Fiscal Decentralisation and Economic Growth in the OECD

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Abstract

What impact, if any, does fiscal decentralisation have on economic growth? Further investigations of the inter-relationships between fiscal decentralisation and economic growth are timely given that government decentralisation remains at the forefront of many OECD policy agendas. The study incorporates new measures of fiscal decentralisation to better account for the impact of different levels of subnational fiscal autonomy on economic growth. The analysis also considers the impact of previously omitted public sector decentralisation variables that provide further indication of the extent to which subnational governments are 'closer to the people' and potentially better able to account for local preferences in fiscal decision-making. Whilst little evidence of a direct relationship between fiscal decentralisation and output growth is found, some evidence is found to support the hypothesis that a medium degree of fiscal decentralisation is positively related to growth in the capital stock and the level of human capital.

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Introduction

'FISCAL DECENTRALIZATION is in vogue.'

Wallace E. Oates (1999)

'The subject you are discussing [decentralisation and devolution]... is the most
important current issue in democracy today and is as much of interest to the
Commonwealth as it is to the wider international community...'
Address to the Commonwealth Workshop on Decentralisation and Devolution
Commonwealth Secretary-General Donald McKinnon (2000)

Fiscal decentralisation is once again a hot topic amongst policy-makers. Out of 75 developing and transitional countries with populations greater than 5 million, all but 12 claim to have embarked on some form of government decentralisation initiative over the last decade.[2] Fiscal decentralisation has also featured in the recent policy agendas of many Organisation for Economic Co-operation and Development (OECD) countries. For example, in the United States, the central government has returned significant portions of federal authority to the states particularly concerning areas such as welfare, Medicaid, education and job training. In the United Kingdom under the Blair government, both Scotland and Wales have opted for their own regional parliaments. Australia has recently experienced vigorous debate over the need for reforms to its Commonwealth-State fiscal arrangements to improve the supply-side of its economy, with the complex cobweb of intergovernmental relations accused of dragging back productivity, creating export bottlenecks, infrastructure shortages and even crisis in its heath and education systems.

Given that the stated objective of fiscal decentralisation in many countries is to promote economic growth, and given the current policy interest in fiscal reforms in developed countries like Australia, studies of the relationship between fiscal decentralisation and economic growth are timely. Of course, until recently, discussions about the normative design of fiscal systems and analyses of their performance were not particularly concerned with the objective of whether they

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[2] See Ebel and Yilmaz (2003) and Dillinger (1994)

enhanced economic growth. It remains an open question as to whether fiscal decentralisation actually plays a statistically significant role in enhancing or inhibiting economic growth.

This paper investigates the relationship between fiscal decentralisation and economic growth in a group of OECD countries. After defining fiscal decentralisation, the paper provides a review of the literature concerning fiscal decentralisation and growth. The analytical framework is then introduced. A discussion of the measures of fiscal decentralisation and the data follows. The empirical analysis incorporates traditional measures of fiscal decentralisation and a number of new measures that attempt to account for different degrees of subnational fiscal autonomy. Indicators used to test the hypothesis that there may be a hump-shaped relationship between fiscal decentralisation and economic growth (that is, a medium degree of decentralisation is best for growth) are also refined. Further, the analysis includes previously omitted political and public sector decentralisation variables that potentially affect the relationship between fiscal decentralisation and growth. Such factors provide an indication of the extent to which subnational governments are 'closer to the people' and potentially better able to account for local preferences in fiscal decision-making.

The relationship between the different measures of fiscal decentralisation and growth is investigated using both cross-section and panel data. Existing intuitive discussion of the potential relationship fiscal decentralisation and growth suggests that the connection may be indirect, that is, decentralisation may influence economic growth by improving efficiency and increasing the quantity and quality of inputs to the production process. Therefore, the paper also extends study of the indirect impact of fiscal decentralisation on economic growth, via the components of the growth equation, to a panel context.

Overall, there is little or no statistical evidence of direct relationship between fiscal decentralisation and growth for the sample of OECD countries examined, given the data and methods used. However, when one analyses the components of the growth equation, there is some evidence that a medium degree of decentralisation is best for the growth in both physical and human capital.

Defining Fiscal Decentralisation

What exactly do economists mean by fiscal decentralisation? In its most basic form, fiscal decentralisation refers to the division of budgetary responsibilities between different levels of government. Of course, true decentralisation is not simply a geographical de-concentration of the central government's bureaucracy or service delivery, rather it is essentially linked to the territorial distribution of power. The Commonwealth Secretariat (1985) defines the decentralisation of government as 'the transfer of power and/or authority to plan, make decisions and/or manage public functions from a higher level of government to a lower one'.

Therefore, for the purposes of this paper, fiscal decentralisation refers to *the amount of independent decision-making power involved in subnational expenditure and revenue decisions*. The term 'subnational' collectively stands for levels of government below the national government, both lower level governments (municipalities, communes or local councils) and intermediate tiers (regions, states, provinces, counties, territories or districts). 'Decentralisation' is used in the static sense to describe systems in which responsibilities are divided among tiers, rather than in the dynamic sense of becoming 'decentralised'. Thus, the extent of fiscal decentralisation depends on *the ability of lower levels of government to make independent revenue and expenditure decisions regarding the provision of public goods and services within a geographic domain, without interference by the central government.*

Literature Review

Traditional discussions about the normative design of fiscal decentralisation (hereafter denoted FD), and analyses of how decentralised systems perform in practice, were not concerned with the effects of FD on economic growth. Rather, Musgrave (1959) stated that the three main objectives of government regarding public finance were efficiency, income redistribution and macroeconomic stability. The literature concerning fiscal decentralisation and economic growth implicitly assumes that FD affects growth through its impact on these three factors. Therefore, the issue is whether or not changes in efficiency, macroeconomic stability and income redistribution resulting from increased (or decreased) FD have a statistically

significant impact on economic growth. Nevertheless, there is no theoretical model of the direct relationship between fiscal decentralisation and economic growth and there has been little effort to formally define the links between FD and growth via the channels of efficiency, macroeconomic stability and equity.

Efficiency

The major argument for fiscal decentralisation involves its potential to enhance efficiency. There are two notions of efficiency that may be affected by FD. 'Consumer efficiency' is improved if public spending at the subnational level, as opposed to the national level, can result in increased individual welfare. Decentralisation may enhance consumer efficiency if consumers in different jurisdictions have different preferences or if subnational governments are generally more responsive to the needs and priorities of taxpayers. However, it is unclear what impact increased consumer efficiency would have on economic growth. Martinez-Vazquez and McNab (1997:16) argue that, by better matching individual's preferences and increasing their welfare, there could be secondary effects on work effort, savings and investment that have a positive impact on economic growth. However, they acknowledge that the level and combination of public expenditures that maximise the welfare of local citizens may not necessarily maximise measured economic growth over time.

Decentralisation enhances 'producer efficiency' if subnational governments can yield better quality or larger quantities of public goods with a given budget, or provide the same level of goods and services at a lower cost. Both Martinez-Vazquez and McNab (1997:14) and Theissen (2000:8) assert that FD can foster experimentation and innovation in the production and supply of public goods. If such innovation leads to greater producer efficiency, then the higher quantity or quality of public goods could eventually result in increased income and therefore measured economic growth. However, this notion remains controversial. Bahl and Linn (1992:414) point out that greater *centralisation* improves producer efficiency if a given public service entails economies of scale or scope. Prud'homme (1995:209) argues that central bureaucracies operate closer to the technical production frontier as they tend to attract

more qualified people due to greater career opportunities and have more scope to invest in technology, research, development and innovation.[3]

The notion that FD may affect efficiency is underpinned by the seminal work of Tiebout (1956) and Oates (1972). In Tiebout's (1956) model, local governments compete to lure perfectly informed individuals to their locality using fiscal instruments. By 'voting with their feet' people convey information about their preferences to local governments. This revelation of preferences, and the governments' competitive response, brings about a Pareto efficient equilibrium. The ability of individuals to move to the jurisdiction that provides the best perceived combination of taxes and public services enhances consumer efficiency. Fiscal competition may force governments to deliver services at the minimum feasible cost, enhancing producer efficiency. Brennan and Buchanan's (1980:175) 'leviathan restraint hypothesis' asserts that if governments behave as revenue maximisers, intergovernmental competition can contribute to containing the size of their budgets. Therefore, FD can prevent an oversupply of public goods or x-inefficiency, and thus contribute to economic growth.

Nevertheless, it is argued that too much fiscal competition can be destructive. In the presence of factor mobility, FD may result in 'fiscal wars' as jurisdictions under-provide public services and basic infrastructure, in an effort to retain their tax bases. Further, interjurisdictional competition may be a zero-sum game for a fixed set of resources. Prud'homme (1995:204) suggests that if all local governments offer identical higher levels of public services (at a cost to their taxpayers), spatial patterns will remain the same, but the balance between the public and private sectors will move away from an optimal equilibrium. 'Efficiency enhancing' competition between governments is likely to depend on the ability of citizens to compare different government's services and taxes, and keep governments at all levels accountable for their decisions. Neither the theoretical nor the empirical literature concludes whether fiscal competition is essentially beneficial or detrimental.

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[3] The quality of local government officials relative to central government officials and the extent of corruption at the local level also have implications for producer and consumer efficiency. However, these factors are more likely to be important for developing countries than for the sample of OECD countries examined in this paper.

The major contribution of Oates' (1972) model was to demonstrate that, even without factor mobility, a uniform level of public services across all jurisdictions is inefficient when geographically separated consumers have different demands for a given public good or service. Oates' (1972:54) 'decentralisation theorem' states that 'in the absence of cost savings from the centralized provision of a [local public] good and of interjurisdictional externalities, the level of welfare will always be at least as high (and typically higher) if Pareto-efficient levels of consumption are provided in each jurisdiction than if any single, uniform level of consumption is maintained across all jurisdictions'. In theory, central governments could provide public services that are diversified across communities, although distance from local interests implies greater information, control and transaction costs in central provision. Another argument in favour of decentralisation, based on Oates (1972:34) 'correspondence principle', suggests that public goods should be provided at the lowest governmental level, to allow an approximate correspondence between those who benefit, those who decide on the amount provided and those who have to pay.

There are limits to the applicability of both the Tiebout (1956) and Oates (1972) models. The Tiebout concept of individual mobility assumes that voters move while politicians are constant. In practice, governments evolve through elections and individuals are less likely to relocate. Such mobility also assumes that earnings are independent of location. Both models assume no economies of scale or externalities in public service provision. In the presence of these two factors, the argument for decentralisation may be weakened.

In more recent work, Oates (1993:240) argues that the *static* proposition that FD enhances allocative efficiency can also apply in a *dynamic* framework. That is, if subnational expenditures are more efficient, then this static advantage may also be present in a dynamic sense – increased efficiency may enhance economic growth. Policies concerning inputs to the production process, such as infrastructure and human capital, that are sensitive to local conditions are likely to be more effective in encouraging economic development than centrally determined policies that ignore geographic differences (similar arguments are made by Martinez-Vazquez & McNab, (1997:12) and Theissen (2000:7)). In light of this, and the discussion on producer and consumer efficiency, authors such as Martinez-Vazquez and McNab (2001:18)

suggest that empirical studies should analyse the impact of FD on the *components* of growth (better quality and quantity of inputs) rather than on output growth per se.

Macroeconomic Stability

There is no consensus concerning the impact of fiscal decentralisation on macroeconomic stability. Sewell (1996:147) argues that large subnational governments can play an important role in stabilisation policy as regional swings in the business cycle can be very diverse, and it may be costly to differentiate the central government's budget on the scale required to respond to them. However, Tanzi (1995) and Prud'homme (1995) are among those who argue that subnational governments have little scope or incentive to act counter-cyclically in a coordinated and symmetric fashion. They suggest that fiscal decentralisation has the potential to worsen structural imbalances and interfere with the central government's ability to conduct stabilisation policy by reducing their share of the total government budget.

McLure (1995:224) and Sewell (1996:147) note that if most of the budget is pre-committed, stabilisation is most likely to come from the built-in effects of certain taxes and transfer payments. They assert that using variations in other types of public spending as a stabilisation tool can result in considerable inefficiency, given the difficulty in forecasting macroeconomic conditions and the lead times in most projects. This suggests that the same level of stabilisation can be achieved, regardless of the relative size of the national and subnational budgets.

Clearly, if FD has an impact on macroeconomic stability, this is likely to affect economic growth. The recent empirical studies of Kroft and Lloyd-Ellis (2002), and Ramey and Ramey (1995), provide evidence of a negative cross-country relationship between economic growth and macroeconomic volatility.

Equity

The third way in which fiscal decentralisation may affect economic growth is through distributional issues. Prud'homme (1995:203) suggests that fiscal decentralisation, all else equal, is likely to lead to a concentration of resources in a few geographic areas.

It is generally assumed that *centralised* provision of public services leads to a more equal distribution of resources across local jurisdictions. Prud'homme (1995:203) asserts that this exposes a basic contradiction in fiscal decentralisation – decentralisation requires central government transfers to reduce inequities, but this intervention erodes FD. Nonetheless, there has been no empirical test of the relationship between FD and inequality.

Evidence on the relationship between income inequality and growth is mixed (see for example Barro (2000) and Deininger & Squire (1997). Some empirical studies, such as those of Birdsall et. al. (1995), and Persson and Tabellini (1994), suggest that countries with low levels of income inequality tend to grow faster, but there is little consensus about how inequality across regions affects long term economic growth.

Summary

In summary, fiscal decentralisation may be *growth-enhancing* if it leads to increased efficiency in the supply of public goods by considering local preferences (consumer efficiency) or if it leads to subnational innovations, cost reductions and productivity improving intergovernmental competition (producer efficiency). Alternatively, *growth-impeding* hypotheses can be postulated from the suggestion that FD might lead to harmful competition, macroeconomic instability and a more unequal distribution of resources.

Of course, one should not necessarily expect a monotonic relationship between FD and growth. That is, it may not be true that the more decentralised a country's fiscal system becomes, the faster (or slower) that country grows. Rather, Theissen (2000:19) and Eller (2004:30) argue that there is an *optimal degree of FD*, usually though to be some 'medium degree', that is less than complete decentralisation. Low levels of FD may not provide enough incentive for subnational governments to improve allocative and productive efficiency. In this case, the fixed costs of maintaining subnational governments may outweigh any benefits in terms of efficiency, hindering economic growth. Too much FD may lead to macroeconomic instability and inequality, also having a negative impact on economic growth in the long run.

The few previous estimates of the relationship between FD and economic growth that are provided in the literature are largely contradictory. Of the cross-country studies, Oates (1995), Iimi (2005) and Yilmaz (1999) find a positive relationship between FD and output growth. Davoodi and Zou (1998) find a negative relationship for developing countries and none for developed countries. Similarly, Woller and Phillips (1998) find a negative correlation for developing countries. Thiessen's (2000; 2001) and Eller's (2004) results support the hypothesis that a medium degree of fiscal decentralisation tends to best promote economic growth in OECD countries.

Methodology

There is no clear theoretical framework to guide empirical work on the relationship between fiscal decentralisation and economic growth. As Levine and Renelt (1992) point out, there is no model that completely specifies the factors that one should hold constant while conducting statistical inference on the relationship between growth and the economic variable of interest. Empirical analysis of the links between FD and economic growth can be divided into two broad frameworks. The first approach, used only in one previous study of FD and growth, is based on cross-country growth accounting.[4] The second and most common approach, involves informal growth regressions. In the latter case formal theoretical models may be used to justify the inclusion of FD, or some of the control variables, in the growth regression but econometric specification is primarily driven by results in previous literature.

Cross-country growth accounting, following Temple (1999:124), involves regressing the growth rate of output on the growth rate of inputs. Part of the model may be formulated to capture differences in total factor productivity (TFP) growth due to specific variables. This is important since the literature suggests that FD is likely to affect growth through its impact on efficiency. The typical model begins with a Cobb-Douglas production function

$$y = Ak^{\alpha}h^{\beta} \tag{1}$$

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[4] See Eller (2004).

where y is the output labour ratio, k is the physical capital labour ratio, h is the human capital labour ratio and A is overall efficiency or TFP. Taking logs and first differences yields

$$\Delta \ln y_i = \Delta \ln A_i + \alpha \Delta \ln k_i + \beta \Delta \ln h_i \tag{2}$$

As all the variables are expressed in their growth rates, the approach rules out dynamic panel estimation – there is no need to include previous levels of income to control for the transitional dynamics induced by factor accumulation. Note that there is no term representing initial efficiency and in practice, A is replaced with some function of observables.

Eller (2004:36) uses this framework to build the following relationships between efficiency growth and fiscal decentralisation. The growth rate of efficiency is assumed to be determined by an exogenous component, γ_A, and either the change in FD or the level of FD

$$\Delta \ln A_i = \gamma_{A0} + \gamma_{A1} \Delta FD_i \tag{3}$$

or

$$\Delta \ln A_i = \gamma^\rho_{A0} + \gamma^\rho_{A1} FD_i \tag{4}$$

Equation (3) suggests that changes in FD lead to growth in efficiency. Since a change in FD affects its level, equation (4) suggests that a higher *level* of fiscal decentralisation permanently increases the growth rate of efficiency. Substituting (3) or (4) into (2) yields

$$\Delta \ln y_i = \gamma_{A0} + \gamma_{A1} \Delta FD_i + \alpha \Delta \ln k_i + \beta \Delta \ln h_i \tag{5}$$

or

$$\Delta \ln y_i = \gamma^\rho_{A0} + \gamma^\rho_{A1} FD_i + \alpha \Delta \ln k_i + \beta \Delta \ln h_i \tag{6}$$

Equation (5) represents what Eller (2004:37) calls the 'temporary decentralisation-induced efficiency-led growth hypothesis' and equation (6) represents the 'permanent decentralisation-induced efficiency-led growth hypothesis'.

This approach has a number of shortcomings. Although the hypothesis in (5) makes much intuitive sense, few measures present an accurate picture of actual changes in fiscal decentralisation and thus estimation of this equation may involve substantial measurement error. Although this model considers the efficiency channels through which FD affects growth, it can still be criticised on the grounds that it does not allow one to distinguish between consumer or producer efficiency or determine FD's impact on growth through the channels of macroeconomic stability or inequality.[5]

A more common approach in studies of FD and economic growth is to run informal growth regressions. The Davoodi and Zou (1998) framework, also adopted by Iimi (2005) and a number of single country studies, uses a simple theoretical model to justify the inclusion of FD in growth regressions. Other control variables are chosen from results in the literature, typically including those used by Levine and Renelt (1992) – the initial level of real GDP per capita, the population growth rate, the initial secondary school enrolment ratio (as a proxy for initial human capital) and the investment to GDP ratio.

Theissen's (2000; 2001) cross-country studies of FD and growth, and Lin and Liu's (2000) analysis of China, use informal growth regressions loosely based on the Mankiw, Romer and Weil (MRW) (1992) economic growth model. As these regressions include the investment ratio and initial income, the authors insist that they can be interpreted in terms of the MRW model. However, this extension is not perfect as terms from the theoretical model, such as the initial level of efficiency, are omitted from the estimated equation as they are unobservable or difficult to approximate. The omitted variable problem means that if one or more regressors are correlated with these terms, the parameter estimates will be biased. For instance, if countries with relatively low levels of initial efficiency tend to have low levels of decentralisation, this correlation may mean that FD takes a negative sign when entered into a growth regression, even if it has no long run effect on output. Therefore, Temple (1999:124) asserts that such informal growth regressions neglect important insights in the absence of a formal theoretical derivation.

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[5] This is acknowledged in Eller's (2004) study.

One empirical issue that was considered before analysing the relationship between FD and economic growth concerned the potential endogeneity of FD to the growth process. A significant body of empirical literature suggests that the level of income is a determinant of FD.[6] Development stimulates demand for variety and quality in the range of public services being provided whilst increasing the revenue raising capacity of governments, making decentralisation affordable. If FD has a high income elasticity, then higher income per capita may allow the constitution of a new level of decentralisation. If FD affects economic growth, then the new level of decentralisation will in turn have an impact on the level of income. This suggests a potential bi-directional relationship between FD and economic growth. Further, unobservable and omitted variables that tend to simultaneously affect both decentralisation and economic growth may also exist. If this is the case, then simply including FD in a growth regression could lead to simultaneity bias. Bruess and Eller (2004), Eller (2004) and Iimi (2005) acknowledge this possibility but do not formally test the hypothesis.

Hausman tests for simultaneity were conducted when using both the growth accounting and informal growth regression frameworks. In the case of the informal growth regressions similar to those of Davoodi and Zou (1998) and Theissen (2000; 2001), the null hypothesis that there is no simultaneity associated with the FD variable is rejected. However, in the growth accounting framework the null hypothesis cannot be rejected. This was the case for both the cross-section and panel regressions. Therefore, it is unclear whether a bi-directional relationship between FD and economic growth exists.

As mentioned earlier, cross-section informal growth regressions necessarily omit the initial level of efficiency. If FD is correlated with the initial level of efficiency (which is likely) FD will be correlated with the error term in the cross-section regressions. The growth accounting framework, by including variables in their growth rates, has no need for a term in initial efficiency, and interestingly FD is not found to be correlated with the error term. Nevertheless, the Hausman test results are the same in

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[6] See for example Oates (1972), Kee (1977), Pommerahne (1977), Bahl and Nath (1986), Wasylenko (1987), Patsouratis (1990), Panizza (1999), Eller (2004) and Letelier (2005). Other determinants of FD include the extent of diversity and taste differentiation, geographic area and population characteristics, urbanisation, military expenditure, trade and transfers between levels of government.

the panel framework, where the need for a term in initial efficiency in the informal growth regressions is eliminated by the time dimension.[7] Given that tests do not suggest that simultaneity is a significant problem in the growth accounting framework, the study proceeds with this approach.

A second econometric issue that was considered concerns the procedure of adding FD into the growth accounting equation, which implicitly assumes that FD does not affect the other inputs. Rather it influences growth only through its impact on the productivity residual. As discussed above, the producer and consumer efficiency hypotheses suggest that FD may affect growth by improving or increasing investment in human and physical capital. Theissen's (2000; 2001) studies use pooled cross-section analysis to investigate the effect of FD on TFP growth and investment growth. He uses the two step method suggested by Elias (1992) and Fischer (1993). The first step involves examining the direct relationship between growth and FD. In the second stage, the policy variable is regressed against inputs and either the Solow or MRW residuals.

This paper extends Theissen's (2000; 2001) analysis of the relationship between FD and the components of the growth equation in four ways. Firstly, his study uses pooled cross-section regressions. The obvious advantage of using panel data or pooled cross-section regressions over pure cross-section regressions is that they provide 'more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency' (Baltagi, 1996:4). Therefore, it has the potential to produce more reliable parameter estimates. Panel data has the added advantage of allowing one to control for omitted variables that are persistent over time. Including country specific effects allows one to better control for individual heterogeneity. The inclusion of country and time specific effects may also be necessary to inhibit correlation between the regressors due to contemporaneous time or country shocks. Without these effects, there may be parameter heterogeneity,

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[7] Note that the all the regressions used static panel estimation, excluding the initial (or lagged) levels of income. The level of income tends to be correlated with the FD in studies concerned with the determinants of FD. Thus including the lagged level of income, and using dynamic panel estimation, may solve the simultaneity problem in the informal growth regressions. The growth accounting method can be implemented in the panel context without need for dynamic panel estimation as there is no need to include previous levels of income to control for transitional dynamics induced by factor accumulation.

which could lead to meaningless estimates. Tests for parameter heterogeneity reject the hypothesis that the intercept can be held constant over countries and time, so this analysis, unlike Theissen's (2000; 2001), uses a static panel framework with fixed time and individual effects.

The analysis presented here also examines the relationship between FD and the growth rate of physical capital, between FD and the growth rate of human capital and between FD and measured TFP.[8] The analysis also uses the new measures of FD, and includes more disaggregated 'hump-shaped' indicators. Finally, results using Fischer's (1993) approach to the second stage regressions (he uses the explanatory variables from the first stage regression as the control variables for the second stage regressions), are compared with results using the control variables from Theissen's (2000; 2001) study and those from the cross-section study of human capital and FD by Treisman (2000).[9]

Data and Measurement

There is no single, or simple, measure of fiscal decentralisation. Fiscal decentralisation is 'so multidimensional that specification of a formal hypothesis for statistical testing requires stepping down from a view of the general picture, to a level which provides only a narrow slice of the panorama' (Guess, Loehr, & Martinez-Vazquez, 1997:1). The first dimension of FD considered in this study concerns the formal division of expenditures and revenues between levels of government. The second, and most important dimension, is the extent to which fiscal decision-making is decentralised.

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[8] Theissen (2000; 2001) was concerned with the relationship between FD and the growth rate of investment, on the one hand, and the Solow residual on the other.

[9] Theissen (2000; 2001) uses the unemployment rate, the GDP deflator, the fiscal balance and the standard deviation of domestic credit growth as control variables. Treisman (2000) conducted a pure cross-section study of the effect of public sector decentralisation on illiteracy rates. He controls for log GNP per capita (PPP) and democracy. In this paper, GDP per capita (PPP) is used to maintain consistency with the rest of the study. Democracy is proxied by the political freedom index.

Measures Used in Previous Analysis

The primary way of measuring FD is the 'budget data' approach. Previous cross-country studies of FD and growth have used budget data measurements based on the Government Financial Statistics (GFS) of the International Monetary Fund (IMF). Most studies use the subnational share of general government expenditures or revenues as a proxy for decentralisation.[10] However, three main deficiencies of the GFS are identified in the literature.[11] Firstly, the GFS provides a breakdown of revenues and expenditures by type and function but they are reported at the level of government that receives or operates them, irrespective of whether it has discretion over them. Thus, local expenditures that are directed by the central government are included in subnational expenditure. Secondly, it does not identify the sources of revenues, and no distinction is made between locally determined own taxes, piggybacked or shared taxes. Thirdly, it does not disclose the proportion of intergovernmental transfers that are conditional or the criteria (objective or discretionary) by which transfers are distributed. Therefore, although GFS data has consistent definitions across countries over time, it ignores the degree of central government control over local revenues and expenditures. These measurement errors mean that the degree of fiscal decentralisation tends to be overestimated.

More general criticisms of the budget data measurements include the fact that they do not reflect restraints on local fiscal autonomy arising from legislation, regulation, norms, minimum quality standards and other qualitative restrictions imposed by the central government. Subnational governments that have the autonomy to decide the amount and type of tax to collect, and to determine the allocation of their expenditure, are more decentralised than those whose spending and revenue is determined by national legislation. Further, changes in budget data measures over time do not necessarily reflect changes in subnational government autonomy. Stegarescu

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[10] For example Oates (1995), Davoodi and Zou (1998), Woller and Phillips (1998), Xie et. al. (1998), Theissen (2000; 2001), Eller (2004) and Iimi (2005). Oates (1995) and Theissen (2000; 2001) also consider self-reliance ratios, the share of subnational government's own revenues in their total revenues. Woller and Phillips (1998) use the share of subnational government revenues, less grants, in total government revenue and construct an expenditure share subtracting defence and social security spending. They argue that these provide a better of indication of the revenues and expenditures that could 'in principle' be the responsibility of either level of government.

[11] For example Ebel and Yilmaz (2002) and Stegarescu (2004).

(2004:20) claims that the tax bases of national and subnational governments typically have different elasticities. Therefore, business cycles cause automatic fluctuations in the revenue indicators, even though the assignment of competencies remains unchanged.

Another problem with existing measures of FD is that they aggregate all subnational governments into a single group. This horizontal aggregation does not take into account the number of participating subnational governments and the differences in competencies between them. Bahl and Linn (1992:391) point out that the data does not indicate whether subnational revenues and expenditures are concentrated in one or two jurisdictions or evenly distributed across all areas. The degree of fiscal autonomy may also differ between subnational jurisdictions.[12] A more correct measure of FD might consider the horizontal disaggregation of fiscal data by jurisdiction. The main difficulty with this involves finding indicators that are comparable across countries.

Stegarescu's Indicators of FD

Stegarescu (2004) provides six new indicators of tax and revenue decentralisation that attempt to capture different levels of subnational autonomy. These indicators have not previously been used in a study of FD and growth. The measures are based on the OECD (1999) survey *Taxing Powers of State and Local Government*. The survey classifies subnational taxes in decreasing order of fiscal autonomy according to three criteria: legislative abilities to determine the tax base and tax rate; the attribution of tax receipts; and tax administration. Based on the 4-digit classification of taxes by tax base reported in the annual OECD Revenue Statistics, the survey classifies each tax for each country according to the degree of decision-making autonomy as presented in Table 1.

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[12] This is particularly a concern with regions of special status in France, Italy and Spain, and for Scotland, Wales and Northern Ireland in the United Kingdom.

Table 1

OECD Classification of Taxes

(in decreasing order of control over revenue sources)

(a)	subnational government (SNG) determines tax rate and tax base
(b)	SNG determines tax rate only
(c)	SNG determines tax base only
(d)	tax sharing:
(d.1)	SNG determines revenue-split
(d.2)	revenue-split only changed with consent of SNG
(d.3)	revenue-split unilaterally changed by central government (CG) (fixed in legislation)
(d.4)	revenue-split unilaterally change by CG (in annual budgetary process)
(e)	CG determines tax rate and tax base

Source: Stegarescu (2004) and OECD (1999)

In cases (a) to (c), referred to as 'own taxes', the subnational governments have total or significant control. In the case of the revenue sharing categories (d.1) to (d.2), the subnational governments have limited influence. For categories (d.3) to (e), they have no control.

Stegarescu (2004) uses these classifications, the OECD Revenue Statistics, GFS data and 23 comprehensive surveys of national financial laws and constitutions, to create new indicators of tax and revenue decentralisation for 23 countries.[13] He provides time-series data on 'own taxes' (1965-2001) and 'own revenues' (1975-2001), adjusting the classification of autonomy for each subnational government tax on an annual basis according to changes in legal provisions.[14] His paper presents the 1996 to 2001 average value for five of his six measures.[15]

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[13] The survey covers Austria, Belgium, the Czech Republic, Denmark, Finland, Germany, Hungary, Iceland, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Stegarescu (2004) does not calculate measures of FD for the Czech Republic, Hungary, Mexico or Poland, but adds measures for Australia, Canada, the United States, France, Greece, Italy, Ireland and Luxembourg.

[14] There are gaps in the time-series for most countries before 1980. After 1980s there are missing data points for Greece, Iceland, Italy, Japan, New Zealand and Switzerland.

[15] With the exception of RDEC2, see equation (11).

Stegarescu's (2004:7) three measures of tax revenue (*tax-only*) decentralisation are subnational own tax revenue (TDEC1), subnational own and shared taxes (TDEC2) and total subnational tax revenue (TDEC3), all calculated as the share of general government (GG) tax revenue. Own taxes refer to those taxes for which the subnational government (SNG) can determine the tax rate or tax base or both. Formulas for each of these measures are outlined below.

$$TDEC\,1 = \frac{SNG\ own\ tax\ revenue\ (a)\ to\ (c)}{GG\ total\ tax\ revenue} \qquad (7)$$

$$TDEC\,2 = \frac{SNG\ own\ tax\ revenue\ (a)\ to\ (c) + shared\ tax\ revenue\ (d.1)\ to\ (d.2)}{GG\ total\ tax\ revenue} \qquad (8)$$

$$TDEC\,3 = \frac{SNG\ tax\ revenue\ (\,a\,)\ to\ (\,e\,)}{GG\ total\ tax\ revenue} \qquad (9)$$

Three corresponding measures of (*broader)* revenue decentralisation are given by:

$$RDEC\,1 = \frac{SNG\ own\ tax\ rev.\,(\,a\,)\ to\ (\,c\,) + nontax\ \&\ capital\ rev.}{GG\ total\ tax\ rev. + nontax\ \&\ capital\ rev.} \qquad (10)$$

$$RDEC\,2 = \frac{SNG\ tax\ rev.\,(a)to(c) + sh.\,tax\ (d.1)to(d.2) + nontax\ \&\ capital\ rev.}{GG\ total\ tax\ rev. + nontax\ \&\ capital\ rev.} \qquad (11)$$

$$RDEC\,3 = \frac{SNG\ own\ tax\ rev.\,(\,a\,)\ to\ (\,e\,) + nontax\ \&\ capital\ rev.}{GG\ total\ tax\ rev. + nontax\ \&\ capital\ rev.} \qquad (12)$$

Stegarescu (2004:13) also provides two measures of *expenditure* decentralisation. These measures are based on total subnational expenditure and lending, minus loan repayments, as a percentage of consolidated general government expenditure, without social security and EU payments. EDEC1 excludes transfers to other levels of government, whereas EDEC2 includes transfers to other levels of government net of received transfers. Again, none of these measures have been used in previous studies of FD and growth.

Unfortunately, it must still be recognised that these new measures of fiscal (revenue and expenditure) decentralisation do not provide a remedy to all the limitations of budget data discussed earlier. The degree of subnational fiscal autonomy is based on the provisions fixed in legislation, and actual implementation is not taken into account. Therefore, the measures only indicate the *potential* degree of fiscal autonomy and may still overestimate *actual* FD. The criticisms about horizontal aggregation are still valid. Further, there is some measurement error in these indicators for the countries that Stegarescu (2004) adds to the OECD survey.[16] Nonetheless, these measures provide a solid step towards better accounting for the varying degrees of autonomy that subnational governments have over their taxes and revenues.

Hump-Shaped Indicators of FD

Using these measures of FD, how does one test the hypothesis that a medium degree of decentralisation is best for economic growth? In previous work Theissen (2000; 2001) and Eller (2004) have found significant support for this hypothesis using 'hump-shaped' indicators based on the traditional budget data measures (the subnational share of general government revenues and expenditures). In this study, hump-shaped indicators were also created for each of Stegarescu's (2004) new decentralisation measures. A number of different approaches were tried in the construction of hump-shaped indicators. Following the divisions outlined in Theissen (2000; 2001), three dummy variables were created for *high*, *medium* and *low* levels of FD.[17] Similarly, dummy variables were created following Eller (2004) using *equal-sized* high, medium and low FD groups. Finally, countries were divided into five equal sized groups, denoting *very low*, *low*, *medium*, *high* and *very high* decentralisation. Since these indicators proved to be time-invariant for many countries, more disaggregated hump-shaped indicators were constructed by ranking each country, for each time period, from the lowest level of decentralisation to the

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[16] Note that there is significant measurement error for Australia. Stegarescu (2004) assigns Australian states complete autonomy over all sources of tax revenue, that is, grants from the Commonwealth Grants Commission are considered autonomous own taxes. The measures do not reflect Australia's large vertical fiscal imbalance, with the Commonwealth spending only about a third of the tax revenue it raises. Although most of the gap between subnational expenditure and revenues is filled by grants from the Commonwealth Grants Commission (which may be considered general purpose grants based on objective criteria), purpose-specific grants are not considered. In both cases the subnational governments do not control the tax rates or tax bases and thus including them in TDEC1 and RDEC1 raises questions about measurement error for this country.

[17] The medium degree of FD was postulated to be a subnational share of 30 to 45 per cent.

highest, and assigning numbers that increase toward the median value (such that the country and time period with the highest and lowest levels of FD were given the number 1, the second highest and lowest levels of decentralisation were assigned the number 2 and so on).[18] The latter approach was used to construct the indicators used in both the panel and cross-section analyses reported in the paper.

Other Measures of Public Sector Decentralisation

Finally, a number of other measures of government decentralisation, omitted from previous studies of FD and growth, are considered. General decentralisation of the public sector invokes a number of notions, each of which involves vertical decentralisation, that is, the division of government into a number of tiers. Appointment, electoral and personnel decentralisation refer, respectively, to the level at which government officials are appointed and dismissed, whether there are democratic elections at each level, and the share of administrative personnel employed at the subnational level. Bahl (1999:6) suggests that the true extent of fiscal decentralisation may be described by a number of such factors, ranging from elected local councils, locally appointed officers, institutional provisions, the size and number of subnational authorities and their organisational structures. These more general aspects of public sector decentralisation provide some indication of the ability of subnational governments to respond to local constituencies in their fiscal decision-making.

Therefore, the paper includes a number of indicators of public sector decentralisation. The number of subnational jurisdictions in the intermediate and lower tiers of government is considered. Two countries may have the same subnational share of expenditures or revenues but different numbers of participating subnational governments. More participating units, ceteris paribus, would imply more fiscal decentralisation.[19] Secondly, an indicator was included to account for electoral decentralisation, taking the value of 0 if there are no subnational elections, 1 if either local or intermediate tiers of government are elected, or 2 if both are subject to

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[18] The main problem with this measure, and those based on equal shares, is that what constitutes a 'medium degree' of FD depends on the country sample.

[19] This was pointed out by Bahl and Nath (1986:407) but has not been considered in an empirical study of FD and growth.

elections.[20] Subnational elections provide some indication of the ability of consumers to express their preferences to different levels of government and the incentive for governments to respond to those preferences. The indicator of constitutional structure used in the cross-section analysis was taken from Lijphart (1999), provided in Armingeon et. al.'s (2002) dataset. [21] This is an index of federalism on a five-point scale; (1) unitary and centralised, (2) unitary but decentralised, (3) semi-federal, (4) federal but centralised, and (5) federal and decentralised. In federal countries, subnational governments are more likely to have a permanent right to govern their own affairs. These three variables are largely time-invariant and hence they are not included in the panel analysis.

Resource decentralisation is considered using the ratio of subnational government employees to central government employees, using data provided by Schiavo-Campo et. al. (1997). Unfortunately this data is not readily available over time. These four general aspects of public sector decentralisation provide some indication of the extent to which subnational governments are 'closer to the people' and are therefore better able to account for local preferences in fiscal decision-making.

Other Variables

The empirical analysis uses three year averages based on annual data (see Appendix 1 for data sources). Growth is measured by the change in the natural log of real GDP per capita in constant local currency units and income levels are measured using PPP comparisons.[22] Both are expressed in per capita terms. The perpetual inventory method (PIM) was used to construct a measure of the capital stock from gross fixed capital formation (GFCF), following De la Fuente and Domenech (2000).

In this study the *level* of human capital is proxied by average years of schooling. Unfortunately, this data is only available in five-year increments and thus was interpolated for the panel analysis. Given this, however, calculating the growth rate of

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[20] France, Germany, Ireland, Italy, New Zealand, Poland and the United States were given a value of 3 as they have three elected subnational tiers.

[21] Studies of FD and economic growth have not considered a federalism dummy, although of Yilmaz (1999) implements separate regressions for federal and unitary countries.

[22] This follows Nuxoll's (1994:1434) argument that one should use PPP comparisons to measure the level of GDP and domestic national accounts data to calculate and compare growth rates.

human capital from this series may be misleading. Since a more consistent annual time series is available for the secondary school enrolment ratio, the *growth rate* of human capital is proxied by the growth rate of the secondary school enrolment ratio. It is acknowledged that there is likely to be some measurement error. These are typical problems encountered in the empirical growth literature. Authors such as De la Fuente and Domenech (2000:1) note that poor measurement and data quality means that educational variables frequently turn out to be insignificant or have the 'wrong' sign in growth regressions. Levine and Renelt (1992:945) acknowledge that incorrect measures of human capital may induce biased results. However, they still include the secondary school enrolment ratio in their growth regressions, arguing that some measure of human capital is required and other measures produce similar results. Most previous studies of FD and growth have included the secondary school enrolment ratio.

To control for macroeconomic disturbances, external shocks and structural rigidities that could impact both FD and growth, the GDP deflator is included. As Eller (2004:64) points out, when studying the impact of FD on economic growth, it is also important to control for the size of the public sector. Therefore, general government final consumption expenditure, as a percentage of GDP, is incorporated into the regressions. Other control variables used in this paper include the vertical fiscal imbalance (transfers to subnational governments as a share of subnational government expenditures), the standard deviation of domestic credit growth (used as a proxy for the uncertainty of financial variables) and a measure of political freedom (countries allocated a number between 1 and 2.5 are considered 'free', between 3 and 5.5 'partly free' and above 5 are considered 'not free').

Empirical Results

The expenditure, taxation and revenue decentralisation measures are plotted against economic growth in Figures 1, 2 and 3, respectively. The cross-section sample includes the countries for which all the FD measures are available – Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, the United Kingdom, Greece, Iceland, Italy, Japan, the Netherlands, New Zealand,

Norway, Portugal, Sweden and the United States.[23] Fitting a simple polynomial trend to the graphs suggests that, consistent across each measure of FD, there is some casual support for the hypothesis that a medium degree of decentralisation is best for growth. Switzerland has the highest overall level of decentralisation (averaged across the indicator measures), closely followed by Canada, whilst New Zealand and Portugal are the most centralised.[24]
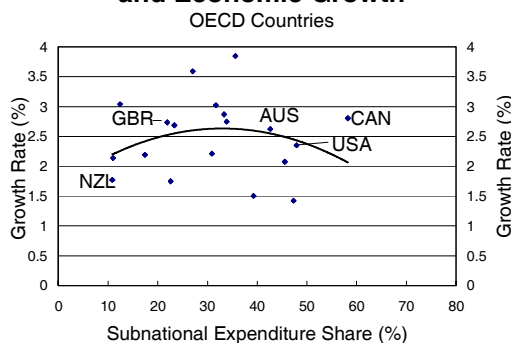
Figure 1

Measures of Expenditure Decentralisation and Economic Growth: OECD

EDEC1 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI
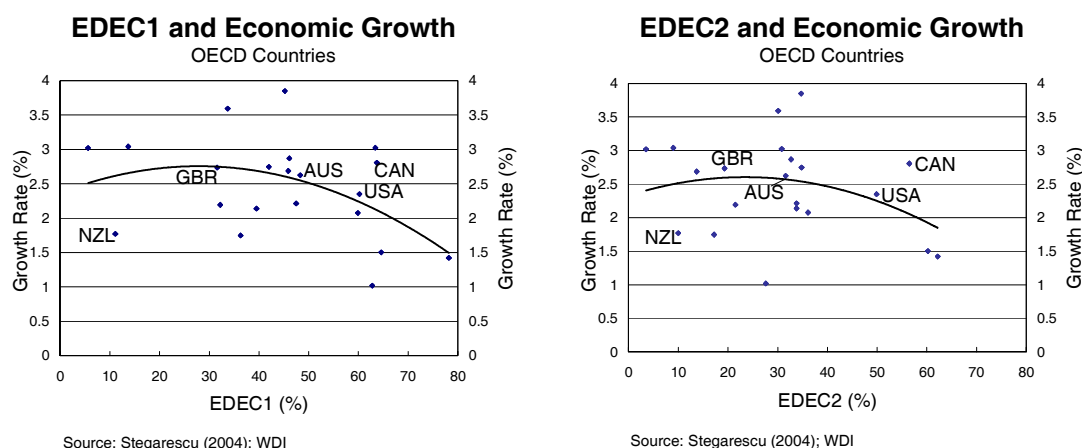
EDEC2 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI

Subnational Expenditure Share
and Economic Growth
OECD Countries

Source: World Bank Fiscal Decentralisation Indicators; WDI

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[23] Stegaresu (2004) provides the new measures of FD averaged over 1996-2001. Data on the traditional revenue and expenditure shares is only available to 1998 or 1999 (2000 for Denmark), thus the average from 1996 to the most recent available year is used. Japan and Greece are missing data on the revenue indicators. Luxembourg and Ireland had unusually high growth rates during this period, of 7.95 and 4.88 per cent respectively, which were substantially higher than those of the other 19 countries whose growth rates were below 4 per cent. These two outlier countries tended to drive the overall pattern detected between growth and decentralisation and therefore were excluded from the cross-section analysis.

[24] According to the new measures of FD and this sample, Australia has a relatively high share of direct expenditure decentralisation and a medium level of tax and revenue decentralisation. Out of the 19 countries, Australia has the median level of decentralisation in terms of own taxes, and the share of subnational revenues without social security payments. Australia.s revenue decentralisation is higher than tax decentralisation, mainly due to non-tax revenue accrued by local governments.

Figure 2

Measures of Tax Decentralisation and Economic Growth: OECD

TDEC1 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI

TDEC2 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI

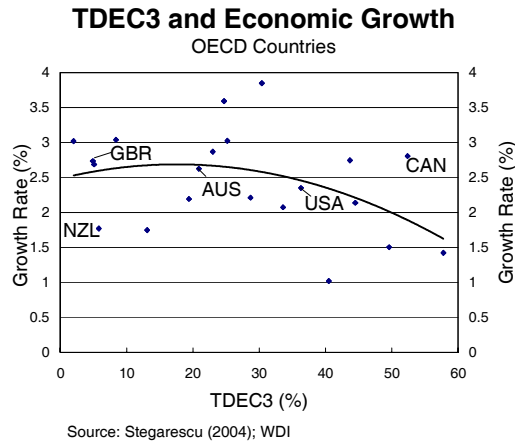**TDEC3 and Economic Growth**
OECD Countries

Source: Stegarescu (2004); WDI
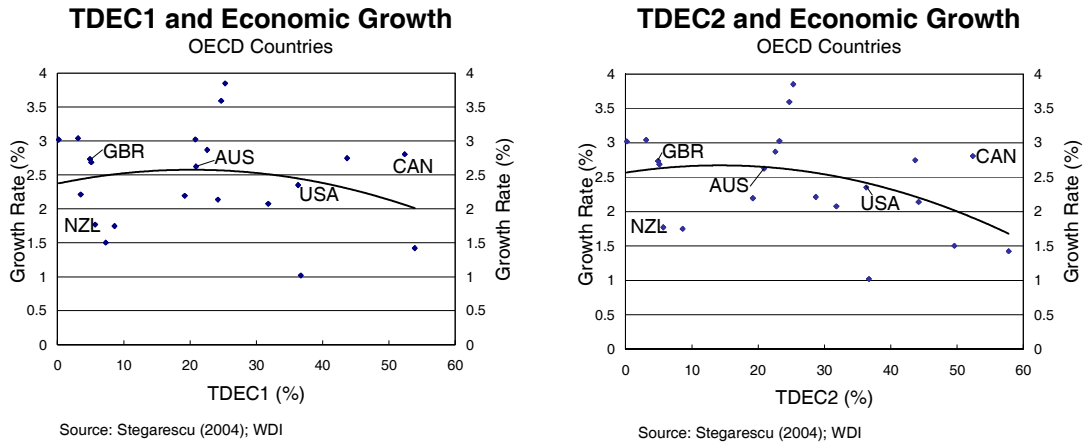
Figure 3

Measures of Revenue Decentralisation and Economic Growth: OECD

RDEC1 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI

RDEC3 and Economic Growth
OECD Countries

Source: Stegarescu (2004); WDI

**Subnational Revenue Share
and Economic Growth**

OECD Countries

Source: World Bank Fiscal Decentralisation Indicators; WDI
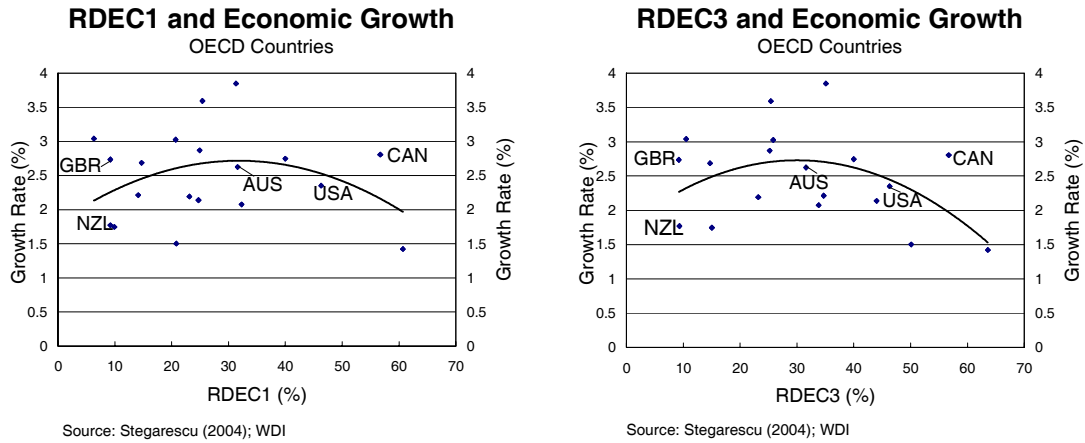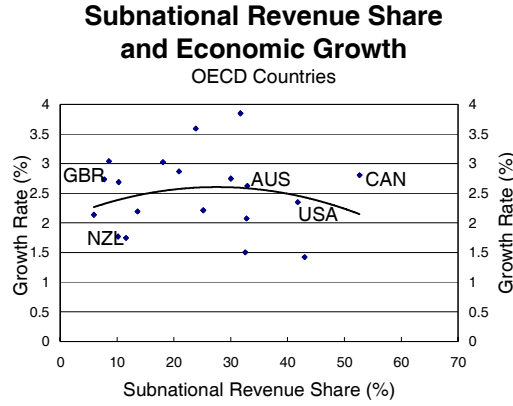
Cross-sectional Analysis

More formal testing of the hypothesis that FD affects economic growth begins with the form in equation (6), that is,

$$\Delta ln\,RGDPC_i = \Delta ln\,A_i + \alpha\Delta ln\,k_i + \beta\Delta ln\,h_i \qquad (6)$$

where RGDPC is real GDP per capita, *A* is efficiency, *k* is capital per capita and *h* is the measure of human capital. Equation (4), determining the growth rate of efficiency, is modified slightly so that efficiency also depends on other measures of public sector decentralisation, such that:

$$\Delta \ln A_i = \gamma_{A0} + \gamma_{A1} FD_i + \gamma_{A2} FU_i + \gamma_{A3} NSGVT_i + \gamma_{A4} ELECT_i \qquad (13)$$
$$+ \gamma_{A5} EMPLOY_i$$

where FU is the federalism dummy, NSGVT is the number of subnational government units, ELECT is the number of elected subnational tiers of government and EMPLOY is the subnational to central government employee ratio.

Substituting (13) into (6) gives

$$\Delta ln\,RGDPC = \gamma_{A0} + \gamma_{A1} FD_i + \gamma_{A2} FU_i + \gamma_{A3} NSGVT_i + \gamma_{A4} ELECT_i \qquad (14)$$
$$+ \gamma_{A5} EMPLOY_i + \alpha_1 \Delta ln\,k_i + \alpha_2 \Delta ln\,h_i$$

Further, control variables are added to equation (14) to absorb the effect of the size of the government and macroeconomic shocks. The estimated equation is outlined in (15). *GCGDP* is the government consumption to GDP ratio and *DEF* is the GDP deflator.

$$
\begin{aligned}
\Delta ln\,RGDPc = {} & \gamma_{A0} + \gamma_{A1} FD_i + \gamma_{A2} FU_i + \gamma_{A3} NSGVT_i + \gamma_{A4} ELECT_i \\
& + \gamma_{A5} EMPLOY_i + \alpha_1 \Delta ln\,k_i + \alpha_2 \Delta ln\,h_i + \alpha_3 \Delta ln\,GCGDP_i \\
& + \alpha_4 \Delta ln\,DEF_i + \varepsilon_i
\end{aligned}
\tag{15}
$$

The cross-section results are presented below.[25] The number of subnational governments, the subnational employee to central employee ratio, and the GDP deflator are consistently insignificant. The growth accounting components, FD and other significant explanatory variables are reported in Table 2a and 2b, for the linear and hump-shaped indicators respectively. No measure of FD, linear or hump-shaped, is found to be significant. Interestingly, in all cases the federalism indicator is negatively related to growth. Therefore, in this sample federal decentralised countries tend to have lower growth rates than unitary centralised countries.[26]

Another possible explanation is based in political business cycle theory. Roubini and Sachs (1989:903), and Alesina and Tabellini (1990:407) argue that political systems with frequent changes in political power generally have larger government employment, spending, deficits and debt. If more subnational elections lead to a higher turnover of politicians at lower levels, this may decrease politicians' concern about the long-term consequences of their actions, leading to overspending, higher deficits and higher debt. This would tend to lower growth. Further, such electoral decentralisation may have a negative impact on macroeconomic stability, and therefore growth. Nonetheless, such regressions do not allow one to determine why this negative relationship exists.

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[25] To keep the sample constant across the cross-section equations, Japan and Greece were excluded due to missing data for the revenue indicators. Iceland is excluded due to missing data for ELECT.

[26] The countries with more elected subnational tiers of government generally have lower economic growth rates. There are many possible reasons for this result. A higher number of elected tiers of government allows residents greater opportunity to express their preferences. As mentioned earlier, the level and mix of public goods demanded by local residents may not necessarily be the level that maximises economic growth.

Table 2a
Growth Accounting: OECD

Measure of FD	EDEC1	EDEC2	TDEC1	TDEC2	TDEC3	RDEC1	RDEC3	EXP	REV
C	0.028872*** (4.495400) [0.0009]	9.298651*** (4.970101) [0.0004]	0.031387*** (4.640822) [0.0007]	7.107345*** (4.955417) [0.0004]	0.031932*** (4.882458) [0.0005]	0.031257*** (4.757567) [0.0006]	0.031731*** (4.931630) [0.0004]	0.029899*** (4.471468) [0.0009]	0.031185*** (4.984254) [0.0004]
FD	0.000190 (1.683076) [0.1205]	3.95E-05 (0.308916) [0.7632]	6.48E-05 (1.158674) [0.2711]	1.26E-05 (0.149973) [0.8835]	4.17E-05 (0.472129) [0.6461]	7.43E-05 (1.150202) [0.2745]	5.27E-05 (0.472160) [0.6460]	0.000158 (1.751427) [0.1077]	0.000122 (1.395703) [0.1903]
FU	-0.003784** (-2.645579) [0.0228]	-0.002439* (-1.805853) [0.0984]	-0.002448** (-3.020411) [0.0116]	-0.002206** (-2.365939) [0.0374]	-0.002459** (-2.413168) [0.0344]	-0.002614** (-2.994914) [0.0122]	-0.002590* (-2.101803) [0.0594]	-0.003014*** (-3.650701) [0.0038]	-0.002849*** (-3.348097) [0.0065]
ELECT	-0.005047* (-1.93535) [0.0791]	-0.004421* (-1.839703) [0.0984]	-0.004194 (-1.795760) [0.1000]	-0.004341* (-1.917838) [0.0815]	-0.004350* (-1.903489) [0.0835]	-0.004173 (-1.791582) [0.1007]	-0.004311* (-1.889369) [0.0855]	-0.004332* (-1.846670) [0.0919]	-0.004238* (-1.890447) [0.0853]
$\Delta \ln(k)$	0.446167*** (3.647692) [0.0038]	0.349329** (3.081107) [0.0105]	0.357328*** (3.820993) [0.0028]	0.338909*** (3.126868) [0.0096]	0.356555*** (3.353983) [0.0064]	0.358267*** (3.999813) [0.0021]	0.357098*** (3.544235) [0.0046]	0.364924*** (4.107668) [0.0017]	0.362121*** (4.519251) [0.0009]
$\Delta \ln(h)$	-0.038313 (-0.475937) [0.6434]	-0.028372 (-0.391383) [0.7030]	-0.033913 (-0.530748) [0.6061]	-0.021467 (-0.324170) [0.7519]	-0.027023 (-0.417147) [0.6846]	-0.034055 (-0.546008) [0.5960]	-0.028126 (-0.451420) [0.6605]	-0.046589 (-0.682075) [0.5093]	-0.036290 (-0.600528) [0.5603]
$\Delta \ln$(GC-GDP)	-0.314224** (-2.403126) [0.0350]	-0.332169** (-2.482516) [0.0304]	-0.333135** (-2.328884) [0.0399]	-0.339651** (-2.526022) [0.0282]	-0.344664** (-2.535473) [0.0277]	-0.329066** (-2.321145) [0.0405]	-0.342137** (-2.519440) [0.0285]	-0.274593** (-2.102355) [0.0594]	-0.297218** (-2.367637) [0.0373]
Adj-R^2	0.513870	0.381340	0.411629	0.377735	0.385983	0.408145	0.385998	0.456274	0.423518
Obs	18	18	18	18	18	18	18	18	18
F-value	3.995012 [0.022743]	2.746454 [0.069766]	2.982223 [0.055574]	2.719927 [0.071610]	2.781089 [0.067440]	2.953878 [0.057091]	2.781203 [0.067433]	3.377621 [.038607]	3.081536 [0.050614]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Heteroskedasticity-Consistent Standard Errors and Covariance

Table 2b

Growth Accounting: OECD: Hump-Shaped FD Indicators

Measure of FD	HEDEC1	HEDEC2	HTDEC1	HTDEC2	HTDEC3	HRDEC1	HRDEC3	HEXP	HREV
C	0.026849*** (3.776557) [0.0031]	0.031456*** (4.070987) [0.0018]	0.031795*** (4.833361) [0.0005]	0.028804*** (4.207469) [0.0015]	0.028918*** (4.096660) [0.0018]	0.031643*** (4.519958) [0.0009]	0.028869*** (4.329481) [0.0012]	0.027938*** (4.113858) [0.0017]	0.028578*** (3.571110) [0.0044]
FD	0.000510 (1.310740) [0.2167]	0.000139 (0.313358) [0.7599]	0.000126 (0.356566) [0.7282]	0.000534 (1.122513) [0.2855]	0.000535 (1.060072) [0.3118]	0.000120 (0.287200) [0.7793]	0.000522 (1.498755) [0.1621]	0.000584 (1.348013) [0.2048]	0.000459 (0.756908) [0.4650]
FU	-0.001944** (-3.030171) [0.0114]	-0.002023** (-2.765627) [0.0184]	-0.002025** (-3.062924) [0.0108]	-0.001771** (-2.953459) [0.0131]	-0.001814** (-3.036603) [0.0113]	-0.002036** (-2.704336) [0.0205]	-0.001994*** (-3.305145) [0.0070]	-0.001834*** (-3.247655) [0.0078]	-0.001727* (-2.179955) [0.0519]
ELECT	-0.003158 (-1.329020) [0.2107]	-0.004185 (-1.738170) [0.1101]	-0.004419* (-1.915142) [0.0818]	-0.004233* (-1.950462) [0.0771]	-0.004118* (-1.931587) [0.0796]	-0.004337* (-1.881533) [0.0866]	-0.004035* (-1.860625) [0.0897]	-0.004046* (-1.797516) [0.0997]	-0.004284* (-1.846555) [0.0919]
Δ ln(k)	0.321264*** (3.687892) [0.0036]	0.319931*** (4.217634) [0.0014]	0.330332*** (3.868839) [0.0026]	0.327784*** (3.933708) [0.0023]	0.303961*** (3.980457) [0.0022]	0.332539*** (3.868367) [0.0026]	0.325895*** (3.963886) [0.0022]	0.337555*** (3.876750) [0.0026]	0.348567*** (3.687506) [0.0036]
Δ ln (h)	0.016813 (0.228739) [0.8233]	-0.017819 (-0.264497) [0.7963]	-0.014976 (-0.226884) [0.8247]	0.007989 (0.104085) [0.9190]	0.016062 (0.186037) [0.8558]	-0.012366 (-0.168592) [0.8692]	0.006244 (0.092290) [0.9281]	0.013366 (0.180790) [0.8598]	0.024513 (0.284822) [0.7811]
Δ ln(GC-GDP)	-0.316005* (-2.196744) [0.0504]	-0.317680** (-2.392105) [0.0357]	-0.330348** (-2.560335) [0.0265]	-0.265431** (-2.566226) [0.0262]	-0.296878** (-2.859262) [0.0155]	-0.328197** (-2.446787) [0.0324]	-0.321099** (-2.523047) [0.0283]	-0.302471** (-2.343398) [0.0398]	-0.303765** (-2.590748) [0.0251]
Adj-R²	0.442083	0.382122	0.382096	0.442264	0.453647	0.381096	0.463125	0.477857	0.415030
Obs	18	18	18	18	18	18	18	18	18
F-value	3.245076 [0.043520]	2.752255 [0.069370]	2.752064 [0.069383]	3.246729 [0.043454]	3.352567 [0.039484]	2.744653 [0.069889]	3.444119 [0.036386]	3.593022 [0.031930]	3.010216 [0.054121]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Heteroskedasticity-Consistent Standard Errors and Covariance

The growth rate of the capital stock and the growth rate of government consumption have the expected signs. Growth in the secondary school enrolment ratio, used to proxy for human capital growth, is consistently insignificant.

Therefore, there is no evidence of a direct relationship between FD and economic growth, using cross-sectional data for this group of 18 OECD countries. However, there is some evidence that other aspects of public sector decentralisation have a negative impact on economic growth.

Panel Data Analysis

The panel regressions are based on the OECD countries for which the four panel indicators of FD are available over the period 1981 to 1998 (Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, the United Kingdom, Ireland, Italy, Luxembourg, Norway, Portugal, Sweden and the United States).[27] The results are given in Table 3. Few FD measures, linear or hump-shaped, are significantly correlated with growth. The growth rate of human capital is rarely significant and in the one case that it is, its sign is counter-intuitive. This is a common problem found in studies of FD and growth, and is probably due to measurement error.[28] Significant control variables are signed as expected.

Both the cross-section and panel results suggest that FD does not have a significant direct relationship with growth in this sample of OECD countries. Nonetheless, FD may affect growth indirectly, via the components of the growth accounting equation. According to the consumer efficiency hypothesis, by better matching individuals' preferences and increasing their welfare, FD may have secondary effects on work effort, savings and investment. If the producer efficiency hypothesis is correct, FD may lead to better quality and larger quantities of inputs to the production process. The remainder of this paper investigates the impact of FD on the components of the growth equation.

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[27] Despite Ireland and Luxembourg's unusually high growth rates in the late 1990s, their growth over the whole 1981-1998 period did not seem unusual. Iceland, New Zealand and the Netherlands were excluded as they were missing data on unemployment (Iceland), and fiscal balance (New Zealand and the Netherlands). RDEC1 is missing data for Portugal and Italy. Luxembourg was excluded from the human capital equations due to missing data on average schooling. Political freedom data is missing for Germany prior to 1990.

[28] Davoodi and Zou (1998:250) also have this problem.

Table 3

Panel: Growth Accounting

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	0.035496*** (0.034705) [0.0004]	0.033225*** (4.121632) [0.0008]	0.030109*** (8.894614) [0.0000]	0.024483*** (5.882247) [0.0000]	0.023514*** (12.24666) [0.0000]	0.043494*** (11.72980) [0.0000]	0.028765*** (7.646469) [0.0000]	0.028283*** (11.82687) [0.0000]
FD	-0.000420 (-0.000338) [0.2865]	-0.000358 (-1.205629) [0.7479]	-0.000265** (-2.500215) [0.0130]	5.73E-05 (0.550293) [0.5826]	8.79E-06 (0.316935) [0.7515]	-0.000208*** (-6.090571) [0.0000]	-4.71E-05 (-1.234471) [0.2180]	-2.98E-05 (-1.644364) [0.1014]
$\Delta \ln(k)$	0.621800*** (0.576006) [0.0001]	0.518121*** (4.437366) [0.0000]	0.511229*** (4.284765) [0.0000]	0.580819*** (5.144858) [0.0000]	0.516467*** (4.474011) [0.0000]	0.636676*** (5.273866) [0.0000]	0.541745*** (4.736837) [0.0000]	0.589435*** (5.293637) [0.0000]
$\Delta \ln(h)$	-0.014620 (-0.008613) [0.6775]	-0.006672 (-0.311205) [0.5519]	-0.007550 (-0.350762) [0.7260]	0.005244 (0.384908) [0.7006]	-0.005964 (-0.291906) [0.7706]	-0.039289* (-1.833635) [0.0678]	-0.012260 (-0.570852) [0.5686]	-0.001796 (-0.124302) [0.9012]
$\Delta \ln(\text{GC-GDP})$	-0.317723*** (-0.318745) [0.0000]	-0.320726*** (-6.396655) [0.0000]	-0.316075*** (-6.257687) [0.0000]	-0.388285*** (-7.497905) [0.0000]	-0.318110*** (-6.316350) [0.0000]	-0.311440*** (-5.965870) [0.0000]	-0.320378*** (-6.381472) [0.0000]	-0.385568*** (-7.189021) [0.0000]
$\Delta \ln(\text{DEF})$	-0.174937*** (-0.193359) [0.0000]	-0.194766*** (-4.023488) [0.0005]	-0.188316*** (-4.136606) [0.0000]	-0.277812*** (-6.299870) [0.0000]	-0.184066*** (-4.201739) [0.0000]	-0.205025*** (-5.034346) [0.0000]	-0.190944*** (-4.449093) [0.0000]	-0.272928*** (-6.201563) [0.0000]
Adj-R^2	0.547852	0.547270	0.547622	0.614882	0.546148	0.598551	0.548602	0.616650
Countries	18	18	18	16	18	18	18	16
Obs	324	324	324	288	324	324	324	288
F-value	11.03506 [0.000000]	11.01152 [0.000000]	11.02575 [0.000000]	13.38447 [0.000000]	10.96630 [0.000000]	13.34836 [0.000000]	11.06552 [0.000000]	13.47737 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Fiscal Decentralisation and the Components of the Growth Equation

Results for the regressions of FD against the growth rate of capital, are shown in Table 4a and 4b, using Fischer's approach (the explanatory variables from the growth equation are used as the control variables for the second stage regressions) and Theissen's (2000; 2001) control variables respectively. In both cases, the linear relationship between FD and growth is significant for the subnational expenditure share and the own tax share. The subnational revenue share is significant in the second framework. The relationship is positive for expenditures and negative for revenues and taxes. However, the sign and significance of the hump-shaped indicators is consistent across all measures of FD (with the exception of RDEC1 which is insignificant using the first approach). This provides some support for the hypothesis that a medium degree of FD has positive effect on the growth rate of the capital stock.

Interestingly the fiscal balance (FISBAL) is generally significant and positively related to capital growth. That is, the higher the share of transfers in subnational government expenditures, the higher the capital growth rate. The standard deviation of domestic credit growth (STDDOM) is also positively related to capital growth. The explanatory power of all the capital stock growth regressions is higher than those of the GDP growth rate.

The relationship between FD and either the level of or growth in human capital depends on how one measures the latter variable. The growth rate of the secondary school enrolment ratio had the wrong sign in the growth regressions. The growth rate of average years of schooling could not be obtained. However, the relationship between the level of human capital, measured by average years of schooling, and the level of FD is interesting and easier to measure. These results are given in Table 5a and 5b, using Fischer's approach and the control variables from Triesman's (2000) cross-section study, respectively. Although the analysis is constrained by the available data, this is the only investigation to account for the time dimension.

Table 4a

Panel: Growth Rate of the Capital Stock and FD (1)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	-0.027915*** (-6.283814) [0.0000]	0.015105*** (2.978586) [0.0031]	0.016035*** (5.526323) [0.0000]	0.002330 (0.680866) [0.4966]	6.73E-05 (0.020740) [0.9835]	0.003888 (1.086197) [0.2783]	0.005122* (1.954328) [0.0516]	0.003377** (2.220025) [0.0273]
FD	0.001168*** (10.35028) [0.0000]	-0.000208 (-1.359076) [0.1752]	-0.000284*** (-4.048563) [0.0001]	8.07E-05 (0.672696) [0.5018]	0.000103*** (3.956834) [0.0001]	6.19E-05** (2.239938) [0.0259]	4.86E-05*** (2.907085) [0.0039]	1.69E-05 (1.373800) [0.1707]
Δ ln(GC GDP)	0.055411** (2.319122) [0.0211]	0.062733** (2.439991) [0.0153]	0.065731** (2.449443) [0.0149]	0.046006 (1.647426) [0.1007]	0.057809** (2.103228) [0.0363]	0.060409** (2.216525) [0.0274]	0.065771** (2.414584) [0.0164]	0.045091 (1.599002) [0.1111]
Δ ln(DEF)	0.057590* (1.891517) [0.0596]	0.028090 (0.852290) [0.3948]	0.029768 (0.952109) [0.3418]	0.138226*** (5.894164) [0.0000]	0.039346 (1.363007) [0.1740]	0.038901 (1.319274) [0.1881]	0.039762 (1.343332) [0.1802]	0.133281*** (5.627513) [0.0000]
Δ ln(SEC)	0.012190 (1.101251) [0.2717]	0.007690 (0.607504) [0.5440]	0.006778 (0.524869) [0.6001]	0.020517** (2.173260) [0.0307]	0.017789 (1.456782) [0.1463]	0.016964 (1.242113) [0.2152]	0.012991 (1.061594) [0.2893]	0.023458** (2.212830) [0.0278]
Adj-R^2	0.790222	0.743910	0.746420	0.761413	0.763022	0.751848	0.748130	0.762136
Countries	18	18	18	16	18	18	18	16
Obs	324	324	324	288	324	324	324	288
F-value	33.01901 [0.000000]	25.69140 [0.000000]	26.01994 [0.000000]	26.44213 [0.000000]	28.36834 [0.000000]	26.75317 [0.000000]	26.24758 [0.000000]	26.54367 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Table 4b

Panel: Growth Rate of the Capital Stock and FD (2)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	-0.026666*** (-5.930250) [0.0000]	-0.0003555 (-0.688295) [0.4918]	-0.0008660** (-2.419066) [0.0162]	-0.010246* (-1.709906) [0.0885]	-0.012856*** (-5.015392) [0.0000]	-0.016757*** (-4.364728) [0.0000]	-0.016166*** (-4.825585) [0.0000]	-0.010256 (-1.636520) [0.1030]
FD	0.000910*** (7.626031) [0.0000]	-0.000394*** (-2.862725) [0.0045]	-0.000200*** (-3.145344) [0.0018]	0.000180 (1.299264) [0.1951]	7.87E-05*** (3.341033) [0.0009]	7.59E-05*** (3.092250) [0.0022]	3.76E-05*** (3.102792) [0.0021]	3.83E-05*** (2.909012) [0.0040]
FISBAL	4.31E-05 (1.178856) [0.2394]	6.06E-05 (1.240593) [0.2158]	9.19E-05** (2.447702) [0.0150]	0.000226*** (7.430207) [0.0000]	5.86E-05 (1.297645) [0.1955]	0.000187*** (5.700890) [0.0000]	0.000146*** (5.135864) [0.0000]	0.000208*** (7.683835) [0.0000]
ΔUR	-0.001506*** (-3.078871) [0.0023]	-0.001987*** (-3.678910) [0.0003]	-0.001839*** (-3.489755) [0.0006]	-0.001466*** (-2.678961) [0.0079]	-0.001687*** (-3.412597) [0.0007]	-0.001904*** (-4.199012) [0.0000]	-0.001748*** (-3.552127) [0.0004]	-0.001623*** (-3.031625) [0.0027]
DEF	0.000107*** (3.401635) [0.0008]	0.000297*** (6.731345) [0.0000]	0.000280*** (6.933487) [0.0000]	9.10E-05 (1.239814) [0.2162]	0.000197*** (5.050318) [0.0000]	0.000184*** (4.829918) [0.0000]	0.000249*** (6.068746) [0.0000]	0.000126 (1.583669) [0.1145]
STDDOM	2.68E-14*** (3.216350) [0.0014]	3.63E-14*** (6.310754) [0.0000]	3.54E-14*** (5.121481) [0.0000]	3.41E-14*** (5.317652) [0.0000]	3.84E-14*** (7.175281) [0.0000]	3.77E-14*** (5.944684) [0.0000]	3.52E-14*** (6.062546) [0.0000]	3.52E-14*** (5.837649) [0.0000]
Adj-R²	0.790335	0.768724	0.768059	0.765314	0.776874	0.777806	0.769328	0.769522
Countries	18	18	18	16	18	18	18	16
Obs	324	324	324	288	324	324	324	288
F-value	32.21925 [0.000000]	28.52819 [0.000000]	28.42559 [0.000000]	26.29483 [0.000000]	29.83617 [0.000000]	29.99187 [0.000000]	28.62193 [0.000000]	26.89832 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Table 5a

Panel: Growth Rate of Human Capital and FD (1)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	8.798625***	9.959801***	9.198892***	10.72883***	8.495331***	8.806572***	9.168417***	9.555702***
	(66.27326)	(49.79260)	(56.78630)	(44.83460)	(139.1756)	(135.0757)	(101.9597)	(137.2755)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
FD	0.012719***	-0.028904***	0.000140	-0.034629***	0.008046***	0.004194***	0.000378	0.002168***
	(3.313435)	(-4.785199)	(0.025791)	(-5.250709)	(11.07042)	(5.638151)	(0.561011)	(4.243299)
	[0.0010]	[0.0000]	[0.9794]	[0.0000]	[0.0000]	[0.0000]	[0.5753]	[0.0000]
$\Delta \ln$(GC GDP)	1.910951	1.638942	1.861711	2.053217*	1.835127*	1.780695*	1.889281	1.631572
	(1.640803)	(1.438119)	(1.557310)	(1.798184)	(1.934131)	(1.698877)	(1.625876)	(1.193821)
	[0.1020]	[0.1516]	[0.1206]	[0.0734]	[0.0541]	[0.0905]	[0.1052]	[0.2338]
$\Delta \ln$(DEF)	-4.398982***	-5.646994***	-4.724708***	-6.848147***	-4.190236***	-4.110050***	-4.682067***	-6.842822***
	(-9.345491)	(-9.372821)	(-8.774880)	(-7.250305)	(-6.963824)	(-7.073439)	(-8.933993)	(-7.098151)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$\Delta \ln$(k)	-19.99150***	-18.73991***	-17.99098***	-17.39302***	-23.84487***	-19.61200***	-18.16420***	-17.79433***
	(-4.979137)	(-4.185260)	(-4.220449)	(-4.427329)	(-6.847419)	(-5.297317)	(-4.506219)	(-4.180166)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Adj-R^2	0.972342	0.972727	0.972143	0.950568	0.977100	0.973765	0.972156	0.947377
Countries	17	17	17	15	17	17	17	15
Obs	306	306	306	270	306	306	306	270
F-value	290.7942	295.0082	288.6652	148.7964	352.7228	306.9647	288.8051	139.3679
	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Table 5b

Panel: Growth Rate of Human Capital and FD (2)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	-3.124247 (-0.970460) [0.3327]	-0.758260 (-0.242538) [0.8086]	-1.483791 (-0.491687) [0.6234]	1.556122 (0.438783) [0.6613]	-0.701987 (-0.196841) [0.8441]	-2.245350 (-0.596858) [0.5511]	-0.858260 (-0.268588) [0.7885]	-1.495127 (-0.421679) [0.6737]
FD	-0.015998*** (-2.759848) [0.0062]	-0.007300 (-0.692853) [0.4890]	0.005492 (1.167601) [0.2441]	-0.030452*** (-3.862107) [0.0001]	0.005428*** (6.837707) [0.0000]	0.003562*** (4.793003) [0.0000]	0.000134 (0.164709) [0.8693]	0.001286** (2.417186) [0.0165]
ln(RGDPC)	1.329997*** (4.116201) [0.0001]	1.053798*** (3.212241) [0.0015]	1.095832*** (3.600942) [0.0004]	0.941295*** (2.742747) [0.0066]	0.961841*** (2.687133) [0.0077]	1.143834*** (3.089528) [0.0022]	1.045179*** (3.296600) [0.0011]	1.151496*** (3.251522) [0.0013]
PF	-0.810296*** (-11.22737) [0.0000]	-0.775200*** (-8.400951) [0.0000]	-0.760803*** (-7.419844) [0.0000]	-0.771824*** (-9.831823) [0.0000]	-0.600554*** (-4.962790) [0.0000]	-0.684210*** (-5.995015) [0.0000]	-0.773437*** (-7.460582) [0.0000]	-0.805257*** (-8.379251) [0.0000]
Adj-R^2	0.969964	0.969665	0.969674	0.943681	0.971887	0.970787	0.969626	0.940707
Countries	16	16	16	14	16	16	16	14
Obs	288	288	288	252	288	288	288	252
F-value	265.8097 [0.000000]	263.1177 [0.000000]	263.1993 [0.000000]	128.4467 [0.000000]	284.4831 [0.000000]	273.4939 [0.000000]	262.7679 [0.000000]	121.6727 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

As with the capital growth equations, the linear expenditure measure is positive and the revenue measures are negative. No measure of tax decentralisation, linear or hump-shaped, is significantly related to human capital. However, all other hump-shaped indicators are positive and significant at the 1 per cent level. This suggests that a medium degree of FD is correlated with a higher level of human capital. When significant, growth in government spending is positively related to human capital levels. Growth in the GDP deflator, as a proxy for volatility, has an inverse relationship with human capital. However, capital growth is negatively related to the level of human capital. In Table 5b, higher human capital levels are associated with higher income levels and greater political freedom.

Finally, analysis of the relationship between FD and TFP growth was conducted. The Solow residuals and MRW residuals were calculated following Fischer (1993:495).

$$SRES_{it} = \Delta\,ln\,GDP_{it} - 0.4\Delta\,ln\,K_{it} - 0.6\Delta\,ln\,L_{it} \qquad (16)$$

$$MRES_{it} = \Delta\,ln\,GDP_{it} - 0.333\Delta\,ln\,K_{it} - 0.333\Delta\,ln\,L_{it} - 0.333\Delta\,ln\,H_{it} \qquad (17)$$

Results with both sets of residuals were similar so only those using the MRW residuals are reported. Table 6a and 6b use Fischer's approach, and Theissen's (2000; 2001) control variables respectively, to control for macroeconomic shocks.

The relationship between TFP and FD is very sensitive to the country sample. Adding the Netherlands and New Zealand (excluded to keep the sample consistent with earlier regressions), causes the hump-shaped indicators of EXP and TDEC1 to be significant in the first framework, as they are in the second. Overall, there is no evidence of a significant relationship between TFP growth and the linear measures of FD, and only mixed support for a hump-shaped relationship with expenditure and own tax revenue decentralisation.

Table 6a

Panel: MRW Residuals and FD (1)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	0.016916 (1.539278) [0.1248]	-0.004085 (-0.271638) [0.7861]	0.002507 (0.579232) [0.5629]	0.002304 (0.335055) [0.7379]	0.002534 (0.675048) [0.5002]	0.009319** (2.526332) [0.0121]	0.002125 (0.472919) [0.6366]	0.006258*** (3.676430) [0.0003]
FD	-0.000285 (-0.819679) [0.4131]	0.000516 (0.802824) [0.4227]	0.000265 (1.261698) [0.2081]	0.000219 (0.877429) [0.3811]	5.95E-05 (1.498229) [0.1352]	-1.49E-05 (-0.375329) [0.7077]	6.44E-05 (1.312488) [0.1904]	2.65E-05 (1.296818) [0.1959]
ΔUR	-0.012980*** (-10.75635) [0.0000]	-0.012838*** (-11.58019) [0.0000]	-0.012937*** (-11.58129) [0.0000]	-0.012966*** (-11.47422) [0.0000]	-0.012691*** (-11.61405) [0.0000]	-0.012784*** (-12.01370) [0.0000]	-0.012810*** (-11.84714) [0.0000]	-0.013045*** (-12.11461) [0.0000]
Adj-R^2	0.605979	0.606699	0.605986	0.670825	0.607279	0.605214	0.608072	0.670977
Countries	18	18	18	16	18	18	18	16
Obs	324	324	324	288	324	324	324	288
F-value	14.79871 [0.000000]	14.84037 [0.000000]	14.79912 [0.000000]	18.20226 [0.000000]	14.87408 [0.000000]	14.75459 [0.000000]	14.92028 [0.000000]	18.21410 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Table 6b

Panel: MRW Residuals and FD (2)

Measure of FD	EXP	REV	TDEC1	RDEC1	HEXP	HREV	HTDEC1	HRDEC1
C	0.011872 (1.183246) [0.2377]	0.002367 (0.149888) [0.8810]	0.009432** (1.973167) [0.0494]	0.003754 (0.481950) [0.6303]	0.004255 (0.991369) [0.3223]	0.014154** (2.561666) [0.0109]	0.001213 (0.303886) [0.7614]	0.010204*** (3.203257) [0.0015]
FD	-5.97E-05 (-0.205192) [0.8376]	0.000302 (0.488182) [0.6258]	2.37E-05 (0.143567) [0.8859]	0.000299 (1.257548) [0.2097]	6.32E-05*** (3.074537) [0.0023]	-4.22E-05 (-1.183848) [0.2375]	8.76E-05* (1.896606) [0.0589]	3.02E-05 (1.453122) [0.1474]
$\Delta \ln(GCGDP)$	0.388993*** (10.65884) [0.0000]	0.393961*** (9.343889) [0.0000]	0.389214*** (9.974571) [0.0000]	0.281749*** (5.567902) [0.0000]	0.376791*** (10.23127) [0.0000]	0.375625*** (8.903957) [0.0000]	0.404703*** (10.87708) [0.0000]	0.278433*** (5.794765) [0.0000]
$\Delta \ln(DEF)$	-0.257535*** (-4.251850) [0.0000]	-0.248257*** (-4.069779) [0.0001]	-0.256027*** (-4.218789) [0.0000]	-0.276691*** (-5.262208) [0.0000]	-0.252027*** (-4.174570) [0.0000]	-0.257859*** (-4.079781) [0.0001]	-0.248070*** (-4.460998) [0.0000]	-0.288379*** (-5.405611) [0.0000]
Adj-R^2	0.517167	0.517635	0.517134	0.537657	0.519629	0.518492	0.522603	0.537338
Countries	18	18	18	16	18	18	18	16
Obs	324	324	324	288	324	324	324	288
F-value	10.35051 [0.000000]	10.36805 [0.000000]	10.34925 [0.000000]	10.53575 [0.000000]	10.44316 [0.000000]	10.40026 [0.000000]	10.55638 [0.000000]	10.52352 [0.000000]

Note: t-statistics are in parentheses and p-values in square brackets. Asterisks indicate significance at the 10%(*), 5%(**) and 1%(***) level. OLS: White Cross-section Standard Errors and Covariance (degrees of freedom corrected)

Conclusions

As can be seen, there is little evidence of a direct relationship between fiscal decentralisation and economic growth. This supports Davoodi and Zou's (1998) study, in which they used the subnational share of total government spending as a proxy for FD. The analysis further demonstrates that a more diverse range of FD indicators, including newly developed measures that capture different levels of fiscal autonomy, give similar results. Unlike the studies by Theissen (2000; 2001) and Eller (2004), hump-shaped indicators of FD are not found to be directly related to growth.

Nevertheless, other measures of government decentralisation seem to have a direct relationship with economic growth. In this sample of OECD countries, federal systems tend to have lower growth rates. The number of government personnel employed at the subnational level, relative to those employed by the central government, and the number of subnational government jurisdictions, do not have a significant impact on economic growth. However, countries with more elected tiers of government generally have lower economic growth.

Finally, there is some evidence, using panel data, that a medium degree of decentralisation is associated with growth in the physical capital stock and higher levels of human capital. No statistically significant relationship is detected between FD and total factor productivity.

Where should research go from here? Whilst this paper incorporates measures of FD disaggregated by different levels of subnational discretion over tax rates and tax bases, future research may consider developing more disaggregated measures of fiscal autonomy in different areas of expenditure or measures that are horizontally disaggregated across subnational jurisdictions. Measures of FD that accurately represent changes in fiscal decentralisation or capture qualitative restrictions on subnational autonomy (such as those outlined in the World Bank's *Qualitative Decentralization Indicators* (2001)) may provide further insights. Better data on human capital, especially better time-series data, is also necessary.

Work on the theoretical front should seek to connect studies of FD and growth with research suggesting that income is a determinant of FD. Structural equations specified for both the determinants of FD and the inclusion of FD in growth regressions, may allow one to establish more reliable tests for endogeneity or simultaneity in the relationship. Even if there is no *direct* relationship between fiscal decentralisation and economic growth, further theoretical work joining the two areas is warranted. If the level of FD affects growth in the capital stock, this may have an indirect impact on GDP growth, leading to a new level of GDP, which in turn may have an impact on the level of fiscal decentralisation. Similarly, one of the major problems with the growth literature is that there is reason to believe that the major components of the growth equation, capital and human capital, are endogenous. With the exception of Iimi's (2005) cross-section analysis, all studies of FD and growth ignore this issue. Future studies may attempt to account for such endogeneity. One possible line of research, suggested by Temple (1999), is to adapt empirical growth models to allow explicitly for the possibility of regressors that are endogenous to the growth rate or level of income. Finally, empirical work has not yet involved cross-country studies of the impact of fiscal decentralisation on macroeconomic stability or inequality.

As long as the current interest in the decentralisation of fiscal responsibilities is maintained, the effect of fiscal decentralisation on the overall economy will continue to be debated. With this interest, more reliable data and more work on the theoretical front, the lens through which one studies the interrelationships between fiscal decentralisation and real economic variables can continue to be refocused, until a clearer picture comes into view.

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Appendix 1

Variable	Source
Number of subnational jurisdictions	*World Development Report* (1999/2000)
Number of elected subnational tiers of government	*World Development Report* (1999/2000)
Constitutional structure	*Armingeon et. al.* (2002)
Subnational and central government employees	*Schiavo-Campo et. al.* (1997)
GDP and GDP growth	*World Development Indicators*
Gross fixed capital formation	*World Development Indicators*
Secondary school enrolment ratio	*Database for the Global Development Network; World Development Indicators*
Average years of schooling	*Barro and Lee* (2000)
GDP deflator	*World Development Indicators*
General government final consumption expenditure	*World Development Indicators*
Vertical fiscal imbalance	*Fiscal Decentralization Indicators*
Domestic credit growth	*World Development Indicators*
Political freedom	*Freedom House*