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Fiscal Federalism, Decentralization and Economic Growth: Survey and Meta-Analysis

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Abstract

The theoretical literature on the economics of fiscal federalism has identified several potential effects of government decentralization on economic growth. Much of the traditional literature focuses on the efficiency aspects of a decentralized provision of public services. However, decentralization may also increase growth by raising the ability of the political system to innovate and carry out reforms. On the contrary, some authors argue that decentralization increases corruption and government inefficiency. After a discussion of the theoretical arguments, we provide both a traditional survey and a meta-analysis of the empirical literature on decentralization and economic growth. Based on our survey, we identify open questions and discuss possible ways of answering them.

JEL-Code: C180, E020, H110, H770, O430.

Keywords: fiscal federalism, fiscal competition, economic growth, meta-analysis.

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1. Federalism and Growth: Introduction

What impact can fiscal federalism have on economic growth? If we take the perspective of the standard Solow-Swan growth model (Solow 1956, Swan 1956), this is a trivial question. With a given production technology, income per capita in the steady state is fully determined by the savings rate, the rate of population growth and the rate of depreciation of the capital stock. *Prima facie*, it is thus unclear by which mechanisms fiscal federalism, as a principle of organizing government, could have an impact on economic growth. Yet, while a direct effect of federalism would be inconsistent with the Solow-Swan framework, federalism may have an indirect effect by affecting the exogenous parameters of the Solow-Swan model. As we will see later, federalism may, for example, result in a different propensity to save than a unitary state if the saving decision is endogenized in a model with overlapping generations. If federalism was indeed associated with different propensities to save, different growth rates on the convergence paths towards the respective steady states would be expected for otherwise identical model economies.

But an effect that runs through the exogenous parameters in the Solow-Swan framework is certainly not the first line of thought that comes to mind when considering the link between fiscal federalism and economic growth. As Oates' (1999) survey shows, the efficiency (or inefficiency) properties of fiscal competition, fiscal equalization systems, or intergovernmental relations in a polity in general can all have an immediate effect on economic performance. These properties have been the focus of a large number of theoretical and empirical studies during the last decades. Based on a review of theoretical arguments, Oates (1993) arrives at the conclusion that fiscal federalism is likely to affect economic development. Those familiar with endogenous growth theory may wonder which transmission mechanisms supposedly exist between federalist institutions and the usual variables determining long-run growth in these models. In this paper, we shed some light on these issues in two steps: First, we provide a survey of the theoretical literature on fiscal federalism, decentralization and economic growth. In particular, we focus on the transmission channels by which federalism affects growth. Second, we review the empirical evidence on the link between federalism and growth. Since the results vary greatly, it is difficult to obtain clear-cut conclusions by simply providing a traditional survey of empirical results. We therefore conduct a quantitative meta-analysis which targets the effect of decentralization on growth and identifies how, within the existing body of literature, the idiosyncratic characteristics of a study determine its results.

Finally, as meta-analytical techniques are relatively rarely used in economics, we also aim at contributing to the establishment of these methods (Stanley 2001, 2008).

The paper is organized as follows: In *Section 2*, the theoretical studies on the impact of fiscal federalism on economic growth are reviewed. A brief survey of the empirical studies follows in *Section 3*. They are quantitatively reviewed in *Section 4*. In *Section 5*, the results of meta-regressions are reported in order to get an impression as to how the idiosyncratic characteristics of a study influence its results. *Section 6* provides a discussion of the results and some conclusions.

2. How Could Fiscal Federalism Affect Economic Growth? The Theoretical Arguments

2.1 Introduction: The Solow-Swan Framework

The basic theoretical considerations on fiscal federalism and growth can be exemplified using a simple Solow-Swan model of economic growth incorporating a Cobb-Douglas production function $Y = AL^{\alpha}K^{1-\alpha}$ with $0 < \alpha < 1$, L denoting the amount of labor employed which is assumed to be identical to the number of individuals, K denoting capital used and A denoting the level of technology. With a savings rate s, a rate of depreciation δ and a rate of population growth n, it is straightforward that the steady state capital stock per physical unit of labor is

$$k^* = \left[\frac{sA}{n+\delta}\right]^{\frac{1}{\alpha}} \tag{1}$$

and the corresponding steady state income per physical unit of labor is

$$y^* = A^{\frac{1}{\alpha}}\left[\frac{s}{n+\delta}\right]^{\frac{1-\alpha}{\alpha}}. \tag{2}$$

With A and s fixed in time, total capital stock and total output grow with the constant rate n, while an exogenous increase of either A or s will initiate transitional dynamics with temporarily higher growth rates of K and Y, until a new steady state with higher per-capita capital stocks and incomes is obtained. If, as suggested by some of the contributions reviewed below, fiscal federalism is associated with a relatively higher level of efficiency in governance – a

higher value of A – then we would expect a regime change towards federalism to be associated with temporarily higher growth rates, and eventually a higher level of income. The same holds for an increase in the value of s, which other contributions to be reviewed below argue to result from a switch to a federal regime. In both cases it is important to note that working with a Solow-Swan framework, the expected effects of federalism on the rate of output growth may be only temporary and difficult to detect in empirical cross-section analyses, while at the same time substantial effects on steady state per-capita income may be observed.

If we account for the possibility of a steady growth in time of A due to technological progress, the steady state levels of capital and income, defined per efficiency unit of labor rather than per physical unit of labor, and rather than steady state levels of k and y, the model now yields a steady state growth rate of both, namely

$$\gamma_k = \gamma_y = x \tag{3}$$

where x is the constant rate of growth of the level of technology (e.g., Barro and Sala-i-Martin 2001, p. 34). If a theoretical link between x and the level of decentralization of government can be established, then we have reason to expect that federal systems are associated with persistently different growth rates of income per capita than unitary systems. This would, however, require entirely different theoretical arguments than the possibility of a one-off realization of microeconomic efficiency gains due to a regime change. We will later in this paper discuss arguments that claim, for example, that there is a relatively higher capacity of federal systems to induce political innovations. But before having a closer look at endogenized technological change, we will in the following subsection review some pioneering attempts of incorporating federalism into models with endogenous decisions on saving and investment, i.e., on the value of s.

2.2 Federalism, Capital Accumulation and Endogenous Savings Decisions

Brueckner (1999) has been the first to incorporate fiscal federalism into growth models with endogenous savings decisions. He uses a Diamond-OLG growth model extended to include the provision of a publicly provided private good, financed with uniform lump-sum taxes. Heterogeneity of the population is captured by allowing for different levels of demand for the publicly provided good for young and old individuals. A unitary government is assumed to supply some compromise level of the good which lies in between the utility-maximizing levels of the two respective age cohorts. This assumption may be thought of as a simple way to

capture democratic processes, where the enacted policies represent some bargaining solution that lies between the ideal policies of different constituencies. In a federal system, Brueckner assumes a perfectly working Tiebout (1956) sorting mechanism, which implies that in equilibrium two jurisdictions are characterized by age-homogeneous populations, each receiving its utility-maximizing level of the publicly provided good.

In this overlapping-generations framework, the assumption is pivotal that in each period *t*, members of the young generation save and buy the entire existing capital stock from members of the old generation, who want to transform savings into consumption during their retirement period. Thus, in equilibrium

$$(4) \qquad (1+n)k_{t+1} = s(w(k_t), r(k_{t+1}))$$

must hold at any point in time: Saving is a function of the wage *w* and the interest rate *r*, which in turn are functions of the current and future per capita capital stock. Current savings must equal the planned capital stock, taking into account that the population grows with a constant rate *n*. Steady states are identified by solving (4) for the planned capital stock such that

$$(5) \qquad k_{t+1} = H(k_t)$$

and searching for fixed points which are characterized by (i) an identity of current and planned capital stocks and (ii) stability ensured by $H'<1$. As the shape of *H* is not determined by the assumptions of the model, either a single or multiple stable steady states may exist. One key insight from Brueckner (1999) is the fact that, if a regime change from a unitary to a federal regime (or vice versa) has an effect on planned savings, and if this distorts the equilibrium in (4), the resulting effect may not only be a gradual adjustment of the steady state capital stock. Rather, dynamic effects may be larger, driving the economy from one of the multiple steady states to another.

It is therefore important to inquire how a regime change may impact planned savings. Under Brueckner's (1999) assumption of weak complementarity between public and private goods, an increase of the quantity of the publicly provided good would unambiguously increase the marginal utility of the private good consumed by both young and old individuals. If now we have a situation where the desired quantity of the publicly provided good is greater for the young than for the old, then a switch to federalism increases the marginal utility of private

consumption for the young and decreases it for the old – compared to the benchmark of a unitary state, with an intermediate quantity of the publicly provided good. The individuals readjust their consumption plans by saving less today in order to consume more of the private good in their young and less in their old age. The converse argument would hold if the old preferred a larger quantity of the publicly provided good than the young. In this case, higher savings would be the result of a switch to federalism.

The steady state capital intensity of a federal system as compared to a unitary system does therefore ultimately depend on the initial assumptions on the relative demands of the young and the old for the publicly provided good. If the young demand a higher quantity than the old, federalism reduces steady state capital intensity. If the young demand a lower quantity, then the steady state capital intensity increases after a federal system is implemented. It is important to note that differences in the growth of capital stock and output between the two regimes are again temporary, following a regime change. Once the new steady state is obtained, the growth rate is equal to n, as in the basic Solow-Swan framework. Since the two regimes lead to different steady states, the model can, however, explain persisting differentials in the levels of capital and outcome per capita between otherwise identical economies, depending on the constitutional framework.

A model that relies on a perfectly working Tiebout sorting mechanism obviously presents an extreme case. Nevertheless it is useful to remember that the main justification for fiscal federalism in the literature has always been diversity of preferences for public goods (e.g., Oates 1972) and the ability of local governments to supply specific levels and types of public goods which are in line with the demands of their respective populations. If this mechanism is at work in the real world, then the argument presented by Brueckner (1999) is likely to also have some empirical relevance – even if sorting in the real world is not perfect. Still, the ambiguity of the sign of the growth effect – its dependence on the demands for public goods of different groups in the economy – must appear as somewhat unsatisfactory.[1]

Brueckner (2006) tackles two problems by using a different theoretical framework which allows to (i) explain persistent growth rate differentials due to the use of an endogenous growth model, and (ii) shows unambiguously that a switch to federalism increases human capital in-

1. Similarly, Kellermann (2007) shows that decentralization of public investment decisions under the presence of head taxes may lead to either less or more economic growth, depending on auxiliary assumptions.

vestments and therefore growth. The basic approach is an OLG framework as in Brueckner (1999), but it is now embedded in an endogenous growth model along the lines of Yakita (2003) which Brueckner extends to include a publicly provided good. Individuals can invest in human capital while young in order to increase their productivity and earnings when becoming old. Thus, they always earn higher incomes in their older ages and correspondingly have a lower demand for the public good when they are young. Assuming a perfect Tiebout sorting mechanism and the assumption that a unitary government supplies some intermediate level of the public good, the same intuition as in Brueckner (1999) applies. The decisive difference is that now it can be shown that the young always have a lower demand for public goods than the old, and the steady state capital intensity in a federal system is higher.

Another interesting problem in our context is the demand side of the capital market, i.e., the impact of government decentralization on the incentives to invest into the stock of public capital. Thus far, only few theoretical studies concern themselves with this issue, and Brueckner (1999, 2006) deliberately leaves it out of consideration. Zou (1994, 1996) has a closer look at public investment, albeit in a very different theoretical framework. He is not interested in comparisons of unitary and federal regimes, but in the impact of different intergovernmental grant schemes in a federal framework. Zou (1994) focuses on the effects of federal grants-in-aid in the form of matching and non-matching grants on the investment decisions of local governments. Growth effects are not explicitly considered here, although the accumulation of public capital which results from local investment decisions obviously must have some relevance for growth, in particular if it crowds out public or private consumption. Zou (1994) models a government which maximizes present and discounted future utility of a representative citizen and also abstracts from private capital accumulation. He shows that different schemes of grants-in-aid have very different effects on public sector investment decisions. Only a permanent increase of non-matching grants and a temporary increase of either matching or non-matching grants reliably stimulate local public capital accumulation, while other grant schemes involve different ambiguities.

Zou (1996) extends the analysis and presents a fully-equipped local growth model with both private and public capital accumulation and consumption, and endogenous decisions on the local level of taxation. Again, however, a government maximizing an infinitely lived, representative citizen's lifetime utility is at the center of the model – there are no overlapping generations. The somewhat surprising result is that the sign of the effects of different schemes of

financing local public goods crucially depends on the utility function that is used in the analysis. With a standard utility function that includes only private and public consumption, there are no differential effects from the composition of financing instruments on long-run economic variables. If, on the other hand, an Arrow-Kurz (1970) utility function is used, which also includes the public capital stock, then a federal grant that sponsors local public consumption crowds out investments into the local capital stock. Using a local consumption tax to finance the local budget is then associated with faster accumulation of both private and public capital.

The discussion of the theoretical contributions in this subsection shows that both the choice between a unitary and a federal government as well as the choice between different instruments of financing a local budget are associated with rather ambiguous effects on growth. A harmful use of inefficient instruments to finance local budgets can obscure a positive effect on growth that the more fundamental decision to move from a unitary to a federal regime might in fact have. Thus, we have a strong argument here to control for different modes of financing the local budgets in empirical studies relating decentralization to economic growth.

2.3 Agglomeration, Heterogeneity in the Productive Sector and Economic Growth

The concept of Tiebout competition between local jurisdictions (Tiebout 1956) has at its core a notion of efficiency in the consumption of public goods. Sorting of individuals into jurisdictions according to their heterogeneous preferences for government activity is presented as a welfare-maximizing process. While this is certainly a laudable property of fiscal federalism, a link from here to economic growth has so far only been established in the literature via the detour of individual savings decisions, as we have seen in the previous subsection. It would be much more straightforward to establish a causal link between a region-specific supply of public goods and growth if regional heterogeneity was introduced into the models not (only) between consumers, but also in the production economy, which is quite likely an empirically relevant case. In fact, there is a large body of literature in the area of New Economic Geography (see Krugman 1991 or Baldwin et al. 2003 for surveys) which lays the theoretical foundations for explaining the spatial allocation of productive activities, and accounts for agglomeration effects that explain regional differences in the structure of the productive sector.

Among the most important reasons for agglomeration effects are economies of scale, which are traded off against transportation costs. Regional immobility of some resources is another important feature that influences the spatial allocation of productive activities in such models,

which often predict core-periphery patterns of productive activity (Ottaviano and Thisse 2004). Another important mechanism driving agglomeration is the existence of different types of knowledge spillovers that lead businesses using similar immaterial resources to allocate in close proximity to each other, with Silicon Valley being probably the most prominent example (for a survey, see Döring and Schnellenbach 2006). We can expect these forces of agglomeration to have growth effects by themselves. Countries that manage to attract centers of productive activity benefit from a relatively faster accumulation of physical capital (Baldwin and Martin 2004). Furthermore, agglomeration forces may be at least partially influenced by regional policies, given the fact that the regional conditions that drive agglomeration are not only the result of pure chance (e.g. the presence of natural resources), but more importantly are found in the presence of specific human capital (Camagni 1995) whose accumulation can be influenced by education and other policies.

In this sense, regional policies will have an impact on the speed of capital accumulation, and also on the quality of capital that is accumulated. In an important paper which links a standard notion of fiscal competition with agglomeration effects, Justman et al. (2002) show that regional politicians have an incentive to differentiate the supplies of public infrastructure in different regions in order to alleviate the pressures of fiscal competition. As a result, these regions will also attract different types of private capital. Justman et al. thus offer a politico-economic rationale for the emergence of regional heterogeneity in productive activities that does not depend on exogenous differences between jurisdictions. In other important contributions linking fiscal competition to agglomeration, Baldwin and Krugman (2004) analyze core-periphery models leading to full agglomeration of the mobile factor in one region. They show that the resulting existence of an agglomeration rent for the mobile factor implies that further economic integration (e.g. through declining trade costs) will be followed by rising instead of declining tax rates on the income of the mobile factor. Borck and Pflüger (2006) generalize this result to a model economy with only partial agglomeration.

From a growth-oriented perspective, the presence of strong agglomeration effects implies that peripheral regions eager to develop have little other policy alternatives than to attract businesses with a suitable fiscal policy (Brakman et al. 2002). Given that agglomeration effects are relevant empirical phenomena also in unitary states, this means that political devolution is likely to enhance the opportunities of peripheral regions to initiate catch-up processes. If this is not only a zero-sum transfer of capital from one region to another, but instead leads to addi-

tional capital accumulation, it is plausible to assume that federal states are characterized by higher steady-state per capita incomes and higher growth rates on the way to the steady state.

In this context, it is important to note that on theoretical grounds, transfers from a rich to a poor region will have temporary effects at best in a new economic geography model (Brakman et al. 2006). The reason is that in this class of models, a stable equilibrium also serves as an attractor, i.e., the model economy reverts to the initial equilibrium even if a different one is theoretically conceivable as long as the departure from the status quo ante is not sufficiently large. This appears to be in line with empirical results from the United Kingdom that transfers have only very small effects on firm location, and that these effects are smaller where the number of similar firms already present in a region are smaller (Devereux et al. 2007). Put differently: when only very few similar firms are already present in a region, then a subsidy needs to be very large in order to attract additional firms to locate in this region. Thus, the perspective for growth in peripheral regions is likely to be brighter when they can apply their own fiscal policy, tailored to their specific conditions, compared to a situation in which the same regions receive grants from their neighbors or from central government.

Becker and Rauscher (2007), although not working within a New Economic Geography framework, but within a standard Barro (1990) growth model, investigate the effects of fiscal competition with quadratic installation and de-installation costs for physical capital, i.e. with costs of relocating the physical capital stock between regions. Furthermore, they assume benevolent governments. While their main contribution is to find optimal capital tax rates, and showing that the impact of installation costs on the optimal rate of taxing capital is ambiguous, they also show that no equilibrium may exist for high installation costs of capital. In this case, the tax rate chosen by welfare maximizing governments can become so high that capital owners want to reduce the capital stock at a rate that conflicts with the smooth consumption paths desired by consumers. In this sense, a certain intensity of tax competition (which in their model is associated with sufficiently low installation costs of capital) may be a prerequisite for the existence of a balanced growth path.

This leads us to a more general point. If regions are, for whatever reason, heterogeneous – and there are certainly also a number of reasons for heterogeneity that do not rely on agglomeration externalities –, then it is quite likely that a regional government is endowed with a greater ability to enact a growth-promoting policy for its region as compared to a central, unitary government. This point has been informally made already by Oates (1993, 1999). Davoodi

and Zou (1998) incorporate the idea into an endogenous growth model, which they use as a workhorse for their empirical analysis. Similar to Barro (1990) private and public capital enter a Cobb-Douglas production function, but Davoodi and Zou split the public capital stock into three fractions: federal, state and local capital. This specification guarantees that there exist unique and strictly positive growth-maximizing quantities of public goods for each level of government; it is never optimal to centralize (or to decentralize) public good provision completely. However, it is important to realize that this result is driven entirely by the specification of the production function, so that it can at best serve as a reduced-form sketch of much more complex, underlying processes.

Xie et al. (1999) formulate a technically slightly more general model based on a CES production function

$$y = \left[\alpha k^{\phi} + \beta f^{\phi} + \gamma s^{\phi} + \omega l^{\phi}\right]^{\frac{1}{\phi}} \quad with \quad -\infty < \phi < 1 \tag{5}$$

where Cobb-Douglas is a special case. Output thus depends not only on the private capital stock *k*, but also on the levels of *(f)*ederal, *(s)*tate and *(l)*ocal public goods and their respective parameters $\alpha + \beta + \gamma + \omega = 1$. A representative individual with an infinite planning horizon chooses her optimal consumption path, solving

$$\max \int_0^{\infty} \left[\frac{c^{1-\sigma} - 1}{1-\sigma}\right] e^{-\rho t} dt \tag{6}$$

and taking into account the growth of her capital stock through her dynamic budget constraint. The representative individual will thus prefer a tax rate $\tau > 0$. It is shown that the optimal value of τ is strictly increasing in the public sector productivity parameters. Xie et al. (1999) show that maximization of the growth rate of consumption requires the setting of unique optimal levels of public good provision. Let $f + s + l \equiv g$ and $\beta^{1/(1-\phi)} + \gamma^{1/(1-\phi)} + \omega^{1/(1-\phi)} \equiv \Pi$, then the optimal shares are

$$\left(\frac{f}{g}\right)^{*} = \frac{\beta^{1/(1-\phi)}}{\Pi}; \quad \left(\frac{s}{g}\right)^{*} = \frac{\gamma^{1/(1-\phi)}}{\Pi}; \quad \left(\frac{l}{g}\right)^{*} = \frac{\omega^{1/(1-\phi)}}{\Pi}. \tag{7}$$

Certainly, the model by Xie et al. (1999) has only limited predictive power, as actual political decision-making does not enter the model, but it nevertheless helps to clarify some important issues. The model incorporates both the tax and the expenditure side of the budget, and it

shows that if long-term growth is to be maximized, then regional idiosyncrasies need to be taken into account. It is easily conceivable that institutional, technological or even historical and geographical differences between regions imply that the parameters on the right-hand sides of (7) assume different values in different regions. This, in turn, leads to differences in the growth-maximizing tax burdens and expenditure shares in those regions. A roughly similar argument has been made by Cerniglia and Longaretti (2008) with regard to education policy. They show that federal regimes, where education-related public goods are tailored to regional idiosyncrasies, will outperform unitary regimes with uniform education policies.

In the model of the Barro (1990) type used by Xie et al. (1999), the economy is always on a steady-state growth path. A regime-change from a relatively inefficient unitary regime to a relatively efficient federal system would be associated with permanently higher growth rates for the more efficient regime. This is in contrast to the Solow-Swan model sketched in Section 2.1. There, the effects of public investments would be lumped into the level of technology $A(t)$, and the effect proposed by Xie et al. would be associated only with a one-off efficient restructuring of government spending, i.e., there would be a single, positive level effect, but the growth rate x of $A(t)$ and thus steady state growth would be left unaffected. Put differently, this mechanism does not provide a rationale for federalism as a framework that leads to steadily higher, dynamic increases in government efficiency, compared to a unitary constitution.

Again, it is also important to note that the model sketched above has no implications as to whether sub-central governments in a federal framework indeed impose growth-maximizing policies. Rather, the model exemplifies how regional heterogeneity translates into optimal fiscal policy heterogeneity. However, within the framework of benevolent governments, one could argue that even a unitary government must be able to supply regionally differentiated quantities of public goods, as long as these have a limited spatial reach. Even a unitary, benevolent government would thus be able to supply an efficient quantity and type of public good to each region (Besley and Coate 2003). The generic benefit of decentralization must therefore be found less in regional heterogeneity itself, but rather in the incentives and capabilities of policy-makers to optimally respond to existing economic heterogeneity.

An obvious place to look for is the possibility of informational advantages held by decentralized governments; even if a unitary government is benevolent, it may find it difficult to obtain reliable information regarding the efficient types and quantities of public goods in regions far away from the center (Hayek 1948). We will return to information-related arguments at length

in the next subsection. Besley and Coate (2003) argue differently, and explain the benefits of decentralization in a political economy framework: With a unitary government, pork-barreling and cost-sharing on the central level, voters in the regions have incentives to strategically delegate public good lovers as representatives to the central level. Having a unitary government evokes a fiscal commons problem and leads to an inefficient oversupply of public goods. Schnellenbach, Feld and Schaltegger (2010) develop a model in which rent-extraction by representatives instead of strategic delegation is the motive for centralization, and show that fiscal referenda can serve as a decision-making mechanism to impede inefficient government centralization.

Although an oversupply of public goods can have negative effects on economic growth, a more important causal influence of decentralization on growth, especially within the context of regional heterogeneity in the productive sector, may have to do with the political management of structural change. Aghion and Howitt (2006) have argued that in particular for countries whose productive sectors are close to the world technology frontier, a high firm turnover yields higher growth rates. This argument relies on a Schumpeterian endogenous growth model, and is backed by empirical evidence. Caballero (2007) has also argued for the importance of creative destruction for economic growth, and hinted at economic policies such as labor market regulations that may slow down processes of restructuring.

But how could federalism have an impact on structural change? This question has, to our knowledge, not been comprehensively studied so far. Nevertheless, there may be some relatively straightforward mechanisms at work. It is a well-known stylized fact that industrial policies in developed countries tend to be directed at preserving incumbent industries. For risk-averse politicians, this is a thoroughly rational choice: In times of a structural crisis, the demise of an unsubsidized incumbent industry may be more or less certain, while the emergence of new industries is uncertain as far as their sizes and types are concerned; preserving the incumbent may thus easily turn out to be the dominant strategy. But if the Besley-Coate overprovision argument holds, then we can also expect the public funds that are directed towards structural preservation to be higher under a unitary than under a federal regime. The problem may be aggravated with sufficiently heterogeneous regions in a unitary state. In this case, a single or a few well-organized regions suffering from asymmetric shocks could engage in interest group politics on the central level and effectively lobby for structural preservation through a transfer of tax revenue into their regions.

Furthermore, fiscally autonomous regions have a larger set of instruments allowing them to react to a crisis of incumbent industries. For example, tax incentives can be used to attract new businesses, compensating for the demise of the old. With a unitary government, which often acts under (constitutional) provisions to levy uniform nation-wide tax rates, this would obviously not be possible. Thus, there is some reason to believe that local and regional fiscal autonomy would not only enable the supply of efficient, region-specific public goods (from a static perspective) but would also be associated with swifter structural change, and thus higher growth rates.

2.4 Political Competition and Economic Growth

Closely related to the positive effects of fiscal federalism discussed above – which principally stem from the heterogeneity of regions – are effects that have their roots in competition between sub-central governments. This is, in a sense, the other side of the Tiebout mechanism: Individuals do not only sort into regions according to their preferences, but they can also avoid unfavorable combinations of taxes and public good supplies by relocating themselves or at least their mobile capital. They become endowed with additional instruments to discipline self-interested representatives. However, the use of these instruments may also yield effects that deplete economic efficiency. Oates (1972) has already pointed out that efficiency requires fiscal equivalence, i.e., that those who decide on the provision of sub-central public goods are in congruence with those who consume and finance them.

There is a wealth of contributions to the literature which analyze how externalities between jurisdictions distort efficiency, and how efficient compensating transfers might correct for these problems. Discussing these horizontal and vertical externalities in detail here would clearly be beyond the scope of this paper (see Wellisch 2000 for a survey of the issues). Few papers have dealt with the externality issue explicitly within the framework of a growth model, however. An example is Devereux and Mansoorian (1992) who analyze an endogenous growth model of the Barro (1990) type with two countries whose decisions on tax levels produce fiscal externalities. Whether independently chosen tax levels are too high or too low depends on preferences in this model. In any case, coordination of fiscal policies improves welfare – but not necessarily growth, because the decentralized equilibrium may be characterized by too low public consumption and too high public investment. It is therefore not possible to derive clear-cut predictions regarding growth effects of uncoordinated, decentralized policy from this model. In a different two-country endogenous growth model with imperfectly

mobile capital, Lejour and Verbon (1997) show that uncoordinated source taxes on capital returns may actually imply too much redistribution. The reason is a growth externality: If one country levies a tax, it reduces investment at home, but by depleting the equilibrium return to capital in the entire economic union, also in the other region. Contrary to conventional wisdom, efficient coordination would then lead to lower public consumption and lower tax rates compared to an uncoordinated equilibrium.

Given the lengthy discussion of different externalities emerging from decentralized policy, it is useful to recall that there is also a lengthy discussion on how to efficiently offset these externalities. Bucovetsky and Smart (2006) have shown that pragmatically correcting for horizontal fiscal externalities, which lead to an inefficiently low tax effort by local jurisdictions, may in fact require only a rather simple fiscal equalization grant. Generally, it appears that possible negative effects on efficiency that are associated with fiscal externalities in competitive federalism can be dealt with by imposing an appropriate institutional framework for jurisdictional competition. Even for the issue of economies of scale in the production of public goods, which may not always be exploited by relatively small jurisdictions, one can argue that voluntary contracts between such polities will eventually solve efficiency problems.

Moreover, there are a number of unambiguous benefits resulting from fiscal decentralization. A classical argument is that Leviathan tendencies in government are reduced by the pressures of fiscal competition (Brennan and Buchanan 1980). While this may on first sight appear as a pure distributive issue between taxpayers and representatives, a reduction of rent-extraction in government essentially means that the costs per unit of public good are reduced from the perspective of the taxpayers. This can result in a smaller distortionary tax burden, or in a larger quantity of productive public goods being supplied which may also accelerate growth (Aschauer 1989). Having fiscal competition as a mechanism to restrict self-interested representatives may be particularly useful if formal constitutional rules are difficult to enforce (Schnellenbach 2004). In this case, federalism can even be thought of as a "market-preserving" institutional framework (Weingast 1995). Given that mobile factors have the option to leave, it becomes difficult for governments to severely intervene into private property rights, and large-scale interventions into the market process become more unlikely.[2]

2. Rauscher (2005) assumes a Leviathan government analyzing tax competition in an endogenous growth model with a productive public input. A taming of Leviathan governments by more intense inter-jurisdic-

A related and more formal point has been made by Edwards (2005), who models a time-inconsistency problem. In his neoclassical growth model, human capital investment drives growth. But a unitary government cannot commit to low tax rates in the future, and accordingly, the unitary state is characterized by high taxes, low human capital and low growth. Local governments, however, are exposed to the threat of out-migration of fiscally expropriated factors. The exit option helps to solve the time-inconsistency problem, and the decentralized equilibrium is characterized by low taxes, high investment and high growth rates. Madiès and Ventelou (2004) analyze a Leviathan setting and set up a model which allows them to analyze the trade-off between introducing vertical fiscal externalities, which result from different levels of government sharing the same tax base, and having a more targeted supply of public goods (education) on the local level. They show that under reasonable assumptions, the public good effect over-compensates the inefficiencies introduced by the vertical externalities, which yields positive overall growth effects.

Hatfield (2011) develops an endogenous growth model of the Barro (1990) type and shows that the competition of governments for mobile capital alone suffices to increase growth in decentralized systems. The model allows for capital and labor taxation, and incorporates heterogeneity of individuals who are endowed with different personal capital stocks. Hatfield then compares political and economic equilibria in a unitary framework and in a framework with competition for mobile capital. He shows that the trade-offs faced by the individuals are different under both regimes. Without tax competition, it is feasible to increase current consumption by surrendering some economic growth by taxing capital too heavily. The median voter is shown to prefer a tax policy that does not maximize growth, and the magnitude of this result increases when the personal capital stock of the median voter decreases. Under tax competition, however, governments attract capital only if they choose the growth-maximizing tax policy, and maximizing growth becomes the equilibrium policy.

Koethenbuerger and Lockwood (2011) introduce portfolio diversification as a second motive, beyond post-tax interest rate arbitrage, for individual investment decisions. In their model, sub-central jurisdictions are subject to region-specific, stochastic shocks. Individuals hedging against this risk therefore have an incentive to regionally diversify their capital investments.

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tional competition induces higher economic growth if the Leviathan's elasticity of intertemporal substitution, which is also the elasticity of substitution between rents and political support, is not substantially larger than one, i.e., if current and future utility or rents and political support are bad substitutes.

This allows decentralized governments for producing a negative fiscal externality for inhabitants of other regions by exporting tax burdens. If this negative externality overcompensates the positive fiscal externality of mobile capital moving to other regions, then decentralized tax policy could even lead to higher tax rates and lower growth compared to a unitary regime. Whether this is indeed relevant for real-world federal regimes is an empirical question.

An issue that is still much contested is the influence of fiscal federalism and fiscal competition on corruption. This question is of interest here, because corruption probably exerts a negative effect on government efficiency. If it increases the costs of providing productive public services, then it is also likely to be associated with negative growth effects. Cai and Treisman (2004) even predict a "state-corroding federalism" as the result of fiscal competition. According to their model, local governments decide to shield business located under their jurisdiction from centralized law enforcement, effectively eroding the rule of law. In their case study of China, they argue that local governments shielded local businesses from investigations related to corruption. This extends an argument made by Bardhan and Mookherjee (2000) and Blanchard and Shleifer (2001), who point out how local governments may be more easily captured by special interest groups. Martinez-Vazquez and McNab (2003) survey the literature on this issue more thoroughly. These arguments can, however, be contested on the grounds that fiscal competition will generally reduce the scope for redistributive special interest politics, since mobile tax bases can leave when they perceive to be exploited. Furthermore, already Riker (1964) stated that simple institutions, such as a strong national party system, can help to countervail unfavorable tendencies towards local capture. Again, it is thus possible to compensate for the problems of federalism by choosing an appropriate institutional framework.

Finally, there is another politico-economic avenue via which federalism may have an impact on growth, namely that of fostering political innovation. Realizing the relevance of this requires a step back from the standard neoclassical model, in which we got used to have a clear benchmark for an optimal policy, and the question is only under which conditions we can expect the optimal policy to be executed. In a world with model uncertainty, in which neither the policymaker nor a consulting economist knows the true, underlying model of the economy, the task of the policymaker is to learn from mistakes and to gradually improve his politics in a long-term process of trial-and-error. Oates (1990, 1999) has hinted at the fact that federalism may be useful in this respect, by speaking of "laboratory federalism" – a system where many, parallel small-scale experiments can be undertaken at the sub-central level. Besley and

Case (1995) and Salmon (1987) have argued for the relevance of yardstick competition as a mechanism allowing voters to assess the competence of their own representatives by comparing their policies with political results in neighboring jurisdictions. Inman and Rubinfeld (1997) make the point that the US welfare reform of 1996 was an application of the idea of laboratory federalism.

Again, the argument is not uncontested. Rose-Ackerman (1980) argued that information resulting from political experiments is a pure public good. Given that such experiments are risky and that failure may lead to a denial of reelection, sufficiently risk-averse representatives will abstain from conducting experiments themselves and instead attempt to free-ride. Kotsogiannis and Schwager (2006) argue that self-interested representatives can even use policy innovations to increase their scope for extracting rents from office, because voters are uncertain about what could have been achieved with a different policy. As far as free-riding is concerned, Strumpf (2002) shows that the argument depends on the degree of heterogeneity between regions. As soon as regions become sufficiently heterogeneous, the learning externality loses relevance, and each region has to experiment to learn about policies being implemented under its specific conditions. Finally, Schnellenbach (2008) shows that for rationally ignorant voters' factor migration is necessary to disturb a given equilibrium distribution of policy-related beliefs in the electorate – changing factor prices as a result of migration induce collective learning processes that would not occur otherwise.

Only very few papers attempt to incorporate political innovation into growth models. An example is Rauscher (2007) who analyzes an endogenous growth model with Leviathan governments. In this model, tax competition leads to a reduced frequency of political innovation and slower growth for reasonable parameter values. In a sense, this is a standard tax competition result carried into a dynamic model: Standard tax competition models predict an undersupply of public goods due to the increased opportunity cost of public funds, and in the model discussed here the public good is innovation undertaken by the government. The politico-economic arguments that hint into the opposite direction are neglected in this framework. Maybe even more importantly, in order to keep the model tractable, Rauscher (2007) assumes that the private capital stock is constant and that only public capital accumulation drives growth, which is a very unrealistic assumption. Rauscher (2006) allows also for private sector capital accumulation, and reaches the opposite result: Increased mobility of tax bases now yields an increased frequency of political innovation and also higher growth rates.

Taking all the arguments in this subsection together, and relating them to the neoclassical growth model from the beginning of Section 2, we can conclude that mechanisms through which federalism may permanently change the growth rate x of $A(t)$ are most likely to be found among the political-economic mechanisms. The sign of such a change is, however, theoretically ambiguous. If federalism is indeed state-corroding, and if decentralization indeed increases the likelihood of government capture by interest groups, then this will generate an economic environment that is rather adverse to technological progress. More decentralized countries will *ceteris paribus* be characterized by permanently lower growth rates, even in a neoclassical growth model. If, on the other hand, federalism indeed increases the quality of governance, if it increases the rate of policy innovation and thereby also the quality of technologies used in the public sector at a faster pace, then federal countries will be characterized by permanently higher growth rates.

A final important point in this review of theoretical arguments whether the state-corroding or the governance-enhancing effects of federalism prevail is that it probably depends on the broader institutional framework. Not only the degree of decentralization (measured, e.g., by sub-central expenditure shares) determines the outcome, but also the quality of the constitutional framework within which government decentralization operates is of great importance (Enikolopov and Zhuravskaya 2007).

2.5 Where Do the Theoretical Arguments Lead Us To?

In light of all the arguments for and against a positive effect of federalism on economic growth, this survey of the theoretical analyses helps to identify several transmission channels through which fiscal federalism may influence economic growth. First, a decentralization of public good provision and financing allows for considering heterogeneous demands for public goods and may thus positively affect economic growth (Heterogeneity channel). Second, tax competition between regions restricts Leviathan governments in the exploitation of mobile tax bases and keeps government interventions at a low scale such that private initiative could fully display its usefulness for economic development (Market-Preservation channel). Third, given the presence of agglomeration economies and knowledge spillovers, regional fiscal policies do not have much leverage at all. But in particular tax competition is providing for the means to successfully attract businesses and adapt to structural change (Structural Change channel). Fourth, policy innovation induced by fiscal competition may play a role for eco-

nomic growth in particular in a situation of dynamic structural change when creativity and willingness for experimentation are necessary (Political Innovation channel).

3. The Results of Previous Empirical Work

The existing empirical evidence does not test the before-mentioned transmission channels explicitly, but addresses this research question differently. If federalism or decentralization is favorable for economic development and structural change in a country, a salient question is which role lower-level governments play for the economic development of a country as a whole. If it is also important to know which type of internal arrangement of a country favors regional development, a bottom-up perspective can be assumed by focusing on lower level jurisdictions, regions and agglomerations. The empirical studies can thus be distinguished in cross country and single country studies. It will nevertheless be possible to underline on which transmission channels the empirical studies mainly focus.

3.1 Cross-Country Studies

The majority of the cross country studies interprets fiscal federalism as decentralized organization of government activities and measures decentralization by the fraction of sub-federal spending (revenue) from total government spending (revenue) using the IMF's Government Finance Statistics (GFS). This approach is problematic as theoretical analyses presume autonomy of sub-federal decision-making on provision and financing of public goods, while spending decentralization might simply indicate the extent of administrative federalism with states, provinces or cantons providing public services according to federal mandates and financed by the federal government (Treisman 2002, Rodden 2004, Stegarescu 2005). As long as fiscal transfers from other jurisdictions (or proxies for autonomy) are not controlled for, the estimates for spending decentralization may thus be biased. Using spending decentralization as a measure for fiscal federalism controlling for transfers would at best allow for testing the Heterogeneity channel.

Given the measurement problems, the authors of the early cross-country studies on the impact of federalism on economic growth unsurprisingly end up with ambiguous results (see Table 1). Davoodi and Zou (1998), for instance, find a weakly significant negative correlation between decentralization and the average growth rate of GDP per capita for a sample of 46

countries and the period from 1970 to 1989. This effect is not significant for the sub-sample of developed countries. The negative effect for the sub-sample of developing countries is robust, though only weakly significant. According to these estimates, an additional decentralization of functions by 10 percent reduces the growth of real GDP per capita in developing countries by 0.7 – 0.8 percentage points. Woller and Philipps (1998) do not report a robust relation between economic growth and decentralization either, using a sample with a lower number of developing countries and a shorter period. Also, they analyze, in addition to the five year averages of growth, the annual growth rates in a panel. Both studies use fixed-effects models. In contrast to Davoodi and Zou (1998), Woller and Philipps (1998) consider a common time trend. Iimi (2005) uses more recent data for 51 countries – average growth between 1997 and 2001 – and applies an instrumental variable approach. Spending decentralization turns out to be highly significant such that a 10 percent higher decentralization of spending increases growth of real GDP per capita by 0.6 percentage points.

Table 1: Empirical studies on the influence of fiscal decentralization or federalism on economic growth in cross-country studies

Study	Countries	Period	Method	Main results
Davoodi and Zou (1998)	46 Developing and Developed Countries	1970-1989 five and ten year averages	Fixed Effects Model, Time Dummies, Unbalanced Panel	10% higher decentralization of spending reduces growth of real GDP per capita in developing countries by 0.7-0.8%-points (10% significance level). (−)
Woller and Philipps (1998)	23 Developing Countries	1974-1991 three and five year averages and annual data	Fixed Effects Model, OLS	No robust significant effect of the decentralization of spending or revenue on growth of real GDP per capita. (+/−)
Yilmaz (2000)	17 Unitary States, 13 Federal Countries, Newly Industrialized Countries and Developed Countries	1971-1990 annual data	Fixed Effects Models, Time Dummies, GLS	Decentralization of expenditures at the local level increases growth of real GDP per capita in unitary states more than in federal countries. Decentralization at the regional level is not significant. (+)
Ebel and Yilmaz (2002)	6 Transition Countries	1997-1999	Bivariate OLS	Decentralization is in general positively related to economic growth. (+)
Thießen (2003)	21 Developed Countries	Cross-section of the averages of 1973-1998	OLS	Decentralization of spending by 10% increases growth of real GDP per capita by 0.15%-points (5% significance level), quadratic term is significantly negative. (+)
Thießen (2003a)	26 Developed Countries	Panel data 1981-1995	GLS	Decentralization of spending by 10% increases growth of real GDP per capita by 0.12%-points (5% significance level). (+)

Table 1 (cont.): Empirical studies on the influence of fiscal decentralization or federalism on economic growth in cross-country studies

Study	Countries	Period	Method	Main results
Eller (2004)	22 OECD Countries	1972-1996, annual and four year averages	Fixed Effects, Time Dummies	Decentralization is positively related to economic growth. (+)
Iimi (2005)	51 Developing and Developed Countries	Cross-section of the average of 1997 to 2001	OLS, IV	10% higher decentralization of spending increases growth of real GDP per capita by 0.6%-points (1% significance level). (+)
Martinez-Vazquez and McNab (2006)	66 Developing and Developed Countries	Panel data 1972-2003	OLS, IV, PCSE	Negative "direct" effect of fiscal decentralization on economic growth in developed countries, but positive in developing countries. (+/−)
Enikolopov and Zhuravskaya (2007)	75 Developing and Transition Countries	Cross-section of the averages 1975-2000	OLS, 2SLS	10% higher decentralization of revenue reduces growth of real GDP per capita in "young" developing countries by 0.14%-points (5% significance level), but positive in "older" ones. (+/−)
Rodriguez-Pose and Kroijer (2009)	16 Central and Eastern European countries	Panel data 1990–2004	Fixed Effects regressions	Expenditure decentralization has a negative effect on growth, revenue decentralization has initially a negative effect which becomes positive over time. (+/−)
Rodriguez-Pose and Ezcurra (2010)	21 OECD countries	Panel data 1990-2005	OLS	Negative effect of fiscal decentralization on economic growth. (−)
Bodman (2011)	18 OECD Countries	Cross-section of 1996 and Panel data 1981-1998	OLS	No significant effect of revenue or spending decentralization on economic growth. (+/−)
Baskaran and Feld (2013)	23 OECD Countries	Panel data 1975-2008	OLS and Fixed Effects regressions	Negative relationship between revenue decentralization and economic growth. (−)
Gemmell, Kneller and Sanz (2013)	23 OECD Countries	Panel data 1972-2005	Pooled Mean Group and IV regressions	Spending decentralization decreases growth, revenue decentralization increases growth. (+/−)

Source: Own compilation.

Yilmaz (2000) analyzes the different effects of fiscal decentralization in 17 unitary and 13 federal states for the period 1971-1990 with annual data. He finds that decentralization of expenditures to the local level increases the growth of real GDP per capita in unitary states more than in federal countries. However, decentralization to the regional level in federal countries is not significant. Still, none of these studies proxies autonomy properly.

The studies by Ebel and Yilmaz (2002), as well as Rodriguez-Pose and Kroijer (2009) focus on Central and Eastern European countries. Ebel and Yilmaz (2002) report a positive and sig-

nificant correlation between decentralization and economic growth, but only for 6 transition countries and the years 1997 to 1999. The sample used by Rodriguez-Pose and Kroijer (2009) is much broader including 16 Central and Eastern European countries and covering the period from 1990 to 2004 with annual data. In their fixed effects regressions, expenditure decentralization affects growth negatively, while the effect of revenue decentralization is ambiguous. Including transfers which have a consistent and robust negative effect on growth revenue decentralization becomes significantly positive with six lags and more.

Additionally considering institutional aspects and including a measure of expenditure decentralization net of transfers between jurisdictions, Enikolopov and Zhuravskaya (2007) present evidence for average economic growth of the past 25 years in a cross-section of 91 countries that the effects of fiscal decentralization largely depend on the structure of the party system and on the degree of subordination of lower tier governments. According to these results, the growth-enhancing effect of decentralization increases with the age of the most important political parties, particularly in developing and transition countries. In developing countries with a "younger" party system, a 10 percent higher decentralization of revenue decreases real GDP per capita growth by 0.14 percentage points. These results challenge those by Martinez-Vazquez and McNab (2006) according to which decentralization of revenue significantly reduces real GDP per capita growth in developed, but not in developing and transition countries.

Thießen (2003) analyzes similar to Enikolopov and Zhuravskaya (2007) with a measure of expenditure decentralization net of transfers between jurisdictions, the average growth of real GDP per capita for a cross-section of 21 developed countries in the period 1973-1998 and in a companion study (Thießen 2003a) for a panel of 26 countries between 1981 and 1995. According to his estimates a 10% stronger expenditure decentralization increases the growth of real GDP per capita by 0.12-0.15%-points in high-income countries. But the relation between federalism and economic growth may be non-linear as a quadratic term of expenditure decentralization is significantly negative. His results are corroborated by Eller (2004).

Rodriguez-Pose and Ezcurra (2010) follow a different approach. They focus on spending decentralization, while their revenue decentralization measure does not distinguish between true tax autonomy of sub-central jurisdictions and fiscal transfers. Moreover they control for administrative and political decentralization which do however not provide clearcut results. According to their analysis of annual panel data for 21 OECD countries between 1990 and 2005,

fiscal decentralization exerts a consistent and robust negative effect on economic growth. This holds even when decentralization in particular spending categories is considered.[3]

In subsequent cross-country studies, the focus of the analysis shifts to revenue decentralization and can thus rather be considered as tests of the Market Preservation channel. While earlier studies have not been interested in exactly measuring the extent of actual tax autonomy of subfederal jurisdictions, the collection of data according to the OECD (1999) methodology, in particular by Stegarescu (2005), allows for capturing to what extent subfederal jurisdictions determine the tax rates or bases of the tax revenue collected. Thornton (2007) uses the measure originally constructed by the OECD (1999). These data are only available for 19 countries such that he analyzes a cross-section of average GDP growth between 1980 and 2000. This in turn implies that the results, which indicate that there is no robust relation between fiscal decentralization and economic growth, might be distorted due to unobserved heterogeneity and/or small-sample biases. Bodman (2011), however, corroborates these findings using the Stegarescu annual data and reports that tax decentralization has no robust significant effect on economic growth for 18 OECD countries and a yearly panel between 1981 and 1998.

These findings are contested by subsequent studies, but with contradicting results. Feld (2008) and Baskaran and Feld (2013) also use the new annual data provided by Stegarescu (2005). They find that subnational tax autonomy has a moderately, but relatively robust negative effect on real GDP growth per capita in a panel of 23 OECD countries between 1975 and 2008. Gemmel et al. (2013) use almost the same annual panel data set, i.e., 23 OECD countries between 1972 and 2005, particularly focusing on the Stegarescu data of revenue autonomy. Overall, their study is methodologically advanced estimating pooled mean group regressions and instrumental variables regressions with 3rd and 4th lagged values as instruments. According to their results spending decentralization tends to reduce economic growth, while a decentralization of revenue on which sub-federal governments autonomously decide significantly increases growth. These contradicting results may not be surprising given the different methodologies used. Asatryan and Feld (2014) follow a Bayesian Model Averaging (BMA)

3. Up to this point, we do not clearly distinguish between revenue and spending decentralization. As long as transfers are somehow controlled for both measures rather capture heterogeneity within a country. This also holds for the Enikolopov and Zhuravskaya (2007) paper which considers general revenue decentralization interacted with a measure of self-governance. In the subsequent paragraphs the tax autonomy mea-

approach which tests the robustness of the tax autonomy effect on economic growth, using the Stegarescu data and controlling for spending decentralization, by allowing any subset of up to 25 potential growth determinants to enter the regressions. All in all, over 33 million different models are estimated by this approach. The initial negative effect of tax autonomy on GDP growth is not robust to the inclusion of fixed effects, to the use of 5-year-averages and to influential observations, in particular Switzerland.

This survey of the cross country studies does not provide for robust conclusions. Starting from the question whether federalism or decentralization are favorable for economic development of a country as a whole, two different transmission channels distilled in our survey on the theoretical literature are addressed. First, the Heterogeneity channel is looked at in those studies mainly focusing on spending decentralization and controlling for inter-jurisdictional transfers. Though the evidence is mixed, the majority of the studies find a positive effect under certain conditions, in particular determined by the additional institutional provisions. The structure of the party system and its age play a role, for example. The distinction between developing (low income) versus developed (high income) countries is not sufficient as a proxy for these institutional features.

The studies focusing on tax autonomy as a measure for revenue decentralization could be considered as testing the Market Preservation channel. Ambiguous results are obtained by these studies. The contradictory results by Baskaran and Feld (2013) and Gemmel et al. (2013) may come from the use of pooled mean group regressions in the latter. Indeed, Asatryan and Feld (2014) identify the use of five-year-averages as reducing robustness. In general, the negative effect of tax autonomy on growth is not robust, however. As institutional structure plays a role for the validity of the Heterogeneity channel through which federalism might positively affect economic growth, fixed effects models might be the favored overall. But fixed effects reduce robustness considerably. Moreover, it could be argued that fiscal decentralization is relatively time invariant such that fixed effects models are not adequate, hence the estimation of pooled mean group regressions. However, single observations also influence estimation results strongly.

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sures by the OECD (1999) and Stegarescu (2005) focus on tax setting possibilities of subfederal jurisdictions and hence follow a different approach.

In none of those studies, endogeneity problems are sufficiently addressed. Only Gemmel at al. (2013) explicitly consider this problem. But the use of 3rd and 4th lagged values as instruments is not fully convincing at least from a theoretical point of view. Finally, neither the Structural Change channel, nor the Political Innovation channel is tested in any of these studies. Overall, this leaves plenty of room for future research.

3.2 Single Country Studies

The empirical results concerning the impact of decentralization on economic growth for individual countries are no less ambiguous. Asking which type of internal arrangement of a country favors regional development, analyses have been conducted for China, the Ukraine, India, Russia (see Table 2), and the U.S., Spain, Switzerland and Germany (see Table 3). Zhang and Zou (1998, 2001) report a significantly negative effect of expenditure decentralization on economic growth in 28 (29) Chinese provinces, using annual data between 1987 and 1993. Jin, Qian and Weingast (2005), however, find a weakly significant positive effect of expenditure decentralization on economic growth of almost the same sample of Chinese provinces over time. The most important difference between the studies – aside relatively small differences in the explanatory variables – is that Zhang and Zou (1998, 2001) do not use time dummies. Consequently, the common positive and negative economic shocks in China are inadequately controlled for as compared to Jin, Qian and Weingast (2005). Qiao, Martinez-Vazquez and Xu (2008) report similarly positive growth results for expenditure decentralization even without any fixed effects. Lin and Liu (2000) corroborate the result of a positive impact of decentralization on economic growth in Chinese provinces for the period 1970 to 1993 also for the revenue side. Moreover, a higher responsibility of public budgets at the provincial level is associated with increased economic growth. These authors, too, use time dummies in addition to cross-section fixed effects. Jin and Zou (2005) present evidence that a higher divergence between local expenditure and revenue increases growth.

The relevance for the estimates of using time dummies points to the strong economic dynamics in China. The sometimes enormously high Chinese growth rates cannot be exclusively covered by structural variables such that dummy variables for the individual years are necessary for specifying the model. The fact that Zhang and Zou neglect them must be interpreted as a mis-specification of the model. Thus, for China, decentralization of government activity has rather a positive impact on economic growth. This assessment is corroborated by the time

series analysis by Feltenstein and Iwata (2005). Overall, the Heterogeneity channel is supported.

Table 2: Empirical studies on the influence of fiscal decentralization or federalism on economic growth in China, Russia, Ukraine and India

Study	Countries	Period	Method	Main results
Zhang and Zou (1998)	28 Chinese Provinces	1987-1993 Annual Data	Fxed Effect Models without Time Dummies	Decentralization of expenditure to the provinces reduces growth of real GDP per capita
Lin and Liu (2000)	28 Chinese Provinces	1970-1993 Annual Data	Fixed Effect Models, Time Dummies	Revenue decentralization by 10% increases growth of real GDP per capita by 2.7%-points (5% significance level)
Zhang and Zou (2001), Sample 1	29 Chinese Provinces	1987-1993, annual data	OLS, Fixed Effects	Decentralization reduces economic growth
Feltenstein and Iwata (2005)	Central Level in China	1952-1996	VAR with Time-series data	Fiscal decentralization has adverse implications for macroeconomic stability but tends to increase growth
Jin and Zou (2005)	30 Chinese Provinces	1979-1999	Fixed Effects with Corrected Standard Errors	Divergence between local expenditures and revenue (i.e. centralization) increases growth
Jin, Qian and Weingast (2005)	29 Chinese Provinces	1982-1992 Annual Data	Fixed Effect Models, Time Dummies	Expenditure decentralization by 10% increases growth of real GDP per capita by 1.6%-points (10% significance level)
Qiao, Martinez Vazquez and Yu (2008)	28 Chinese Provinces	1985-1998	2SLS with Pooled Data	Expenditure decentralization increases growth of nominal GDP per capita significantly (5% significance level)
Zhang and Zou (2001), Sample 2	16 Indian States	1970-1994	OLS	Decentralization increases economic growth
Desai, Freinkman and Goldberg (2005)	80 Russian Regions	1996-1999	OLS with panel corrected standard errors, TSLS	Decentralization has a positive but non-linear effect on growth
Naumets (2003)	24 Ukrainian Oblasts and Autonomous Republic of Crimea	1998-2000	Fixed-Effects and Random Effects Models	Not robust negative impact of own revenue decentralization on growth of real gross value added

Source: Own compilation.

Desai, Freinkman and Goldberg (2005) are in line with the Jin, Qian and Weingast (2005) approach by focusing on revenue retention in transition countries. For 80 Russian regions between 1996 and 1999, they report a significant positive effect of revenue retention rates on growth of gross regional products. In addition, a conditional effect of natural resources and

budgetary transfers on the relation between retention rates and cumulative output growth occurs. The effect of retention rates on growth switches from positive to negative when transfers cover more than 45 percent of total revenues, while this effect declines in magnitude, but remains positive when regions become more resource abundant. Similarly, Zhang and Zou (2001) report a positive decentralization effect for India. These results provide some support for the Market Preservation Thesis. It does however not generally hold for transition countries. Naumets (2003) finds a negative, though not robust impact of the share of own revenue from consolidated regional revenue on growth of real gross value added in a panel of 24 Ukrainian regions from 1998 to 2000.

Table 3: Empirical studies on the influence of fiscal decentralization or federalism on economic growth in the U.S., Germany, Spain and Switzerland

Study	Countries	Period	Method	Main results
Xie, Zou and Davoodi (1999)	Central Level in the USA	1951-1992	Time Series Analysis, OLS	No significant impact of expenditure decentralization on growth of real GDP per capita
Akai and Sakata (2002)	50 US States	1992-1996, Cross-Section of Average Growth Rates, Panel with Annual Data	OLS and Fixed Effects Model, Time Dummies	Expenditure decentralization by 10% increases growth of GDP per capita by 1.6-3.2%-points (robust 10% significance levels)
Stansel (2005)	314 US Metropolitan Areas	1960-1990	Robust OLS	Higher fragmentation is associated with significantly higher growth in (log) real per capita money income
Akai, Nishimura, and Sakata (2007)	50 US States	1992-1997	Maximum Likelihood Method	Hump-shaped relationship between decentralization and economic growth
Behnisch, Büttner and Stegarescu (2002)	Central Level in Germany	1950-1990	Time Series Analysis	Increase of federal share of expenditure in total expenditure has positive effect on German productivity growth
Gil-Serrate and Lopez-Laborda (2006)	17 Spanish Autonomous Communities	1984-1995	Fixed and Random Effects, Time trend	Revenue control decentralization has a positive effect on decentralization
Feld, Kirchgässner, and Schaltegger (2004, 2005)	26 Swiss Cantons	1980-1998	OLS, 2SLS	Tax autonomy and tax competition are not harmful for economic growth

Source: Own compilation.

Much the same holds for individual developed countries. Exploring American economic development between 1790 and 1840, Wallis (1999) argues that fiscal federalism was an important institutional precondition that fostered economic growth of the U.S. In a time-series analysis for the U.S. general government from 1951 to 1992, Xie, Zou and Davoodi (1999)

claim that the U.S. find themselves in a decentralization equilibrium because differences in decentralization at the state level or at the local level do not have statistically significant effects on real GDP growth. Akai and Sakata (2002), however, offer evidence to the contrary for U.S. states. Taking into account additional explanatory variables and various indicators for the degree of fiscal federalism, they underline the positive influence on economic growth. If expenditure decentralization increases by 10 percent, then the growth of GDP per capita increases by 1.6-3.2 percentage points. However, decentralization on the revenue side and indicators for fiscal autonomy of sub-national levels, measured by the share of own revenue in total revenue, do not have any significant impact. Stansel (2005) develops a different approach by testing the impact of local fragmentation on growth of local real per capita money income. Similarly, Hatfield and Kosec (2013) report evidence that a doubling of the number of county governments in a metropolitan area increases the average annual growth rate of earnings per employee by 17 percent in the period from 1969 and 2006. Overall, the U.S. studies provide evidence for the Heterogeneity channel. But Stansel (2005) and Hatfield and Kosec (2013) also support the Market Preservation Hypothesis. Their idea is related to the fragmentation argument by Brennan and Buchanan (1980) according to which a higher fragmentation of a polity into different jurisdictions increases the intensity of inter-jurisdictional competition and thus restricts Leviathan governments. Indeed, Hatfield and Kosec (2013) interpret their findings as the result of inter-jurisdictional competition.

Three studies have been conducted for Germany. Berthold, Drews and Thode (2001) analyze the effects of horizontal fiscal equalization between states and of supplementary federal grants on regional economic development of the 16 Laender in a panel analysis with annual data from 1991 to 1998. According to their estimates higher grants in horizontal and vertical fiscal relations reduce the growth of nominal GDP per capita of the Laender significantly. However, these econometric results suffer from severe endogeneity problems as slowly growing Laender may receive higher grants. Berthold and Fricke (2007) thus update their study for the more recent years until 2003 and employ an instrumental variable technique. As instruments they use the GDP level, the unemployment and employment rates, the fraction of people receiving social assistance and further variables. Unfortunately, they do not report tests on the validity of the instruments or on over-identification. Their selected list of instrumental variables casts some doubts as to the validity of the instruments however as they appear to be correlated with the dependent variable and would thus not satisfy the orthogonality condition. Still, these instruments are theoretically unsatisfactory. If the instruments were valid, this evi-

dence would partly support the Structural Change thesis as higher grants would apparently provide incentives to adopt structural change more slowly. Behnisch, Büttner and Stegarescu (2002) indeed contradict these results as they report a positive effect of increasing federal activities – measured by the share of expenditure at the federal level – on German productivity growth in a time series analysis from 1950 to 1990.

A study of structural change is provided by Feld, Schnellenbach and Baskaran (2012) for Germany. Structural change is measured by the declining share of relative employment in steel and mining industries in the regions of Saarland (in Germany), Lorraine (in France) and Luxembourg. In a time series analysis from 1961 to 2004, they establish a causal link from the employment share in declining industries to intergovernmental transfers, but not vice versa. It thus appears that transfers from the fiscal equalization system do not promote structural change, but flow as a response to the declining relative employment share in old industries (Feld and Schnellenbach 2011).

In a study for Switzerland, Feld, Kirchgässner and Schaltegger (2004, 2005) analyze the impact of tax competition, fragmentation and grants on economic performance more explicitly. Controlling for expenditure decentralization in a panel of 26 cantons between 1980 and 1998, a higher intensity of tax competition exerts a significantly positive impact on cantonal labor productivity. The stronger a canton finds itself in tax competition, the higher cantonal economic performance. Fragmentation of a canton in its communities does not have any robust effect on labor productivity. Thus Stansel's (2005) and Hatfield and Kosec's (2013) results for the U.S. cannot be replicated for Switzerland. The estimation results for vertical matching grants suffer from endogeneity problems and may thus be biased. The effects of tax competition and fragmentation are however not affected by the inclusion of grants. Gil-Serrate and Lopez-Laborda (2006) report evidence pointing in the same direction for Spain.

Overall, the single country studies provide more robust conclusions than the cross-country studies. This is to a considerable extent due to the use of particular instruments of federalism instead of the crude decentralization measures. Despite some differences between the studies, the results for the U.S., Spain and Switzerland lend some support for a positive effect of competitive federalism on economic development. While the U.S. studies unequivocally support the Heterogeneity channel and provide some support for the Market Preservation channel, the Swiss results are rather in line with the latter. The existing analyses for Germany indicate that measures which reduce autonomy such as higher intergovernmental grants reduce structural

change. This is some evidence for the Structural Change channel. However, a rigorous analysis of the growth-implications of German cooperative federalism is still lacking. There is no evidence on the effect of political innovations induced by inter-jurisdictional competition on economic growth. The Political Innovation channel remains under-researched also in single country studies.

4. Quantitative Literature Review

In the next two sections, we discuss the literature on decentralization and economic growth more systematically by conducting a quantitative literature review. For this, we have constructed a database consisting of information on altogether 449 empirical models estimated in the 31 studies listed in Tables 1 to 3. Our goal was to include all empirical studies that have been conducted hitherto. The database encompasses both published papers and the latest unpublished working paper versions.[4]

4.1. Descriptive Statistics on Studies

The literature on fiscal federalism and economic growth is heterogeneous along many dimensions. We coded the characteristics of the studies included in our database with dummy and continuous variables. There is, of course, some subjectivity involved when classifying individual studies with their idiosyncratic characteristics into somewhat general groups. For example, we differentiate the countries with which a study is concerned into two groups only: developed and developing. Consequently, we do not classify transition countries separately but instead assign them to the group of developing countries. Even though such classifications are somewhat arbitrary, inherent subjectivity is unavoidable in both meta-analyses and traditional literature reviews. The major advantage of a meta-analysis compared to traditional reviews is that the former makes the subjective judgments of the reviewer explicit.

4. We do not include working paper versions of published studies. Please do not simply count the number of rows in Table 2 as Zhang and Zou (2001) is one single study that uses two different samples. Some studies mentioned in the text are not included in the meta-analysis. This is partly due to dependent variables that are not directly related to economic growth, as in the case of Feld, Schnellenbach and Baskaran (2012) or Hatfield and Kosec (2013). In other cases, we do not include papers which suffer from obvious econometric problems like Berthold, Drews and Thode (2001) or Berthold and Fricke (2007) with serious endogene-

With this caveat in mind, we describe in the following the broad characteristics of the 31 studies in our database quantitatively. First, both single country and cross-country studies have been conducted on decentralization and growth. Each of the two groups of studies can be further subdivided according to whether they consider developed or developing countries, or, in the case of cross-section studies, both. Within the subgroup of single country studies, a further differentiation according to individual countries is possible.

Table 4: Cross-Tabulations of Study Type (Single- or Cross-Country) and Study Subject (Developed, Developing or Both Types of Countries)

	Cross-country		
(only) Developing	*No*	*Yes*	*Total*
No	7	12	19
Yes	9	3	12
Total	16	15	31
(only) Developed	*No*	*Yes*	*Total*
No	9	8	17
Yes	7	7	14
Total	16	15	31
Both	*No*	*Yes*	*Total*
No	0	10	10
Yes	0	5	5
Total		15	15

Source: Own calculation.

Overall, 16 single and 15 cross-country studies make up our database. Table 4 provides cross-tabulations of single- and cross-country studies against studies on developed and developing countries. Out of the 15 cross-country studies, three are exclusively on countries from the developing world, seven are exclusively on countries from the developed world, and five consider countries from the developing and the developed world at the same time. Out of the 18 single-country studies, eleven cover developing and seven developed countries.

There are twelve studies (three cross-country and nine single-country) which exclusively focus on developing countries. The majority of these studies (seven) are single-country studies for China. One of these studies, Zhang and Zou (2001), provides separate analyses for China and India. This is the reason why in Tables 2 and 3, the number of rows sum up to 17. On the other hand, there are 14 studies that exclusively focus on developed countries. Overall, it ap-

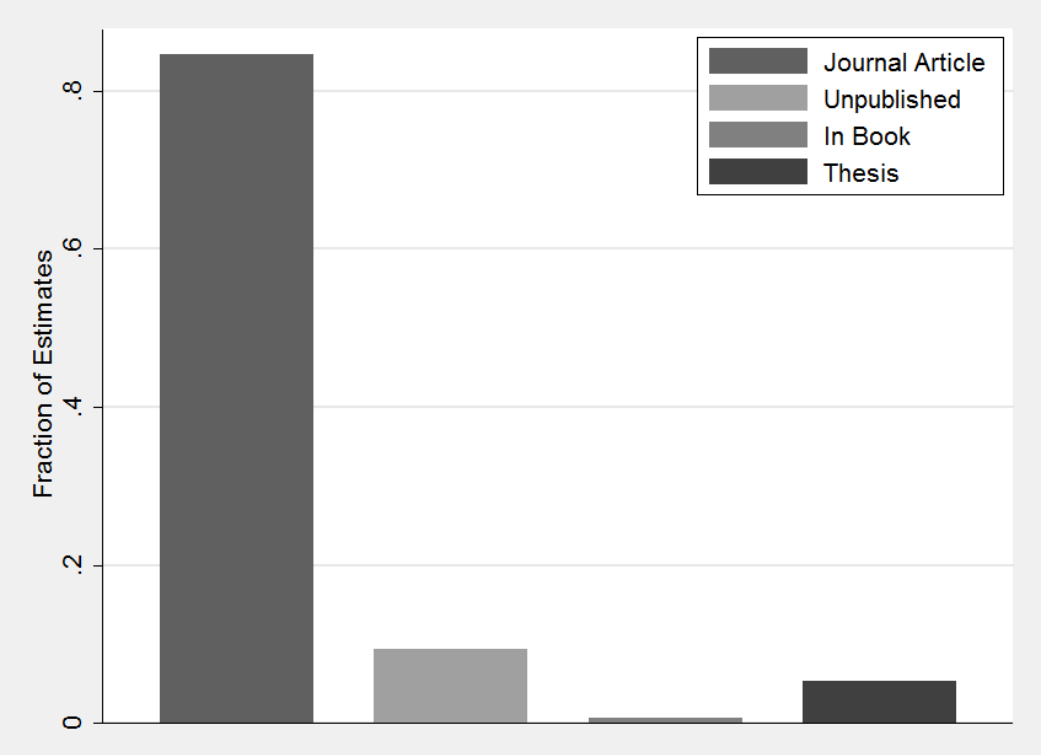
ity problems. The paper by Thornton (2007) is not included because of the very small number of observa-

pears that single country studies are primarily conducted with developing countries, while cross-country studies tend to focus on developed countries.

4.2. Summary Statistics on Estimated Models

In each of the 31 studies, a varying number of models are estimated. These regressions result altogether in 449 point estimates of the effect of decentralization on economic growth. Since we will focus on these point estimates in the meta-regressions, we provide separate summary statistics for them.

Figure 1: Publication Status of Models



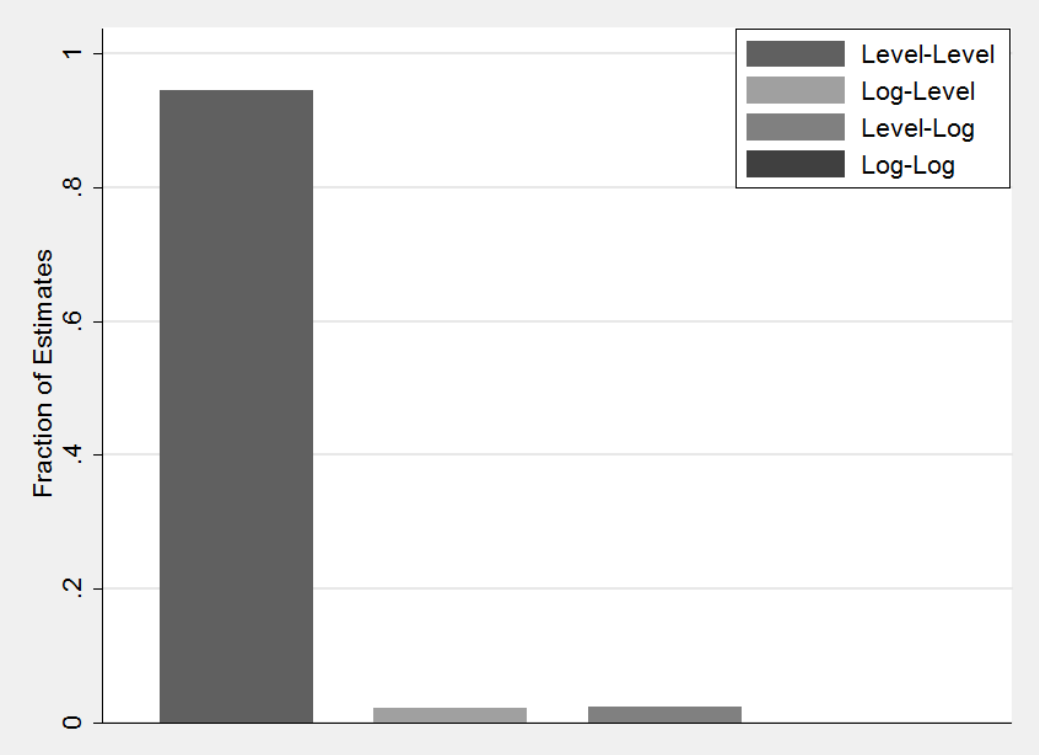
Source: Own calculation.

The majority of studies in our database, 21, are journal articles, five are unpublished (discussion papers, working papers, etc.), two are master's or PhD. theses, and one is a book chapter. According to Figure 1 most of the estimates, around 85%, in our sample thus derive from journal articles. These models, having passed peer review, should satisfy some minimum quality standards. Around 9% are obtained from unpublished manuscripts and discussion papers, while all other publication types together contribute around 6% to the sample. Given the

tions. Actually, given the countries and years covered, Bodman (2011) "encompasses" Thornton's study.

large number of estimates published in journal articles the effects of publication bias usually reported in meta-studies should be limited (Stanley 2005, Feld and Heckemeyer 2011).

Figure 2: Model Specification

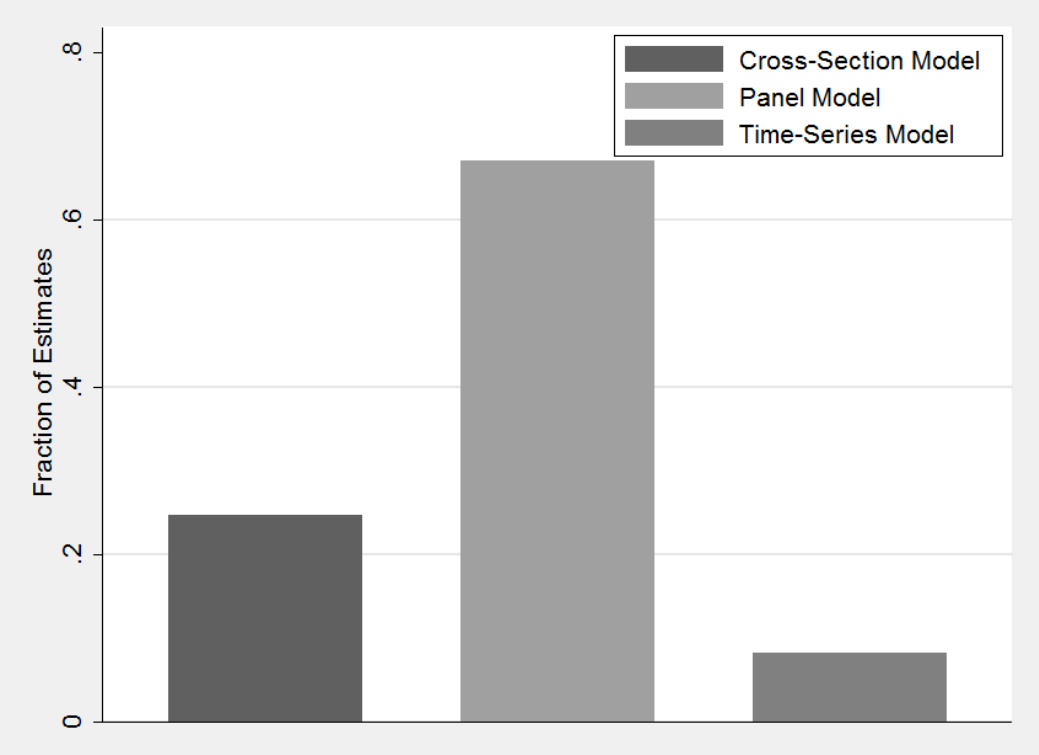


Source: Own calculation.

The point estimates can be further differentiated by the particular models specified. Figure 2 provides information as to whether the dependent variable and the decentralization variable have been specified in level or log form. This figure shows that the majority of point estimates originate from models specified in the level-level form, other specifications are quite rare, and not a single model was estimated with a specification that facilitates an interpretation of the effect of fiscal decentralization on growth as elasticity, i.e., with a log-log specification.

In Figure 3, we collect information on the type of data used. The majority of estimates use panel data. However, there are also a significant number of estimates deriving from cross-section models. Time-series models, on the other hand, are rare.

Figure 3: Type of Data



Source: Own calculation.

According to Table 5, almost half of the point estimates are from models where only fixed effects for cross-section units are included. A small share of the estimates, around 2.5%, derive from models with only time fixed-effects. About 25% of all estimated models include both cross-section and time effects. According to Table 6, about 16% of models consider non-linearities, notably interaction and quadratic terms. However, none use both simultaneously, i.e., about 14% of models use quadratic terms, and about 2% exclusively interaction effects.

Table 5: Cross Tabulations Regarding the Use of Fixed Cross-Section and Time-Effects (in %)

	Fixed Effects		
Time Effects	*No*	*Yes*	*Total*
No	47.66	2.45	50.11
Yes	20.49	29.40	49.89
Total	68.15	31.85	

Source: Own calculation.

Several measures of decentralization have been used in the literature, for instance expenditure and revenue shares, the divergence between central and sub-national government spending or revenue, and measures that capture the tax autonomy of sub-national governments. Figure 4 provides information on the relative frequency of these measures. The expenditure share of

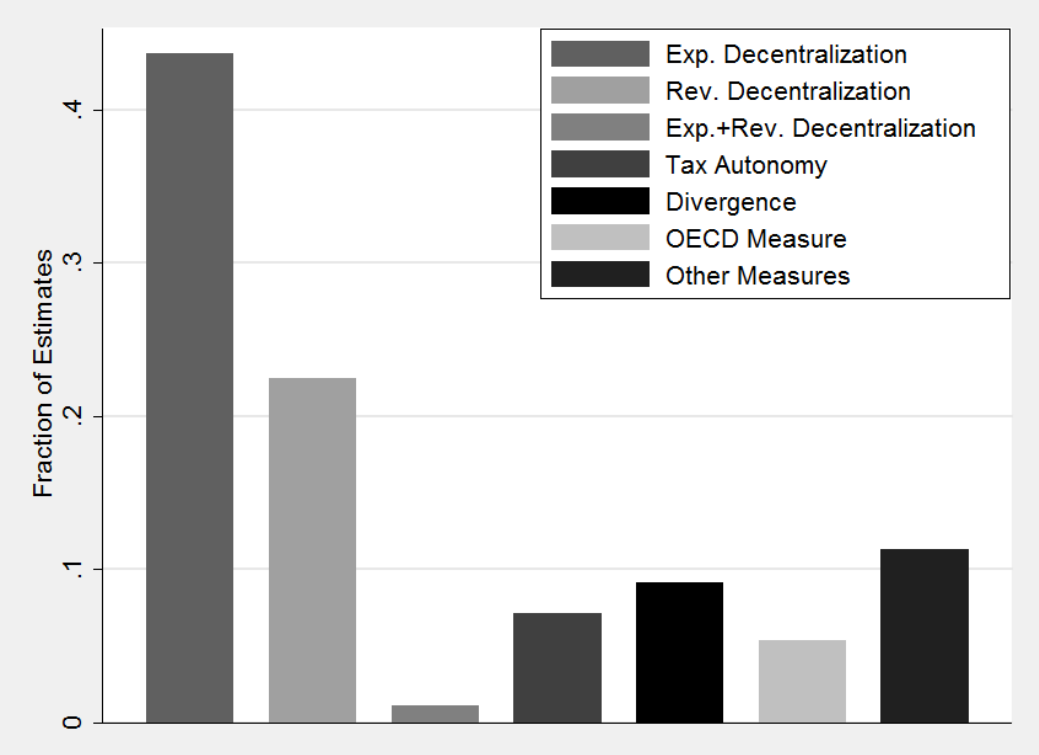
sub-national governments or closely related measures is used as the decentralization variable in about 44% of models, revenue decentralization is used in about 22% of models, the OECD measure (OECD, 1999) that takes the extent of subnational tax autonomy into account is used in 5% of the models, and each of the remaining measures, except the (weighted) average of expenditure and revenue decentralization, is used in 5%-10% of all estimated models.

Table 6: Cross Tabulations of Nonlinear Terms (in %)

	Interaction		
Quadratic	*No*	*Yes*	*Total*
No	83.74	2.23	85.97
Yes	14.03		14.038
Total	97.78	2.23	100

Source: Own calculation.

Figure 4: Decentralization Measure

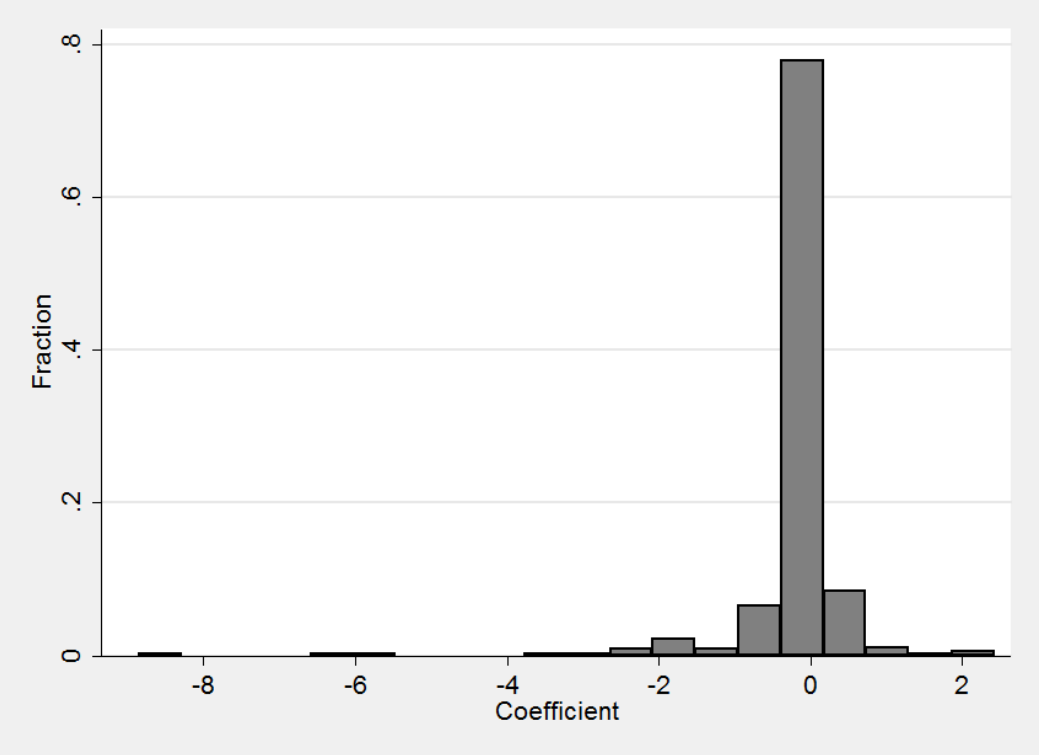


Source: Own calculation.

The distribution of the estimated coefficients is depicted in Figure 5. Since the estimated coefficient is a measure with a dimension, the spread originating simply due to the use of particular units can be substantial. We found that the minimum value of the estimated coefficients in our database is -3623 while the maximum is +5391. In order to maintain some informative

content in the histogram, we have excluded extreme outliers, and included all coefficients with an absolute value of less than 10. Moreover, we have not used coefficient estimates from non-linear models as they do not result in a single relevant estimate (most studies operating with non-linear terms also do not provide estimates at some characteristic values, for example the sample average). We have also excluded one estimate from Zhang and Zou (2001) because it had inconsistent signs for the coefficient and the corresponding t-statistic. Thus, only 367 of the 449 observations are used for this histogram.

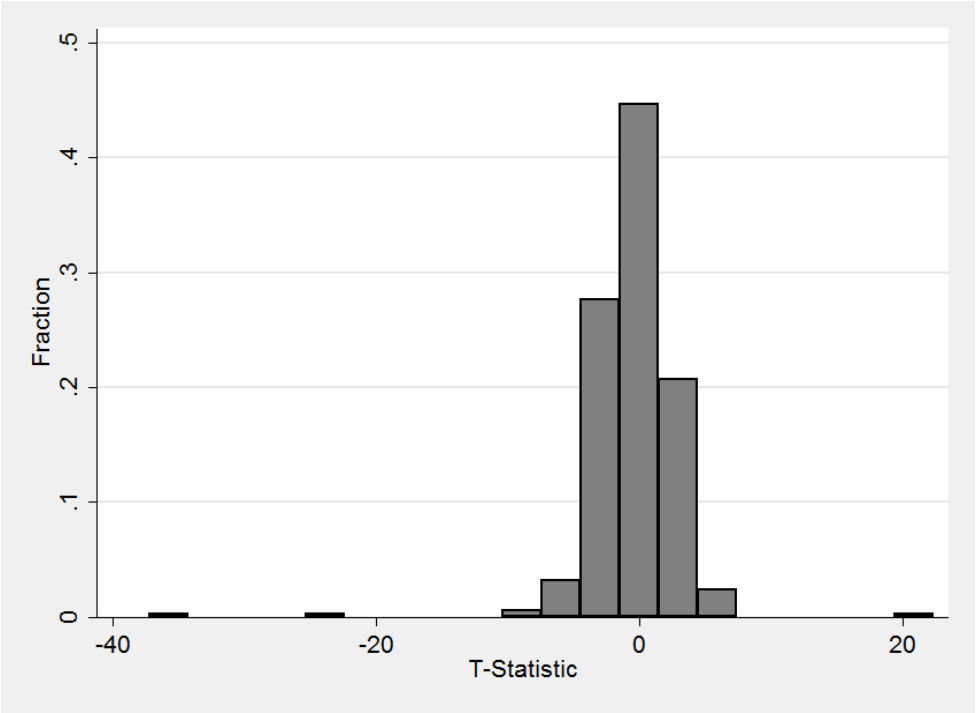
Figure 5: Estimated Coefficients



Source: Own calculation.

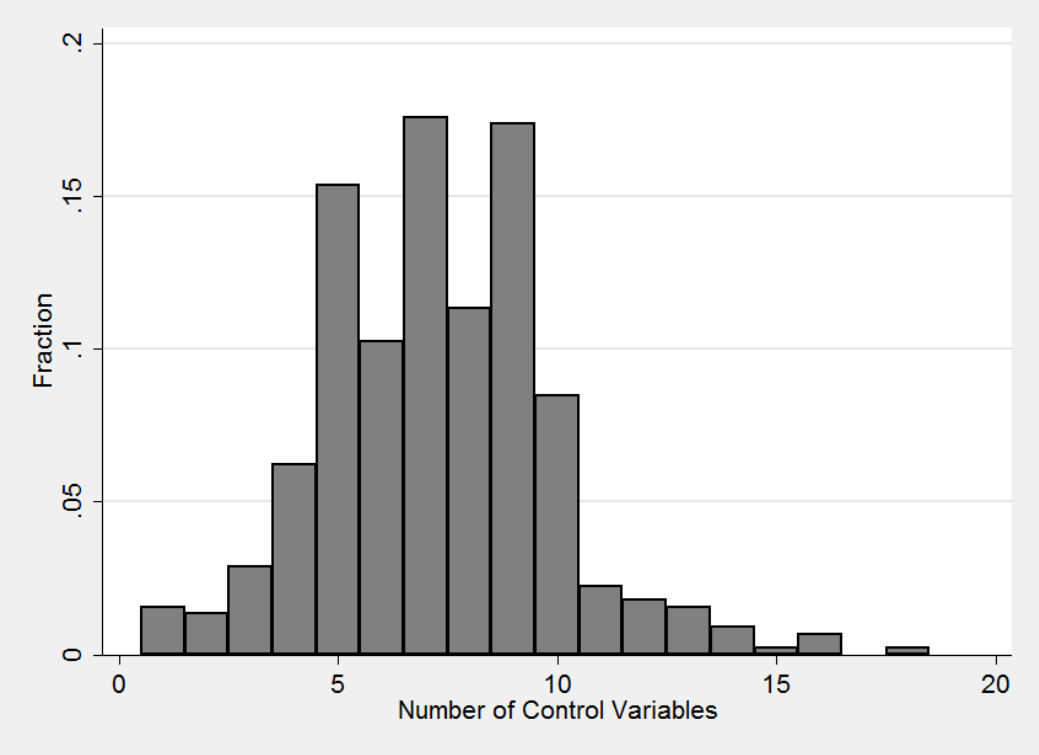
Figure 6 presents a histogram on the t-statistics or, respectively, the z-statistics, depending on what is reported in the original studies. (Note that we use in the following the term t-statistic to describe both t- and asymptotic z-statistics.) This histogram does not exclude outliers. The number of observations is only 376, i.e., less than the full sample of 449 observations. This is again due to the fact that non-linear models do not result in one single relevant estimate and because most authors do not provide separate t-statistics at some characteristic value. Nor do they provide the variance-covariance matrix of the estimated coefficients, so that we cannot calculate the t-statistics on our own at such characteristic values. As in the histogram for the estimated coefficients, we find that the t-statistic histogram is centered around zero.

Figure 6: Estimated t-Statistics



Source: Own calculation.

Figure 7: Number of control variables

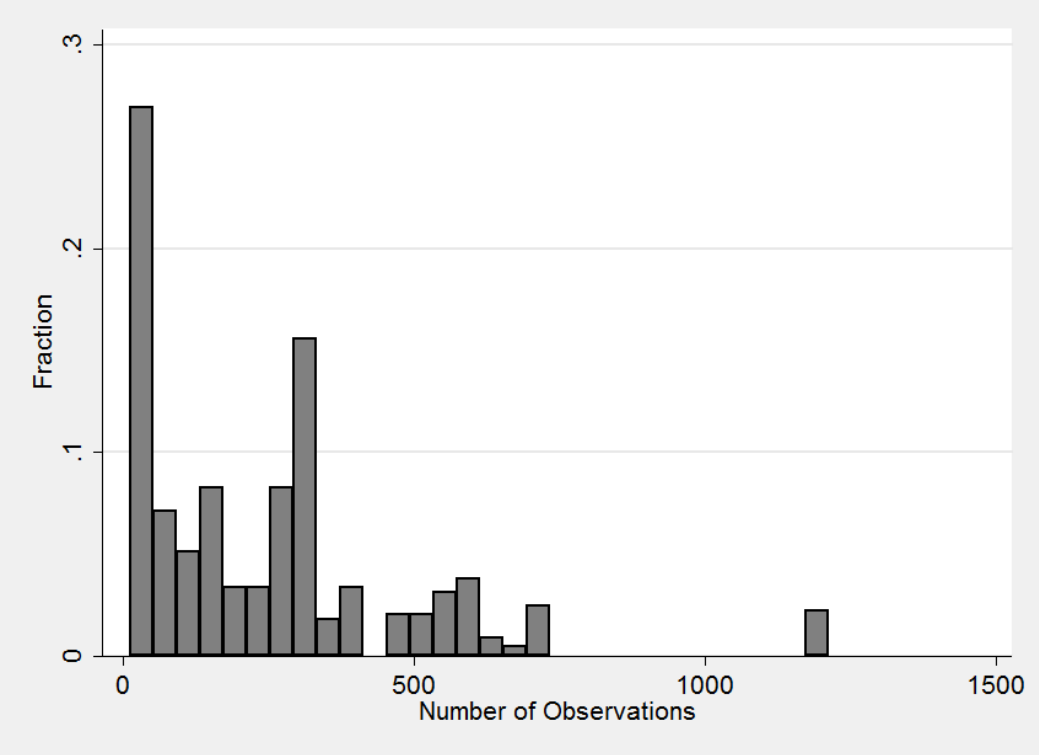


Source: Own calculation.

In Figure 7, we provide a histogram on the number of control variables other than the constant or country and time fixed effects. On average, a model has about 7 to 8 controls. However,

the dataset also contains estimates from bivariate regressions and from models with a more extensive list of control variables. In Figure 8, we depict a histogram on the number of observations showing that a large number of models have been estimated with less than 100 observations. On average, a study has about 250 observations. There are also models with more than 1000 observations.

Figure 8: Number of observations



Source: Own calculation.

5. Meta-Regressions

5.1. The Meta-Regression Model

In this section, we study how the idiosyncratic characteristics of an empirical model determine the magnitude and the sign of the estimated effects. That is, we explore how the choice of a particular measure of decentralization, a particular set of countries, or a particular specification affects the estimated effects. The most widely used technique for explaining heterogeneous findings across models is meta-regressions.[5] The applicability of the meta-regression

5. We do not include an extensive discussion of the methods used in meta-analyses. For a general discussion see Sutton et al. (2000), Stanley (2001, 2005, 2008), Wooldridge (2002) and Feld and Heckemeyer (2011).

approach in the current context relies on the premise that individual studies estimate models whose specification roughly resembles the following equation:

$$Y = X\phi + \gamma DEC + \nu \ , \tag{8}$$

where Y is a measure of economic growth, X a vector of control variables including a constant, DEC a measure of decentralization, and ν an error term that either conforms to the assumptions of the classical regression model or can be transformed appropriately. By fitting the model to the data by some technique, for example OLS, an estimate of the true effect of decentralization on economic growth, $\hat{\gamma}$, is obtained. This framework suggests that a meta-regression model can explain diverse findings in the original regressions. Consequently, a meta-regression model for our sample of studies could be specified as follows:

$$\hat{\gamma}_{ij} = a + Z_{ij}\beta + \varepsilon_{ij} \qquad \text{(i=1,…35; j=1,…,L)} \ , \tag{9}$$

where $\hat{\gamma}_{ij}$ is the estimated coefficient j in study i, Z_{ij} a vector of variables which describe the characteristics of the particular model that resulted in the estimate $\hat{\gamma}_{ij}$, and ε_{ij} the meta-regression error term. A problem with using the plain coefficients is that different studies use different units in the variables through which they operationalize decentralization and growth. The estimated coefficients are not dimensionless and therefore not directly comparable across studies without some standardization. Therefore, we use the variability of the estimate as a scaling parameter, i.e. instead of the plain coefficient in model (9) the t-statistic is used as the dependent variable in our meta-regressions. The t-statistic is a dimensionless measure that can be compared across different models. Moreover, the statistical significance of an estimated coefficient relies on the t-statistic, and if there is publication bias in favor of significant estimates, we should expect that researchers care about the t-statistics rather than about the coefficients as such. We specify our meta-regression model therefore as:

$$t_j = \frac{\hat{\gamma}_j}{sd_j} = \alpha + Z_j\beta + \eta_j \qquad \text{(j=1,…L).} \tag{10}$$

The control variables (i.e., the characteristics of the original models) that we include in our meta-regression models are listed in Table 7.

Applications in economics include Jarrell and Stanley (2004), Rose and Stanley (2005), Dominicis et al.

Table 7: Explanatory Variables in the Meta-Regressions

Variable	*Definition*	*Variable*	*Definition*
SINGLE	Dummy variable=1 for single country study	PUB	Dummy variable = 1 if paper is published as journal article or as in book contribution
OECDDEC	OECD decentralization measure (OECD 1999)	DEVELOPING	Dummy variable=1 if developing country (-ies) only
REVDEC	Dummy variable = 1 if revenues based measure of decentralization	EXPDEC	Dummy variable = 1 if expenditure based measure of decentralization
LEVELLOG	Dummy variable = 1 if level-log model	LOGLEV	Dummy variable = 1 if log-level model
FIXED	Dummy variable = 1 if cross-section fixed effects included	TIME	Dummy variable = 1 if time fixed effects included
USA	Dummy variable = 1 if data from the USA is used in the regressions (single country study at the subnational level)	CHINA	Dummy variable = 1 if data from China is used in the regressions (single country study at the subnational level)
SWISS	Dummy variable = 1 if data from Switzerland is used in the regressions (single country study at the subnational level)	GER	Dummy variable = 1 if data from Germany is used in the regressions (single country study at the subnational level)
NUMC	Number of control variables	OBS	Number of Observations
PANEL	Dummy variable = 1 if panel data is used in the regressions	YEAR	Year of publication of manuscript
GOVERNANCE	Dummy variable = 1 if measure for democratic tradition or absence of armed conflict included as control variable	FREEDOM	Dummy variable = 1 if measure of political freedom included as control variable
EXPGDP	Dummy variable = 1 if Measure for public sector expenditures (scaled by GDP) included as control variable	REVGDP	Dummy variable = 1 if measure for total public sector revenues (scaled by GDP) included as control variable

5.2. Results

Ideally, we should rely only on results from fixed effects models to establish how the t-statistics change with varying model characteristics within a given study. However, a number of study characteristics cannot be included in fixed effects models because they do not vary within studies, such as the publication status or the type of countries (developed vs. developing) included in the sample. Therefore, we estimate in addition to the fixed effects models

(2006), Feld and Heckemeyer (2011), Feld, Heckemeyer and Overesch (2013).

also pooled OLS and random effects models. In Table 8 pooled OLS estimates are denoted as OLS1 and OLS2, random effects estimates as RE1 and RE2 and fixed effects estimates as FE1 and FE2. Hypothesis tests are always based on heteroscedasticity robust standard errors. Standard errors are additionally clustered at the study level in the pooled OLS models.

The results reported in Table 8 confirm that several study characteristics significantly influence the t-statistics. First, estimates based on models using subnational expenditures as share of total expenditures, subnational revenues as share of total revenues or the OECD tax autonomy measure as proxies for decentralization find larger t-statistics than those based on the remaining proxies for decentralization treated as the baseline.[6] Models using (time or country) fixed effects report significantly smaller t-statistics corroborating the findings by Asatryan and Feld (2014). Second, models using a level-log specification display higher t-statistics than models that use the linear-linear. This estimated coefficient is significantly positive in the fixed effects specification. We also find that models in which the extent of government quality is controlled for display smaller t-statistics. In addition, the results suggest that controlling for total government revenues or expenditures as share of GDP leads to significantly smaller t-statistics. The estimated models that use data from a single country tend to produce higher t-statistics. However, this conclusion relies on the results in the pooled OLS and random effects models as the SINGLE dummy cannot be included in the fixed effects models. Finally, it also seems to matter which country is studied. In particular, models using data from China, Germany or Switzerland find smaller t-statistics than studies for Russia, India, Spain, and Ukraine. For China, this even holds when we include study fixed effects. However, only the study by Zhang and Zou (2001) displays within-study variation for this dummy.

One drawback of the previous regressions is that published and unpublished studies are analyzed together as it is possible that the impact of some study characteristics varies between published and unpublished studies. For example, editors who are ideologically biased toward centralization may accept studies that find a large t-statistic more readily (Stanley 2005, Feld and Heckemeyer 2011). If this is true, then researchers will have an incentive to report only those models that are in line with such biases, and papers that have been published have (apart from obvious quality differences) different characteristics than unpublished papers.

6. These are, e.g., divergence between expenditure and revenue decentralization, the weighted average of expenditure and revenue decentralization, or non-OECD tax autonomy measures of own-source revenues.

Table 8: Meta-Regressions, Full sample

	OLS1	OLS2	RE1	RE2	FE1	FE2
	b/se	b/se	b/se	b/se	b/se	b/se
OECDDEC	2.388	3.570	4.885	5.505	6.832*	6.802*
	(3.673)	(3.765)	(3.600)	(3.741)	(3.955)	(3.967)
EXPDEC	1.593	2.648*	2.891*	3.603**	4.608*	4.577*
	(1.159)	(1.342)	(1.637)	(1.822)	(2.496)	(2.493)
REVDEC	2.743**	3.945**	4.288**	5.049**	6.226**	6.207**
	(1.128)	(1.440)	(1.691)	(1.967)	(2.697)	(2.695)
PANEL	0.490	0.589	0.576	0.398	2.114**	1.523
	(0.874)	(1.005)	(0.874)	(1.028)	(0.978)	(1.114)
FIXED	-1.594*	-1.873*	-1.110	-1.265	-1.697**	-0.841
	(0.813)	(0.992)	(0.769)	(0.908)	(0.803)	(0.627)
TIME	1.198	1.389	0.623	0.829	-2.648***	-2.976***
	(0.766)	(1.014)	(0.978)	(0.987)	(0.707)	(0.798)
OBS	-0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
NUMC	-0.126	-0.122	0.006	-0.031	0.090	0.053
	(0.094)	(0.091)	(0.073)	(0.062)	(0.068)	(0.068)
REVGDP	-1.802***	-2.442***	-2.499***	-2.826***	-1.971***	-0.559
	(0.629)	(0.800)	(0.687)	(0.845)	(0.352)	(0.447)
EXPGDP	-2.807***	-3.016***	-2.253***	-2.004**	-1.560*	-0.893
	(0.790)	(0.874)	(0.875)	(0.803)	(0.882)	(0.587)
LEVELLOG	1.074	0.636	1.060*	0.780	0.176***	0.188***
	(0.683)	(1.005)	(0.631)	(0.795)	(0.019)	(0.020)
LOGLEV	0.963	1.532	1.793	2.384		
	(1.168)	(1.306)	(1.548)	(1.517)		
YEAR	-0.062	-0.087	-0.154	-0.161*		
	(0.086)	(0.083)	(0.112)	(0.091)		
PUB	0.942	0.447	0.513	-0.265		
	(0.783)	(1.102)	(1.008)	(1.341)		
SINGLE	1.587**	3.193**	2.180**	4.285***		
	(0.591)	(1.268)	(0.951)	(1.202)		
DEVELOPING	0.377	-0.624	0.926	-0.510		
	(0.771)	(1.207)	(1.097)	(1.207)		
FREEDOM	2.544**	2.182*	2.544**	1.924*		
	(1.195)	(1.147)	(1.085)	(1.070)		
GOVERNANCE	-0.049	-0.125	1.002	0.934		
	(1.175)	(1.336)	(1.220)	(1.326)		
CHINA		-0.001		-0.020		-3.163***
		(0.949)		(1.137)		(0.645)
USA		-1.734		-2.434**		
		(1.417)		(1.147)		
SWISS		-5.559**		-6.264**		
		(2.111)		(2.607)		
GER		-3.247		-5.541***		
		(2.028)		(1.840)		
N	376	376	376	376	376	376
Studies	28	28	28	28	28	28
R2	0.106	0.118			0.115	0.118
RMS error	3.275	3.253	3.052	3.061	2.888	2.882

Note: The dependent variable is the t-statistic. We discard several observations due to the fact that the original studies use non-linear models terms so that no single t-statistic can be used in the regression (usually, no hypothesis tests are presented at characteristic values such as the sample average are presented either). Heteroscedasticity robust standard errors are reported in parentheses. Standard errors in the pooled OLS models are also clustered at the study level. Asterisks indicate significance at the 10% (*), 5% (**) and 1% (***) level. Model FE1 and FE2 provide estimates for the China dummy because one article, Zhang and Zou (2001), provides separate estimates with a sample from China and India.

Table 9: Meta-Regressions, published and unpublished

	OLS1	RE1	FE1	OLS2	RE2	FE2
	b/se	b/se	b/se	b/se	b/se	b/se
	Published			Unpublished		
OECDDEC	-0.933	0.526	1.092	19.291***	19.291***	20.151***
	(2.823)	(2.411)	(2.482)	(0.946)	(0.946)	(0.000)
EXPDEC	0.324	0.344	0.480	6.242**	6.242**	6.769**
	(0.554)	(0.655)	(0.593)	(2.468)	(2.468)	(2.224)
REVDEC	1.870***	1.999***	2.271***	3.909*	3.909**	6.302**
	(0.611)	(0.503)	(0.523)	(1.846)	(1.846)	(2.048)
PANEL	-0.174	-0.015	1.282	6.182*	6.182**	3.357***
	(0.802)	(0.967)	(0.939)	(2.629)	(2.629)	(0.682)
FIXED	-2.078***	-1.392*	-1.400	1.028	1.028	0.737***
	(0.660)	(0.752)	(0.926)	(1.022)	(1.022)	(0.040)
TIME	1.560**	0.844	-2.155***			
	(0.584)	(0.789)	(0.564)			
OBS	0.000	-0.000	-0.000	-0.003	-0.003	0.006***
	(0.001)	(0.000)	(0.000)	(0.005)	(0.005)	(0.001)
NUMC	-0.077	0.028	0.077	0.782***	0.782***	0.355
	(0.085)	(0.051)	(0.077)	(0.190)	(0.190)	(0.243)
REVGDP	-1.585***	-2.289***	-2.445***	-1.568	-1.568	1.395***
	(0.499)	(0.504)	(0.342)	(1.601)	(1.601)	(0.053)
EXPGDP	-3.373***	-1.520**	-0.572			
	(0.776)	(0.600)	(0.523)			
YEAR	-0.013	-0.109		-1.082*	-1.082**	
	(0.054)	(0.073)		(0.502)	(0.502)	
SINGLE	1.189**	1.653***		1.829**	1.829***	
	(0.497)	(0.615)		(0.677)	(0.677)	
DEVELOPING	0.308	0.100		-1.104	-1.104	
	(0.496)	(0.605)		(0.997)	(0.997)	
LOGLEV	-0.470	-0.573				
	(0.588)	(0.958)				
LEVELLOG	0.922	0.773	0.187***			
	(0.611)	(0.584)	(0.021)			
FREEDOM	3.002***	2.007**				
	(0.767)	(0.863)				
GOVERNANCE	-0.311	0.930				
	(0.918)	(0.885)				
N	325	325	325	51	51	51
Studies	21	21	21	7	7	7
R2	0.169		0.062	0.388		0.402
RMS error	2.771	2.601	2.513	4.250	4.250	4.019

Note: The dependent variable is the t-statistic. We discard several observations due to the fact that the original studies use non-linear models terms so that no single t-statistic can be used in the regression (usually, no hypothesis tests are presented at characteristic values such as the sample average are presented either). Heteroscedasticity robust standard errors are reported in parentheses. Standard errors in the pooled OLS models are also clustered at the study level. Asterisks indicate significance at the 10% (*), 5% (**) and 1% (***) level. Some variables are dropped in in the regressions with this restricted sample (compared to the sample used to produce the results in Table 8) because of multicollinearity.

To explore whether our results are affected by such considerations, we re-estimate equation 10 separately for published and unpublished studies. Note that some control variables cannot be included in each of the two sets of regressions because there is sometimes no variation within the subsamples. Most obviously, the PUB dummy has to be dropped since both subsamples cannot, by definition, vary in this variable. In addition, we also found that there is no

or only little variation within the unpublished-subsample for the LEVELLOG, LOGLEV, FREEDOM, GOVERNANCE, and the country dummy variables.

The results for the published- and unpublished-subsamples are reported in Table 9. They suggest that the relation between study characteristics and estimated t-statistics differs somewhat between published and unpublished studies. The effect of including fixed effects, for example, tends to be negative within the group of published studies, though not significantly so, but significantly positive within the group of unpublished studies. Second, using the OECD measure of decentralization leads to significantly higher t-statistics within the class of unpublished studies. Third, the number of control variables is positively related to the t-statistic for unpublished studies while being insignificant in the group of published studies.

Such diverging results between published and unpublished studies suggest that there are significant differences between these two groups. This might, on the one hand, indicate that the publication process is indeed effective in distinguishing between high-quality and low-quality studies. On the other hand, they might also suggest the presence of publication bias.

Overall, our meta-analysis leads to three conclusions. First, the choice of the variable with which decentralization is measured is obviously important for the sign and significance of the estimate. Using traditional expenditure and revenue decentralization measures leads to larger t-statistics and thus to more significant results than other measures of fiscal decentralization. The effect of the OECD style measure which takes subnational tax autonomy into account has diverging effects in published and unpublished studies. It tends to be insignificant in the published-subsample and increases t-statistics in the unpublished-subsample. Related to this observation, the second conclusion that follows from our results is that the impact of study characteristics varies to some extent between the groups of published and unpublished studies. In particular, including fixed effects is insignificantly negative within the group of published studies, but significantly positive within the group of unpublished studies. Finally our results also suggest that the inclusion or omission of certain control variables significantly influences the estimates. In particular, the inclusion of a variable measuring governance and controlling for either total government revenues or expenditures leads to significantly smaller t-statistics.

6. Discussion of the Results and Concluding Remarks

Our review of theoretical and empirical studies on fiscal decentralization and economic growth and the meta-analysis of the estimation results provide interesting insights into the literature. With respect to the theoretical studies, it is possible to obtain arguments as to how fiscal federalism, decentralization or fiscal competition might affect economic growth, that are related to microeconomic analyses from the theory of fiscal federalism. First, an advantage of decentralized provision and financing of public goods, namely tailoring them to heterogeneous preferences of individuals, shows up in economic growth as resulting different savings rates might affect the transition to a steady state (Heterogeneity channel). Second, and more importantly, decentralization allows for designing regional economic policies to the necessities of a regional economy, and thus increases growth (Structural Change channel). If this is accompanied by sub-federal experimentation, an argument could, third, be made that political innovation serves as another growth enhancing mechanism (Political Innovation channel). Finally, to the extent to which fiscal federalism actually contributes to solve political economy problems, there might as well be another way how economic growth is enhanced (Market-Preservation channel). It should be noted, however, that the theoretical literature on federalism and growth is still in its early stages. Moreover, a growth-enhancing or decreasing effect of federalism (or more precisely fiscal competition) in many cases heavily depends on particular assumptions. It is therefore still open which transmission channel is most persuasive if there is an effect on economic growth at all.

Empirical studies do not provide strong support for an impact of federalism, decentralization or fiscal competition on economic growth. Overall, the empirical evidence is rather inconclusive whether there is an effect at all. The studies also suffer from the facts that often the autonomy of sub-federal jurisdictions is not properly measured and endogeneity issues are not convincingly tackled. Moreover, the current study design does not allow for clearly identifying particular transmission channels of the impact of fiscal federalism on economic growth.

The cross-country studies which aim at analyzing the effect of federalism or decentralization on economic growth of a whole country could be divided in those which are rather compatible of studying the Heterogeneity channel and those better fitting to an analysis of the Market Preservation channel. In the first group, expenditure or revenue decentralization at large is included controlling for transfers or some degree of autonomy, but without considering tax competition properly. If the institutional heterogeneity is controlled for, these studies tend to

show a positive effect of federalism on growth, weakly supporting the Hetereogeneity channel. The second group of studies focuses on tax competition by including measures of subfederal tax autonomy more properly. These studies are inconclusive.

More robust support for the Market Preservation channel stems from the single country studies aiming at the importance of internal arrangements for higher regional development. In particular the studies on the U.S. and Switzerland, but also on Russia and India, in which inter-jurisdictional competition is more exactly captured provide support for the Market Preservation channel. The studies on China, however, rather support the Hetereogeneity channel, while the studies on Germany provide some evidence on the Structural Change channel showing that inter-jurisdictional transfers do rather not promote structural change. No evidence is available yet on the Political Innovation Channel.

The meta-regressions shed additional light on the relationship between study characteristics and the estimates for the impact of fiscal federalism on economic growth, and provide explanations for the sometimes widely diverging results in the empirical literature. For example, single country studies tend to indicate a positive effect of federalism on growth. This may be because they are able to analyze the impact of decentralization within a common institutional framework, whereas cross-country studies may have more difficulties in isolating the effect of decentralization from other institutional determinants of economic growth. In general, our meta-regressions show that the idiosyncratic characteristics of the original empirical models and the sample used to estimate them affect the results significantly.

Therefore, future empirical research on the relationship between decentralization and economic growth will have to improve the empirical specification. According to our meta-regressions, the sign and significance of the estimates varies according to the choice of control variables. It is therefore imperative to devote additional theoretical and empirical efforts in establishing the various transmission channels through which decentralization affects economic growth. This will allow empirical researchers to identify more appropriate specifications for their models. In particular, the importance of including fixed effects must be discussed. In addition, it is necessary to establish a consensus as to how to measure decentralization. Our meta-regressions show that the particular choice of the empirical measure for decentralization has a large effect on the t-statistic. Therefore, no final agreement can be reached regarding the impact of decentralization on economic growth without a consensus as to how to measure decentralization in the first place.

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