Spoor A3:

Fiscal Federalism, Tax Competition and Economic Agglomeration

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Fiscal Federalism, Tax Competition and Economic Agglomeration[1]

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Abstract

The purpose of this paper is first to describe how fiscal de-centralization can have an impact on economic performance and growth. We start by referring to the basic economic principles of fiscal federalism. We then tune in on the concern that decentralization may lead to tax competition and result in a race to the bottom, therefore justifying some tax coordination or tax harmonization. This is especially a concern for corporate taxation as firms are often considered to be 'footloose'. However, we argue that in the presence of agglomeration economies (regional economic concentration), the traditional view of tax competition no longer holds.

In particular, in the presence of strong agglomeration economies (triggered by knowledge spillovers, input linkages and access to workers) there is a margin to sustain regional differences in corporate taxation. To back this, we engage in an micro econometric analysis to identify agglomeration rents. To this end, we use firm level panel data for Belgium to estimate agglomeration economies in firm level productivity. A doubling of our agglomeration measures (input linkages, knowledge spillovers, labor market pooling) implies an increase in firm level total factor productivity of between 1 and 4%.

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1. Introduction

Figure 1A shows a relationship between fiscal decentralization, measured as the sub-national share of total government expenditure, and the average annual growth rate of real GDP per capita between 1997 and 2007 for a sample of developed and less developed countries. Figure 1B shows the same, but in which GDP per capita has been adjusted to take into account differences in initial conditions that affect GDP growth, including the initial level of GDP (in 1997), whether the country belongs to the European Union or not and an indicator of political freedom (a proxy for measuring democracy)[2]. From this, we can note that once we take into account differences in the level of development, there seems to be a positive correlation between GDP growth and fiscal decentralization. When decentralization is defined as the amount of taxes collected at sub-national government levels, relative to total government expenditures, the relationship remains positive and becomes even stronger[3]. This is not surprising as such a measure captures fiscal responsibility of collecting taxes.

This positive correlation between fiscal decentralization and economic growth suggests that the nature of fiscal federalism and hence the level of fiscal autonomy is a potentially important factor for triggering economic growth and economic performance in general. Fiscal federalism here refers to the (complex) organization of fiscal and budgetary relationships between national and local levels of government and hence which level of government should collect and use which type of taxes[4]. It follows that we need to understand which functions and instruments are best centralized and which are best placed in the sphere of decentralized levels of government. This is, according to Oates (1999), the fundamental subject matter of fiscal federalism.

[2] In particular, Figure 2 shows on the vertical axis the residuals of the following regression: growth = a + bln(gdp1997)+cEU+dFreedom+u. Thus this is an adjusted growth rate taking into account initial differences in economic and political development.

[3] Iimi (2005) investigates this relationship in an econometric growth model, taking into account endogeneity of institutions and fiscal decentralization. He finds evidence of a strong positive relationship between fiscal decentralization and economic growth.

[4] The literature on federalism goes beyond fiscal federalism. In particular, one important strand in the literature deals with the formation of federations, starting with Riker (1964) and more recently Alesina and Spolaore (2003). A second group of papers on federalism deals with the attribution of responsibilities between different levels of government, following the seminal work of Tiebout (1956) and the third deals with fiscal federalism, which is the focus of the present paper.

Figure 1A: GDP Growth and Fiscal Decentralization

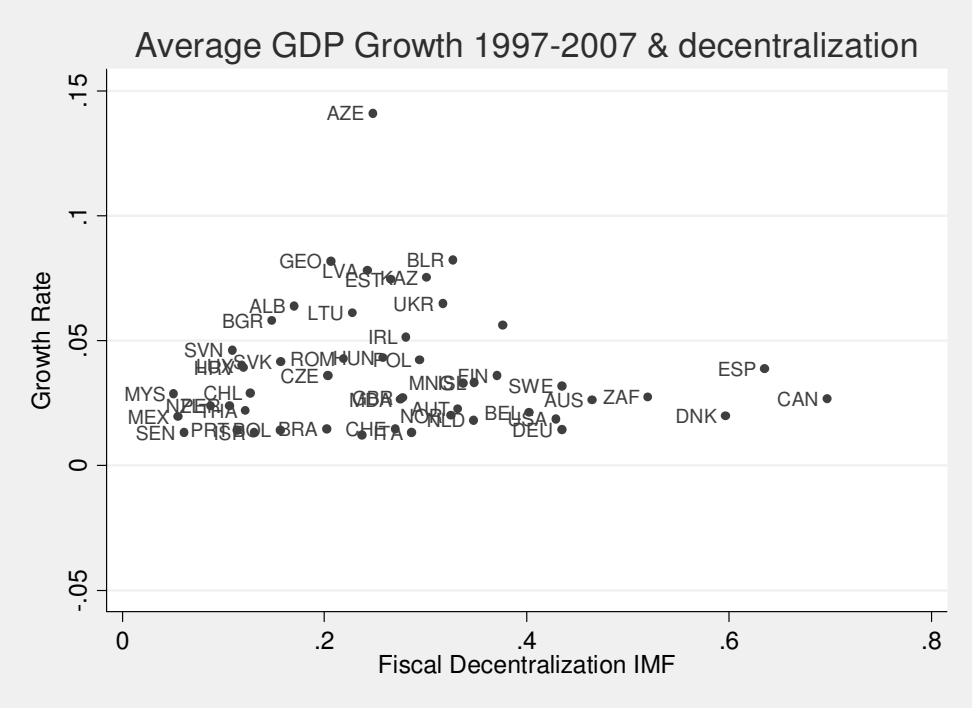
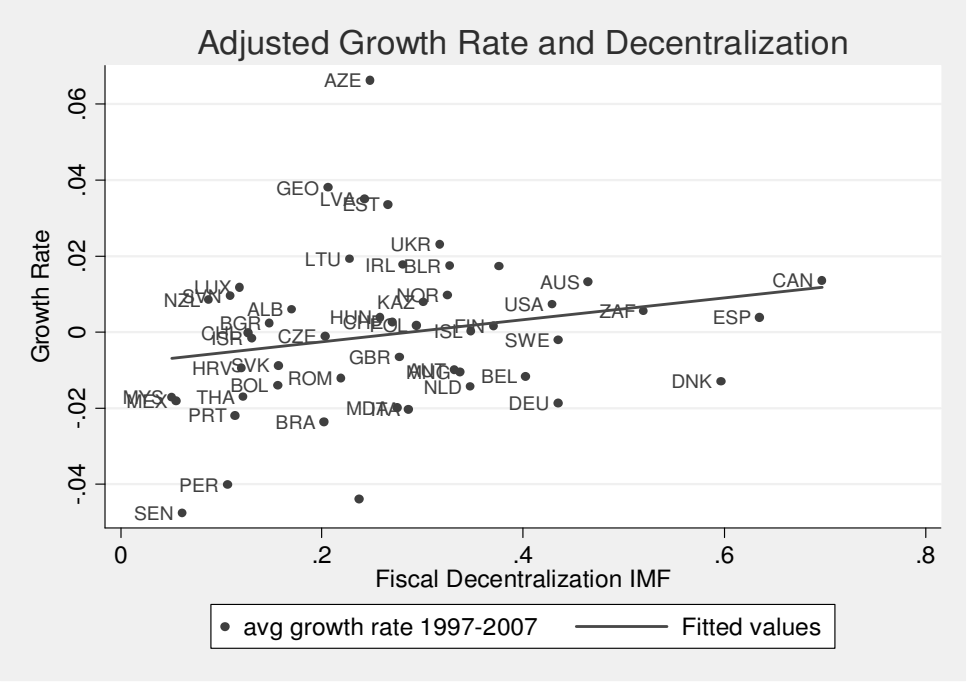


Figure 1B: GDP Growth and Fiscal Decentralization



The purpose of this paper is first to describe how fiscal federalism can have an impact on economic performance and growth, by spelling out the basic economic principles of fiscal federalism, as described in the rather large literature on this topic. Then, we will discuss in this context whether there is a case for fiscal harmonization in the European Union, given tax competition between Member States may end up in a race to the bottom and hence sub-optimal tax rates. We also discuss the implications for further fiscal autonomy in regions within federal states. In particular, we use firm level data for Belgium to estimate the presence of agglomeration rents and show that they exist. We argue that the presence of such agglomeration rents weakens the case for tax harmonization as tax competition becomes less important when agglomeration economies are present.

2. Fiscal Federalism and Economic Performance

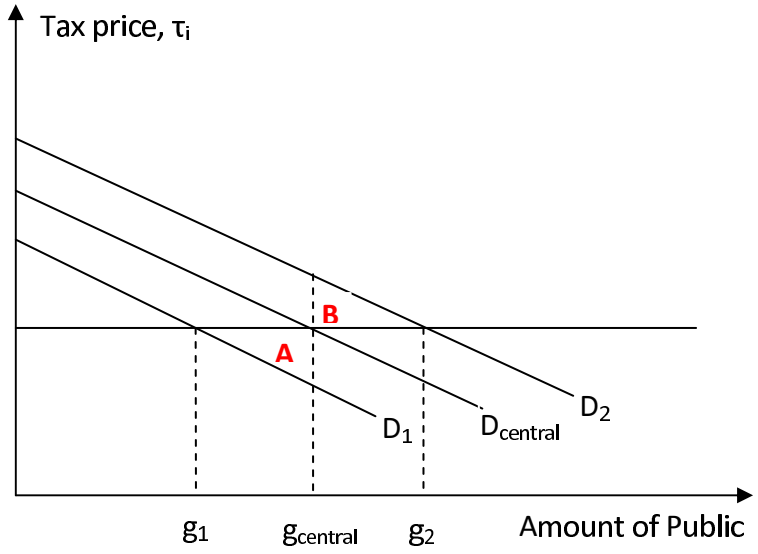
2.1. The Basic theory of fiscal federalism

A key question in the literature on fiscal federalism is the degree of correspondence between tax collection and the provision of public goods. Typically this involves a basic trade-off: On the one hand the production of public goods or a public service may benefit from scale economies when this is done at a centralized level. Scale economies emerge when there are large fixed costs in the production of a public good or service, which are easier to justify when these are shared over a large number of consumers. A good example is the fixed costs associated with defense and guaranteeing security for citizens through the military. On the other hand also the nature of the (local) demand for the public good matters. When it concerns a demand for a public good that is local with little or no externalities to other localities, it may be more efficient to produce and offer the public good locally. For instance, demand for public day care is typically local in nature as proximity to the household and workplace seem to matter, with little or no externalities to other regions. These examples illustrate the basic insight from the de-centralization theorem of Oates (1972, 1999) also referred to as the principle of perfect correspondence.

Figure 2 illustrates the efficiency loss nicely when there are differences in local demand (preferences) for a public good that is produced centrally. When local preferences for a public good are different this will be reflected in differences in local demand or 'willingness' to pay (as reflected by the taxes) for the public good. The optimal amount of supply depends on the (marginal) cost of producing the public good, which is assumed to be constant, thus independent of the amount that is produced. When the public good is provided centrally, then the central government takes into account an average demand function (Dcentral). It is clear that in that case the optimal amount of the provision of the public good is too high from the point of view of region 1 (g1<gcentral), but too low from the point of view of region 2 (g2>gcentral). This leads to a welfare (efficiency) loss, measured by area's A and B in Figure 2. In contrast, when the public good is provided in a decentralized way the marginal benefit of the public good equals the marginal cost in both regions and hence maximizes welfare and efficiency. It is also clear from this simple illustration that the more inelastic the demand (steeper slopes) for public goods is, the higher the efficiency loss of a centralized provision. Rubinfeld (1987) and Oates (1996) survey the

econometric evidence that has estimated these elasticities and find overwhelming evidence that the demand for local public goods is typically highly price inelastic, which suggests that the potential welfare gains from decentralization may be quite large.

Figure 2

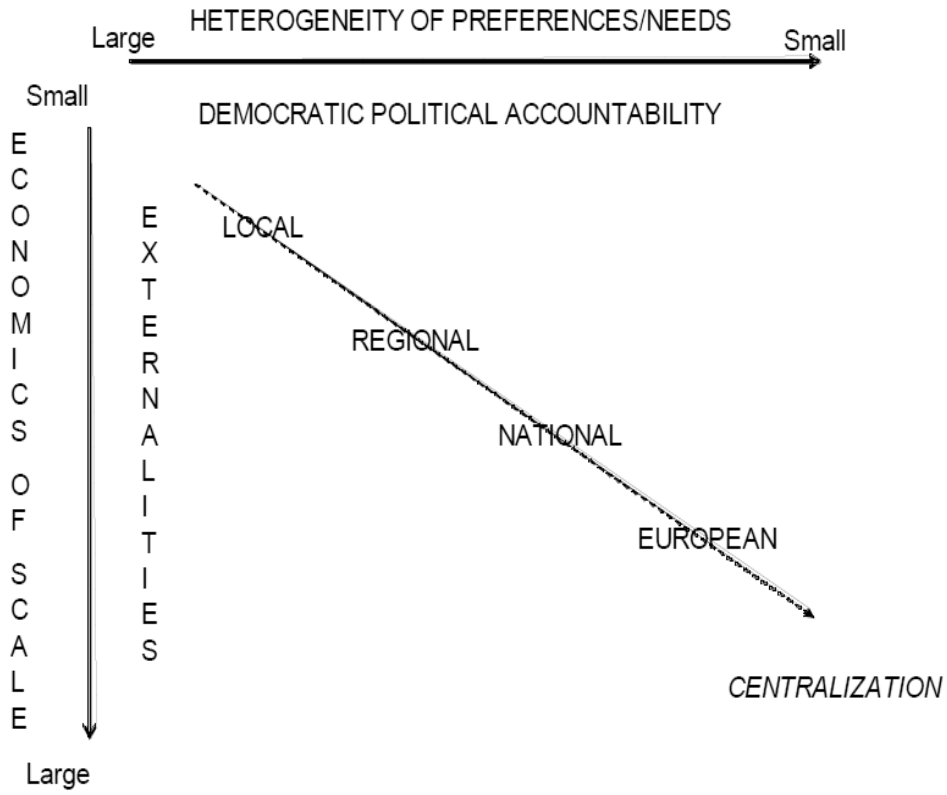


Apart from the standard economic analysis there are also a number of other arguments that favor decentralization. A first one is related to information costs. Local authorities are usually better informed about local preferences and conditions than are central authorities, which allows them to take better decisions tailored towards the local needs. Second, competition between local authorities pushes them to more budgetary discipline and higher efficiency. As Tiebout (1956) in his seminal contribution pointed out local voters can either use their 'voice' or move jurisdiction, although the latter is often difficult in the presence of high transaction costs. Thus, the efficiency enhancing competition between local governments will depend on the ability of citizens to compare different government services relative to the tax burden they face and to keep authorities accountable for their decisions. Third, there may exist political pressures that limit the capacity of central governments to provide different levels of a public service in different regions, which again favors decentralization.

There are of course also drawbacks of fiscal decentralization. The most prominent one is that decentralization potentially does not fully exploit existing economies of scale due to smaller jurisdiction size (Oates, 1972, Alesina and Spoalore, 1997). Also the failure to account for negative externalities or spillovers between jurisdictions favors centralization, which can internalize them. Alternatives include a minimum form of coordination or compensating transfers. Finally, tax competition is considered as a problem when there is a mobile tax base (Brueckner, 2004).

A nice way to summarize the above insights regarding at which level of government the provision and financing of public services is best organized is given in Figure 3[5]. Figure 3 illustrates the basic trade-off between scale economies and heterogeneity of preferences. When scale economies and externalities are low and preferences are highly asymmetric, it is best to produce and finance public goods locally. Also democratic accountability of politicians matters in this context. In contrast, when scale economies are large and preferences are homogeneous, a central level, like the national or EU level is the most appropriate level to organize the public service (e.g. EU trade policy, EU monetary policy). While the trade-off between scale economies and heterogeneity of preferences provides a good framework to how best designing fiscal federalism, its link with economic growth is less obvious. We therefore discuss the link with economic growth next.

Figure 3



[5] See also Algoed, Heremans and Peeters (2007)

2.2. Economic Growth and Fiscal Decentralization

Theoretical background

To tease out the relationship between fiscal decentralization and economic growth, it is useful to refer to Musgrave (1959), who has indicated the main economic functions of government should focus on: (i) macroeconomic stability, (ii) efficiency in public finances, (iii) guaranteeing an equal income distribution. Economic performance and growth is then indirectly affected though the impact of fiscal decentralization on these three factors. Macroeconomic stability is done through fiscal and monetary policy, which can imply some deficit spending. The efficiency with which this can occur depends on various kinds of multipliers and whether one holds a neo-Keynesian or a neo-Classical view of the world. But it is clear that the ability of a government to engage in counter-cyclical stabilization policy and its implications for unemployment and hence the structural or natural rate of unemployment can have an impact on the natural rate of output and hence on long run economic growth.

It is clear from neoclassical growth theory that the key determinants of economic growth are technological progress and the process of capital accumulation, which in turn depends on savings. Other factors may influence these processes, such as infrastructure, human capital accumulation and institutional design. Oates (1993) conjectured that better targeting of growth-enhancing infrastructure investment under federalism could raise an economy's growth rate, which triggered a series of empirical papers with mixed results. But only recently, a more systematic theoretical framework to think about these issues has been developed (e.g. Brueckner, 2006). The key mechanism is that federalism affects the incentive to save and hence the capital accumulation in the economy, which affects growth. In particular, Brueckner (2006) shows that decentralization allows public good levels to be tailored to suit the differing demands of young and old consumers in different jurisdictions, which increases their incentive to save. This in turn leads to an increase in investment in human capital and eventually to faster economic growth.

From the decentralization theorem of Oates we can also infer that under decentralization efficiency should improve. Martinez-Vazquez and McNab (1997) argue that better matching individual's preferences could have an additional effect through increased work effort, savings and investment, which in turn leads to higher economic growth. Likewise, if the local provision of public goods improves the technical or producer efficiency by offering better quality and larger quantities of the public good, it can foster innovation in the production and supply of public goods. This in turn affects economic growth positively.

Empirical Evidence

The empirical evidence on the relationship between growth and fiscal decentralization has been mixed and seems to depend on the initial level of development, which begs the question of causation. For instance, Davoodi and Zou (1998) find a negative relationship for developing countries and none for developed ones. In contrast, Oates (1995) and more recently Iimi (2005) finds a positive relationship between fiscal decentralization and output growth. Bodman and Ford (2009) show evidence of an inverted U-shape between various measures of decentralization and growth, suggesting that

intermediate levels of fiscal decentralization have the largest impact. They take into account further the extent to which sub national governments are 'closer to the people' and potentially better able to account for local preferences in fiscal decision-making. It seems then that other factors may be important as well to determine whether fiscal decentralization is helping economic performance. These factors typically depend on the design of fiscal decentralization, planning and organizing public projects, the degree of administrative and political decentralization associated with fiscal decentralization, etc. (e.g. Iimi,2005 and references therein). All in all, it seems that using a simple measure of fiscal decentralization, i.e. the sub-national government share of total government expenditure, and accounting for reverse causation, the evidence points towards a positive relationship as also suggested in Figure 1.

Also other performance indicators have been the focus of research, such as the relationship between fiscal decentralization and corruption (e.g. Mello and Barenstein, 2001), its impact on health outcomes (e.g. Khaleghian, 2003) or education outcomes (e.g. Barankay and Lockwood, 2007). Most of these studies find positive effects of decentralization. The level of fiscal decentralization also matters for the overall size of the government and deficit spending. The opportunity for deficit spending through public borrowing and money creation offers a softer budget constraint when compared with the lower levels of government. Hence countries which are more decentralized are likely to have lower deficits as shown by Moesen and Van Rompuy (1990). All these factors will have an indirect effect on economic growth and performance.

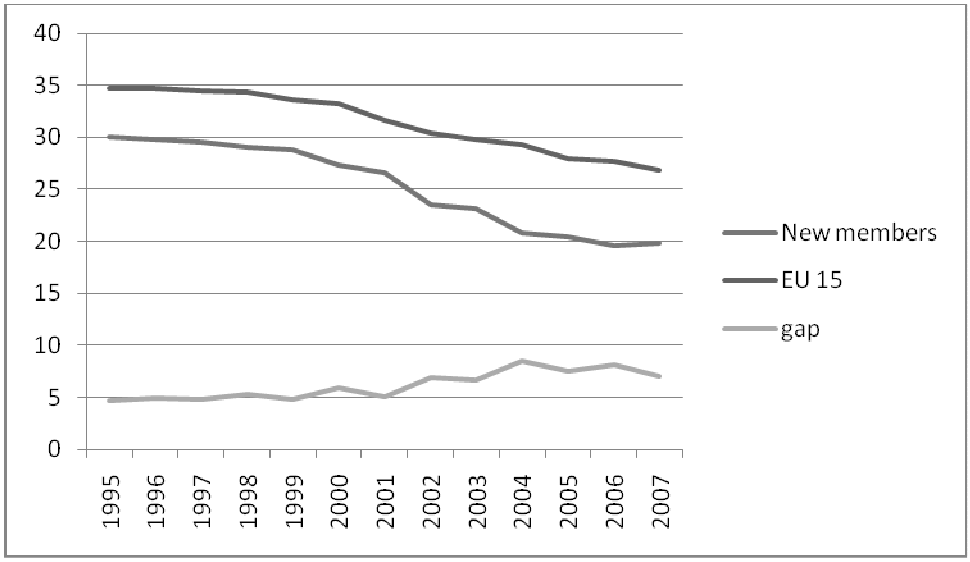
An important concern, however, with further fiscal decentralization and autonomy, is the fear of increased tax competition resulting in a race to the bottom in taxes and hence a sub-optimal tax rate which is not maximizing social welfare. This concern is especially raised in the context of mobile capital when trade costs are falling and economies get further integrated. Hence the debate on tax harmonization in the European Union or a common tax rate to avoid a "race to the bottom" which will undermine the generous welfare systems in various countries. This is the same argument why there is reluctance in a number of countries to further engage in tax decentralization. The recent insights in economic geography, however, shed a different perspective on this debate, which is elaborated on in the next section.

3. Tax competition, Agglomeration and Economic Integration

3.1. Tax Competition versus Tax Harmonization in the European Union

Figure 4 shows the evolution of corporate tax rates in the European Union since the mid '90s. Since 1995 corporate tax rates both in the EU 15, the 'Old' Member States and in the New Member States have been declining. However, the gap between the two groups of countries has been increasing slightly, which suggests that there has been no convergence in corporate tax rates, rather a slight divergence. This is surprising as in the presence of mobile capital and further economic integration, tax competition should result in converging tax rates across the border.

Figure 4: Evolution Corporate Tax Rates between the 'old' EU and the new Member States



It is also clear from Figure 4 that the enlargement of the European Union and the further economic integration has not led to a race to the bottom of corporate taxes, albeit they are on a declining trend. This questions whether the call for tax harmonization at the European level is justified. So, why is it possible to maintain different corporate tax rate in a world where firms have become increasingly mobile? The answer is that there are significant agglomeration economies in certain regions and countries which prevent firms from moving.

This insight has been spelled out by Baldwin and Krugman (2004). They argue that countries with generous welfare states typically have a higher level of GDP and are more developed. As a result they offer firms advantages of an established infrastructure, better logistics, a high-skilled labor force, accumulated experience, etc.. In other words, such countries offer important positive external economies. The important contribution of the economic geography literature is exactly that such external economies are determined endogenously through the interaction of what is called agglomeration forces with dispersion forces.

Agglomeration forces emerge for a number of reasons. First, firms want to locate in large markets, close to customers, to reduce trade costs. But by locating in a large market, they make the market larger because workers spend their wages locally, firms buy from each other, etc.. There are also cost advantages. Firms may decide to locate in a concentrated region to locate near suppliers and suppliers may want to move together, which pushes prices of intermediates down. Of course, there exist also dispersion forces. When regions get congested land prices, office prices and wages tend to raise. Furthermore, local competition is intensified, which may trigger firms to move to less dense regions to avoid competition and enjoy local monopoly power.

The presence of agglomeration economies and concentration of economic activity implies that it allows concentrated or "core" regions to hold on to mobile factors of production even when their tax rate is set at a higher level than less advanced nations, also called periphery regions. By dividing nations or regions into "core" or rich nations versus "periphery" or poor regions Baldwin and Krugman (2004) point out that differences in tax rates can be sustainable and even persistent, without generating tax competition. They show in fact that greater economic integration may lead to a "race to the top" rather than a "race to the bottom". The key mechanism is that the "core" region creates an agglomeration rent through the concentration of economic activity with important linkages in supply chains and strong demand. Agglomeration thus means that industry is not indifferent to where it locates as it can earn more in the core than in the periphery. Hence governments can tax their industry in the core at a higher rate than in the periphery. Of course there are limits to the tax difference that can be supported in the presence of such external effects or agglomeration economies. If the agglomeration benefits are entirely taxed away, dispersion forces may start dominating which may be irreversible. For a detailed analysis of the mechanisms behind agglomeration forces and dispersion forces see also Combes, Mayer and Thisse (2008)

The government in the core region can engage in a "limit tax" in which it sets a tax rate sufficiently low to make the periphery government abandon the idea of trying to attract the core. Hence the periphery government can set its tax ignoring the tax policy to attract industry. Or as Baldwin and Krugman (2004) put it, *"tax competition is one sided as the core finds its tax rate constraint by potential competition from the periphery, but since the core limit taxes the periphery, the periphery knows it will not get the core and so sets its tax rate on purely domestic concerns"*. In equilibrium, the tax rate in the agglomerated region will be higher than in the periphery region.

In this context, simple tax harmonization, defined as the adoption of a common tax rate, may in fact be harmful to at least one nation or region. Suppose for instance that a harmonized tax rate implies that a rate is chosen between a high tax rate (applied in the core region) and a low tax rate (applied in the periphery region). Recall that the initial tax rates reflect an equilibrium in which the core region chose such a tax which limits the periphery region in its tax setting up to the point that a lower tax in the periphery cannot attract the core. A harmonized tax implies an even lower tax rate in the core region and a higher one in the periphery. In this scenario the periphery will not be able to attract the core as taxes are even higher than before, while in the core taxes are lower as before. Furthermore, the tax no longer reflects the optimal tax that was set to satisfy local demand for public services and goods, given the structure (concentration) of the economy in respectively the core and the periphery. This leads to a distortion and welfare loss.

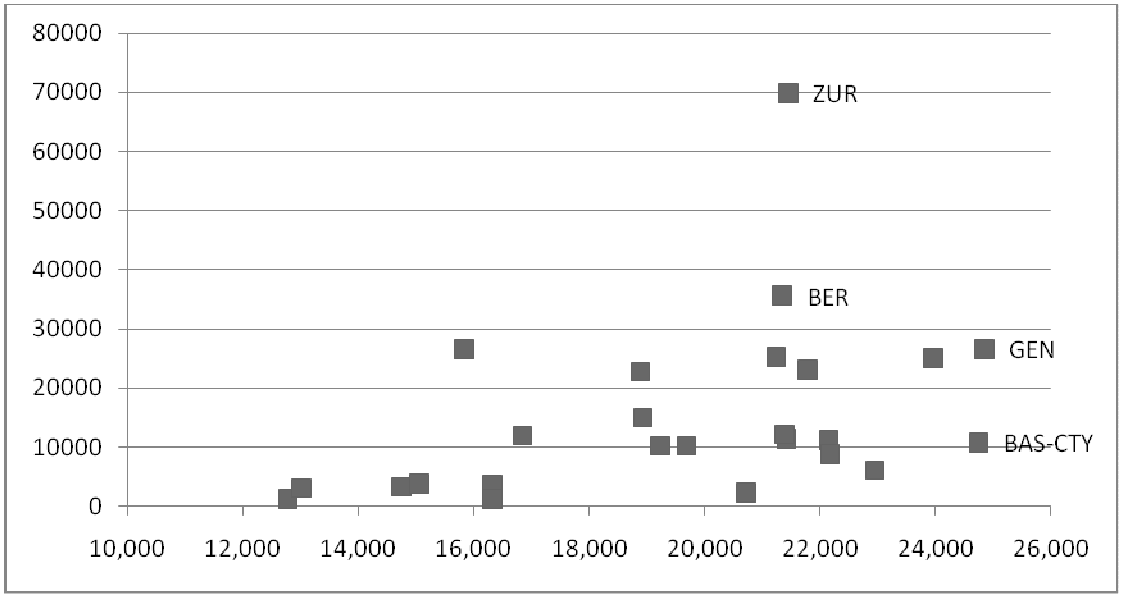
3.2. Tax Competition and Fiscal Decentralization within Countries: Micro econometric evidence on agglomeration economies in production

While this framework turns out to be a useful one to guide the debate on tax harmonization at the European level, it can also be applied to the context of fiscal decentralization in federal states. In particular, following Oates decentralization theorem one could argue that firms mainly benefit from local infrastructure, such as roads, railways, logistics, education level of the workforce and therefore

corporate income tax should best be levied locally as it serves local demand of public services by local companies. This suggests that corporate taxation even within nations should be decentralized. And this would even be possible without triggering relocation of companies, given agglomeration and dispersion forces are important to determine industry location. Arguably, a number of public services benefiting corporations are less local in nature, such as a common competition policy and a common trade policy, both policies that are organized at the EU level. Hence, a part of corporate taxation could be considered to be centralized, not at the nation level, but at the EU level.

Figure 5 provides further suggestive evidence that differences in corporate tax rates, even within the same country, are possible without triggering relocation of firms. Figure 5 shows the corporate tax rates in the various jurisdictions in Switzerland versus the number of firms in each jurisdiction. Switzerland is a good example as it is one of the few countries that has differences in corporate tax rates across its regions. If tax competition in the traditional sense is at work, we would expect a negative correlation between the number of firms in each region and the corporate tax rate that is set. Thus a high tax rate should result in a relocation of firms to the regions setting the low tax rate. Furthermore, we would expect to see convergence in tax rates. Figure 5, however, shows the opposite. The high tax regions are also the regions with the highest number of firms. This indicates that agglomeration forces are important in core regions, such as Basel, Zürich, Geneva or Bern, not surprisingly typically rich or core regions in Switzerland (see also Brülhart et al, 2007).

Figure 5: Number of firms versus corporate tax rate in Swiss regions, 2008



Source: author's calculations, based on Amadeus & Swiss Tax data

The pattern in Figure 5 suggests that it is indeed possible to sustain differences in corporate tax rates across various regions. There are also other examples for federal states. For instance in Italy particular regions have substantial fiscal autonomy. In this context, there has been a recent debate in Belgium of implementing further fiscal autonomy by regionalizing corporate tax rates.

A key question then is to what extent agglomeration economies are present in the various regions, such that different corporate tax rates can be sustained. To explore this, Figure 6 shows the concentration of economic activity, measured as the number of firms per square km in various regions in Belgium.

Figure 6: Number of companies per km2

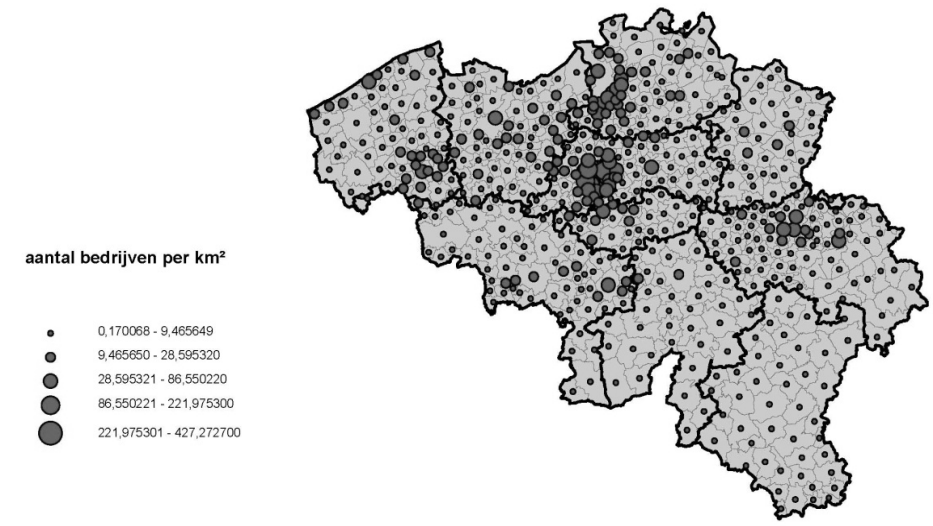


Figure 6 suggests that agglomeration forces are also important in a small country like Belgium. In fact, the 2009 World Development Report shows that such regional concentration is occurring in most countries worldwide. Thus also within countries it is possible to determine the core regions versus the periphery ones. For Belgium it seems that the core regions are mostly located in the Central-Northern part of Belgium. This is not surprising given that Brussels is not only the capital city of Belgium, but also holds the seat of many international organizations like the European Commission, the European Parliament, NATO, etc.. And in the Northern part of Belgium there are natural locational advantages such as the Port of Antwerp, Zee-Brugge and Ostend. Nevertheless, apart from these regional amenities, a recent literature on agglomeration externalities has identified numerous other possible sources for the advantages that arise from the concentration of economic activities.

The origin of the debate about the nature of these agglomeration externalities and resulting agglomeration rents can be traced back to the ideas of Marshall (1898). In his seminal work, he identified three different sources of agglomeration economies: *knowledge spillovers, input sharing and labor market pooling*[6]. *Knowledge spillovers* or learning externalities typically emerge between firms that belong to the same industry, often through worker mobility between firms carrying along job specific knowledge and expertise. But it can also occur through technological transfers, sharing of common technology platforms and imitation strategies of firms operating in the same sector. *Input sharing* is a second source of agglomeration economies. Supplier linkages reduce logistical costs and transportation costs. Furthermore, many suppliers active in the same region will result in more

[6] See Rosenthal and Strange (2004) for a detailed discussion of these three forces.

competitive pricing of intermediate inputs. There may also be some learning effect (or knowledge spillover) from working close with suppliers and having access to a large variety of input providers (e.g. Amiti & Konings, 2007 in the context of trade liberalization). A final source of agglomeration externalities is related to *labor market pooling*, which can arise from the mere size of the labor market pool, regardless of which industrial experience the workers possess. A large labor market pool makes it easier for firms to find 'the right man for the job' and vice versa, thereby leading to an increase in productivity (e.g. Shimer and Smith (2001), Gaultier and Teulings (2006) and De Melo (2009)) or it can simply reduce recruitment costs resulting in a higher degree of cost effectiveness.

We will analyze these agglomeration externalities using a firm-level productivity approach. In a first stage, firm-level total factor productivity will be estimated[7]. We assume a simple Cobb-Douglas log linear value added production function and use as estimation method the algorithm developed by Levinsohn and Petrin (2003). This methodology allows us to control for the endogeneity of the input decisions of firms. In doing so, we also take into account that firms operating in different sectors face different technologies, hence we estimate production functions for each 2-digit NACE sector separately. Total factor productivity of a firm is then defined as the estimated residual term in the production function, i.e. the variation in firm level output not explained by the variation in its input factors. For a detailed discussion about the estimation technique, we refer to Levinsohn and Petrin's (2003) original paper.

In a second stage, we will regress firm level total factor productivity (TFP) on our three measures of agglomeration externalities. Starting with a measure for *Labor Market Pooling (LMP),* although Marshall assumed that this should be proxied by the presence of labor in the own industry, we believe that the benefits arising from a sizeable labor pool are broader. Therefore, we apply a more general measure: the relevant region's total labor force. To identify a firm's relevant labor market we used data on commune to commune commuting flows within Belgium. These data allow us to calculate the 75th percentile commuting distance for all commuters in Belgium, which amounts to 26.11 km[8]. By using the coordinates of the commune's City Halls, the firm's relevant labor pool is calculated by summing up the own region's labor force with the labor force of all the communes who's City Hall lies within a ray of 26.11 km from the own region's City Hall. Note that this labor pool measure is place of residence, rather than working place based. We believe this is the most correct way of constructing a variable reflecting the presence of potential workers. The labor market pooling measure is region specific and hence takes on the same value for all firms located in one specific commune.

$$LMP_{rt} = ln[LF\ within\ the\ 75^{th}\ percentile\ commuting\ distance]$$

[7] In particular we estimate a function of the form $y = \alpha + \beta l + \gamma k + \varepsilon$, where y stands for the log value added of firm i at time t, l represent the log of firm level employment, k is the log of tangible fixed assets and ε is the error term that contains the productivity shock, which potentially is correlated with the input factors.

[8] Note that the commuting distance for all workers who commute within the same commune they live in are considered to be zero. Therefore 26.11 kilometers is likely to be an underestimation of the true value. However, communes in Belgium are rather small, so this underestimation will be only minor and hence not problematic. Also, by calculating this 75th percentile based on the whole sample of national data, we implicitly assume that average commuting distances do not vary by region. This assumption is rather strong. However, if one would be able to calculate

A second source that Marshall identified was the existence of input linkages between final good producers and their intermediates suppliers. The variable *Input Linkages (IL)* measures total employment of all the *K* industries that supply to the final good industry *i* under consideration, where each these supplying industry's employment is weighted by their respective shares of their supplies in the total inputs used by the final good industry ($\propto_{i \to k}$). These shares, only available at the NACE2 sector level, are derived from the Belgian 2005 input-output tables and do not vary over time. The variation in this variable thus stems solely from the variation in the regional employment (E) of the supplying industry. Note that this measure is industry-region specific, where subscript r stands for region, i for final good industry and t for time:

$$IL_{irt} = \ln\left[\sum_{k}^{K} \propto_{i \to k} E_{kr}\right]$$

The final Marshallian source of agglomeration externalities are *Intra-Industry Knowledge Spillovers (IIKS)*. Since Marshall argued that knowledge was industry specific and were likely to emerge from interpersonal interaction between workers employed within one specific industry, the most appropriate proxy for this channel is regional industry-employment where an industry is defined at the NACE4 level. Own firm employment is subtracted to avoid possible endogeneity issues and 1 is added to ensure that not every observation where the firm is the only regional representative of its industry is dropped[9]. This implies that our spillover measure is firm specific (where j stands for firm j and i for sector i):

$$IIKS_{jirt} = \ln\left[E_{irt} - E_{jirt} + 1\right]$$

As mentioned before, the relevant regional scope of the labor market pooling proxy was determined on the basis of commuting data. To identify the relevant regional scope of input linkages and knowledge spillovers, these variables were constructed for concentric rings at different distances around the commune where the firm is located. The rings are constructed using the coordinates of the City Halls of the Belgian communes, as explained before. The closest ring, which is actually a circle ranging from 0 to 5km, includes the commune where the firm is located, as well as all communes who's City Hall is located within a 5 km radius. The other rings (5 to 10km, 10 to 20km, 20 to 40 km and 40 to 60 km) are defined accordingly.

The final equation that will be taken to the data thus looks as follows:

$$\ln TFP_{jirt} = \alpha + \beta_1 LMP_{rt} + \beta_2 IL_{irt} + \beta_3 IIKS_{jirt} + d_t + d_j + \varepsilon_{jirt} ,$$

where α is a constant term and d_t and d_j are time and firm dummies respectively. Adding firm fixed effects allows us to control for unobserved firm heterogeneity that is likely to be correlated with the agglomeration variables. For example, firms that are inherently more productive are more likely to withstand the competition that arises from a large regional presence of firms that are active in the same

[9] Since the logarithm of zero is undefined.

industry, leading the coefficient on *IIKS* to be upward biased due to a selection effect. Other issues for the identification of β_2 and β_3 result from the relationship between industry specific shocks and industry employment levels. If an industry is hit by a positive shock, and this induces this industry (and its suppliers) to expand their employment levels during that same period, β_2 and β_3 will be upward biased. This effect is not controlled for in the equation specified above since we only control for nation-wide time varying shocks.

Since all the agglomeration proxies in the above equation are expressed in terms of logarithms, we can easily interprete them as elasticities. Thus, a 1% increase in e.g. knowledge spillovers (IIKS) is then associated with a β_3 % increase in productivity. Or a doubling of knowledge spillovers would imply an increase in total factor productivity of $(2^{\beta_3} - 1) \times 100\%$[10].

However, a robustness check will be performed in which we control for region as well as industry specific shocks. Firm TFP is calculated using BELFIRST, which is a firm-level database with balance sheet data on all Belgian firms. After applying some common cleaning rules, we are left with 98 401 firm-year observations. The data span from 1997 up to 2007. Our agglomeration measures are calculated based on a dataset from the Belgian National Social Security Office (NNSO), a decentralized plant level data base on number of firms and jobs. This database is disaggregated at the regional commune level[11] and the NACE4 industry level. The NNSO data cover nearly 100% of the Belgian private payroll employment.

We present some summary statistics of our data in Tables I and II. We can note that the average firm employees 21 workers, the largest firm engages more than 10 000 workers and the smallest has one employee. The heterogeneity in total factor productivity, which is best interpreted as an index, becomes clear from comparing the minimum with the maximum. In table II summary statistics, including the mean and the median of our agglomeration measures are reported. It is also clear that there exist substantial cross-section variation in these measures and that the distribution is skewed. We will take this into account when interpreting our results.

Table I: Summary statistics firm level data

	mean	std. dev.	min	Max
Employees	21.27	121.52	1	10864
value added	1 470 146	$1.21*10^7$	7000	$1.25*10^9$
Total Factor Productivity	43 802	44 243	1343	1 110 958

[10] Consider two firms in regions1 and 2, respectively, that differ only in terms of knowledge spillovers, IIKS. Then their main difference in terms of productivity is such that log (TFP2/TFP1)= β_3 log(IIKS2/IIKS1). Let IIKS2/IIKS1 = k, we have TFP2/TFP1 = k^{β_3}

[11] Of which there are 589 in Belgium.

Table II: Summary statistics agglomeration measures

	mean	median	min	max	std. dev.
Labour Market Pooling 75th percentile	364 444	278 501	9 824	1 069 175	244 656
Input Linkages 0 – 40 km	20 411	16 160	0	331 155	17 253
Intra-Industry Knowledge Spillovers 0 – 5 km	455	95	0	26 130	1 133

In Table III we provide the results of the above regression equation, where we consider various specifications. Column (1) of table III tests for the presence of a *Labour Market Pooling* effect on firm TFP. This effect proofs to be highly significant, as the result shows that an increase in the availability of workers in a region with 10%, results in a 0.8% increase in firm productivity. In column (2), firm productivity is regressed on the *Input Linkages* measure for concentric rings at different distances from the commune where the firm is located. The coefficients indicate that this effect is strongest for the region which is most nearby, and then attenuates slightly with distance, to disappear after 40 km of distance. We conclude that the relevant geographical scale to measure the effect of regional input linkages on firm productivity is about 40 km. So, doubling regional employment in the industries where a firm is connected with by intermediate supply linkages, results in a productivity increase of 1.8% (column (3)). Also this result appears highly significant in the specification.

Testing for the relevant geographical scope of *Intra-Industry Knowledge Spillovers* reveals that this Marshallian class of agglomeration externalities are even more confined to nearby regions then the input linkages were. The effect of these spillovers is highest in the near surroundings of a firm, within a circle of 5 km radius around the commune where the firm is located. Thereafter, although still statistically significant, the effect declines strongly and the coefficient is very close to zero. Based on this, we conclude the relevant geographical scope for knowledge spillovers to be the 5 km radius region. This result favors Marshall's line of reasoning, which posits that knowledge spillovers arise primarily from personal interactions between employees working in different firms that operate in a narrowly defined sector class.

The specification in column (6) control for all three effects simultaneously and although the coefficients decline slightly, all three variables still have a statistically significant effect on firm productivity. Column (7) performs an additional robustness check, where yearXdistrict and yearXnace3 dummies are added to the regressions. These interaction dummies control for region specific and industry specific shocks respectively. Note that this is a very restrictive specification, as we control for more than 2200 variables. By controlling for all these interacted time dummies in an attempt to get rid of the endogenous variation in the variables, you are bound to rule out some of the good variation too. As Angrist and Pischke (2009) put it: "You throw away the baby (good variation) with the bathwater (bad variation)." Even so, the results are very similar compared to the model that only controls for firm fixed

effects. However, given the restrictive nature of this specification and its associated efficiency problems, we will use the results in column (6) as our baseline outcome.

Table III: the effects of agglomeration on firm-productivity: the Marshallian Sources investigated
dependent variable: logarithm of firm total factor productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Labour Market Pooling (75^{th} perc. com. dist.)	**0.0808*** ***(0.025)***					**0.055** ***(0.026)***	**0.078** *(0.05)*
Input Linkages (0 to 40 km)			**0.0276*** *(0.007)*			**0.017*** ***(0.006)***	**0.006** *(0.0048)*
0 to 5 km		0.027*** *(0.008)*					
5 to 10 km		0.004 *(0.003)*					
10 to 20 km		0.01*** *(0.003)*					
20 to 40 km		0.012** *(0.005)*					
40 to 60 km		-0.003 *(0.005)*					
Intra-Industry Spillovers (0 to 5 km)					**0.016*** *(0.003)*	**0.013*** *(0.003)*	**0.012*** *(0.0027)*
0 to 5 km				0.015*** *(0.003)*			
5 to 10 km				0.0017** *(0.0008)*			
10 to 20 km				0.0016* *(0.0009)*			
20 to 40 km				0.0014 *(0.0014)*			
40 to 60 km				-0.0004 *(0.0015)*			
firm dummies	yes	yes	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes	yes	yes
yearXn3 dummies	no	no	no	no	no	no	**yes**

yearXdistrict[12] dummies	no	no	no	no	no	no	**yes**

*Robust standard errors are reported. *, **, *** indicate significance at the 10, 5 and 1% level respectively*

To test whether the results derived in table III are not only statistically significant, but also economically meaningful we will perform an exercise where we compute the effect of a doubling of our agglomeration measure on firm level total factor productivity. We also compute the comparison of agglomeration densities of firms in the 25th percentile of the agglomeration density distribution (lowly agglomerated regions) versus those in the 75th percentile (highly agglomerated regions). Table IV shows the results of such an exercise using the specification from column (6) in table III. We can note that at first sight labor market pooling seems the most important, however, when we compare the 25th percentile with the 75th percentile of the agglomeration distribution, the importance of knowledge spillovers increases. The reason is that the distribution of knowledge spillovers is very skewed and hence there is a large difference between lowly agglomerated and highly agglomerated regions in terms of knowledge spillovers. The estimated effects on total factor productivity are in line with similar results for other countries. For instance Combes et al (2008), using French data, find that a doubling of local industry employment density would increase productivity by 2.1%.

Table IV: the effects of doubling agglomeration density on Total Factor Productivity

	doubling agglomeration density	Comparting 25percentile with 75th percentile agglomeration distribution
Labour Market Pooling	**3.8%**	**7.6%**
Input Linkages	**1.1%**	**2.2%**
Intra-Industry Knowledge Spillovers	**1%**	**4%**

[12] There are in 43 districts in Belgium. The district coincide with the NUTS-3 Eurostat classification.

4. Conclusions

This paper has started with outlining the basic concepts of fiscal federalism and in particular tuned in on the relationship between fiscal decentralization and economic performance. The evidence in the literature is somewhat mixed (with a slight bias towards positive), which suggests that the 'design' of fiscal decentralization is at least as important. This typically implies making regions responsible both for their expenditures *and* their revenues, taking into account the principle of perfect correspondence as launched by Oates.

The paper has further discussed the desirability of fiscal harmonization, both at the EU level and at the level of individual countries. We argue that the insights from the new economic geography literature, emphasizing the importance of agglomeration economies and the distinction between core versus periphery regions, indicate that fiscal harmonization is not necessarily enhancing economic performance of countries/regions. Agglomeration economies change the scope of fiscal competition in such a way that it is feasible to sustain differences in tax rates across countries and regions. Whether this would hold in a more dynamic setting is, however, not clear and seems to be an important topic for future research.

The econometric analysis tests for the existence of these agglomeration economies. The three main Marshallian channels, the availability of a sizeable regional labor pool, the regional presence of intermediate input suppliers and intra-industry knowledge spillovers, through which agglomeration of economic activity translate into increased firm productivity were investigated. All three channels exerted a significant positive influence on firm productivity, thereby providing evidence for the existence of agglomeration rents. This finding implies that the scope of regional corporate tax competition is reduced substantially in the presence of agglomeration economies. Recalling the principle of perfect correspondence, there seems to be scope for further decentralization (to the municipal level), without necessarily resulting in a race-to-the bottom tax competition.

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Fiscal Federalism, Tax Competition and Economic Agglomeration[13]

Abstract

The purpose of this paper is first to describe how fiscal de-centralization can have an impact on economic performance and growth. We start by referring to the basic economic principles of fiscal federalism. We then tune in on the concern that decentralization may lead to tax competition and result in a race to the bottom, therefore justifying some tax coordination or tax harmonization. This is especially a concern for corporate taxation as firms are often considered to be 'footloose'. However, we argue that in the presence of agglomeration economies (regional economic concentration), the traditional view of tax competition no longer holds.

In particular, in the presence of strong agglomeration economies (triggered by knowledge spillovers, input linkages and access to workers) there is a margin to sustain regional differences in corporate taxation. To back this, we engage in an micro econometric analysis to identify agglomeration rents. To this end, we use firm level panel data for Belgium to estimate agglomeration economies in firm level productivity. A doubling of our agglomeration measures (input linkages, knowledge spillovers, labor market pooling) implies an increase in firm level total factor productivity of between 1 and 4%.

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