



OECD Working Papers on Fiscal Federalism No. 15

Decentralisation
and Economic Growth - Part
2: The Impact on Economic
Activity, Productivity
and Investment

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<https://dx.doi.org/10.1787/5k4559gp7pzw-en>

ABSTRACT / RÉSUMÉ

Decentralisation and economic growth

Part 2: The impact on economic activity, productivity and investment

This paper analyses the relationship between fiscal decentralisation and economic activity. Like other institutional arrangements, fiscal decentralisation affects firms, households and public entities, and the way they save, invest, spend or innovate. This in turn may have considerable consequences for the long-term growth potential of a country. Based on a set of growth regressions, the results suggest that the relationship between fiscal decentralisation and GDP per capita, productivity or human capital is positive and statistically significant, while the relationship with investment is insignificant. Doubling the sub-central tax or spending share (*e.g.* moving from a decentralisation ratio of 15 to 30%) is associated with an increase of GDP per capita by 3% on average. Revenue-based decentralisation indicators (*e.g.* decentralisation of tax revenue or tax autonomy) deliver results both statistically and economically (larger coefficients) more significant than spending-based indicators. The results vary little between federal and unitary countries in general. Intergovernmental transfers tend to be negatively associated with GDP per capita. Finally, the relationship between decentralisation and GDP per capita is non-linear, with results suggesting that returns to decentralisation are decreasing.

JEL classification codes: O43; H70; H77

Keywords: Fiscal decentralization; fiscal federalism; economic growth; productivity

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Décentralisation et croissance économique

Partie 2 : Impact sur l'activité économique, la productivité et l'investissement.

La présente note analyse la relation entre la décentralisation budgétaire et l'activité économique. À l'instar d'autres modalités institutionnelles, la décentralisation influe sur les entreprises, les ménages et les entités publiques, ainsi que sur la manière dont ils économisent, investissent, dépensent ou innovent. Cela peut à son tour avoir des conséquences considérables sur le potentiel de croissance à long terme d'un pays. S'appuyant sur une série de régressions de croissance, les résultats conduisent à penser que la relation entre la décentralisation budgétaire et le PIB par habitant, la productivité ou le capital humain est statistiquement significative, alors que la relation avec l'investissement ne l'est pas. La multiplication par deux de la part des impôts ou des dépenses relevant des administrations infranationales (le ratio de décentralisation passant ainsi de 15 à 30 %, par exemple) est associée à une hausse du PIB par habitant de 3 % en moyenne. Les indicateurs de décentralisation fondés sur les recettes (par exemple la décentralisation des recettes fiscales ou l'autonomie fiscale) offrent des résultats plus significatifs statistiquement et économiquement (coefficients plus élevés) que les indicateurs basés sur les dépenses. Les résultats ne varient guère entre les pays à régime fédéral et les autres pays d'une manière générale. Les transferts intergouvernementaux se corrélaient généralement de manière négative avec le PIB par habitant. Enfin, la relation entre la décentralisation et le PIB par habitant n'est pas linéaire, les résultats conduisant à penser que le rendement de la décentralisation est en recul.

Classification JEL : O43 ; H70 ; H77

Mots clés : décentralisation budgétaire ; fédéralisme budgétaire ; croissance économique ; productivité

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DECENTRALISATION AND ECONOMIC GROWTH PART 2: THE IMPACT ON PRODUCTIVITY, INVESTMENT AND GROWTH

By Hansjörg Blöchliger and Balázs Égert¹

1. Introduction

This paper describes the empirical work carried out to establish the link between intergovernmental fiscal frameworks (“decentralisation”, for short) and economic activity. Such frameworks are usually based on the constitutional principles of a country, and these are not necessarily geared towards contributing to economic policy objectives. However, like most institutional arrangements, the organisation of the public sector across government levels affects firms, households and public entities, and the way they save, invest, spend or innovate. This in turn may have considerable consequences for the long-term growth potential of a country. This paper reviews the theories linking decentralisation and economic activity, describes the empirical methods to establish this link for a sample of OECD countries and reports the estimation results.

The results can be summarised as follows:

- There is a significant positive relationship between decentralisation and economic activity. A 10% increase in the decentralisation ratios (spending or tax revenue shares) is associated with a 0.3% higher GDP per capita on average.. The impulse stems both from productivity and human capital improvements, while capital investment appears to have little economic effect.
- Results vary little between federal and unitary countries in general, suggesting that differences between the two country groups are small. Variations appear to be larger *within* than *across* country groups. The small sample size tends to render results for country sub-groups (federal and unitary) sometimes insignificant.
- The annual regressions, covering all years for between 1970 and 2010, provide better results than the selected-year regressions covering only the years 1995, 2002, 2005 and 2008. This suggests that, given the inertia of such frameworks in most countries, the analysis of intergovernmental frameworks requires longer and annual time series.
- The revenue decentralisation indicators (sub-central revenue share, sub-central tax revenue share, sub-central tax autonomy) usually provide more significant results than the spending decentralisation indicators. In some specifications the tax decentralisation impact is twice the spending decentralisation impact. This suggests that the revenue side of intergovernmental frameworks – tax and revenue assignment across government levels and tax autonomy – has a

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stronger impact on economic activity and might also provide a more accurate picture of the true fiscal power of sub-central governments.

- There is some indication that the relationship has strengthened over time, especially in the period after the turn of the millennium. This suggests that fiscal competition between jurisdictions has become fiercer over the past 10 or 15 years, enhancing public sector efficiency.
- The relationship between decentralisation and GDP appears to be non-linear, revealing decreasing returns of decentralisation. Highly centralised countries can expect a larger effect from devolving fiscal powers to SCGs than more decentralised countries. Yet the relationship is not hump-shaped, i.e. there is not an “optimal degree of decentralisation”.

The paper is organised as follows. Section two summarises previous research on decentralisation and growth, focussing on explanations why the empirical results vary across studies. Section three describes the mechanisms underlying the relationship between decentralisation and growth and how they fit into conventional growth models, and provides details on data selection, especially on the various indicators that measure the degree of decentralisation and are useful in assessing intergovernmental fiscal frameworks. Section four presents the results of two empirical specifications: one using spending, revenue and tax revenue decentralisation indicators and another specification which also includes an indicator of tax autonomy, but which covers a shorter time span.

2. Previous research

The set of empirical studies that have established a link between intergovernmental fiscal frameworks and economic activity has generated every possible answer, from a clear positive to a clear negative relationship, with several studies concluding that there is no relationship at all. Averaging over all studies leads to the conclusion that decentralisation and growth are unrelated. The results, however, depend on the type of study, what was examined, what countries and time periods were covered and the empirical approach that was selected. Results also much depended on whether a study examined a single country (i.e. local and/or regional governments in one country) or covered the sub-central level in a cross-country setting. One of the most contentious topics in the empirical analysis is the choice of the variable capturing “decentralisation” with authors being faced with a plethora of fiscal, political or administrative variables reflecting the intergovernmental set-up. Since empirical results often depend on the choice of the decentralisation variable, academics and policymakers have recently turned towards the question on how to improve the measurement of decentralisation (Kim, Lotz and Blöchliger, 2013).

A summary table of the empirical studies can be found in the appendix. Decentralisation appears to have a more beneficial effect in high than in low-income countries, pointing at particular problems of fiscal decentralisation and local capture in developing or transition economies (Yakovlev and Zhuravskaya, 2004). Using a revenue decentralisation measure has a slightly stronger effect than using a spending decentralisation measure, but the effect is small. Using the tax autonomy indicator, which measures the extent to which SCGs have the power to set the base and rates of their own taxes, delivers sometimes very significant results. Differences are also due to the estimation technique: Cross-sectional analyses tend to provide more positive results than panel analyses. Finally, the studies focusing on a single country usually deliver a clearer and more positive picture than cross-country studies, probably owing to the strong institutional differences and measurement problems when dealing with several countries. A meta-analysis by Feld and Schnellenbach (2009) provides similar results, suggesting that decentralising fiscal frameworks in the OECD context would be beneficial but will hardly trigger a large jump in economic activity.

3. Modelling decentralisation and growth

3.1. Growth and inter-jurisdictional competition

The transmission channel from intergovernmental fiscal frameworks to growth can be modelled using the basic framework developed by Solow (1956) and augmented by Mankiw, Romer and Weil (1992). In these models, the level of economic activity depends on physical and human capital, population and the level of technological efficiency, with long run (steady-state) activity solely determined by technology. While the Solow model assumed that technological efficiency is exogenous and growing at a constant rate, in the newer models it is driven by institutions and policy settings such as the extent of fiscal decentralisation. Decentralisation is assumed to be beneficial for the efficiency of the public sector, as it can foster the capacity for innovation in the production and management of public services and reduces government's margins to engage in non-productive and wasteful activities. Several models directly link public sector efficiency gains to decentralisation, such as the models of fiscal or tax competition (Besley and Case, 1995 or Fredriksson et al., 2003). In a decentralised setting, which results in a growth-enhancing public sector, the private sector should be more productive. While these models do not contain an explicit link with economic growth, they provide the links from institutions to private and public sector efficiency, and such links can easily be incorporated into the growth framework.

Competition between SCGs is one of the most frequent transmission channels assumed to run from decentralisation to growth, the main hypotheses being that a SCG's central policy objective is to attract and retain mobile production factors. The amount of production factors a jurisdiction will attract or retain depends on the returns to private investment, which are assumed to depend on SCG's public investment and to be decreasing with higher investment levels. SCGs may use various fiscal policy instruments to affect investment returns such as a reduction in the tax burden or an increase in public investment (Zodrow and Mieszowski, 1986 or Keen and Marchand, 1997). If production factors are mobile, capital will leave those jurisdictions with lower after-tax returns and move to jurisdictions where returns are higher, until the equilibrium with identical returns across all SCGs is restored (Keen and Kotsogiannis, 2004). The models suggest that SCGs in a decentralised relative to a centralised environment tend to over-invest in capital services that raise corporate productivity such as infrastructure (e.g. transport) and under-invest in consumptive and residential services (e.g. amenities), although the effective spending structure much depends on the sub-central tax structure and on the political economy settings. For example, SCGs relying on the personal income tax may spend relatively more – or even too much – on residential services.

Competition for production factors is strategic, i.e. SCGs set their policies subject to the policy decisions of the other SCGs (e.g. Hauptmeier et al., 2008). Since sub-central economies are spatially linked, SCGs change their tax rates if they observe their neighbouring SCGs doing the same; or they change their investment behaviour if they observe a similar policy change in adjacent jurisdictions. The reaction curve is usually positive, i.e. a tax rate decrease in one SCG leads to a tax rate decrease elsewhere, or a jump in a SCG's investment spending induces other SCGs to also invest more.² The newer empirical literature suggests that policy interactions across SCGs can be quite complex and usually concerns jointly both sides of sub-central budgets. For example, SCGs may react to a tax decrease of a neighbouring SCG by increasing productive inputs or by amending the regulatory framework for corporate investment (Büttner, 1999 or Fredriksson et al., 2003). The newer models that incorporate strategic interactions can explain the observation that in several countries an equilibrium of high-tax, high-public input and low-tax, low-public input regions exists without production factors – firms and jobs etc. – moving across jurisdictions (Bénassy-Quéré, 2007 or Hauptmeier et al., 2008). Strategic interactions do not even require production factor mobility to exist at all since SCGs (and their voters) may simply take policy decisions by

2. Positive reaction curves are an empirical observation. Theoretically, the slope of the reaction curve is undetermined (Brückner et al., 2003).

observing tax and spending policy in neighbouring jurisdictions, irrespective of whether firms and residents potentially threaten to leave (yardstick competition, e.g. Besley and Case, 1995).

Other elements of the intergovernmental fiscal framework may affect outcomes on growth as well. First, the size of the intergovernmental transfer system may have an impact. The empirical literature on fiscal federalism suggests that transfers and tax sharing tend to implicitly re-centralise fiscal policy and create a common-pool problem (Feld, 2003 or Rodden, 2003). To that avail, variables reflecting the size of grant systems will be inserted into the growth regressions. Second, fiscal decentralisation may affect the functioning of markets and hence economic activity negatively. This can be due to diseconomies of scale and scope in public service delivery, to SCGs erecting barriers to internal markets, to rent seeking and capture by sub-central interest groups, etc. (Rodden and Rose-Ackermann, 1997; or Yakovlev and Zhuravskaya, 2004). These effects will not be explicitly modelled but are captured by non-linear estimations.

3.2. Model and estimation issues

GDP estimations

The starting point is the neoclassical growth model in which output (Y) depends on the stock of physical and human capital (K and H respectively) and total factor productivity (A).

$$Y_{(t)} = K_{(t)}^a H_{(t)}^b A_{(t)}^{1-a-b} \quad (1)$$

where K and H are physical and human capital, A denotes technology, and a and b are the partial elasticities of K and A with respect to output. The model is augmented by adding decentralisation, which, as part of a set of institutions and public policies, are supposed to have a positive impact on the technology variable A. The overall long-term impact of decentralisation on output is estimated within a framework of an error correction model, along the lines of Bouis et al. (2011):

$$dY_t = a + b*(Y_{t-1} + c_1*K_{t-1} + c_2*H_{t-1} + c_3*DEC_{t-1}) + d_1*dK_t + d_2*dH_t + d_3*dDEC_t + e_t \quad (2)$$

where Y is per capita income, and is a function of physical capital accumulation, measured as the investment to GDP ratio (K), human capital accumulation (H), captured by average years of schooling, the degree of fiscal decentralisation (DEC) and e is the error term. The term d denotes growth rates. The terms a, b and the vectors c and d are the estimated coefficients. The error correction term provides a test for cointegration. Kremers et al. (1992) argue that in a time series context it is more powerful than the residual-based cointegration tests in testing for co-integration. If the error correction term is negative and statistically significant the variables are connected through a long-term co-integration vector. In this case, the long-term coefficients can be obtained by a normalisation through the coefficient b:

$$Y_t = c_1/b*K_t + c_2/b*H_t + c_3/b*dPOP_t + c_4/b*DEC_t + e_t \quad (3)$$

The estimation of the error correction model including the short-term dynamics is compromised by relatively few degrees of freedom, given that most data do not go back further than around 1995. Therefore a truncated version of equation [2] is estimated:

$$dY_t = a + b*(Y_{t-1} + c_1*K_{t-1} + c_2*H_{t-1} + c_3*DEC_{t-1}) + e_t \quad (4)$$

The long-term coefficients can be computed as in [3]. Equation [4] is estimated on pooled data but also includes country fixed effects alone and country and time fixed effects at the same time. Given that the decentralisation indicators, in particular the tax autonomy indicator, change little over time and thus can be viewed as a country fixed effect, equation [4] is also run including only time fixed effects.

Transfers to sub-central governments can interact and influence overall fiscal autonomy as well as the structure of sub-central public spending. Therefore, transfers to lower level governments are used as a control. Alternatively, the fiscal autonomy variables are interacted with the transfer variable. In addition to these variables, the size of government, measured as tax revenues over GDP, and the tax structure (recurrent property and consumption taxes as a share of total tax revenues) are added as control variables. For some specifications, a set of conventional control variables thought to affect growth such as inflation, the openness ratio (export and imports of goods and services over GDP) and population growth are added.

TFP and business investment estimations

The degree of decentralisation is expected to influence per capita income through its effect on TFP. But the literature also found fiscal decentralisation to influence per capita income via higher business investment, in turn the result of higher returns on such investment (or, correspondingly, lower user cost of capital) due to SCG competition to attract mobile production factors (Zodrow and Mieszowski, 1986; Keen and Marchand, 1997; Keen and Kotsogiannis, 2004; Vartia, 2008). Therefore, both the relationship between decentralisation and TFP as well as the relationship between the business investment rate and decentralisation is assessed. The baseline equation for TFP growth is as follows:

$$dA_t = a + b \cdot dA_{t-1} + c \cdot K_{t-1} + d \cdot DEC_{t-1} + e_t \quad (5)$$

where TFP growth depends on its past value, lagged government investment and the decentralisation indicator lagged one period. The control variables that are added to (5) are transfers, the size of government, and the tax structure. For some specifications, inflation and the openness ratio are added. The above equation is also estimated for the log level of TFP. The business investment equation incorporates the investment to GDP ratio (K) as a function of its lagged value, the lagged real interest rate (CPI-deflated long-term nominal interest rate) and fiscal decentralization indicators:³

$$K_t = a + b \cdot K_{t-1} + c \cdot r_{t-1} + d \cdot DEC_{t-1} + e_t \quad (6)$$

Equations 4 to 6 are estimated on a dataset comprising all OECD countries and covering the period from 1970 to 2010 for the annual dataset and 1995 to 2010 for the data based on multi-year averages. A subset of the annual dataset covering 1995-2010 is also analysed to check whether the effect of decentralisation has changed over time (trend breaks) and to ensure comparability of the results obtained for the two datasets. The data sample is also split along the cross-sectional dimension: the estimations are run separately for federal and non-federal countries. Finally, the robustness of the results for outliers is checked by performing a jackknifing exercise, in which equations 4 to 6 are estimated, excluding one country at a time. For each specification, this implies a subset of results corresponding to the number of countries included in the initial dataset. The idea behind jackknifing is that if some countries are driving the overall results, their exclusion from the sample will have a strong influence on the estimation results.

3.3 Testing non-linear effects

Decentralisation might have a non-linear impact on per capita income. The negative effects of decentralisation mentioned above – diseconomies of scale and scope, internal trade barriers, rent seeking – may become relatively more important than its advantages, leading to decreasing marginal returns of growing decentralisation. Some authors even argue that the relationship is hump-shaped with an “optimal” degree of decentralisation beyond which additional sub-central fiscal powers would have negative implications for economic activity (e.g. Thiessen, 2003 using a quadratic estimation term). We therefore

3. Business investment data are not available for all OECD countries. This is why total investment is used. It is highly correlated with the business investment variable for countries where the latter is available.

test, whether a non-linear relationship between per capita income and decentralisation exists. Threshold models are estimated, in which the effect of fiscal decentralisation on per capita income, TFP growth and investment depends on the level of fiscal decentralisation. The testing procedure developed by Hansen (1999) is used, in which the threshold values are determined endogenously through a grid search, and in which the linear specification is tested against a two-regime model. If the null hypothesis of the linear model can be rejected against the alternative of a two-regime model, the null of a two-regime model is tested against the alternative of a three-regime model. The linear, two-regime and three-regime models can be written as follows.

$$Y_t = \alpha + \beta \cdot DEC_t + \varepsilon_t$$

$$Y_t = \begin{cases} \alpha_1 + \beta_1 \cdot DEC_t + \varepsilon_t & \text{if } DEC_t < T \\ \alpha_2 + \beta_2 \cdot DEC_t + \varepsilon_t & \text{if } DEC_t \geq T \end{cases} \quad (7)$$

$$Y_t = \begin{cases} \alpha_1 + \beta_1 DEC_t + \varepsilon_t & \text{if } DEC_t < T_1 \\ \alpha_2 + \beta_2 DEC_t + \varepsilon_t & \text{if } T_2 > DEC_t \geq T_1 \\ \alpha_3 + \beta_3 DEC_t + \varepsilon_t & \text{if } DEC_t \geq T_2 \end{cases}$$

where T is the value of the threshold of fiscal decentralisation in the two-regime model and T₁ and T₂ are the lower and upper threshold values of fiscal decentralisation in the three-regime model. Once the threshold values are identified, the null hypothesis of $\beta_1 = \beta_2$ can be tested using a likelihood ratio test, where the test statistic is obtained through bootstrapping with random draws with replacement using 500 replications. If the likelihood ratio test statistic rejects the null hypothesis of the linear model against the two-regime model, then in a next step the two-regime model is tested against a model of three regimes.

3.4. Data

Decentralisation data are taken from the OECD fiscal decentralisation database. Since one of the main objectives of the analysis is to compare different definitions of decentralisation and their relationship with economic activity, care is taken to select adequate decentralisation indicators. Four different indicators were finally selected to enter *alternatively* into otherwise identical equations: spending decentralisation (the share of sub-central spending in general government spending), revenue decentralisation (the share of sub-central revenue – taxes, user fees and other revenue – in general government revenue), tax decentralisation (the share of sub-central tax revenue in general government tax revenue) and tax autonomy (taxes for which SCGs have some power to set the base and/or rate as a share of general government tax revenue). While total revenue and tax revenue decentralisation are similar in highly decentralised countries, they are not so in countries with little sub-central tax revenue and where SCGs often depend heavily on user fees and other non-tax own revenues (excluding grants). Spending, revenue and tax decentralisation indicators are available for the period 1970 to 2011 for few OECD countries, for the period 1985 to 2011 for around half of the countries, and for the period 1995 to 2011 for most countries. This allows testing for different panels, both balanced and unbalanced. The tax autonomy indicator is available for 1995, 2002, 2005 and 2008 only.

Given the different availability and periodicity of the four decentralisation indicators, two different model specifications are run: a panel regression using annual data for spending, revenue and tax revenue decentralisation (*annual specification*), and a panel regression using all decentralisation indicators for the four years noted above (*selected years specification*). Finally, intergovernmental transfers reflecting the wider fiscal framework enter the model in two ways: either as the share of transfer spending in general government spending, or as an interaction terms whereby each decentralisation indicator is replaced by the

product of the decentralisation indicator times the share of transfer spending in general government spending. The latter specification gauges the possible negative effect of transfers on the supposed positive effect of decentralising other fiscal variables such as spending or tax revenue. The remaining control variables are taken from various OECD databases. Human capital is measured in terms of average years of schooling and is obtained from Bouis et al. (2011).

4. Results

4.1. Bivariate regressions

As a starting point, we first look at the bivariate relationship between per capita income and the various measures of fiscal decentralisation, and the possible channels through which fiscal decentralisation may affect per capita income: *i)* the TFP – fiscal decentralisation channel, *ii)* the investment – fiscal decentralisation channel, and *iii)* the human capital – fiscal decentralisation channel. The results suggest a positive relationship between decentralisation and economic activity and human capital, while the relationship between decentralisation and productivity is weaker. Decentralisation and investment appear to be unrelated (Table 1). The results are similar for the annual specification, which does not include the tax autonomy indicator. Results are similar for federal and unitary countries, except for TFP where some relationships are negative. Coefficients are higher for the revenue variables than for the expenditure variables. Human capital is particularly strongly correlated with all decentralisation variables, suggesting that decentralised fiscal policy making does not only affect economic activity through the technology channel but also more directly *via* a better human capital stock. Overall these results tend to suggest that decentralisation has a “broad band impact” and that one can pinpoint which sub-channels are important and which are not.

Table 1. Decentralisation and GDP, TFP, investment and human capital
Bivariate estimations, time fixed effects, unbalanced panel, selected years specification

	All countries				Federal countries				Unitary countries			
	Tax autonomy	Spending	Revenue	Tax revenue	Tax autonomy	Spending	Revenue	Tax revenue	Tax autonomy	Spending	Revenue	Tax revenue
GDP(-1)	0.01*	0.01*	0.01*	0.02*	0.01*	-0.01*	0.01*	0.01*	0.02*	0.00*	0.01*	0.02*
TFP(-1)	0.004*	0.006**	0.004	0.004*	-0.003	-0.005*	-0.003	-0.002	0.008**	0.002	0.002	0.005
INV(-1)	-0.01	-0.03	-0.04	-0.02	0.04	0.01	-0.01	0.00	-0.05	-0.05	-0.08	-0.02
EDU(-1)	0.07*	0.05*	0.07*	0.08*	0.07*	0.09*	0.10*	0.10*	0.08*	0.03*	0.05*	0.06*
	r^2_{adj}											
GDP(-1)	0.22	0.10	0.14	0.20	0.15	-0.03	0.34	0.31	0.22	0.02	0.04	0.13
TFP(-1)	0.02	0.05	0.01	0.02	0.01	0.04	0.01	0.00	0.04	-0.01	-0.01	0.00
INV(-1)	-0.01	0.01	0.01	-0.01	-0.05	-0.11	-0.11	-0.08	0.01	0.03	0.03	-0.02
EDU(-1)	0.18	0.16	0.25	0.25	0.15	0.14	0.62	0.45	0.15	0.05	0.06	0.12
No. of obs.	111	106	106	130	36	34	34	40	79	75	75	96

Note: The table shows the long run bi-variate correlations between decentralisation variables (columns) and lagged output variables (rows): GDP, TFP, investment and human capital. The coefficients provide estimates of elasticities or per cent changes. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively. Adjusted R squared for each correlation are shown in the lower section of the table.

4.2. Annual specification

Results for the simple GDP specification using only the production function variables plus alternatively the decentralisation variables suggest a positive relationship between decentralisation and GDP. The relationship becomes stronger once additional controls are included (Table 2). In the extended version, all decentralisation variables are significant, with the coefficients for the revenue side being somewhat higher than those for the spending side. A 10% decentralisation increase is associated with a GDP per capita increase of around 0.3%. Results for the sub-categories of federal and unitary countries are less significant, suggesting that fiscal frameworks vary more within the two sub-categories than across

them, although a smaller sample size might also affect significance. The control variables have mostly the expected sign but are often not significant: the size of the transfer system has a negative impact, government size has an insignificant impact, and the share of property and consumption taxes is, against expectations, negative. The production function variables (education and investment) are sometimes significant with the wrong sign. Adding population growth, inflation and openness produces better results for the education and investment variables (both become positive and sometimes significant), but reduces the significance of the decentralisation variables. Using only data since 1995 raises the decentralisation coefficients somewhat, suggesting that fiscal federal frameworks have become more important for economic activity over time (not shown). Jackknifing countries – i.e. eliminating single countries one by one to test for their impact on the results – reveals small changes in the results, suggesting that the country panel yields robust results. Using a pooled instead of a time fixed effects specification changes the results only slightly, suggesting that decentralisation variables as a whole are trending little. Using country fixed effects dramatically increases r^2 but in general reduces the significance of most coefficients and lowers their robustness, suggesting that the differences in fiscal federal arrangements across countries are to a large extent captured by the country fixed effects and that the results are driven by a few countries.

Table 2. Annual times series results: decentralisation and GDP

Panel A. Basic version, time fixed effects, unbalanced panel, all OECD countries

	All countries			Federal countries			Unitary countries		
	exp	rev	taxrev	exp	Rev	taxrev	exp	rev	taxrev
c	-12.487**	-12.324**	-10.652**	-228.213	-47.125	-2.697	-11.887**	-12.118**	-10.174**
lgcapp(-1)	1**	1**	1**	1	1	1	1**	1**	1**
inv(-1)	0.021	0.021	-0.016	4.599**	0.736**	-0.094	-0.016	-0.013	-0.037
edu(-1)	0.027	-0.004	-0.099**	6.613**	1.142*	0.465	0.028	0.009	-0.12*
decentral	0.003	0.01**	0.015**	-0.361	-0.05	0.102**	-0.008	0.006	0.01
r^2_{adj}	0.51	0.51	0.35	0.74	0.74	0.45	0.45	0.45	0.30

Table 2. Annual times series results: decentralisation and GDP (cont.)

Panel B. Extended version, time fixed effects, unbalanced panel, all OECD countries

	All countries			Federal countries			Unitary countries		
	exp	rev	taxrev	exp	Rev	taxrev	exp	Rev	taxrev
c	-9.651*	-9.182	-9.443	-2.529	-6.328	-8.669	-11.292**	-11.403**	-11.437*
lgcapp(-1)	1**	1**	1**	1	1	1	1**	1**	1**
inv(-1)	0.002	0.003	0.018	-0.188**	-0.096	-0.042	-0.022	-0.015	-0.003
edu((-1)	-0.165*	-0.209**	-0.179*	-0.293	-0.13	-0.026	-0.069	-0.076	-0.064
govsize(-1)	-0.005	-0.01	-0.013	0.034	0.014	-0.001	-0.015	-0.017	-0.023
taxstruc(-1)	-0.039*	-0.039*	-0.041**	0.046	0.038	0.031	0.027	0.028	0.026
transfers(-1)	-0.044*	-0.01	-0.008	0.009	0.017	0.024	-0.066**	-0.029	-0.029
decentral	0.03**	0.032**	0.033**	0.01	-0.003	-0.01	0.027*	0.031**	0.033**
r^2_{adj}	0.52	0.53	0.54	0.74	0.74	0.73	0.49	0.49	0.50

Note: The table shows the long-run coefficients between a set of decentralisation variables and GDP per capita. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

Results for the simple TFP specification using only the production function variables plus alternatively the decentralisation variables suggest a positive relationship between decentralisation and TFP (Table 3), which becomes a little weaker once additional control variables are added. All three decentralisation variables have a positive and significant sign, with the coefficients for revenue decentralisation being again larger and more significant than spending decentralisation. Results for the two constitutional sub-groups – federal versus unitary – are however not significant, again owing probably to smaller sample size. Adding more controls changes the decentralisation coefficients little, with all three decentralisation variables remaining significant and again with revenue decentralisation having a stronger

impact than spending decentralisation. However, an increase of the decentralisation ratio by 10% increases productivity by less than 0.1%. Jack-knifing countries changes results somewhat. Excluding Slovakia, Portugal and the United Kingdom increases the significance of the decentralisation variables in some cases. The influence of the size of the transfer system is, unexpectedly, positive, while the share of property taxes has an insignificant influence. Also government size has no significant impact. Again using a pooled mean group estimation instead of time fixed effects hardly changes the results, while the results of the country-fixed effects estimation suggest that intergovernmental fiscal frameworks are idiosyncratic and time-invariant.

Table 3. Annual times series results: decentralisation and TFP

Panel A. Basic version, time fixed effects, unbalanced panel, all OECD countries

	All countries			Federal countries			Unitary countries		
	exp	rev	taxrev	exp	rev	taxrev	exp	rev	taxrev
c	-10.55**	-10.512**	-10.622**	-12.809*	-13.098	-10.67**	-10.383**	-10.349**	-10.525**
logtfp(-1)	1**	1**	1**	1	1	1*	1**	1**	1**
inv(-1)	0.039**	0.04**	0.046**	0.173**	0.199**	0.062	0.034**	0.034**	0.043**
decentral	0.004**	0.004**	0.006**	-0.004	-0.012	-0.003	0.002	0.003	0.006**
\hat{r}^2_{adj}	0.49	0.49	0.3351	0.60	0.60	0.35	0.48	0.48	0.33

Table 3. Annual times series results: decentralisation and TFP (cont.)

Panel B. Extended version, time fixed effects, unbalanced panel, all OECD countries

	All countries			Federal countries			Unitary countries		
	exp	rev	taxrev	exp	rev	taxrev	exp	rev	taxrev
C	-10.486**	-10.543**	-10.573**	-11.466**	-11.648**	-11.486**	-10.499**	-10.592**	-10.552**
logtfp(-1)	1**	1**	1**	1**	1**	1**	1**	1**	1**
inv(-1)	0.033**	0.034**	0.036**	0.126**	0.126**	0.115**	0.027**	0.03**	0.031**
govsize(-1)	-0.001	-0.001	-0.002	-0.033**	-0.031*	-0.031*	-0.002	-0.003	-0.004
taxstruc(-1)	0.003	0.003	0.004	0.03	0.029	0.022	0.008	0.009	0.009
transfer	0.004	0.009*	0.008*	0.022	0.013	0.022	-0.002	0.005	0.005
auton	0.004*	0.005**	0.006**	-0.011	-0.008	-0.002	0.005	0.008	0.008*
\hat{r}^2_{adj}	0.51	0.51	0.52	0.62	0.62	0.61	0.50	0.51	0.52

Note: The table shows the long-run coefficients between a set of decentralisation variables and total factor productivity. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

Finally, results for the channel running from decentralisation to business investment are shown in Table 4. Business investment – here proxied by total investment since business investment is available only for a subsample of countries and since the correlation between business and total investment is above 85% – has no clear relationship with intergovernmental fiscal frameworks. This holds true for both the simple specification with only the real interest rate as control variable as well as including the size of the transfer system. Also the control variables are mostly insignificant.

Table 4. Annual time series results: decentralisation and investment

Time fixed effects, unbalanced panel, all OECD countries

	All countries			Federal countries			Unitary countries		
	exp	rev	taxrev	exp	rev	taxrev	exp	rev	taxrev
C	1.666**	1.705**	1.722**	0.885	0.894	0.746	1.674*	1.744*	1.857**
inv(-1)	1**	1**	1**	1**	1**	1**	1**	1**	1**
Rir	-0.071	-0.071	-0.073	0.072	0.072	0.061	-0.114	-0.111	-0.105
transfer	0.019	0.021	0.021	0.017	0.015	0.021*	0.011	0.019	0.017
decentral	0.002	0.001	0	-0.001	-0.001	0.001	0.006	0.001	-0.001
r^2_{adj}	0.87	0.87	0.90	0.91	0.91	0.92	0.86	0.86	0.89

Note: The table shows the long-run coefficients between a set of decentralisation variables and investment. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

4.3. Selected years specification

The selected years specification with four variables – tax autonomy, revenue share, tax revenue share and spending share – delivers similar results, but the coefficients of the decentralisation indicators are less significant (Table 5). In the basic version the four decentralisation variables are positively related to GDP per capita, with revenue and tax revenue decentralisation having a slightly higher impact than spending decentralisation, but none of the coefficients is significant. Results do not vary much across country types, except for spending decentralisation having a negative influence in federal countries. In an alternative specification using the period 2005 and 2008 only in federal countries tax autonomy becomes significantly positive while the other variables remain insignificant, suggesting that the active use of tax autonomy has become a more important tool in local and regional economic policy during the last decade. Adding more controls changes the results little, with coefficients becoming even smaller and remaining insignificant. Eliminating alternatively single countries to test for their impact on the results does not change the results. Many control variables behave erratically; the human capital variable is sometimes significantly negative. The size of the transfer system has almost no influence on GDP. Estimating a pooled mean group instead of time fixed effects does hardly change the results, except that tax autonomy becomes (again) a significant growth determinant in federal countries in 2005 and 2008. Using country fixed effects dramatically increases r^2 but in general lowers the coefficients, suggesting that the differences in fiscal federal arrangements across countries are to a large extent captured by the country fixed effects.

Table 5. Selected years results: decentralisation and GDP

Panel A. Basic version, time fixed effects, unbalanced panel, all OECD countries

	All countries				Federal countries				Unitary countries			
	auton	exp	rev	taxrev	auton	exp	rev	taxrev	auton	exp	Rev	taxrev
c	-9.64**	-9.934**	-9.808**	-9.979**	-9.218*	-11.652*	-12.64**	-9.248*	-9.778**	-9.764**	-9.763**	-10.225**
lgcapp(-1)	1**	1**	1**	1**	1	1	1	1	1**	1**	1**	1**
inv(-1)	-0.005	-0.003	-0.004	0	-0.001	0.069	0.068	0.015	-0.001	-0.01	-0.01	0.002
edu(-1)	-0.092**	-0.099**	-0.108**	-0.085**	-0.151	-0.06	0.064	-0.196*	-0.093**	-0.115*	-0.12*	-0.078
dpop(-1)	0.119	0.245**	0.242**	0.159*	-0.078	0.118	0.345	-0.16	0.16	0.334**	0.348**	0.234**
decentral	0.003	0.004	0.006	0.004	0.011	-0.005	-0.023	0.014	0.003	0.003	0.007	0.003
r ² adj	0.66	0.66	0.66	0.66	0.71	0.75	0.76	0.74	0.65	0.65	0.65	0.65

Panel B. Extended version, time fixed effects, unbalanced panel, all OECD countries

	All countries				Federal countries				Unitary countries			
	auton	exp	rev	taxrev	auton	exp	rev	taxrev	auton	exp	rev	taxrev
c	-9.598**	-9.898**	-9.889**	-10.077**	-13.435	-11.358	-11.832	-11.589	-9.713**	-10.359**	-10.403**	-10.742**
Lgcapp(-1)	1**	1**	1**	1**	1	1	1	1	1**	1**	1**	1**
inv(-1)	-0.007	0.002	0.002	0.005	0.224	0.066	0.073*	0.12	-0.012	-0.003	-0.002	0.001
edu(-1)	-0.096**	-0.103**	-0.107**	-0.088*	0.125	0.041	0.082	0.063	-0.096	-0.084	-0.082	-0.052
govsize(-1)	0.003	0.006	0.005	0.005	-0.07	-0.027	-0.027	-0.049	0.001	0.003	0.003	0.004
taxstruc(-1)	0.000	-0.002	-0.001	-0.001	-0.119	-0.01	-0.009	-0.058	0.009	0.014	0.014	0.014
transfers	0.009	-0.003	0.004	0.005	0.138	0.049	0.037	0.074	0.006	-0.01	-0.003	-0.001
decentral	0.003	0.006	0.006	0.005	-0.009	-0.012	-0.015	-0.011	0.002	0.005	0.005	0.001
r ² adj	0.68	0.66	0.66	0.63	0.73	0.76	0.76	0.75	0.67	0.64	0.64	0.63

Note: The table shows the long-run coefficients between a set of decentralisation variables and GDP per capita, using the selected years specification. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

The TFP specification delivers hardly different results from the GDP specification (Table 6). In the basic variant with only investment as a control variable, most decentralisation variables remain insignificant, and those being significant are negative (revenue and tax revenue in federal countries). The investment variable is significantly positive. Adding more controls changes the results little, with the tax autonomy indicator showing consistently higher values than the other decentralisation variables, but the coefficients remain insignificant. Eliminating Ireland, Portugal and the United Kingdom makes the revenue variables (tax autonomy, tax revenue, revenue) significant, suggesting that these (partially) high-growth, highly-centralised countries “spoil” the empirical relationship in the full panel. Most controls have the expected sign but are mostly insignificant.

Table 6. Selected years results: decentralisation and TFP

Panel A. Basic version, time fixed effects, unbalanced panel, all OECD countries

	All countries				Federal countries				Unitary countries			
	auton	exp	rev	taxrev	auton	exp	rev	taxrev	auton	exp	Rev	taxrev
C	-9.878**	-10.048**	-10.004**	-9.935**	-9.557	-8.523	-7.587	-8.935	-9.964**	-10.188**	-10.152**	-9.995**
Logtftp(-1)	1**	1**	1**	1**	1	1	1	1	1**	1**	1**	1**
Inv(-1)	0.022	0.027*	0.026*	0.024**	0.05	0.07	0.058	0.049	0.027	0.032**	0.032*	0.027**
decentral	0.002	0.002	0.001	0	-0.012	-0.039	-0.069**	-0.038**	0.001	0.003	0.003	0.001
r^2_{adj}	0.32	0.29	0.29	0.33	0.31	0.35	0.47	0.44	0.38	0.33	0.33	0.38

Panel B. Extended version, time fixed effects, unbalanced panel, all OECD countries

	All countries				Federal countries				Unitary countries			
	auton	exp	rev	taxrev	auton	exp	rev	taxrev	auton	Exp	rev	taxrev
C	-10.224**	-10.295**	-10.332**	-10.332**	-9.925	-8.805	-8.484	-8.933	-10.378**	-10.532**	-10.58**	-10.485**
Logdftp(-1)	1**	1**	1**	1**	1	1	1	1	1**	1**	1**	1**
Inv(-1)	0.019	0.024	0.024	0.025	0.032	0.058	0.062	0.061	0.028*	0.031**	0.033**	0.032**
govsize(-1)	0.000	0.002	0.002	0.002	-0.023	-0.041	-0.045	-0.047	0	0.001	0	0
taxstruc(-1)	0.008	0.004	0.005	0.005	0.019	0.015	0.013	0.009	0.008	0.007	0.008	0.007
transfer	0.01	0.007	0.009	0.009	0.038	0.063**	0.041	0.053	0.009	-0.001	0.005	0.006
decentral	0.003	0.002	0.002	0.003	0	-0.027	-0.029	-0.019	0.001	0.005	0.006	0.004
r^2_{adj}	0.56	0.58	0.579195	0.59	0.35	0.44	0.45	0.42	0.62	0.64	0.64	0.65

Note: The table shows the long-run coefficients between a set of decentralisation variables and total factor productivity, using the selected years specification. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

Finally, testing for the relationship between decentralisation and the investment rate delivers few significant results, both for the basic and the extended version (Table 7). In the basic version, none of the coefficients are significant, and half of them are negative. In the extend version, most coefficients become positive, with tax autonomy having a larger (positive) impact than the other variables, but all coefficients remain insignificant. Jackknifing changes the results little, except that excluding Norway from the sample makes the tax revenue indicator significant. The real interest rate has the expected negative sign, while the impact of the size of the transfer system oscillates between positive and negative, with only some of the positive impacts being significant. Reducing the estimation period to 2005 and 2008 makes most decentralisation indicators significantly positive (not shown). The fact that tax autonomy has the highest indicator value of all decentralisation variables, especially in the federal country sample, suggests again that tax autonomy has become an important policy device for SCGs in promoting investment and economic activity. Estimating investment in growth terms rather than in relation to GDP increases the significance of the revenue side indicators, especially in the federal country panel (not shown).

Table 7. Selected years results: decentralisation and investment

Time fixed effects, unbalanced panel, all OECD countries

	All countries				Federal countries				Unitary countries			
	auton	exp	rev	taxrev	auton	exp	rev	taxrev	auton	exp	rev	taxrev
c	6.126**	7.59**	8.114**	7.545**	8.56*	6.652	8.68	8.314	6.599**	7.646**	7.891**	7.928**
inv(-1)	1**	1**	1**	1**	1**	1**	1**	1**	1**	1**	1**	1**
rir	-0.226	-0.454	-0.449	-0.312	-1.679*	-1.504*	-1.682*	-1.643*	-0.143	-0.384	-0.362	-0.253
transfer	-0.038	-0.016	0	-0.007	0.177**	0.163**	0.174**	0.176**	-0.06	-0.075	-0.02	-0.025
decentral	0.018	0.012	-0.004	0	-0.001	0.022	-0.002	0.002	0.016	0.041	0.027	0.012
r^2_{adj}	0.46	0.51	0.51	0.48	0.72	0.66	0.66	0.68	0.45	0.51	0.51	0.47

Note: The table shows the long run-coefficients between a set of decentralisation variables and the investment rate (investment to GDP), using the selected years specification. Variables are in logarithms, so that the coefficients provide estimates of elasticities. Short-run coefficients are not reported. ***, **, * indicate significance of the coefficients at the 1%, 5%, and 10% level, respectively.

4.4. Non-linearities

The non-linear estimation results obtained for the multi-year dataset suggest the presence of some non-linear effects of fiscal decentralisation on the level of per capita income: the positive influence of fiscal decentralisation on per capita income declines with a higher degree of fiscal decentralisation (Table 8). Nevertheless, the results are somewhat sensitive to the use of alternative measures of fiscal decentralisation. The tax autonomy indicator, the most pertinent indicator of fiscal decentralisation, is found to have no significant impact on the level of per capita income at very low levels of fiscal autonomy. But the effect becomes strongly positive for mid-range values of decentralisation and declines for a high level of decentralisation. A somewhat different pattern is found using tax decentralisation: the effect is strongly positive, when decentralisation is weak, there is no relationship as the degree of decentralisation increases and finally there is a small positive impact for a high degree of decentralisation. Results obtained on the basis of expenditure and revenue decentralisation are less robust. For the former, a two-regime model is selected with the coefficients being statistically insignificant. For the latter, the three-regime model suggests no robust relationship between decentralisation and per capita income when decentralisation is low and the link becomes positive for the upper regime. Tax revenue indicators tend to provide more reliable results than the other decentralisation indicators. Overall, the impact appears to decrease with a rising degree of decentralisation, which suggests decreasing returns to decentralisation.

Table 8. The non-linear effect of fiscal decentralisation on the level of per capita income

Multi-year averages, 1995-2010

Dependent variable: GDP per capita									
Non-linear explanatory variable: fiscal decentralisation									
Threshold variable: fiscal decentralisation									
	Tax autonomy		Spending ratio		Revenue ratio		Tax revenue ratio		
Test of non-linearity	P-value		P-value		P-value		P-value		
Linear vs. 2 regime	0.000		0.002		0.024		0.000		
2 vs. 3regimes	0.000		0.174		0.018		0.072		
	Coefficient		Threshold		Coefficient		Threshold		
Linear model	DEC		0.015**		0.007**		0.009**		0.013**
2-regime model	Low DEC		0.059** T: 13.13		-0.010 T: 27.40		-0.004 18.64		0.077** 6.37
	High DEC		0.019**		0.002		0.006		0.018**
3-regime model	Low DEC		-0.048 T1: 3.51		-0.007 T1: 27.40		0.009 T1: 10.53		0.059** T1: 6.33
	Middle DEC		0.047** T2: 13.13		0.005 T2: 38.69		0.000 T2: 18.46		0.002 T2: 13.70
	High DEC		0.015**		0.003		0.008**		0.016**
No. of observations	111		106		106		130		
No. of countries	33		33		33		33		

Note: * and ** denote statistical significance at the 10% and 5% levels, respectively. . The p-values show the bootstrapped p-value for the test of non-linearity. P-values lower than 0.1 (in bold) imply that the null hypothesis of the linear model (the null hypothesis of the two-regime model) can be rejected against the alternative of the two-regime model (alternative of the three-regime model) at the 10% level.

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APPENDIX. LITERATURE REVIEW

Cross-country studies					
Study	Country coverage	Time period	Fiscal decentralisation indicator	Results ¹	
Asatryan (2011) "Fiscal decentralization and economic growth in OECD countries: A Bayesian model averaging approach".	23 OECD countries	1975-2001	Revenue share and tax discretion ratio.	(-)	Negative impact of fiscal decentralisation on per capita GDP growth rate. Results using the revenue-share indicator are less conclusive. Cross-country data show a significant positive correlation, whereas on panel data the effect is negative, but of limited significance.
Baskaran, Feld (2009) "Fiscal decentralization and economic growth in OECD countries: Is there a relationship?".	23 OECD countries	1975-2001	Tax discretion indicators. ²	No relationship	No relationship found between fiscal decentralisation and growth. Initial results show negative relationship, but these results are not robust to alternative specifications of the model.
Rodriguez-Pose and Kroijer (2009) "Fiscal decentralization and economic growth in Central and Eastern Europe".	16 Central and Eastern European countries	1990-2004	Expenditure share, share of own revenue in total sub-central revenues, grant ratio.	(-)	Fiscal decentralisation has negative impact on growth. Although over time the effect varies according to the type of decentralisation considered. The effect of expenditure decentralisation and transfers remain negative, but revenue decentralisation goes from having a significant negative to a significant positive effect on the national growth rate.
Thornton (2007) "Fiscal decentralization and economic growth reconsidered".	19 OECD countries	1980-2000	Indicator of tax discretion (depends on size of own revenues, and discretionary power for setting taxes).	No effect	No significant relationship between fiscal decentralisation and growth.
Bodman, Ford (2006) "Fiscal decentralization and economic growth in the OECD".	21 high-income OECD countries	Around 2000	Expenditure and revenue shares. Own revenue and non-tax revenue shares. Quadratic indicator.	No effect/ (Non-linear)	Little/no evidence of direct link between fiscal decentralisation and growth. However, when looking for an indirect link, some evidence is found that a medium level of fiscal decentralisation is best for human capital accumulation, whereas the results for the effect of decentralisation on TFP depend largely on the sample.
Martinez-Vasquez, McNab (2005) "Fiscal decentralization, macrostability and growth".	52 developing and developed countries	1972-97	Expenditure share, revenue share.	No effect/+	No direct link between fiscal decentralisation and growth. Indirect link through the positive impact of revenue decentralisation on macroeconomic stability (1% increase in revenue decentralisation decreases the growth in CPI by 0.3%).
Vo (2005) "Fiscal decentralization in Vietnam: A preliminary investigation".	17 OECD and 5 ASEAN countries	1990-2001	Geometric mean of expenditure share and own revenue share adjusted for autonomy on spending decisions, possibility to set tax rates and bases, access to credit markets, and size of intergovernmental transfers.	+	Positive relationship between fiscal decentralisation and growth (solely based on observations, no regression analysis was done).
Eller (2004) "The determinants of fiscal decentralization and its impact on economic growth: Empirical evidence from a panel of OECD countries".	22 OECD countries	1972-96	Expenditure share net of intergovernmental transfers, revenue-share.	(Non-linear)	Converging to a medium degree of expenditure decentralisation yields the best outcome for growth. Revenue decentralisation has no significant effect on growth.
Ghafar, Ismail, Hamzah, Ritonga (2004) "Fiscal decentralization and economic growth: Evidence from selected Muslim countries". biblio says 2006	Indonesia, Kazakhstan, Kyrgyzstan, Malaysia	1976-2000 (Ind.), 1996-2000 (Kaz.), 1996-2000 (Kyr.), 1973-2000 (Mal.)	Revenue share, expenditure share, average of the two.	-	Fiscal decentralisation is detrimental for growth.

Cross-country studies (cont.)

Study	Country coverage	Time period	Fiscal decentralisation indicator		Results¹
limi (2004) "Decentralization and economic growth revisited: An empirical note".	51 countries (7 low income, 10 lower-middle income, 12 upper-middle income, and 22 high income)	1997-2001	Expenditure share.	+	Fiscal decentralisation is growth-enhancing. Estimated coefficient=0.067 (with OLS) and 0.037 (with IV).
Enikolopov, Zhuravskaya (2003) "Decentralization and political institutions".	21 developed and 70 developing and transition countries	1975-2000	Revenue share. Robustness check with expenditure share.	No direct relationship	No direct significant effect. Negative effect when interacted with variables representing features of the political system. In particular, the strength of the national party system (age of main parties, and fragmentation of government parties), and subordination (whether local and state executives are appointed or elected) matter.
Thiessen (2003) "Fiscal decentralization and economic growth in high income OECD countries".	High income OECD excl. Luxemburg	1973-98	Expenditure share, revenue share, un-weighted average of the two, quadratic indicator.	Non-linear	Hump-shaped, non-linear relationship between fiscal decentralisation and growth. "Medium" level of fiscal decentralisation appears to be best.
Wescott, Porter (2003) "Fiscal decentralization and citizen participation in East Asia".	Thailand, Cambodia, the Philippines, Indonesia and China	From 1980s	-	No relationship	Fiscal decentralisation does not matter much for the growth performance of the region. The results are however not based on a formal econometric framework.
Ebel, Yilmaz (2002) "On the measurement and impact of fiscal decentralization".	19 OECD countries	1997-99	Own revenue share, own non-tax revenue share, fiscal dependency and tax sharing ratios.	?	Revenue autonomy is positive for growth. Fiscal dependency has a positive, but insignificant impact. Tax sharing has a negative impact on growth. Substantial differences in results based on the more traditional expenditure share and revenue share indicators.
Yilmaz (2000) "The Impact of Fiscal decentralization on macroeconomic performance".	17 unitary states and 23 federal states, both developed and developing countries	1970-90	Expenditure share.	(+)	Decentralisation of expenditure at the local level increases GDP growth in unitary states, while the results for federal states are less clear-cut.
Davoodi, Zou (1998) "Fiscal decentralization and economic growth: A cross-country study".	46 countries	1970-89	Expenditure share less grants.	(-)	Fiscal decentralisation has negative effect on growth in whole sample and in developing countries; 10% increase in fiscal decentralisation reduces growth rate by 0.7-0.8 percentage points. No significant impact in developed countries.
Woller and Phillips (1998) "Fiscal decentralization and LDC economic growth: An empirical investigation".	23 developing countries	1974-91	Revenue share, own revenue share, expenditure share, and expenditure share of total government expenditure less defense and social security.	No effect	No significant effect of fiscal decentralisation (neither spending nor revenue side) on economic growth.

National studies					
Study	Country coverage	Time period	Fiscal decentralisation indicator		Results ¹
Hammond, Tosun (2009) "The impact of local decentralization on economic growth: Evidence from US counties".	United States	1970-2000	Several measures of local government as well as measures of local government fragmentation on a per capita and per square mile basis. Ratio of county revenue to total local and county revenue.	(+)	Local government organisation matters for local economic growth but impact varies following the government unit considered and also differs for metropolitan vs. non-metropolitan areas. Revenue decentralisation is positive for income growth in metropolitan areas (10% increase in centralisation decreases growth by 0.28%), but has no effect overall.
Carrion-i-Silvestre et al. (2008) "Fiscal decentralization and economic growth in Spain"	Spain	1980-98	Revenue share and expenditure share net of intergovernmental transfers.	+	Fiscal decentralisation has a positive effect both on regional and national economic growth. The effect of the expenditure side is stronger than the revenue side.
Qiao et al. (2008) "The trade-off between growth and equity in decentralization policy: China's experience".	China	1985-98	Expenditure share. Quadratic indicator.	+	Fiscal decentralisation has enhanced growth, but the relationship between the two variables is non-linear.
Åkai, Nishimura, Sakata (2007) "Complementarity, fiscal decentralization and economic growth".	United States	1992-97	Expenditure share, own revenue share, quadratic indicator.	Non-linear	Non linear, humped-shaped relationship between fiscal federalism and growth. The optimal degree of fiscal decentralisation is higher than what is observed for the revenue-share, hence the US would gain in terms of growth from more fiscal decentralisation on the revenue side.
Hammond, Tosun (2006) "Local decentralization and economic growth: Evidence from US metropolitan and non-metropolitan regions".	United States	1970-2000	Number of counties, municipalities, and township governments relative to the region's population.	?	Relatively weak or negative relationship in non-metropolitan areas as opposed to positive impact in metropolitan areas.
Solle-Olle, Esteller-More (2006) "Decentralized provision of public inputs, government responsiveness to local needs, and regional growth. Evidence from Spain".	Spain	1977-98	Dummy variable for legal responsibility of service production.	+	Fiscal decentralisation is positive for road and educational investment and capital stock, and should therefore be beneficial to growth.
Cantarero, Perez Gonzales (2009) "Fiscal decentralization and economic growth: Evidence from Spanish regions".	Spain	1985-2004	Revenue and expenditure share.	(+)	No relationship between expenditure decentralisation and growth. Positive relationship between revenue decentralisation and growth. 10% increase in revenue decentralisation adds 0.5% to GDP per capita growth. No evidence of non-linearities.
Huang, Cheng (2005) "The role of fiscal decentralization in regional economic growth in China".	China	1996-2004	Sub-national retained revenue-share and ratio between retained revenue and total sub-central revenue, quadratic indicator.	-	The direct effect of fiscal decentralisation on growth has been negative. But squared terms suggest non-linear, U-shaped relationship. In highly centralised countries, fiscal decentralisation decreases growth; however this effect becomes smaller with higher decentralisation; and above a certain threshold additional decentralisation is beneficial for regional growth.
Malik, Hassan, Hussain (2006) "Fiscal decentralization and economic growth in Pakistan".	Pakistan	1971-2005	Expenditure share, expenditure share less defence and interest payments, revenue share, own revenue share.	+	Both the expenditure share and the own revenues share have a positive and significant effect on growth (estimated coefficients are 0.54 and 0.62 respectively. When grants are included in SCG revenues the effect of revenue decentralisation is however found to be negative (-0.17) but insignificant.
Jin, Zou (2005) "Fiscal decentralization and economic growth in China".	China	1979-93 and 1994-99	Expenditure share, extra budgetary expenditure share, revenue share, non tax revenue share.	(-)	From 1979-93: Expenditure decentralisation is negative for growth (-2.98), revenue decentralisation is positive for growth (0.54). From 1994-99: Expenditure decentralisation has no effect on growth, revenue decentralisation has negative effect on growth (-0.51).

National studies					
Study	Country coverage	Time period	Fiscal decentralisation indicators	Results ¹	
Feld et al. (2004) "Fiscal federalism and economic performance: evidence from Swiss Cantons".	Switzerland	1980-98	Revenue share and expenditure share, as well as grant share. Tax competition (difference between the tax rate in a canton and the average tax rate in neighbouring cantons), fragmentation (number of communes/population), and urbanisation (share of people living in urban areas).	(+)	Spending and revenue decentralisation have no effect on growth. Matching grants are negatively correlated with economic performance. Tax competition is positive for GDP per capita. Fragmentation has a marginal negative impact, whereas urbanisation has none.
Desai et al. (2003) "Fiscal federalism and regional growth: Evidence from the Russian Federation in the 1990s".	Russia	1996-99	Share of locally generated revenues kept by a region.	+	Positive impact on cumulative output recovery of Russian regions. The positive impact is smaller with higher "rents": revenues from natural resource production and grants from the central government.
Akai, Sakata (2002) "Fiscal decentralization contributes to economic growth: Evidence from state-level cross-section data for the United States".	United States	1992-96	Revenue share, expenditure share, mean of the two, own revenue share.	+	Decentralisation has a positive impact on state gross product. Increase in expenditure decentralisation by 10% increases growth by 1.6-3.2 percentage points.
Akai, Nishimura, Sakata (2002) "Fiscal decentralization, economic growth and economic volatility. Theory and evidence from state-level cross-section data for the United States".	United States	1992-97	Expenditure share, own revenue share.	+	Fiscal decentralisation has positive effect on economic growth; and negative effect on economic volatility.
Behnisch, Buttner, Stegarescu (2002) "Public sector centralization and productivity growth: Reviewing the German experience".	Germany	1950-90	Expenditure share.	+	Increased centralisation has been positive for Germany's productivity growth (though not in the case of education and science sectors nor transport and communication).
Qiao, Martinez, Vazquez, Y. Xu (2002) "Growth and equity trade-off in decentralization policy: China's experience".	China	1985-98	Expenditure share, quadratic indicator.	Non-linear	Fiscal decentralisation leads to growth, but the relationship appears to be non-linear.
Lin, Liu (2000) "Fiscal decentralization and economic growth in China".	China	1970-93	Marginal retention rate.	+	Fiscal decentralisation is positive for economic growth. Raising the fiscal decentralisation indicator from 0% to 100% increases GDP growth rate by 3.62 percentage points.
Xie, Zou, Davoodi (1998) "Fiscal decentralization and economic growth in the United States".	United States	1948-94	Expenditure share for each level of government.	?	The existing level of fiscal federalism has been consistent with growth maximisation. Changing the current level could therefore be harmful for growth.
Zhang, Zou (1998) "Fiscal decentralization, public spending, and economic growth in China".	China	1980-92	Expenditure share, calculated both in total, per capita and relative to income.	-	Fiscal decentralisation is detrimental to growth. Coefficient estimate=-0.054.
Feld, Schnellenbach (2009) "Fiscal federalism, decentralization and economic growth: A meta-analysis".	Both cross-country and within-country			No effect	

1. Parentheses indicate that the estimated effect is either very uncertain, or varies with the indicator chosen or other parameters of the study.
2. Share of sub-federal tax revenues for which local governments can decide either rates, bases or both in total government tax revenue and share of revenue from shared taxes for which local governments may co-determine revenue distribution and/or other allocation details in total government tax revenue.