Easterly and Rebelo, 1993). Thirdly, as was emphasized in section 2, the relationship between government activities and economic growth is complex and likely to be non-linear. The finding of no significant

[9] Easterly and Rebelo (1993) try to overcome this problem by constructing the marginal tax rates in four different ways. For the problems with each of these measures, see Easterly and Rebelo (1993). Also for public investment, various measures are constructed.

relationship between growth and government spending might therefore have to do with the specific (non-linear) form of the relation. One way to test for this could be to add taxes in a non-linear fashion to the regression equation, in order to be able to grasp the complex relations between growth and fiscal policies[10]. Fourthly, the paper by Levine and Renelt (1992) shows rather convincingly that none of the results on the relation between fiscal policy, trade, institutions and economic growth is robust. This can be seen as an econometric problem that the empirical literature in this field of research has to face and for which no apparent solution seems to be available. If any general conclusion can be drawn from the above described studies, it should be that there is no unanimity on the relationship between fiscal policy and economic growth. Maybe this should not be surprising in a research area where so few testable implications follow from the underlying theories, in which non-linearities and complex trade-offs seem to be especially important, and in which good and reliable data are scarce. A fifth problem is that hardly any evidence exists on the efficiency of government spending. Finally, we should mention that many of the results that have been obtained are not easily interpretable. We mentioned, for example, that the black market premium on foreign exchange has been used as a variable by Barro (see, e.g., Barro and Sala-i-Martin 1995) to measure the effects of economic policy. It is however not at all clear how to interpret the negative relation between growth and the black market premium that has been found, not to speak even about formulating policy recommendations on the basis of this type of evidence. Drawing policy lessons on the basis of cross country regression evidence should in other words be done with the utmost caution and recommendations should be treated with sound and fair skepticism.

5. Empirical experiments

In this section, we will offer various empirical experiments to illustrate and verify some of the above mentioned conclusions on the determinants of economic growth. After a concise introduction to the methodology, we will describe the data set and offer and interpret some results.

5.1 Methodology

In this section a regression study considering the explanatory power of various governmental and other variables with respect to economic growth, as dealt with in this paper, will be

[10] Levine and Renelt (1992) make this point forcefully. Nevertheless, they do not extend their analysis to deal with the non-linearities (which could be done by adding, for example, quadratic terms to the regression equation).

carried out. The regression study has a pooled time-series cross-section character. The relationship between different variables in various countries and their associated economic growth rates is addressed in this empirical study, while for each country variable values from multiple periods have been used. By doing so, useful results may be derived on the relevance of country-specific economic, political or other situational conditions for explaining growth, as well as on the relevance of changing economic, political or other situational aspects within a country for explaining changes in growth over time. Data have been gathered for fourteen countries and six time periods, resulting in a total number of 84 observations for each variable in the data set. The countries included are Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, Norway, the Netherlands, Spain, Sweden, United Kingdom and the United States. The time periods considered are 1960-1964, 1965-1969, 1970-1974, 1975-1979, 1980-1984, 1985-1990.

The regression methodology used here is the strategy of "sequential elimination by reducing the set of explanatory variables" as described in Theil (1971)[11]. This method basically consists of running regressions on a given large set of possibly relevant variables and removing in each run the variable which according to significance tests proves to be least appropriate from the set until all remaining variables show statistical significance. This approach is particularly useful, if there is no unambiguous theoretical framework that would lead to a clear choice for the identification of of explanatory variables (a case of a semantically insufficient model).

5.2 Variables employed in the analysis

For a complete overview and explanation of all variables used, we refer to the Appendix. We will focus in particular on fiscal expenditures as well as taxation variables. Also, a number of variables capturing the political situation will be accounted for. In addition to this, some variables encompassing educational aspects and human capital stocks will be added. Finally, a set of variables regarding openness and trade will be used in the analysis.

In all our experiments, we will control for the initial income per capita relative to the USA and the private investment ratio (the variables that have been found to be robust by Levine and Renelt in their extensive study). The fiscal expenditure variables used are the ratio's to GDP of expenditure on education, expenditure on defense and consumption expenditure net of spending on education and defense. Also, public investments are considered. The taxation variables used are the effective tax rates on labour income and capital income. Politically situational variables employed here are the number of assassinations and

[11] This methodology has shown some instability concerning rather different outcomes resulting from not so different variable sets. To some degree, this might be caused by multi-collinearity problems .

revolutions, and indices of political rights and civil liberties as used by Gastil (1979). The human capital variables added are the number of years of education, gross enrollment ratio's, pupil to teacher ratio's and the percentage of people with no schooling in the total population. The variables capturing the trade and openness situation used are the average import export share, a measure of free trade openness, distance to major markets, a tariff restriction variable and a trade shock variable. Dummy variables are used for all countries (except for the United States with serves as the reference country) and for all periods (except for the last period, i.e. 1985-1990, which serves as the reference period) to detect any country or period specific growth effects.

5.3 The results

The results from the analysis are given in Table 1. Unsurprisingly, both the initial income level and the share of private investment are statistically significant as well as of the theoretically predicted sign. The positive effect of the private investment share on economic growth is some supporting evidence for endogenous growth type of models. The negative sign of the coefficient of initial income level upholds the case for the conditional convergence hypothesis.

Table 1. Regression results for economic growth (pooled cross-section analysis)

	Coefficient	t-value
Intercept	-0.0209	-2.636
Rate of initial GDP per capita to USA	-0.1770	-8.623
Ratio of real private investment to real GDP	0.1190	4.814
Effective tax rates on labor income	-0.0630	-5.599
Terms of trade shock	0.1890	3.988
Index of political rights	0.0088	3.415
Percentage of "no schooling" in the total population	-0.0024	-7.718
Total gross enrolment ratio for higher education	0.0585	4.575
Finland	-0.0240	-4.962
Japan	-0.0120	-2.420
Sweden	0.0126	3.278
70-74	-0.0082	-3.450
80-84	-0.0119	-4.823

R Square
0.84

Concerning the influence of human capital it is noteworthy that it is not education expenditures (a flow), but rather the accumulated stock, represented by high-school enrolment rates and the

share of population lacking education, which strongest affects economic growth. The high-school enrolment rates are positively related with economic growth while the "no school" variable negatively affects economic growth. The two variables may be regarded as sufficiently complementary since they show a weak mutual correlation.

The negative sign of the coefficient of taxes on labour income suggests a considerable relevance of disturbances on the labour market. An explanation may be that the increased labour costs resulting from higher labour taxes lead to a process of substitution of labour for capital, causing the marginal product of capital to fall and hence negatively affecting incentives to accumulate physical capital (see Daveri and Tabellini, 1997).

Rather surprising is the fact that the index for political rights shows up with a positive coefficient, signifying that economic growth is higher when political rights are less respected. This does, however, coincide with Olson's theory concerning growth-depressing distributional coalitions arising in economies with democratic freedom of organisation as described in section 3 of this paper. The "trade shock" variable, constructed as the growth rate of export prices minus the growth rates of import prices positively affects economic growth, which may be caused by relative price elasticities of export to import being lower than one.

The period dummies of the early seventies and eighties indicate a less than average performance in these periods, reflecting the poor world-wide economic performance in this period of crisis. It may also partly be explained by the fact that the periods used in this study do not fully coincide with business-cycle patterns. Finally, there are some country dummies showing up as significant in the regression results. These are the dummies for Finland, Japan and Sweden, of whom the coefficients of the first two are positive while the last one has a negative coefficient. The fact that Japan is performing poorly is somewhat surprising. With respect to Finland's negative dummy coefficient, it may be the geographical peripheral location which may, to some degree, play a role in its growth pattern. The positive coefficient of the Sweden dummy may perhaps be taken as evidence for a relatively well-performing Swedish model.

6. Conclusion and future research

The interest in endogenous growth policy is rapidly rising, not only from the perspective of international trade developments and related comparative advantages, but also from the perspective of local or regional development efforts. In a more open and globalizing economy, localities and regions have the need to create a more distinct profile through territorial competition (see also Cheshire and Gordon, 1998). This is inter alia exemplified by current efforts of many areas to attract foreign direct investments (see, e.g., Van Geenhuizen and

Nijkamp, 1998). The main idea is to develop and promote the territory as a competitive place for industrial growth and related spin-offs. This view of course prompts also an interest in public policy as an endogenous response to the needs and opportunities of business life (e.g., by means of tax exemptions, locational incentives etc.). The exploitation of the strong economic-geographical aspects of a given area may increase economic efficiency, although it may also increase regional-economic disparities. Thus, the open character of many regional economies has induced more competition, which may put more stress on interregional convergence often aimed at in regional economic policies.

Profit-seeking behaviour of firms may cause imbalances in a multi-regional system, if the location and competitive conditions are not equal. In this context, R&D policy may become an important endogenous policy tool. This R&D policy is not only related to innovative behaviour of firms, but also to human capital development. The latter is usually more a competence of governments, and hence public policy plays a critical role in an endogenous growth context, not only as a generator but also as a disseminator of scientific knowledge (*cf*. Acs et al., 1994). In this context, regional authorities have to become alert actors with a non-bureaucratic mind (the so-called 'learning regions' concept). Knowledge spill-overs do not only use conventional channels (such as academic research institutes, scientific publications etc.), but increasingly also the entire modern information and communication technology (ICT) sector (e.g., Internet), as well as physical mobility of people. Consequently, the role of the government may also cover the infrastructure of knowledge transfer and the dissemination of technological competence, so as to encourage local innovative performance.

Another element that is of pivotal importance for the relevance of endogenous growth mechanisms in a multi-regional setting is the multi-layer structure of institutional governance (e.g., fiscal federalism). The way governments and institutions impact on regional growth is contingent on the ramifications of formal and informal decision-making systems, so that the impacts of endogenous regional development strategies are co-determined by institutional configurations.

The richness of these ideas and this theorizing about the complex and intriguing potential relationships and trade-offs at the interface of policy and economic growth (see also section 2 and 3) is in sharp contrast with the ways in which the effects of governmental policies have empirically been tested. From the available empirical evidence on the role of fiscal policies, as reviewed in section 4, we have concluded that there is no clear conclusion to be drawn from the empirical research on government spending, taxation, trade, openness, the prevailing political situation, and economic growth. This should not come as a surprise, given the fact that the relationship shows various complex causal mechanisms according to the theory. Furthermore, we have concluded that the literature meets various econometric

problems like a lack of good and reliable data, possibilities of measurement errors, reverse causation and endogeneity biases. We have argued that the most serious problem from which almost all the evidence suffers is the 'Levine and Renelt critique'; none of the results that have been obtained seem to stand the scrutinity of an extensive robustness analysis. In a sense, the Levine and Renelt critique is almost a 'deathblow' for all cross-section regression studies that have been performed in the last decade. A potential way out would be to perform an extensive meta-analytical study on the variety of insights that have been gained in the literature in order to put some testable structure to the obtained evidence. Such a meta-analytical experiment might have various constituents: (i) a comparative analysis of the strengths and weaknesses of the various theoretical paradigms involved; (ii) a review and cross-comparison of various methods used to test the validity of endogenous growth approaches; and (iii) a statistical meta-analytical experiment to test the commonality and transferability of the various study findings. Anyway, for the time being one has to be aware of the problems that the empirical literature faces and one has to treat the results and conclusions with fair skepticism. The results obtained should at most be viewed as empirical regularities, and not as stylized facts or behavioral relationships on which future policies should be designed!

Appendix. List of deployed variables

Independent variable	-	Growth rate of real GDP per capita[1]
General	-	Rate of initial GDP/capita to USA[2] *
	-	Average population growth[3] *
	-	Ratio of total workers to population
Government expenditure	-	Ratio of total nominal government expenditure on education to nominal GDP
	-	Ratio of nominal government expenditure on defense to nominal GDP
	-	Ratio of real government "consumption" expenditure net of spending on Defense and on education to real GDP
Investment	-	Ratio of real public domestic investment to real GDP
	-	Ratio of real private investment to real GDP
Taxation	-	Effective tax rates on labor income[4] **
	-	Effective tax rates on capital income[4] **
Political variables	-	Index of political rights (1 = most rights, 7 = least rights)
	-	Index of civil liberties (1 = most free, 7 = least free)
	-	Number of assassinations per million population per year
	-	Number of revolutions per year
Trade and openness	-	Ratio of export to GDP
	-	Ratio of import to GDP
	-	Terms of trade shock[5]
	-	Distance[6]
	-	Measure of free trade openness[7]
	-	Measure of tariff restriction[8]
Human capital	-	Total gross enrolment ratio for higher education
	-	Total gross enrolment ratio for primary education
	-	Total gross enrolment ratio for secondary education
	-	Average schooling years in the total population over age 25
	-	Average years of higher schooling in the total population over age 25
	-	Percentage of "no schooling" in the total population
	-	Pupil/teacher ratio in primary school
	-	Pupil/teacher ratio in secondary school

Dummy variables			
	Australia	Japan	1960-1964
	Belgium	Netherlands	1965-1969
	Canada	Norway	1970-1974
	Finland	Spain	1975-1979
	France	Sweden	1980-1984
	Germany	United Kingdom	
	Italy		

All variables stem from the Barro-Lee data set except the indexed ones. Single starred variables are derived from the latest version of the Penn World Table (1995); Double starred variable were taken from Daveri and Tabellini (1997).

1) Growth rate of real GDP per capita is derived by calculating yearly growth and averaging for the appropriate five year periods;
2) Rate of initial GDP per capita to USA is derived by calculating the yearly rates and averaging for the appropriate five year periods;
3) Average population growth is derived by averaging for the appropriate five year periods;
4) Tax data are derived by "shifting" the five year periods used by Daveri and Tabellini one year backwards. Shifting of a period is done by first assuming tax rates in each year within a Daveri and Tabellini period to equal the period average after which the yearly tax rates are averaged for the appropriate five year periods used in this paper;
5) Terms of trade shock is constructed as: Growth rate of export prices minus growth rate of import prices;
6) Distance is the average distance to capitals of the world's 20 major exporters, weighted by values of bilateral imports in thousand kilometres;
7) The measure of free trade openness employed is constructed as:
   .528 - .026 log (AREA) -.095 log (DIST), in which AREA is the size of land in million square miles and DIST is equal to the distance variable used;
8) The measure of tariff restriction is constructed as:
   Free trade openness * log (1+OWTI) in which OWTI is the own-import weighted tariff rate on intermediate inputs and capital goods.

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