

Lessmann, Christian

**Working Paper**

## Fiscal decentralization and regional disparity: Evidence from cross-section and panel data

Dresden Discussion Paper Series in Economics, No. 08/09

**Provided in Cooperation with:**

Technische Universität Dresden, Faculty of Business and Economics

*Suggested Citation:* Lessmann, Christian (2009) : Fiscal decentralization and regional disparity: Evidence from cross-section and panel data, Dresden Discussion Paper Series in Economics, No. 08/09, Technische Universität Dresden, Fakultät Wirtschaftswissenschaften, Dresden

This Version is available at:

<https://hdl.handle.net/10419/36484>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

*Dresden Discussion Paper Series  
in Economics*



---

**Fiscal Decentralization and Regional Disparity:  
Evidence from Cross-section and Panel Data**

CHRISTIAN LESSMANN

*Dresden Discussion Paper in Economics No. 08/09*

ISSN 0945-4829

Address of the author(s):

Christian Lessmann  
Technische Universität Dresden  
Department of Business and Economics  
Chair for Public Economics  
01062 Dresden  
Germany

e-mail : [christian.lessmann@tu-dresden.de](mailto:christian.lessmann@tu-dresden.de)

Editors:

Faculty of Business and Economics, Department of Economics

Internet:

An electronic version of the paper may be downloaded from the homepage:  
<http://rcswww.urz.tu-dresden.de/wpeconomics/index.htm>

English papers are also available from the SSRN website:  
<http://www.ssrn.com>

Working paper coordinator:

Dominik Maltritz  
e-mail: [wpeconomics@mailbox.tu-dresden.de](mailto:wpeconomics@mailbox.tu-dresden.de)

# Fiscal Decentralization and Regional Disparity: Evidence from Cross-section and Panel Data

*Christian Lessmann*  
*Technische Universität Dresden*  
*Department of Business and Economics*  
*01062 Dresden*  
[christian.lessmann@tu-dresden.de](mailto:christian.lessmann@tu-dresden.de)

## Abstract:

The advantages and disadvantages of public sector decentralization are widely discussed in economics and political science. Some authors argue that decentralization leads to an optimal provision of public services and promotes economic growth, while others emphasize the dangers of competition between sub-national governments, especially those associated with interregional redistribution. Using cross-section and panel data for 23 OECD countries from 1982 to 2000, this paper empirically studies the impact of fiscal decentralization on regional disparities. We find that a higher degree of decentralization is associated with lower regional disparities. Hence, poor regions experience no disadvantages from decentralization and instead appear to benefit.

JEL-Classification: H72; H77; R11; R50

Keywords: Decentralization, Regional Disparity, Inequality, Fiscal Federalism, Panel Data Evidence

## Acknowledgements:

I would like to thank Michael Berlemann, Gunther Markwardt, Marcel Thum, and the participants of the 10th Anniversary Conference of the Centre for the Study of Globalisation and Regionalisation (CSGR) 2007 at Warwick University for many helpful comments and discussions.

# 1 Introduction

Since the 1970s, there has been an increasing interest in the vertical organization of governments in developed and developing countries. The main question is whether it is advantageous to give sub-national governments more authority and autonomy in decision making or to make decisions at the central level of government. Many economists propose assigning more competencies to sub-national governments to promote economic development [see Oates (1999)]. The primary argument is that decentralization increases overall government efficiency [Oates (1972)]. Decentralization brings the government closer to the people; local officials are better informed about local needs and thus are more able to set the optimal mix of local policies than are central bureaucrats. This increase in efficiency contributes to economic growth. Based on these ideas, many countries all over the world have started to allocate more and more competencies to sub-national jurisdictions. Belgium, for example, became a federal state in 1993; Italy, Spain, and Portugal are moving in the same direction. Decentralization initiatives, however, are taking place not just in highly developed countries but also in developing nations such as Mexico, Bolivia or Belarus. The general decentralization trend in developing countries is supported by the World Bank, which considers decentralization to be a main part of its poverty reduction programs [Development Committee (2006)]. An example of a trend in the opposite direction is the European Union, which is centralizing an increasing amount of responsibilities, reducing the autonomy of its member countries.

In addition to the potential gains of decentralization, several observers are concerned about the redistributive effects of decentralization within federations [Prud'homme (1995) and Tanzi (1996)]. There are several arguments why decentralization might have regressive effects (see section 2 for details). A centralized government, for example, would have more equalizing power due to its larger fiscal capacity compared to a decentralized one. Moreover, if decentralization leads to more fiscal competition, richer regions will be more attractive to mobile factors because these regions often provide better qualified human capital, closer markets, and a better infrastructure at comparatively low costs. Under these circumstances, if decentralization proceeds, richer regions will get richer and poorer regions poorer [see Prud'homme (1995)]. There are, nevertheless, several arguments that might explain a positive effect of decentralization on regional inequality. Qian and Weingast (1997) discuss the incentive effects of decentralization in a setting of inter-jurisdictional competition. In a decentralized system, economically less developed regions may offer more attractive investment conditions, e.g., more flexible labor markets, a less generous welfare state, or lower tax rates. The investments they attract will help poor regions to catch up with richer ones without centrally mandated redistribution.

In light of these opposing theoretical arguments, the effect of decentralization on regional disparities is ambiguous, and empirical work is necessary. Surprisingly, only a handful of studies have focused on this issue. Single-country studies include Kim et al. (2003) for the case of Korea, Akai and Sakata (2004) for the US, Kanbur and Zhang (2005) for China, and Bonet (2006) for Colombia. These case studies present a mixed picture of the effect of fiscal decentralization on regional disparities. While decentralization has fostered disparities in the abovementioned developing countries, a positive impact of decentralization on regional inequality could be observed for the US. However, the results of single-country studies are hardly assignable to other countries, and, therefore, the investigation of cross-country data is a more appropriate strategy to shed light on this research question. Shankar and Shah (2003), Gil Canaleta et al. (2004), Rodríguez-Pose and Gill (2004), and Ezcurra and Pascual (2008) make use of cross-country data.

Studying a sample of developed and developing countries, Shankar and Shah (2003) conclude that federal countries restrain regional inequalities more successfully than unitary countries. However, the result of this first cross-country study must be interpreted with caution since the estimations are based on very few observations and might suffer from an omitted variable bias as well as an endogeneity bias. Moreover, the authors use a dummy variable as a measure for decentralization and therefore consider only one of the different facets of decentralization. Most of this criticism also applies to the subsequent cross-country studies. Gil Canaleta et al. (2004) find a negative correlation between decentralization and regional inequality in a study that distinguishes between nine different measures of political and fiscal decentralization. The power of the underlying estimations is low, since the results are based on 17 observations and do not consider any control variables. The study by Rodríguez-Pose and Gill (2004) contrasts these findings. Based on several case studies of developed as well as developing countries, the authors conclude that the devolution of powers has fostered inequity of regions in most of the countries considered, but they have to admit that the direction of causality remains unconfirmed. Moreover, they do not distinguish between different decentralization measures. The recent study by Ezcurra and Pascual (2008) is able to overcome some of the empirical weaknesses of the former ones by using panel data. Among others, the advantages of using panel data include the greater number of observations and the ability to control for unobserved heterogeneity between countries and in time. The main result is that fiscal decentralization is negatively correlated with the level of regional inequality in European Union member countries. This finding is robust for several data adjustments. However, this study does not distinguish between different decentralization measures, and again the direction of causality remains unclear.

Against this background, the aim of our paper is to investigate the relationship between fiscal

decentralization and regional inequality using a new and wider data set. For this purpose, we analyze cross-country as well as panel data for 23 OECD countries covering the period 1982-2000. In addition to the application of this larger data set, which allows us to consider a wide range of important control variables, the major contribution of this paper to the existing literature is twofold: we make use of different alternative decentralization measures, and we apply several more sophisticated estimation procedures to consider potential reverse causality.

The first issue is related to the difficulty of measuring decentralization. Because the interesting variable is unobservable, we have to find feasible approximations. A dummy variable that reflects whether a country has a unitary or federal constitution, for example, is not able to reflect the different aspects of the devolution of powers to sub-national governments satisfactorily. Standard decentralization measures are based on financial accounts and relate the sub-national government expenditures (or revenues) to the total government expenditures (revenues). This class of decentralization measures, however, is not able to account for the factual autonomy of sub-national jurisdictions, as it is often the case that decisions are made at the central level of government but are executed at the sub-national level, which receives a corresponding financial grant [Oates (1972)]. Therefore, we apply decentralization measures that only consider own revenues of sub-national governments [Rodden (2004) and Stegarescu (2005)].

The second issue is the problem of potential reverse causality associated with the risk of an endogeneity bias on the coefficients of the independent variables. One might argue that in very heterogeneous countries with high regional disparities, there is pressure for more centralization, since people believe that the higher redistributive power of a centralized government will be able to produce a more equal distribution of resources. In this case, the direction of causality runs from regional inequality to centralization, and we have the problem of reverse causality. To overcome this methodological problem that characterizes all existing empirical studies, we apply instrumental variable techniques as well as dynamic panel estimation methods [Baltagi (1995)].

The remainder of the paper is organized as follows. In section 2 we provide an overview of the theoretical arguments concerning the relationship between decentralization and regional disparities. Section 3 describes our data, focusing on alternative measurement concepts of decentralization and regional inequality. In section 4 we conduct our econometric analysis, and we apply several robustness tests in section 5. Finally, we sum up our findings and conclude in section 6.

## 2 The theoretical link between decentralization and regional disparities

The main argument in favor of decentralization is that the transfer of powers to sub-national governments increases public sector efficiency, and thus promotes economic development and growth [Oates (1993)]. Decentralized authorities are much better informed about local needs and can better provide the economically efficient quantity and quality of local public goods. Especially in the case of a federation with heterogeneous regions, decentralized officials are in a better position to meet local demands [Oates (1972)]. The inter-regional mobility of the population can enhance these efficiency gains [Tiebout (1956)]. Another argument in favor of fiscal decentralization is the role of local governments to preserve markets [Weingast (1995)]. The idea is that the government acts as monopolist and has the power to exploit the private sector. In a decentralized setting, fiscal competition limits the government's ability to extract rents, thereby enhancing economic efficiency and thus economic growth.<sup>1</sup>

Some of these arguments could also be made in the case of regional development, which is the focus of our study. Decentralization can provide sub-national governments with the power to actively pursue economic development policies. If sub-national governments are better informed about local strengths and weaknesses, they will also be able to provide better local policies as compared to the central government. Moreover, a certain degree of sub-national autonomy gives local officials the opportunity to attract businesses to their particular regions, e.g., by granting tax privileges or offering other forms of assistance [Martinez-Vazquez and McNab (2003)]. There can also be a positive effect of decentralization on private economic localization, as a close communication channel to the administration is advantageous for businesses. Qian and Weingast (1997) emphasize the incentive effect of inter-jurisdictional competition after fiscal decentralization. Competition among jurisdictions forces governments to represent citizen interests and to preserve markets since inter-jurisdictional competition acts as a disciplinary device to punish sub-national government officials for inappropriate market intervention. Local governments could be removed if they fail to achieve standards of wealth and growth comparable with those of the rest of the country. Moreover, Qian and Weingast (1997) argue that decentralization gives less developed regions a necessary instrument to compete with richer ones by providing more attractive investment conditions, e.g., by means of more flexible labor markets or a less generous welfare state. "Jurisdictional compe-

---

<sup>1</sup>There are several empirical studies that test this theory of a link between fiscal decentralization and economic growth, single country studies, e.g., Zou (1998), Akai (2002), or Jin et al. (2005), as well as cross-country studies, e.g., Davoodi and Zou (1998), Yilmaz (1999), Iimi (2005), or Thornton (2007). Altogether, the results of these studies are inconclusive since some studies find a positive relationship between decentralization and growth, some studies find no significant results, and some find a negative relationship.

tion can therefore reduce regional inequality without centrally-mandated redistribution” [Qian & Weingast (1997), p. 87]. Indeed, there is some anecdotal evidence supporting this view. After the Civil War, the defeated American South had fallen far behind the North economically, but flexible labor market conditions, along with other local growth-enhancing policies, helped the poor South to catch up with the rich North [McKinnon (1997)]. Another example is the case of Ireland, which experienced rapid growth during the 1990s. Levying much lower taxes than core European regions was a crucial factor in overcoming the disadvantages caused by its peripheral location. Harmonization and centralization would have prevented this convergence process [Baldwin and Krugman (2004)]. Thus, decentralization can strengthen regional growth and contribute to a more equal factor distribution.

There are also some reasons to suppose that inter-jurisdictional competition has negative effects on regional inequality. According to Prud’homme (1995), rich regions will have a larger tax base than poorer jurisdictions and will therefore collect more taxes and provide more local public goods. Richer regions could also provide the same quantity and quality of public goods than poorer regions but at lower tax rates. In both cases, mobile businesses and households will prefer richer jurisdictions, enlarging the tax base and increasing the gap in income between regions [Prud’homme (1995), p. 203]. Another issue concerning the relationship between fiscal decentralization and regional disparities is the redistribution aspect. Oates (1972) argues that sub-national governments have no suitable redistributive instruments. If sub-national governments raise taxes in order to equalize, such programs are not likely to succeed because the economic units can easily move across local boundaries, undermining the goals of such programs. Thus, governments can only equalize living standards across regions at a higher centralized government level. In a similar line of reasoning Boadway (2001) discusses the possibility of shifting equity objectives to lower government levels. He emphasizes that the redistributive power of sub-national governments will lead to political programs that do not conform to the national interest. Moreover, sub-national redistributive power will result in fiscal competition with a sub-optimal outcome from a national equity point of view [see also Boadway and Flatters (1982)]. Another argument is related to the budgetary power of central and local governments. As devolution proceeds, decentralization weakens the power of the central government to support poorer regions, and disparities manifest or even increase [see also Oates (1999)]. In a similar manner, Prud’homme (1995) argues that central governments will attempt to produce a more equal distribution by channeling resources from richer areas to poorer ones. This view is supported by Persson and Tabellini (1996), who analyze the effects of intergovernmental transfers on redistribution, finding less equalization in decentralized countries. However, from a public choice perspective, it is not necessarily the case that centralized systems re-

distribute to poorer regions. Richer regions are often disproportionately strong negotiators because the central government cares more about their political support. Those regions therefore have a larger impact on the regional policies of the central government, possibly leading to a reduction in inter-governmental transfers to needy regions. A certain degree of centralization is thus necessary but not sufficient for redistribution.

Altogether, our discussion of the theoretical link between fiscal decentralization and regional disparities shows no clear-cut picture, making empirical investigation necessary. This is not surprising, since we cannot refer to a single, well-established theoretical model, but must instead consider the various aspects of the devolution of powers separately. In light of this, we have to consider different measures for decentralization in our empirical analysis in order to test the miscellaneous theoretical arguments mentioned above. A focal point of the theoretical discussion is related to the inter-jurisdictional competition involved in fiscal decentralization [Qian and Weingast (1997), Prud'homme (1995)]. Therefore, we use—among others—a class of decentralization measures reflecting the fiscal autonomy of sub-national governments. The following section will introduce these measures in detail as well as other important data issues.

## 3 The data

### 3.1 Measures of regional disparity

Measuring regional disparities within countries is difficult, and various measurements are therefore used in the literature. Three different decisions arise when measuring regional inequality: the choice of an appropriate economic indicator as the basis for the calculation, the territorial level to be applied, and an applicable concentration measure [see e.g., Spieza (2003) and Lessmann (2006), pp. 9-12, for details].

*Economic indicator:* The existing cross-country studies of the impact of fiscal decentralization on regional disparities use regional per capita income [Shankar and Shah (2003)], regional GDP per employee [Gil Canaleta et al. (2004)], or regional GDP per capita [Rodríguez-Pose and Gill (2004), Ezcurra and Pascual (2008)] as a starting point for calculating disparity measures. Regional income per capita has the disadvantage that it also includes social security benefits. Since we do not focus on individual redistribution in our paper, the effects of such redistributive instruments should be factored out as much as possible. GDP per capita ( $GDP_{pc}$ ) and GDP per employee ( $GDP_{pe}$ ) are more appropriate for a cross-country study, but both have some important assets and drawbacks. A disparity measure based on  $GDP_{pe}$  is less sensitive to commuting between jurisdictions, but different unemployment rates between two regions could create a distortionary bias. If we use

*GDPpc*, we do not have the latter issue, but commuters are problematic, especially in countries with large metropolitan areas such as Germany (Hamburg, Bremen, Berlin) or Belgium (Brussels). Weighing up the pros and cons, we decided to choose *GDPpc* in the body of our paper since that data is available for considerably more countries.<sup>2</sup> Nevertheless, we consider the *GDPpe* for robustness tests.

*Territorial level:* A further problem arises from the different sizes of the regions considered. In countries with large economic differences and an unequally distributed population, a disparity measure might be biased up- or downward. Therefore, it is necessary to use a territorial classification that creates relatively homogeneous regions. We address this problem in two different ways: first, we use the Eurostat Nomenclature of Territorial Units for Statistics (NUTS) classification level 2 within Europe and state level data for countries outside Europe, which provides us with widely homogeneous regions. Second, we calculate a disparity measure that is adjusted for the different sizes of the regions (*wcov*).

*Concentration measures:* The last question is which concentration measures are applicable for the measurement of regional disparities. Different measures of inequality do not always provide the same country disparity ranking. Especially in cross-country analyses, the concentration measure should be independent of the number of regions considered, should not be sensitive to shifts in average GDP levels, and should satisfy the Pigou-Dalton transfer principle. This principle says that an arithmetical transfer from rich to poor regions reduces inequality [see Dalton (1920) and Pigou (1912)]. The coefficient of variation (*cov*), the adjusted Gini coefficient (*adgini*) and the population-weighted coefficient of variation (*wcov*) satisfy these requirements:

$$cov := \frac{1}{\bar{y}} \left[ \frac{1}{n} \sum_{i=1}^n (\bar{y} - y_i)^2 \right]^{1/2}, \quad (1)$$

$$wcov := \frac{1}{\bar{y}} \left[ \sum_{i=1}^n p_i (\bar{y} - y_i)^2 \right]^{1/2}, \quad (2)$$

$$adgini := \frac{2 \sum_{i=1}^n i y_i}{n \sum_{i=1}^n y_i} - \frac{n}{n-1}, \quad (3)$$

where  $\bar{y}$  is the country's average *GDPpc*,  $y_i$  is the *GDPpc* of region  $i$ ,  $p_i$  is the share of the country's total population in region  $i$ , and  $n$  is the number of sub-national units. We calculate all three disparity measures for 23 OECD countries using data from national statistical offices and Cambridge Econometrics. Our robustness section also considers the coefficient of variation of *GDPpe* (*covPE*). Table 1 shows the results for two different 5-year averaged periods.

---

<sup>2</sup>Using the *GDPpe*, we have to exclude Switzerland, Norway, Japan, Canada and the US from our sample of 23 OECD countries.

Table 1: Regional disparity in OECD countries

| Countries                | Disparity measures       |           |                           |           |                                   |           |                                  |           |
|--------------------------|--------------------------|-----------|---------------------------|-----------|-----------------------------------|-----------|----------------------------------|-----------|
|                          | Coefficient of variation |           | Adjusted Gini coefficient |           | Weighted coefficient of variation |           | Coefficient of variation (GDPpe) |           |
|                          | 1982-1986                | 1996-2000 | 1982-1986                 | 1996-2000 | 1982-1986                         | 1996-2000 | 1982-1986                        | 1996-2000 |
| Austria                  | 22.5                     | 20.1      | 14.6                      | 12.6      | 22.7                              | 21.1      | 21.2                             | 17.4      |
| Belgium                  | 39.8                     | 37.3      | 18.8                      | 18.9      | 40.5                              | 37.3      | 39.8                             | 37.5      |
| Canada                   | 25.6                     | 22.0      | 15.6                      | 13.8      | 14.7                              | 14.0      |                                  |           |
| Czech Rep.               |                          | 38.2      |                           | 16.4      |                                   | 37.0      |                                  | 33.7      |
| Denmark                  | 10.9                     | 10.9      | 8.8                       | 8.5       | 8.6                               | 9.9       | 10.0                             | 11.6      |
| Finland                  | 13.5                     | 18.4      | 7.3                       | 11.1      | 8.6                               | 16.3      | 12.6                             | 14.7      |
| France                   | 16.9                     | 18.8      | 7.6                       | 7.5       | 22.4                              | 27.1      | 12.4                             | 13.2      |
| Germany (West)           | 17.9                     | 19.3      | 9.5                       | 10.2      | 16.1                              | 18.3      | 16.6                             | 17.0      |
| Hungary                  |                          | 28.9      |                           | 18.3      |                                   | 33.7      |                                  | 23.3      |
| Ireland                  | 11.5                     | 19.3      | 11.0                      | 19.0      | 9.3                               | 15.4      | 10.8                             | 16.1      |
| Italy                    | 24.3                     | 25.1      | 14.9                      | 15.4      | 25.4                              | 27.2      | 19.0                             | 17.2      |
| Japan                    |                          | 19.4      |                           | 9.1       |                                   | 27.3      |                                  |           |
| Mexico                   |                          | 45.5      |                           | 26.1      |                                   | 60.1      |                                  |           |
| Netherlands <sup>a</sup> | 25.4                     | 16.5      | 13.6                      | 10.0      | 19.4                              | 13.6      | 26.9                             | 15.5      |
| Norway                   | 15.4                     | 25.8      | 10.2                      | 14.4      | 14.0                              | 28.2      |                                  |           |
| Portugal                 | 26.2                     | 19.6      | 14.2                      | 12.0      | 29.1                              | 23.5      | 25.9                             | 19.2      |
| Poland                   |                          | 18.9      |                           | 10.5      |                                   | 21.1      |                                  | 20.9      |
| Slovakia                 |                          | 53.2      |                           | 27.2      |                                   | 37.6      |                                  | 55.7      |
| Spain                    | 21.1                     | 19.9      | 12.6                      | 12.1      | 18.9                              | 21.9      | 19.5                             | 16.7      |
| Sweden                   | 7.5                      | 13.5      | 4.2                       | 6.5       | 8.7                               | 16.0      | 5.4                              | 9.6       |
| Switzerland              | 10.7                     | 13.9      | 6.9                       | 7.8       | 11.0                              | 14.8      |                                  |           |
| UK                       | 25.4                     | 29.0      | 10.4                      | 12.9      | 30.8                              | 33.9      | 23.6                             | 28.3      |
| USA                      | 38.6                     | 32.0      | 14.7                      | 12.5      | 18.2                              | 16.0      |                                  |           |
| Average                  | 20.8                     | 21.3      | 11.5                      | 12.1      | 18.8                              | 21.1      | 18.7                             | 18.0      |

Note: a) The disparity measures for the Netherlands refer to 1986 because of a reorganisation in the NUTS classification. Source: Own calculations from data of national statistical offices and Cambridge Econometrics. Calculation of averages refers to those countries where data is available for both periods.

The coefficient of variation indicates a disparity far below average for the Scandinavian countries and Switzerland. In contrast, Slovakia, Mexico, and Belgium have a very high level of regional inequality. These results also hold for the alternative disparity measures, although Table A.1 in the appendix shows that the correlation between our disparity measures is in some cases only around 60 percent. Focusing on development over the two periods, the overall average degree of regional disparity was quite stable. However, disparities within countries developed differently—in some countries, regions converged, while they diverged in others.

### 3.2 Measures of decentralization

In addition to measures for regional disparity, we also need adequate measures of fiscal decentralization. In this context, most of the existing literature uses either a dummy variable that captures whether a country has a federal constitution or not or the degree of expenditure decentralization, which relates the expenditures of sub-national governments to consolidated general government expenditures. Recalling our theoretical discussion, it is obvious that these measures are not able to express all the different facets of the devolution of powers to sub-national governments. In particular, given the degree of inter-jurisdictional competition that fiscal decentralization involves, these measures are poor approximations. We overcome this problem by considering several alternative

decentralization measures that reflect *de jure* and *de facto* decentralization without neglecting the commonly used ones.

A necessary condition for the devolution of powers to sub-national jurisdictions is the existence of institutions in those jurisdictions. This property of decentralization can be measured by designing indicators for the organization of governments with respect to laws and institutions from a political economy perspective [see e.g., Lijphart (1984) or Treisman (2002)]. The indices of Treisman (2002) in particular have often been used in the recent literature, and thus we adopt them for our analysis. Among others, Treisman has created two decentralization measures: a federal dummy (*federal*) capturing whether a federal constitution exists (1) or not (0), and a measure of the number of vertical government tiers (*tiers*). These *de jure* indicators are constructed so that they are time invariant in most countries and are therefore only applicable for cross-section analysis.

The class of *de jure* decentralization measures does not, however, indicate the degree of authority and autonomy sub-national governments have. Therefore, most authors revert to measures of *de facto* fiscal decentralization based on financial accounts. We follow this approach and adopt the following commonly used measures: degree of expenditure decentralization (*expdec*) and degree of revenue decentralization (*revdec*). These decentralization indices are calculated by relating the sum of state and local expenditures (revenues) to total government expenditures (revenues) adjusted for intergovernmental grants. Note that, since we include the redistributive effects of social security funds as a control variable, we exclude social expenditures and revenues from our calculations here.

Oates (1972) discusses the limitations of such “classical” decentralization measures. He argues that these measures do not always represent the actual degree of decentralization because it is also important to consider the autonomy of sub-national governments in expenditure or revenue decisions. Otherwise, if sub-national autonomy were not taken into account, these “classical” decentralization measures would indicate a high level of decentralization even though a wide range of sub-national expenditure and revenue decisions is determined by the federal government. To get rid of this bias, the OECD has developed an internationally comparable framework to assess the degree of control sub-central governments have over their revenues [see OECD (1999)]. Table 2 presents the OECD framework of tax classification.

Table 2: OECD framework of tax classification

| Classification of taxes in decreasing order of control over revenue sources |  |
|---|--|
| (a)   | SCG determines tax rate and tax base.                                  |
| (b)   | SCG determines tax rate only   |
| (c)   | SCG determines tax base only   |
| (d)   | tax sharing:   |
| (d.1)   | SCG determines revenue-split   |
| (d.2)   | revenue-split only changed with consent of SCG                         |
| (d.3)   | revenue-split unilaterally changed by central government (CG)          |
| (d.4)   | revenue-split unilaterally changed by CG (in annual budgetary process) |
| (e)   | CG determines tax rate and tax base                                    |
| CG: central government; SCG: sub-central government; Source: OECD (1999).   |  |

The first three rows (a, b, and c) in Table 2 can be interpreted as taxes that sub-national governments can determine autonomously, and (d.1) and (d.2) represent shared (or composite) taxes that are influenced by both central and sub-central governments. In the cases (d.3), (d.4), and (e), the taxes are completely controlled by the central government. All kinds of taxes covered by OECD Government Revenue Statistics are classified in this respect. We follow authors such as, for example, Rodden (2004) and Stegarescu (2005) and create new decentralization measures reflecting the revenue autonomy of sub-national jurisdictions. We calculate the “adjusted revenue decentralization index” (*adrevdec*), relating all autonomous revenues of sub-national governments to total government revenues, as well as the “tax decentralization index” (*taxdec*), focusing just on government tax revenues:

$$adrevdec = \frac{(a) + (b) + (c) + \text{nontax revenue} + \text{capital revenue}}{\text{total government revenue}}, \quad (4)$$

$$taxdec = \frac{(a) + (b) + (c)}{\text{total government tax revenue}}. \quad (5)$$

The *taxdec* decentralization measure not only reflects the degree of autonomy sub-national governments have over their revenue sources, but it also approximates the scope local governments have to compete with each other in terms of taxes. Recall that inter-jurisdictional competition is a key theoretical argument about the nature of the link between fiscal decentralization and regional disparities [Prud’homme (1995), Qian and Weingast (1997)]. Table 3 compares our six measures for *de jure* and *de facto* decentralization, where a high value indicates a high degree of decentralization.<sup>3</sup>

<sup>3</sup>Our observation period ends in the year 2000 since there was a change in the classifications of the IMF government finance statistics (GFS) in 2001. Government finance data based on the new classifications are available since 1995. Since we are interested in long time-series data, we revert to data based on the standards for the compilation of statistics required for fiscal analysis that were established by the 1986 GFS Manual.

Table 3: Decentralization in OECD countries

| Countries      | “de jure”      |              | “de facto”    |        |               |        |                 |        |               |        |
|----------------|----------------|--------------|---------------|--------|---------------|--------|-----------------|--------|---------------|--------|
|                | Treisman       |              | <i>expdec</i> |        | <i>revdec</i> |        | <i>adrevdec</i> |        | <i>taxdec</i> |        |
|                | <i>federal</i> | <i>tiers</i> | '82-86        | '96-00 | '82-86        | '96-00 | '82-86          | '96-00 | '82-86        | '96-00 |
| Austria        | 1              | 4            | 41.0          | 43.5   | 42.8          | 42.9   | 14.1            | 14.1   | 3.5           | 3.5    |
| Belgium        | 1              | 4            | 18.5          | 17.3   | 18.8          | 17.4   | 7.7             | 24.7   | 6.7           | 24.2   |
| Canada         | 1              | 4            | 57.7          | 61.6   | 62.7          | 61.5   | 53.9            | 56.7   | 52.0          | 52.5   |
| Czech Republic | 0              | 3            |               | 24.0   |               | 23.9   |                 |        |               |        |
| Denmark        | 0              | 3            | 46.8          | 48.4   | 47.1          | 46.1   | 30.0            | 32.3   | 28.5          | 31.8   |
| Finland        | 0              | 3            | 44.8          | 41.4   | 44.4          | 41.3   | 31.5            | 31.3   | 26.3          | 25.3   |
| France         | 0              | 4            | 27.7          | 29.7   | 26.1          | 30.1   | 17.1            | 23.1   | 14.2          | 19.2   |
| Germany (West) | 1              | 4            | 64.4          | 63.6   | 61.3          | 60.9   | 22.1            | 20.9   | 7.6           | 7.4    |
| Hungary        | 0              | 3            | 24.9          | 30.3   | 24.7          | 32.4   |                 |        |               |        |
| Ireland        | 0              | 3            | 27.5          | 27.3   | 28.8          | 27.4   | 9.6             | 9.5    | 2.6           | 2.3    |
| Italy          | 0              | 4            | 27.0          | 31.4   | 34.3          | 30.2   | 6.2             | 9.9    | 0.4           | 7.5    |
| Japan          | 0              |              |               |        |               |        |                 |        | 33.5          | 36.5   |
| Mexico         | 1              | 3            | 16.8          | 36.3   | 23.1          | 37.7   |                 |        |               |        |
| Netherlands    | 0              | 3            | 35.3          | 34.3   | 37.9          | 36.5   | 10.3            | 14.7   | 4.2           | 5.1    |
| Norway         | 0              | 3            | 33.0          | 33.6   | 29.3          | 30.1   | 25.4            | 24.9   | 24.1          | 23.1   |
| Poland         | 0              | 3            | 28.2          | 36.3   | 28.8          | 33.1   |                 |        |               |        |
| Portugal       | 0              | 3            |               | 13.0   |               | 12.9   |                 | 6.3    | 0.4           | 3.1    |
| Slovakia       | 0              | 4            |               | 11.3   |               | 11.0   |                 |        |               |        |
| Spain          | 1              | 4            | 32.5          | 48.8   | 32.8          | 45.7   | 14.5            | 20.7   | 10.6          | 20.5   |
| Sweden         | 0              | 3            | 40.1          | 38.6   | 45.0          | 38.8   | 42.6            | 40.0   | 41.9          | 43.5   |
| Switzerland    | 1              | 3            | 70.0          | 68.3   | 69.9          | 69.3   | 63.6            | 60.7   | 57.2          | 53.9   |
| UK             | 0              | 4            | 28.7          | 25.4   | 29.3          | 28.5   | 18.4            | 9.4    | 13.4          | 4.8    |
| USA            | 1              | 4            | 50.2          | 59.2   | 57.9          | 59.9   | 43.2            | 46.3   | 36.8          | 36.4   |
| Average        |                |              | 38.9          | 41.7   | 40.7          | 41.4   | 25.6            | 27.4   | 20.6          | 22.6   |

Source: Own calculations from the IMF Government Finance Statistics and the OECD Government Revenue Statistics. Variables *federal* and *tiers* are taken from Treisman (2002).

The bottom line of Table 3 presents the average degree of decentralization and demonstrates that, indeed, there has been a general trend toward decentralization since the 1980s. Looking more closely at individual countries, however, we find movement in both directions: a rapid increase in decentralization in some countries (e.g., Spain) as well as a shift to centralization in others (e.g., the UK). Turning to the different decentralization measures, we find noteworthy differences, especially between *revdec*, *adrevdec* and *taxdec*. Switzerland, Canada and the US have a competitive fiscal federalism. Local governments in these countries have both a high level of authority, as indicated by the degrees of revenue and expenditure decentralization and a high degree of fiscal autonomy, as shown by the high values of *adrevdec* and *taxdec*. Germany is an example of a cooperative federal system since sub-national jurisdictions have a lot of authority but few autonomous financial resources. Table A.2 in the appendix shows correlations between our decentralization measures, indicating that the different measures indeed reflect different attributes of decentralization.

### 3.3 Other determinants of regional disparities

In order to minimize possible omitted variable bias in the coefficient of our decentralization measures, we include in our regressions a number of controls that have been shown in the literature to impact regional disparity. Following the suggestions of Kuznets (1955), we consider the population

size (*pop*), the population distribution within a federation (*popgini*), and the degree of urbanisation (*urban*) as controls for agglomeration. We control for country size effects using total population. The Gini coefficient of the population concentration (*popgini*) reflects the extent of agglomeration within a country. The degree of urbanisation is also a control for agglomeration effects, although it reflects a different kind of agglomeration compared to the *popgini* variable. Although the degree of urbanisation can be high within a country, meaning that the majority of people live in urban areas, that does not necessarily imply that urbanisation varies across sub-national jurisdictions. In the latter case, we would not expect a large effect on our disparity measure.

Another control is national wealth as reflected by GDP per capita (*gdppc*). A wealthier country has a larger scope for redistributive politics through transmission channels besides interregional grants and transfers, for which we control separately. Furthermore, Kuznets (1955) suggests that farm-based economies have a greater level of inequality and that a greater share of the labor force employed in manufacturing is negatively associated with inequality. Since the regional concentration of agriculture and manufacturing can be observed for most countries in our sample, we consider the share of the working population employed in agriculture in our regressions (*emplagri*). In West Germany, for example, the share of manufacturing in regional gross value added (GVA) varies between NUTS 2 regions from 28.4% in Darmstadt to 50.3% in Tübingen (year 2000).<sup>4</sup> Another control variable we consider is the unemployment ratio (*unempl*). Let us again show the unequal distribution of unemployment using our example of West Germany: In 2000 the NUTS 2 region Oberbayern had unemployment of 3.4%, while Braunschweig had the highest unemployment with 9.1%.

From the perspective of the New Economic Geography, regional disparities are affected by globalization. Fujita et al. (1999) suggest that the opening of an economy to the world market could change internal comparative advantages and hence location patterns. Gianetti (2002) develops a theoretical model and tests it empirically to show that intensified economic interaction promotes growth but exacerbates regional disparities within countries. Therefore, our regressions include the ratio between total trade (exports + imports) and GDP as a measure for global trade involvement (*global*).

We control for the size of the welfare state (*social*) using government expenditures on public welfare as a share of GDP. If, for example, regions were heterogeneous with respect to productivity, unemployment etc., then we would expect that people in richer regions would be net contributors to social security funds, while people in poorer regions would receive net transfers. Thus, one can

---

<sup>4</sup>German city states—Hamburg, Bremen, and Berlin—have even smaller manufacturing shares but are not comparable in this respect.

expect that countries with big welfare states have strong indirect inter-jurisdictional redistribution systems.

Another instrument for redistribution between regions is conditional or unconditional grants made to help the poorer regions catch up with the richer ones. Our empirical model includes the average grants per capita paid by the central government (*grantspc*). The expected sign of the coefficient is unclear because, on the one hand, such payments may retard the structural change in poor regions and hamper the efforts of the transfer recipients, but, on the other hand, such transfers supply financial resources stimulating the growth of investments.<sup>5</sup> See Table A.3 in the appendix for data sources and definitions and Table A.4 for summary statistics of the relevant variables.

## 4 Empirical analysis

### 4.1 Cross-section results

A major challenge for our analysis is the availability of regional data, which is necessary for the computation of disparity measures. We need information for a long time period because we are interested in the dynamics of convergence or divergence within federations, not just disparity levels. This restricts our cross-section analysis to a sample of 23 OECD countries. Figure 1 shows a scatter plot that illustrates the close relationship between fiscal decentralization (*expdec*) and regional disparity (*cov*) based on our cross-country data set. Recall that the negative relationship observed in the figure implies that a higher degree of decentralization is associated with smaller regional disparities. Inspection of the raw data suggests that there are no important outliers.

In order to confirm the result of the graphical analysis, and following the approaches of Shankar and Shah (2003) and Gil Canaleta et al. (2004), we compute the correlation coefficient between regional disparity (*cov*) and fiscal decentralization (*expdec*) to be -0.516, which is statistically significant. However, this result might be biased by omitted variables since we do not control for other determinants of regional inequality. Therefore, we specify the following multiple regression model:

$$RD_i = \alpha + \beta \mathbf{C}_i + \gamma DEC_i + \epsilon_i, \quad (6)$$

where  $RD_i$  denotes the regional disparity in country  $i$ ,  $\mathbf{C}$  captures our control variables,  $DEC$  represents the degree of fiscal decentralization, and  $\epsilon$  is the error term. Since our sample size of 23 observations does not allow us to consider our entire set of control variables, we choose those with

---

<sup>5</sup>See Hansen and Kessler (2004) and Kessler and Lessmann (2008) for a detailed discussion of this issue.

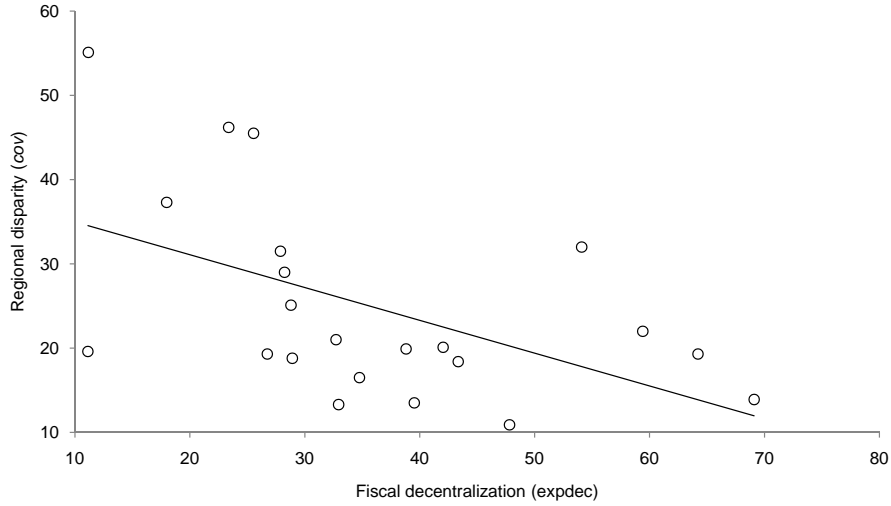


Figure 1: Decentralization and regional disparity (period averages)

the highest correlation with our disparity measure (*social*, *urban*, *gdppc*). To reduce potential problems caused by reverse causality [Wooldridge (2002)], the timing of independent variables is chosen so that they are long averages for a period (1982-1995) prior to the period of the disparity measures (1996-2000), giving us a lag structure.

Table 4 presents the cross-section results for different specifications of equation 6. Due to space limitations, we present estimation results just for the coefficient of variation (*cov*) as the dependent variable; the other abovementioned disparity measures are used for robustness checks [see section 5]. White's test for heteroskedasticity in the residuals rejects the null hypothesis of no heteroskedasticity, so all the standard errors of the coefficients are calculated using White (1980) correction. Columns (1) and (2) show the results for the *de jure* decentralization measures, and columns (3) through (6) contain the results for the *de facto* decentralization measures.

Table 4: Results: Cross-section estimations with OLS

|               | Dependent variable: Coefficient of variation |            |            |            |             |             |
|---------------|--|------------|------------|------------|-------------|-------------|
|               | 1  | 2          | 3          | 4          | 5           | 6           |
| social        | -0.885 **                                    | -1.065 *** | -1.227 *** | -1.283 *** | -1.412 ***  | -1.053 **   |
|               | -2.18  | -2.90      | -4.36      | -4.34      | -3.28       | -2.48       |
| urban         | 0.239  | 0.204      | 0.258      | 0.250      | 0.302 **    | 0.281 *     |
|               | 1.46   | 1.18       | 1.62       | 1.59       | 2.63        | 2.12        |
| gdppc         | -1.044 *                                     | -1.050 **  | -0.112     | -0.090     | 1.041 **    | 0.893 *     |
|               | -2.04  | -2.34      | -0.29      | -0.22      | 2.28        | 2.08        |
| federal       | 1.155  |            |            |            |             |             |
|               | 0.32   |            |            |            |             |             |
| tiers         |  | 6.413      |            |            |             |             |
|               |  | 1.32       |            |            |             |             |
| expdec        |  |            | -34.374 ** |            |             |             |
|               |  |            | -2.69      |            |             |             |
| revdec        |  |            |            | -32.870 ** |             |             |
|               |  |            |            | -2.53      |             |             |
| adrevdec      |  |            |            |            | -32.496 *** |             |
|               |  |            |            |            | -4.93       |             |
| taxdec        |  |            |            |            |             | -26.960 *** |
|               |  |            |            |            |             | -3.98       |
| constant      | 36.237 **                                    | 20.144 *   | 38.366 **  | 39.227 **  | 11.129      | 6.534       |
|               | 2.47   | 1.84       | 2.58       | 2.59       | 1.14        | 0.73        |
| Obs.          | 23   | 22         | 22         | 22         | 17          | 19          |
| Adj.-R2       | 0.2334                                       | 0.3690     | 0.4451     | 0.4264     | 0.4359      | 0.3402      |
| F-test p-val. | 0.065  | 0.017      | 0.006      | 0.008      | 0.026       | 0.041       |

Note: t-values are reported below the coefficients; \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively.

The coefficients of the *de jure* decentralization measures are not significant, implying that political decentralization has no impact on regional inequality. However, the coefficients of the *de facto* decentralization measures are all negative and are significant at conventional confidence levels, supporting our conclusion from Figure 1. The coefficients of our control variables indicate that regional disparities are smaller in countries with large social security systems, smaller in rich countries, and higher in countries with a high degree of agglomeration. The specifications with the *de facto* decentralization measures explain about 40 percent of the variation in regional disparities between countries.<sup>6</sup>

All in all, our cross-section results indicate a negative impact of fiscal decentralization on regional disparities, but we are aware of the problems coming from the small sample size and the potential endogeneity bias. Therefore, we repeat our estimations with a larger panel data set.

## 4.2 Panel data evidence

A major advantage of panel data is that it can capture all unobserved time-invariant country-specific factors, such as geographic area or traditions, by including country fixed effects [Baltagi

<sup>6</sup>We have tried to instrument the decentralization measures with country size in square kilometers, population density, fragmentation, and average size of sub-national jurisdictions, but we only obtain significant results (at the 10 percent level) in the last specification (*taxdec*). Consequently, we can tackle the endogeneity problem in our cross-section estimation only by lagging the independent variables.

(1995), Wooldridge (2002)]. In addition, considering country dummies allows us to focus on within-country variations as opposed to between-country differences in the cross-section analysis. Another benefit from panel data is the larger number of observations that allows us to consider all of the important control variables. With panel data, we are able to apply more sophisticated estimation procedures to determine the direction of causality between the dependent and independent variables, and thus we eliminate a possible endogeneity bias, which is a major drawback of the existing empirical literature. However, panel data makes high demands on data preparation and estimation procedures to avoid misspecification errors such as spurious regression, serial correlation, etc.

In this section, we estimate several panel data models for 17 OECD countries from 1982 to 2000. Due to the unavailability of fiscal and especially regional data for certain periods and countries, the panel dataset is unbalanced. Moreover, we must drop the Eastern European countries, Japan, and Mexico from the data set due to missing long time series data. Our baseline estimation equation looks similar to those of the cross-country analysis and has the following form:

$$RD_{i,t} = \alpha_i + \beta C_{i,t} + \gamma DEC_{i,t} + \delta_t + \epsilon_{i,t}, \quad (7)$$

where  $\alpha_i$  captures country-specific fixed effects and  $\delta_t$  represents period fixed effects. To avoid spurious regressions, we need stationary time series in our panel data set. Several unit root tests such as the Levin, Lin and Chu test, the Im, Pesaran and Shin W-statistics, the augmented Dickey-Fuller test statistic, and the Phillips-Perron Fisher unit root test rule out the existence of non-stationary time-series, individual or common unit roots. Furthermore, the Hausman (1978) specification test rejects models using random effects. We therefore chose the correct econometric specification for our country fixed effects model. Since the Durbin-Watson test statistic indicates some serial correlation, we use an estimation procedure that considers the AR(1) process of the error term.<sup>7</sup>

We address the issue of a potential endogeneity bias in two ways: first, we apply the two-stage-least-squares (TSLS) estimation procedure using one period lagged decentralization as an instrument, and second, we estimate a dynamic panel data model. A dynamic panel data model includes a lagged dependent variable on the right side of equation (7). In this case, the usual approach of estimating the fixed-effects model with OLS generates a biased estimate of the coefficients, since the country fixed effect  $\alpha_i$  is positively correlated with the lagged dependent variable on the right side of the equation. The problem can be solved by computing the first difference of equation (7) to eliminate the fixed effects:

---

<sup>7</sup>This procedure assumes that the error term can be serially correlated of first order  $\varepsilon_{i,t} = \rho\varepsilon_{i,t-1} + u_{i,t}$  with  $u_{i,t}$  as an independently identically distributed (iid) white noise error term and  $\rho$  as the serial correlation coefficient.

$$(RD_{i,t} - RD_{i,t-1}) = \delta(RD_{i,t-1} - RD_{i,t-2}) + \beta(C_{i,t} - C_{i,t-1}) + \gamma(DEC_{i,t} - DEC_{i,t-1}) + (\epsilon_{i,t} - \epsilon_{i,t-1}). \quad (8)$$

In the differenced equation, however, the dependence of  $(\epsilon_{i,t} - \epsilon_{i,t-1})$  on  $\epsilon_{i,t-1}$  implies that OLS estimates of  $\delta$  are inconsistent. Instrumenting is therefore necessary [Bond (2002)]. We use the Arellano and Bond (1991)-estimator, which considers lagged levels of  $RD_{i,t-1} - RD_{i,t-2}$  as an instrument and applies a Generalized Method of Moments (GMM) procedure. The GMM procedure requires no second-order serial correlation in the disturbances of the first-differenced equation, and thus we provide a test for second order serial correlation (AR2-test).

Table 5 reports the results obtained when we estimate our annual panel using ordinary least squares (OLS), two-stage-least-squares (TSLS), and the Generalized Method of Moments (GMM) estimation techniques. Since our *de jure* decentralization measures are time invariant, their effects are included in the country fixed effects, and we are only able to consider the *de facto* decentralization measures. The most important result is that both our static and our dynamic panel regressions support our cross-section results. The coefficients of the different decentralization measures are all negative and are significant at conventional confidence levels. We obtain this result for the OLS regressions as well as for the TSLS and GMM estimations, which control for a potential endogeneity bias.

We now turn to the interpretation of our control variables, providing deeper insights about the determinants of regional inequality. As expected, *poggini*, the measure for the population distribution within a country, has a positive impact on regional disparity—the higher the population concentration, the larger the regional inequalities. Our other measure for agglomeration, *urban*, has no significant impact on regional disparities in our panel. Moreover, big countries, as reflected by the population variable (*pop*), show lower disparities. In contrast to the above expectations, the development stage of a country, as reflected by *gdppc*, has a positive and significant effect on disparities. A possible explanation could be that in the later stages of the development process, the disparities of a country are manifested, as is postulated by the New Economic Geography [Krugman (1991)]. Another result of the regressions is that a high unemployment ratio (*unempl*) seems to be associated with higher regional inequality. Furthermore, open economies (*global*) have smaller disparities than closed ones, supporting the findings of Gianetti (2002). As expected, the negative sign on *social* suggests that social security systems redistribute not only between individuals but also between regions. Employment in agriculture (*emplagri*) is significantly positive in some of the specifications, supporting Kuznets (1955), whereas central government grants (*grantspc*) do

not seem to interact with regional inequality.

We have also investigated the possibility of a non-linear relationship between decentralization and regional disparity. For this purpose, we added the square of our decentralization measures to the empirical model. In almost all specifications, the coefficients of our decentralization measures as well as the coefficients of their squares were insignificant. Moreover, the signs of the coefficients were very sensitive to which measure of regional disparity was used. Therefore, we concluded that there is no clear non-linear relationship.

All in all, our results suggest that fiscal decentralization does not contribute to an increase in regional disparities within our sample of OECD countries. On the contrary, our estimates support the hypothesis that fiscal decentralization promotes a more balanced distribution of resources across regions. Using the coefficient of variation (*cov*) as dependent variable this applies to our decentralization measures reflecting sub-national government authority (*expdec* and *revdec*) as well as to those measures reflecting sub-national government autonomy (*adrevdec* and *taxdec*). The following section provides several robustness tests, which allow more detailed interpretations.

Table 5: OLS [AR1], TSLS and GMM regressions from 1982 to 2000

|                     | Dependent variable: Coefficient of variation |             |             |             |            |            |             |             |           |           |            |           |           |  |  |  |
|---------------------|--|-------------|-------------|-------------|------------|------------|-------------|-------------|-----------|-----------|------------|-----------|-----------|--|--|--|
|                     | OLS<br>1                                     | OLS<br>2    | OLS<br>3    | OLS<br>4    | TSLS<br>5  | TSLS<br>6  | TSLS<br>7   | TSLS<br>8   | GMM<br>9  | GMM<br>10 | GMM<br>11  | GMM<br>12 |           |  |  |  |
| cov lagged          |  |             |             |             |            |            |             |             |           |           |            |           |           |  |  |  |
| popgini             | 57.284 **                                    | 49.214 *    | 53.198 **   | 49.080 *    | 107.675 ** | 82.746 **  | 125.019 *** | 108.605 **  |           | 0.576 *** | 0.586 ***  | 0.565 *** | 0.583 *** |  |  |  |
| urban               | 2.11   | 1.75        | 1.99        | 1.88        | 2.38       | 1.77       | 2.77        | 2.32        | 13.14     | 13.50     | 12.54      | 13.24     |           |  |  |  |
|                     | 0.040  | 0.068       | 0.067       | 0.022       | -0.080     | -0.042     | -0.020      | -0.173 *    | 82.120 *  | 74.795 *  | 65.380     | 40.127    |           |  |  |  |
| pop                 | 0.37   | 0.58        | 0.64        | 0.21        | -0.82      | -0.44      | -0.21       | -1.93       | 1.93      | 1.76      | 1.48       | 0.96      |           |  |  |  |
|                     | -0.039                                       | -0.069      | -0.100 *    | -0.110 *    | -0.184 *** | -0.226 *** | -0.237 ***  | -0.262 ***  | 0.001     | 0.007     | 0.025      | 0.008     |           |  |  |  |
| gdppc               | -0.67  | -1.14       | -1.77       | -1.94       | -3.16      | -4.44      | -5.12       | -5.37       | -0.059    | -0.072 ** | -0.089 *** | -0.087 ** |           |  |  |  |
|                     | 0.691 ***                                    | 0.601 ***   | 0.527 ***   | 0.580 ***   | 1.190 ***  | 1.277 ***  | 0.990 ***   | 1.032 ***   | -1.59     | -2.06     | 0.200      | -2.55     |           |  |  |  |
| emplagri            | 3.22   | 2.70        | 2.62        | 2.93        | 5.24       | 5.61       | 4.53        | 4.55        | 0.137     | 0.193     | 0.200      | 0.216 *   |           |  |  |  |
|                     | -0.133                                       | -0.017      | 0.087       | 0.033       | -0.206     | -0.108     | 0.130       | 0.209 *     | 0.103     | 0.152     | 1.61       | 1.75      |           |  |  |  |
| unempl              | -0.94  | -0.12       | 0.65        | 0.25        | -1.25      | -0.74      | 1.04        | 1.65        | 0.231 **  | 0.241 **  | 0.279 ***  | 0.241 **  |           |  |  |  |
|                     | 0.157  | 0.229 **    | 0.167 *     | 0.241 **    | 0.444 ***  | 0.538 ***  | 0.408 ***   | 0.525 ***   | 2.15      | 2.32      | 2.88       | 2.54      |           |  |  |  |
| global              | 1.63   | 2.28        | 1.78        | 2.54        | 4.72       | 5.68       | 4.69        | 5.85        | -0.019    | 0.046     | 0.010      | 0.038     |           |  |  |  |
|                     | -0.074 ***                                   | -0.067 **   | -0.060 **   | -0.067 ***  | -0.062 **  | -0.055 **  | -0.057 **   | -0.063 **   | -0.30     | 0.74      | 0.16       | 0.61      |           |  |  |  |
| social              | -2.81  | -2.45       | -2.28       | -2.61       | -2.40      | -2.14      | -2.27       | -2.43       | -0.010    | -0.013    | -0.002     | -0.003    |           |  |  |  |
|                     | -0.144 *                                     | -0.141 *    | -0.140 *    | -0.152 *    | -0.123     | -0.115     | -0.150 *    | -0.147 *    | -0.63     | -0.84     | -0.13      | -0.16     |           |  |  |  |
| grantspc            | -1.77  | -1.69       | -1.77       | -1.92       | -1.54      | -1.41      | -1.90       | -1.79       | -0.139 ** | -0.135 ** | -0.127 **  | -0.124 ** |           |  |  |  |
|                     | 0.140  | 0.670       | 0.450       | 1.891       | 0.630      | -0.321     | 1.067       | 1.288       | -2.53     | -2.47     | -2.28      | -2.27     |           |  |  |  |
| expdec              | 0.08   | 0.36        | 0.26        | 0.98        | 0.36       | -0.18      | 0.62        | 0.74        | -0.436    | -0.341    | -0.341     | -1.067    |           |  |  |  |
|                     | -23.493 ***                                  | -18.972 **  |             |             | -18.972 ** |            |             |             | -0.34     | -0.77     | -0.25      | -0.55     |           |  |  |  |
| revdec              | -4.20  | -18.127 *** |             |             | -1.99      | -17.356 *  |             |             | -9.794 *  |           |            |           |           |  |  |  |
|                     |  | -2.68       |             |             |            | -1.68      |             |             | -1.88     | -10.069 * |            |           |           |  |  |  |
| adrevdec            |  |             | -16.038 *** |             |            |            | -27.217 *** |             |           | -1.83     |            |           |           |  |  |  |
|                     |  |             | -3.66       |             |            |            | -4.95       |             |           |           | -8.295 **  |           |           |  |  |  |
| taxdec              |  |             |             | -15.029 *** |            |            |             | -26.743 *** |           |           | -2.08      | -8.169 ** |           |  |  |  |
|                     |  |             |             | -3.43       |            |            |             | -4.92       |           |           |            | -2.24     |           |  |  |  |
| Country dummies     | yes  | yes         | yes         | yes         | yes        | yes        | yes         | yes         | no        | no        | no         | no        |           |  |  |  |
| Time dummies        | yes  | yes         | yes         | yes         | yes        | yes        | yes         | yes         | no        | no        | no         | no        |           |  |  |  |
| Obs.                | 240 (17)                                     | 240 (17)    | 240 (17)    | 244 (17)    | 240 (17)   | 240 (17)   | 240 (17)    | 247 (17)    | 224 (17)  | 224 (17)  | 224 (17)   | 227 (17)  |           |  |  |  |
| Adj. R <sup>2</sup> | 0.4362                                       | 0.4069      | 0.4293      | 0.4336      | 0.3729     | 0.3394     | 0.3877      | 0.3821      |           | 0.032     | 0.046      | 0.021     |           |  |  |  |
| Sargan-test         |  |             |             |             |            |            |             |             | 0.043     | 0.032     | 0.132      | 0.144     |           |  |  |  |
| AR(2)-test          |  |             |             |             |            |            |             |             | 0.115     | 0.122     | 0.132      | 0.144     |           |  |  |  |

Note: t-values are reported below the coefficients(z-values for the GMM procedure, resp.); \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively. We present p-values for the Sargan-test and serial correlation test.

## 5 Sensitivity analysis and robustness checks

To check the robustness of our results, we carried out several sensitivity analyses. Although the estimations above used various measures of fiscal decentralization, it is necessary to repeat this procedure with alternative measures of regional disparity to ensure that our results are not sensitive to the underlying measurement concepts. As discussed in section 3, GDP per capita may be a biased indicator of regional inequality due to commuters. Therefore, we calculate the coefficient of variation based on GDP per employee (*covPE*) and consider it in our robustness analysis. Unfortunately, we have local employment data for a considerably smaller number of countries. Hence, Norway, Switzerland, the US, and Canada are missing from our panel data set, and Mexico and Japan are also missing from the cross-section analysis.

Table A.5 in the appendix presents the results we obtain if we estimate our empirical model with the same econometric methodology as in section 4 but use the adjusted Gini coefficient (*adgini*), the weighted coefficient of variation (*wcov*), and the coefficient of variation based on the GDPpe (*covPE*) as the dependent variable (columns 1-12). Due to space limitations, we are not able to present the entire estimation output, so we focus exclusively on the different decentralization measures and regression diagnostics. Turning our attention to the cross-country data set (columns 1-3), we find that all of the decentralization measures are significantly negative when *adgini* and *wcov* are the dependent variable and are negative but not always significant for *covPE*. Recall that the number of observations is much smaller for *covPE*, and thus we have considerably fewer degrees of freedom. In columns 4 to 12, we present the results of our panel data regressions. On the whole, our finding that fiscal decentralization negatively impacts regional disparities holds using the alternative dependent variables. However, it is noteworthy that the decentralization measures reflecting sub-national government authorities (*expdec* and *revdec*) do not have significant effects if we use *wcov* and *covPE* as disparity measures and simultaneously control for a possible endogeneity bias (TSLS and GMM). In contrast, the decentralization measures reflecting sub-national government autonomy over revenue sources (*adrevdec* and *taxdec*) remain significant in all specifications. This result implies that the impact of fiscal decentralization on regional inequality crucially depends on sub-national government autonomy.

Our next robustness check is to build 3-year period-averages of all variables and repeat the panel estimations with the new data set in order to get rid of business cycle effects. Since we lose several degrees of freedom due to averaging, we drop the control variables that had no significant impact on regional disparities in the annual panel. Columns 13-16 in Table A.5 show the results, which

support our earlier findings.<sup>8</sup> Again, decentralization measures reflecting sub-national government authorities (*expdec* and *revdec*) have negative but insignificant or just weakly significant effects in several specifications.

As the 17 (resp. 23) countries provide only a limited number of cross-sections, the empirical findings might vary for different samples due to outliers. A further sensitivity analysis, therefore, consists of systematically dropping countries from the regressions and checking for the robustness of the results. Except for *revdec*, which is insignificant in three single cases, we obtain results similar to the estimations with the full sample. We also modified the sample by dropping the USA and Canada, because in these cases the state level is used instead of the NUTS 2 classification. Moreover, we estimated the sample without the three poorest countries, without the three richest countries, and without both sets of countries. In another sample adjustment, we exclude the two countries with the highest degree of decentralization and the lowest degree of decentralization, respectively. All of our results are insensitive to these adjustments, indicating sample independence. To sum up, the quantitative analysis provides strong evidence for a negative impact of fiscal decentralization on regional disparities.

## 6 Summary and conclusions

In recent public reforms, the negative redistributive effects of fiscal decentralization were a major argument against fiscal decentralization in both scientific and public discussions. However, the theoretical and empirical findings on this question are ambiguous. The aim of our paper was to analyze the impact of different kinds of decentralization on regional disparity. Since measuring fiscal decentralization and regional inequality is challenging, we have discussed and calculated several alternative measures. Cross-section regressions have shown that countries with a high degree of fiscal decentralization exhibit small regional disparities, and panel regressions have indicated that increasing decentralization leads to decreasing disparity within countries. Our sample consists of 17 (resp. 23) highly developed OECD countries in the period from 1982 to 2000. Our main result holds for different disparity measures as well as for different decentralization measures. Instrumental variable as well as dynamic panel regressions suggest that causation runs from more decentralization to less regional disparities. In general, the results indicate that decentralization is not harmful to the equity of regions, and instead the converse may be true.

Nevertheless, there are considerable differences between alternative decentralization concepts. First,

---

<sup>8</sup>We also ran instrumental variable regressions and regressions with lagged decentralization measures and obtained similar results. All results discussed in this section which are not presented in Table A.5 are available from the author on request.

our cross-section analysis shows that *de jure* decentralization measures—reflecting political decentralization—have no significant impact on regional inequality, while the effect of *de facto* decentralization measures—reflecting fiscal decentralization—is significant negative. Therefore, we can conclude that it is not political decentralization but fiscal decentralization, which determines regional inequality. Second, concerning the *de facto* decentralization measures, we find the coefficients of the “classical” degree of revenue decentralization (*revdec*) as well as the “classical” degree of expenditure decentralization (*expdec*) become insignificant in some of the robustness tests where we control for alternative measurement concepts of regional disparity simultaneously with a potential endogeneity bias. This shows us that sub-national government “authorities”, as reflected by *expdec* and *revdec*, are not necessarily the driving force in regional inequalities. We obtain the more robust results considering the “autonomy” of jurisdictions as reflected by decentralization measures focusing on autonomous revenues of sub-national governments (*adrevdec* and *taxdec*). In conclusion, our results support the theoretical argument that decentralization improves public sector efficiency at the local level [see e.g., Oates (1993)] and that the devolution of power gives poorer regions the scope they need to compete with richer ones [see e.g., McKinnon (1997) and Qian and Weingast (1997)].

Some additional remarks are necessary. The results presented here can only be generalized for highly developed countries like those considered in the analysis. It is possible that, in poor countries, decentralization has a negative impact on redistribution between regions. In a less developed country with weak institutions and extensive corruption, decentralization could give the local authority the chance to exploit the citizens and local companies. Therefore, decentralization might be harmful in poor countries for allocative as well as redistributive reasons. In transition economies, as in some Eastern European countries, decentralization could also increase inequality between regions. Unlike the countries in our study, these countries historically had centralized, communist fiscal constitutions and face now very fast growing agglomeration centers. This difference could not be addressed in this paper because the available time series are too short for a study of transition economies. Such an analysis is a question for further research.

Our policy implication is that increasing fiscal decentralization, even in terms of inter-jurisdictional competition, would not be harmful for the distribution between regions. This holds for the decentralization of sub-national government authority as well as for that of autonomy. Our results might also have some implications for European Union regional policy. As the EU tends to harmonize and centralize more and more decision-making processes in supra-national institutions, our message is that competition between regions is not harmful for convergence.

## References

- Akai, N. (2002). Fiscal decentralization contributes to economic growth: evidence from state-level cross-section data for the United States. *Journal of Urban Economics*, 52(1), pp. 93–108.
- Akai, N. and M. Sakata (2004). Fiscal decentralization, commitment, and regional inequality: evidence from state-level, cross-sectional data for the United States. CIRJE Discussion Paper 315, University of Hyogo and Osaka International University.
- Arellano, M. and S. Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58, pp. 277–297.
- Baldwin, R. E. and P. Krugman (2004). Agglomeration, integration and tax harmonisation. *European Economic Review*, 48, pp. 1–23.
- Baltagi, B. H. (1995). *Econometric Analysis of Panel Data*. Chichester: Wiley.
- Boadway, R. (2001). Inter-governmental fiscal relations: the facilitator of fiscal decentralization. *Constitutional Political Economy*, 12, pp. 93–121.
- Boadway, R. and F. Flatters (1982). Efficiency and equalization payments in a federal system of government: a synthesis and extension of recent results. *Canadian Journal of Economics*, 15(4), pp. 613–633.
- Bond, S. (2002). Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal*, 1(2), pp. 141–162.
- Bonet, J. (2006). Fiscal decentralization and regional income disparities: evidence from the Colombian experience. *Annals of Regional Science*, 40, pp. 661–676.
- Dalton, H. (1920). The measurement of the inequality of incomes. *Economic Journal*, 30, pp. 348–361.
- Davoodi, H. and H. Zou (1998). Fiscal decentralisation and economic growth: a cross country study. *Journal of Urban Economics*, 43, pp. 244–257.
- Development Committee (2006). *Strengthening Bank Group Engagement on Governance and Anticorruption*. Washington, D.C.: Joint Ministerial Committee of the Boards of Governors of the World Bank and the International Monetary Fund on the Transfer of Real Resources to Developing Countries.
- Ezcurra, R. and P. Pascual (2008). Fiscal decentralization and regional disparities: evidence from several European Union countries. *Environment and Planning A*, 40(5), pp. 1185–1201.
- Fujita, M., P. Krugman, and A. J. Venables (1999). *The Spatial Economy*. Massachusetts: The MIT Press: Cambridge.
- Gianetti, M. (2002). The effects of integration on regional disparities: convergence, divergence or both? *European Economic Review*, 46, pp. 539–567.
- Gil Canaleta, C., P. Pascual Arzoz, and M. Rapun Gárate (2004). Regional economic disparities and decentralisation. *Urban Studies*, 41(1), pp. 71–94.

- Hansen, N. A. and A. S. Kessler (2004). Interregional redistribution and mobility in federations: a positive approach. CEPR Discussion Paper 4576.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46, pp. 1251–1272.
- Iimi, A. (2005). Decentralization and economic growth revisited: an empirical note. *Journal of Urban Economics*, 57(3), pp. 449–461.
- Jin, H., Y. Qian, and B. Weingast (2005). Regional decentralization and fiscal incentives: federalism, Chinese style. *Journal of Public Economics*, 89(9-10), pp. 1719–1742.
- Kanbur, R. and X. Zhang (2005). Fifty years of regional inequality in China: a journey through revolution, reform and openness. *Review of Development Economics*, 9, 1, pp. 87–106.
- Kessler, A. S. and C. Lessmann (2008). Interregional redistribution and regional income disparities: how equalization does (not) work. *mimeo, Simon Fraser University, Canada*.
- Kim, E., S. W. Hong, and S. J. Ha (2003). The impact of national development and decentralization policies on regional income disparity in Korea. *Annals of Regional Science*, 37, 1, pp. 79–91.
- Krugman, P. (1991). *Geography and Trade*. Leuven University Press.
- Kuznets, S. (1955). Economic growth and income inequality. *American Economic Review*, 45, 1, pp. 1–28.
- Lessmann, C. (2006). Fiscal decentralization and regional disparity: a panel data approach for OECD countries. Ifo Working Papers 25, ifo Institute for Economic Research.
- Lijphart, A. (1984). *Democracies*. New Haven and London: Yale University Press.
- Martinez-Vazquez, J. and R. McNab (2003). Fiscal decentralization and economic growth. *World Development*, 31(9), pp. 1597–1616.
- McKinnon, R. I. (1997). Market-preserving fiscal federalism in the American monetary union. In M. Blejer and T. Ter-Minassian (editors), *Macroeconomic Dimensions of Public Finance: Essays in Honour of Vito Tanzi*, pp. 73–93. London: Routledge.
- Oates, W. (1993). Fiscal decentralization and economic development. *National Tax Journal*, 46(2), pp. 237–243.
- Oates, W. E. (1972). *Fiscal Federalism*. New York: Harcourt Brace Jovanovich.
- Oates, W. E. (1999). An essay on fiscal federalism. *Journal of Economic Literature*, 37(3), pp. 1120–1149.
- OECD (1999). *Taxing Powers of State and Local Government, OECD Tax Policy Studies No. 1*. Paris: OECD.
- Persson, T. and G. Tabellini (1996). Federal fiscal constitutions: risk sharing and redistribution. *Journal of Political Economy*, 104(5), pp. 979–1009.
- Pigou, A. C. (1912). *Wealth and Welfare*. London: Macmillan.

- Prud'homme, R. (1995). The dangers of decentralization. *World Bank Research Observer*, 10, pp. 201–220.
- Qian, Y. and B. Weingast (1997). Federalism as a commitment to preserving market incentives. *Journal of Economic Perspectives*, 11, pp. 83–92.
- Rodden, J. (2004). Comparative federalism and decentralization: on meaning and measurement. *Comparative Politics*, 36(4), pp. 481–500.
- Rodríguez-Pose, A. and N. Gill (2004). Is there a global link between regional disparities and devolution? *Environment and Planning A*, 36(12), pp. 2097–2117.
- Shankar, R. and A. Shah (2003). Bridging the economic divide within countries - a scorecard on the performance of regional policies in reducing regional income disparities. *World Development*, 31, pp. 1421–1441.
- Spiezza, V. (2003). Measuring regional economies. *OECD Statistics Brief*, 6.
- Stegarescu, D. (2005). Public sector decentralization: measurement concepts and recent international trends. *Fiscal Studies*, 26(3), pp. 301–333.
- Tanzi, V. (1996). Fiscal federalism and decentralization: a review of some efficiency and macroeconomic aspects. In M. Bruno and B. Pleskovic (editors), *Annual World Bank conference on economic development*, pp. 539–567. Washington D.C.: World Bank.
- Thornton, J. (2007). Fiscal decentralization and growth reconsidered. *Journal of Urban Economics*, 61(1), pp. 64–70.
- Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, 64, 5, pp. 416–424.
- Treisman, D. (2002). Defining and measuring decentralization: a global perspective. Working paper university of california.
- Weingast, B. (1995). The economic role of political institutions: market-preserving federalism and economic development. *Journal of Law, Economics and Organization*, 11(1), pp. 1–31.
- White, H. (1980). A heteroskedasticity-consistent covariance matrix and a direct test of heteroskedasticity. *Econometrica*, 48, pp. 817–838.
- Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
- Yilmaz, S. (1999). The impact of fiscal decentralization on macroeconomic performance. In N. T. Association (editor), *Proceedings of the 92nd Annual Conference on Taxation 1999*, pp. 251–260. Washington D. C.
- Zou, H. F. (1998). Fiscal decentralization, public spending, and economic growth in China. *Journal of Public Economics*, 67(2), pp. 221–240.

## Appendix

Table A.1: Correlation of disparity measures

|        | cov       | adgini    | wcov      | covPE |
|--------|-----------|-----------|-----------|-------|
| cov    | 1.000     |           |           |       |
| adgini | 0.788 *** | 1.000     |           |       |
| wcov   | 0.931 *** | 0.625 *** | 1.000     |       |
| covPE  | 0.964 *** | 0.767 *** | 0.869 *** | 1.000 |

Note: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively.

Table A.2: Correlation of decentralization measures

|          | “de jure” |        | “de facto” |           |           |        |
|----------|-----------|--------|------------|-----------|-----------|--------|
|          | federal   | tiers  | expdec     | revdec    | adrevdec  | taxdec |
| federal  | 1.000     |        |            |           |           |        |
| tiers    | 0.449 **  | 1.000  |            |           |           |        |
| expdec   | 0.505 **  | 0.097  | 1.000      |           |           |        |
| revdec   | 0.510 **  | 0.111  | 0.989 ***  | 1.000     |           |        |
| adrevdec | 0.366     | -0.144 | 0.780 ***  | 0.809 *** | 1.000     |        |
| taxdec   | 0.222     | -0.198 | 0.658 ***  | 0.690 *** | 0.978 *** | 1.000  |

Note: \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively.

Table A.3: Data sources and definitions

| Variable | Definition  | Source                                      |
|----------|---|---|
| cov      | Coefficient of variation of regional GDP per capita.  | National statistics, Cambridge Econometrics |
| wcov     | Weighted coefficient of variation of regional GDP per capita.   | National statistics, Cambridge Econometrics |
| adgini   | Adjusted Gini coefficient of regional GDP per capita.   | National statistics, Cambridge Econometrics |
| covPE    | Coefficient of variation of regional GDP per employee.  | National statistics, Cambridge Econometrics |
| popgini  | Gini coefficient of the population concentration among national regions.                              | National statistics, Cambridge Econometrics |
| urban    | Share of urban living population.   | World Bank (WDI)                            |
| pop      | Total Population.   | World Bank (WDI)                            |
| gdppc    | GDP per capita.   | National statistics                         |
| emplagri | Share of employees working in agriculture   | World Bank (WDI)                            |
| unempl   | National unemployment rate  | World Bank (WDI)                            |
| global   | Sum of the relation between imports and GDP and the relation of exports and GDP                       | World Bank (WDI)                            |
| social   | Share of total national social expenditures in relation to GDP.                                       | World Bank (WDI)                            |
| grantspc | Central government grants per capita  | IMF (Government Finance Statistics)         |
| federal  | Dummy for countries with a federal constitution   | Treisman (2002)                             |
| tiers    | Index for the number of vertical government tiers   | Treisman (2002)                             |
| expdec   | Share of sub-national expenditures in relation to total government expenditures without social funds. | IMF (Government Finance Statistics)         |
| revdec   | Share of sub-national revenue in relation to total government revenue without social funds.           | IMF (Government Finance Statistics)         |
| adrevdec | Autonomous revenue decentralization.  | OECD Revenue Statistics                     |
| taxdec   | Decentralization of tax revenue.  | OECD Revenue Statistics                     |

Table A.4: Summary statistics, panel data

| Variable | Obs. | Mean   | Std. Dev. | Min.   |    | Max.    |    |
|----------|------|--------|-----------|--------|----|---------|----|
| cov      | 319  | 20.695 | 7.819     | 6.620  | SE | 48.177  | US |
| wcov     | 319  | 19.604 | 8.230     | 6.984  | DK | 42.289  | BE |
| adgini   | 319  | 11.665 | 3.626     | 3.943  | SE | 20.939  | NL |
| covPE    | 243  | 17.984 | 8.003     | 4.971  | SE | 41.924  | BE |
| expdec   | 276  | 0.403  | 0.152     | 0.091  | PT | 0.703   | CH |
| revdec   | 276  | 0.411  | 0.154     | 0.108  | PT | 0.724   | CH |
| adrevdec | 276  | 0.262  | 0.163     | 0.041  | PT | 0.644   | CH |
| taxdec   | 321  | 0.206  | 0.177     | 0.002  | IT | 0.587   | CH |
| popgini  | 323  | 0.371  | 0.123     | 0.173  | NO | 0.638   | CA |
| urban    | 323  | 74.471 | 12.765    | 32.317 | PT | 97.335  | BE |
| pop      | 323  | 38.168 | 59.146    | 3.480  | IE | 282.224 | US |
| gdppc    | 323  | 17.874 | 5.452     | 6.500  | IE | 33.960  | US |
| emplagri | 323  | 6.742  | 4.565     | 1.500  | UK | 25.200  | PT |
| unempl   | 312  | 8.399  | 4.481     | 0.400  | CH | 23.900  | NE |
| global   | 323  | 69.445 | 30.573    | 17.253 | US | 175.557 | IE |
| social   | 317  | 15.867 | 3.737     | 8.200  | IE | 28.900  | NL |
| grantspc | 281  | 0.091  | 0.415     | 0.0003 | UK | 2.831   | IT |

Table A.5: Robustness tests

| Cross-country data  |          |            |         |            |            |          |            |          |          | Panel (annual data) |          |          |            |            |         |           |       |       |       | Panel (3-year averages) |         |         |         |        |        |        |        |       |      |
|---------------------|----------|------------|---------|------------|------------|----------|------------|----------|----------|---------------------|----------|----------|------------|------------|---------|-----------|-------|-------|-------|-------------------------|---------|---------|---------|--------|--------|--------|--------|-------|------|
| Dependent variable: |          |            |         |            |            |          |            |          |          | Dependent variable: |          |          |            |            |         |           |       |       |       | Dependent variable:     |         |         |         |        |        |        |        |       |      |
| adgini              |          | wocov      |         | covPE      |            | adgini   |            | TSLs     |          | GMM                 |          | OLS      |            | TSLs       |         | GMM       |       | OLS   |       | TSLs                    |         | cov     |         | adgini |        | wocov  |        | covPE |      |
| OLS                 | (1)      | OLS        | (2)     | OLS        | (3)        | OLS      | (4)        | OLS      | (5)      | OLS                 | (6)      | OLS      | (7)        | OLS        | (8)     | OLS       | (9)   | OLS   | (10)  | OLS                     | (11)    | OLS     | (13)    | OLS    | (14)   | OLS    | (15)   | OLS   | (16) |
| yes                 | yes      | yes        | yes     | yes        | yes        | yes      | yes        | yes      | yes      | yes                 | yes      | yes      | yes        | yes        | yes     | yes       | yes   | yes   | yes   | yes                     | yes     | yes     | yes     | yes    | yes    | yes    | yes    | yes   | yes  |
| controls            |          |            |         |            |            |          |            |          |          |                     |          |          |            |            |         |           |       |       |       |                         |         |         |         |        |        |        |        |       |      |
| expdec              | -17.872* | -32.553*** | -39.078 | -12.658*** | -17.718*** | -1.840   | -18.755*** | -8.730   | -2.921   | -4.518              | 3.100    | 4.328    | -30.155*** | -18.184*** | -13.669 | -19.396** | -2.75 | -3.27 | -1.49 | 92 (17)                 | 92 (17) | 92 (17) | 92 (17) | 0.3392 | 0.4451 | 0.4928 | 0.3679 |       |      |
| Obs.                | 22       | 22         | 17      | 240 (17)   | 240 (17)   | 224 (17) | 240 (17)   | 240 (17) | 224 (17) | 181 (13)            | 182 (13) | 170 (13) | 92 (17)    | 92 (17)    | 92 (17) | 70 (13)   |       |       |       |                         |         |         |         |        |        |        |        |       |      |
| Adj. R <sup>2</sup> | 0.5261   | 0.7573     | 0.3490  | 0.4582     | 0.3922     | -        | 0.5550     | 0.5680   | -        | 0.3347              | 0.3093   | -        |            |            |         |           |       |       |       |                         |         |         |         |        |        |        |        |       |      |

| Dependent variable: |          |            |          |          |           |          |           |          |          | Dependent variable: |          |          |          |          |         |         |       |       |       | Dependent variable: |         |         |         |        |        |        |        |       |      |
|---------------------|----------|------------|----------|----------|-----------|----------|-----------|----------|----------|---------------------|----------|----------|----------|----------|---------|---------|-------|-------|-------|---------------------|---------|---------|---------|--------|--------|--------|--------|-------|------|
| adgini              |          | wocov      |          | covPE    |           | adgini   |           | TSLs     |          | GMM                 |          | OLS      |          | TSLs     |         | GMM     |       | OLS   |       | TSLs                |         | cov     |         | adgini |        | wocov  |        | covPE |      |
| OLS                 | (1)      | OLS        | (2)      | OLS      | (3)       | OLS      | (4)       | OLS      | (5)      | OLS                 | (6)      | OLS      | (7)      | OLS      | (8)     | OLS     | (9)   | OLS   | (10)  | OLS                 | (11)    | OLS     | (13)    | OLS    | (14)   | OLS    | (15)   | OLS   | (16) |
| yes                 | yes      | yes        | yes      | yes      | yes       | yes      | yes       | yes      | yes      | yes                 | yes      | yes      | yes      | yes      | yes     | yes     | yes   | yes   | yes   | yes                 | yes     | yes     | yes     | yes    | yes    | yes    | yes    | yes   | yes  |
| controls            |          |            |          |          |           |          |           |          |          |                     |          |          |          |          |         |         |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| revdec              | -14.449* | -33.815*** | -44.793* | -8.295** | -12.472** | -1.530   | -13.975** | 6.317    | -4.832   | 1.575               | -5.992   | 5.252    | -25.515* | -13.560* | -4.767  | -6.824  | -1.91 | -1.97 | -0.43 | 92 (17)             | 92 (17) | 92 (17) | 92 (17) | 0.3789 | 0.3720 | 0.4766 | 0.3212 |       |      |
| Obs.                | 22       | 22         | 17       | 240 (17) | 240 (17)  | 224 (17) | 240 (17)  | 240 (17) | 224 (17) | 181 (13)            | 182 (13) | 170 (13) | 92 (17)  | 92 (17)  | 92 (17) | 70 (13) |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| Adj. R <sup>2</sup> | 0.5170   | 0.7652     | 0.3695   | 0.4236   | 0.3255    | -        | 0.5344    | 0.5567   | -        | 0.3328              | 0.3199   | -        |          |          |         |         |       |       |       |                     |         |         |         |        |        |        |        |       |      |

| Dependent variable: |            |            |         |          |           |          |            |            |            | Dependent variable: |            |          |            |          |            |           |       |       |       | Dependent variable: |         |         |         |        |        |        |        |       |      |
|---------------------|------------|------------|---------|----------|-----------|----------|------------|------------|------------|---------------------|------------|----------|------------|----------|------------|-----------|-------|-------|-------|---------------------|---------|---------|---------|--------|--------|--------|--------|-------|------|
| adgini              |            | wocov      |         | covPE    |           | adgini   |            | TSLs       |            | GMM                 |            | OLS      |            | TSLs     |            | GMM       |       | OLS   |       | TSLs                |         | cov     |         | adgini |        | wocov  |        | covPE |      |
| OLS                 | (1)        | OLS        | (2)     | OLS      | (3)       | OLS      | (4)        | OLS        | (5)        | OLS                 | (6)        | OLS      | (7)        | OLS      | (8)        | OLS       | (9)   | OLS   | (10)  | OLS                 | (11)    | OLS     | (13)    | OLS    | (14)   | OLS    | (15)   | OLS   | (16) |
| yes                 | yes        | yes        | yes     | yes      | yes       | yes      | yes        | yes        | yes        | yes                 | yes        | yes      | yes        | yes      | yes        | yes       | yes   | yes   | yes   | yes                 | yes     | yes     | yes     | yes    | yes    | yes    | yes    | yes   | yes  |
| controls            |            |            |         |          |           |          |            |            |            |                     |            |          |            |          |            |           |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| adrevdec            | -17.085*** | -30.710*** | -29.989 | -4.773*  | -8.920*** | -2.477   | -12.957*** | -22.778*** | -12.293*** | -15.977***          | -22.077*** | -7.023** | -27.181*** | -10.046* | -22.778*** | -19.963** | -2.89 | -1.98 | -3.01 | 93 (17)             | 93 (17) | 93 (17) | 93 (17) | 0.3073 | 0.5521 | 0.5193 | 0.3481 |       |      |
| Obs.                | 17         | 17         | 13      | 240 (17) | 240 (17)  | 224 (17) | 240 (17)   | 240 (17)   | 224 (17)   | 181 (13)            | 182 (17)   | 170 (13) | 93 (17)    | 93 (17)  | 93 (17)    | 70 (13)   |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| Adj. R <sup>2</sup> | 0.3387     | 0.3170     | 0.4432  | 0.4197   | 0.3275    | -        | 0.5541     | 0.5939     | -          | 0.3846              | 0.3802     | -        |            |          |            |           |       |       |       |                     |         |         |         |        |        |        |        |       |      |

| Dependent variable: |            |           |         |          |           |          |            |            |            | Dependent variable: |             |           |           |         |           |           |       |       |       | Dependent variable: |         |         |         |        |        |        |        |       |      |
|---------------------|------------|-----------|---------|----------|-----------|----------|------------|------------|------------|---------------------|-------------|-----------|-----------|---------|-----------|-----------|-------|-------|-------|---------------------|---------|---------|---------|--------|--------|--------|--------|-------|------|
| adgini              |            | wocov     |         | covPE    |           | adgini   |            | TSLs       |            | GMM                 |             | OLS       |           | TSLs    |           | GMM       |       | OLS   |       | TSLs                |         | cov     |         | adgini |        | wocov  |        | covPE |      |
| OLS                 | (1)        | OLS       | (2)     | OLS      | (3)       | OLS      | (4)        | OLS        | (5)        | OLS                 | (6)         | OLS       | (7)       | OLS     | (8)       | OLS       | (9)   | OLS   | (10)  | OLS                 | (11)    | OLS     | (13)    | OLS    | (14)   | OLS    | (15)   | OLS   | (16) |
| yes                 | yes        | yes       | yes     | yes      | yes       | yes      | yes        | yes        | yes        | yes                 | yes         | yes       | yes       | yes     | yes       | yes       | yes   | yes   | yes   | yes                 | yes     | yes     | yes     | yes    | yes    | yes    | yes    | yes   | yes  |
| controls            |            |           |         |          |           |          |            |            |            |                     |             |           |           |         |           |           |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| taxdec              | -13.882*** | -22.892** | -21.775 | -4.549*  | -8.363*** | -3.427*  | -14.904*** | -24.464*** | -13.107*** | -17.228***          | -23.5259*** | -6.735*** | -19.199** | -5.962  | -18.662** | -17.972** | -2.16 | -2.26 | -2.61 | 98 (17)             | 98 (17) | 98 (17) | 98 (17) | 0.3221 | 0.5039 | 0.5024 | 0.3507 |       |      |
| Obs.                | 18         | 18        | 13      | 244 (17) | 247 (17)  | 227 (17) | 244 (17)   | 247 (17)   | 227 (17)   | 184 (13)            | 187 (13)    | 172 (13)  | 98 (17)   | 98 (17) | 98 (17)   | 74 (13)   |       |       |       |                     |         |         |         |        |        |        |        |       |      |
| Adj. R <sup>2</sup> | 0.1810     | 0.1863    | 0.3943  | 0.4210   | 0.3287    | -        | 0.5665     | 0.5804     | -          | 0.4136              | 0.4146      | -         |           |         |           |           |       |       |       |                     |         |         |         |        |        |        |        |       |      |

Note: t-values are reported below the coefficients; \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively. Since the number of observations drops down building 3-year averages, yes# indicates regressions with less control variables (popgini, gdppe, unempl, global, social)







## Dresden Discussion Paper Series in Economics

- 01/08 **Hirte, Georg / Brunow, Stephan:** The Age Pattern of Human Capital and Regional Productivity
- 02/08 **Fuchs, Michaela / Weyh, Antje:** The Determinants of Job Creation and Destruction: Plant-level Evidence for Eastern and Western Germany
- 03/08 **Heinzel, Christoph:** Implications of Diverging Social and Private Discount Rates for Investments in the German Power Industry. A New Case for Nuclear Energy?
- 04/08 **Bieta, Volker / Broll, Udo / Siebe, Wilfried:** The Banking Firm: The Role of Signaling with Collaterals
- 05/08 **Felder, Stefan / Werblow, Andreas:** Do the Age Profiles of Health Care Expenditure Really Steepen over Time? New Evidence from Swiss Cantons
- 06/08 **Broll, Udo / Wahl, Jack E. / Wessel, Christoph:** Export Production, Hedging Exchange Rate Risk: The Duopoly Case
- 07/08 **Choi, Jay-Pil / Thum, Marcel:** The Economics of Political-Connected Firms
- 08/08 **Broll, Udo / Gilroy, B. Michael / Lukas, Elmar:** Export Production under Exchange Rate Uncertainty
- 09/08 **Broll, Udo / Schmidt, Christian W.:** The Effect of Exchange Rate Risk on US Foreign Direct Investment: An Empirical Analysis
- 10/08 **Lehmann-Waffenschmidt, B. Cornelia:** An Evolutionary Agent-Based Simulation Model for the Industry Lifecycle
- 11/08 **Mukherjee, Vivekananda / Ramani, Shyama V.:** R&D Cooperation, Asymmetrical Technological Capabilities and Rationale for Technology Parks
- 12/08 **Lehmann-Waffenschmidt, Marco / Roth, Gerhard / Thießen, Friedrich:** Die (innere) Logik des Entscheidens – Zur neurobiologischen Fundierung ökonomischer Entscheidungen
- 13/08 **Dopfer, Kurt:** Zur Neubestimmung von Geschichte und Theoriegeschichte in den Wirtschaftswissenschaften – Ko-evolution von Wirtschaftsbeobachtung und Wirtschaftswirklichkeit
- 14/08 **Lessmann, Christian / Markwardt, Gunther:** One Size fits all? Decentralization, Corruption, and the Monitoring of Bureaucrats
- 15/08 **Farzanegan, Mohammad Reza / Markwardt, Gunther:** The Effects of Oil Price Shocks on the Iranian Economy
- 16/08 **Fuchs, Michaela / Wohlrabe, Klaus:** Institutions, Trade and Integration: What can be expected within the enlarged EU?
- 01/09 **Broll, Udo / Egozcue, Martin / Wong, Wing-Keung:** Prospect Theory and Two Moment Model: the Firm under Price Uncertainty
- 02/09 **Broll, Udo / Eckwert, Bernhard:** Modelling Information and Hedging: the Exporting Firm
- 03/09 **Binswanger, Hans Christoph:** Die Wachstumsspirale in der Krise – Ansätze zu einem nachhaltigem Wachstum
- 04/09 **Brunow, Stefan / Hirte, Georg:** Regional Age Structure and Economic Growth: An Econometric Study for German Regions
- 05/09 **Broll, Udo / Kemnitz, Alexander / Mukherjee, Vivekananda:** Globalization and a Welfare Program for the Marginalized
- 06/09 **Tscharaktschiew, Stefan / Hirte, Georg:** An Urban General Equilibrium Model with Multiple Household Structures and Travel Mode Choice
- 07/09 **Tscharaktschiew, Stefan / Hirte, Georg:** How does the Household Structure Shape the Urban Economy?
- 08/09 **Lessmann, Christian:** Fiscal Decentralization and Regional Disparity: Evidence from Cross-section and Panel Data

