Regional Inequality and Decentralization – An Empirical Analysis

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Abstract

This paper analyzes the impact of political and fiscal decentralization on regional inequalities, using a unique data set which covers 54 countries at different stages of economic development. Cross-section and panel data estimations show that decentralization decreases regional inequalities in general. However, estimations using an interaction-variable approach imply that the effect depends on the level of economic development. While rich countries benefit from decentralization in that they achieve a more equal regional income distribution, decentralization may lead to higher regional inequalities in developing and emerging economies. The results point in the same direction for measures of fiscal and political decentralization, implying that autonomy in both decision making and fiscal authority are decisive in this context. Thus, when fostering decentralization in developing countries as proposed by international development agencies, the potential negative redistributional consequences should be taken into account.

JEL classification: H11; H77; R11
Keywords: Regional inequality, decentralization, panel data

1 Introduction

Income inequality is growing in many parts of the world, causing dissatisfaction and compromising political stability. The spatial dimension of inequality has attracted considerable policy interest, since regional disparities in economic activity, incomes, and social indicators foster overall income inequality. Besides being a determinant of interpersonal inequality, spatial inequality matters in that it is often an outcome of ethnic conflicts and a breeding ground for separatist tendencies [Kanbur and Venables (2005)]. Despite the obvious importance of regional inequality, few studies exist which analyze its causes systematically. The reason for the scarcity of research in this field is mainly the poor availability of regional data, which is necessary to analyze spatial inequality. Regional data is rare in particular for developing and emerging economies, so that the existing studies mainly focus on highly developed countries. Results of those studies are important to understand the driving forces of regional inequality, but are difficult to generalize. This paper contributes to the empirical literature on the determinants of spatial inequality by using a unique data set covering countries of all continents and all levels of economic development.

One issue that has received a lot of attention in the public debate as well as in the academic literature is the role of decentralization in regional inequalities. The major argument in the still-ongoing discussion is that decentralization enhances public sector efficiency [Oates (1972)], but can weaken inter-jurisdictional redistribution, causing a rise in regional inequality [Prud'homme (1995)]. Thus, a conflict between efficiency and redistribution might arise from decentralization. For many countries in the world this is an essential question, since there is a global trend of public sector decentralization [Watts (2008)]. Examples include highly developed countries such as Spain or Belgium as well as emerging economies such as Chile or Brazil. Decentralization and its effects are particularly relevant to developing countries, since the World Bank and other international agencies consider decentralization as an important element of their development strategy [Gopal (2008)].

The existing evidence on the redistributive consequences of decentralization is mixed. Some authors find an increasing effect of decentralization on regional inequality [see, e.g., Rodríguez-Pose and Gill (2004)], some authors find a decreasing effect [see, e.g., Lessmann (2009) or Ezcurra and Pascual (2008)], and some authors stress different effects for high- and low-income countries [see, e.g., Shankar and Shah (2003) or Rodríguez-Pose and Ezcurra (2010)]. Reasons for the contradictory results are the use of different country samples and observation periods, different measures of decentralization, and different estimation techniques. Hence, there is still demand for a comprehensive empirical study which uses a broader data set including countries of all stages of development, and which uses alternative measures of political and fiscal decentralization as well as adequate empirical methods. The aim of this paper is to fill this gap in the literature.

Consequently, the paper analyzes the determinants of regional inequalities, focussing on the influence of the federal structure. For this purpose, I have collected a unique data set of 54 countries at all stages of economic development, covering the period from 1980 to 2009. In the case of OECD

countries, data collection is quite easy, since the OECD Regional Statistics, EUROSTAT, and Cambridge Econometrics (CAMECON) provide regional data. In contrast, regional data for other countries is often not publicly available and was provided by national statistical offices or central banks on individual request. Most non-OECD countries in my data set are from South America and Asia. Using these regional data to calculate measures of regional inequalities, it turns out that inequalities are significantly higher in developing or emerging economies, and slightly rising within the observation period. The main finding of this analysis is, however, that political as well as fiscal decentralization decreases regional inequality. Moreover, interaction models show that the relationship between decentralization and regional inequality depends on the level of economic development. While decentralization tends to increase regional inequality in poorer countries, it decreases it in richer ones. The findings have important implications for the design of federal systems in developed as well as developing countries. Several observers suspect increasing regional inequalities in decentralizing countries and demand the implementation of interregional transfer schemes. This study shows that this effect should not necessarily be a concern in highly developed countries, since decentralization decreases regional inequalities. Decentralization initiatives in poor countries, however, should take the potential negative redistributional effects into account.

The remainder of the paper is organized as follows: Section 2 presents the unique data set on regional inequality. Section 3 discusses the theoretical framework for the impact of decentralization on regional inequality and summarizes the existing empirical studies. Section 4 presents the econometric analysis. Finally, Section 5 sums up the results and concludes.

2 Regional inequality around the world

The essential requirement for empirical research on regional inequality is to get reliable regional data. For comparative studies one needs regional economic or social accounts at a widely homogeneous territorial level for countries at all levels of economic development. The OECD Regional Statistics, EUROSTAT, or CAMECON provide such data since the 1980s or 1990s. However, data on developing or emerging economies is scarce and cannot be accessed through one single database. For this study, the data was collected from several national statistical offices or central banks. But even if regional data is available, measurement of regional inequality is difficult. Following Lessmann (2009), three different decisions arise: the choice of an appropriate economic indicator, the territorial level to be applied, and an applicable concentration measure. For my empirical investigation, I follow Rodríguez-Pose and Gill (2004), Ezcurra and Pascual (2008), Lessmann (2009), and Rodríguez-Pose and Ezcurra (2010) in using the regional GDP per capita (p.c.) as a starting point for the calculation of disparity measures. The territorial bases are large regions (TL2) in the OECD Regional Statistics (e.g., Australia), NUTS2 regions in countries covered by EUROSTAT and CAMECON (all EU members), and state/province-level data otherwise (India, Brazil, etc.).[1] Using these regional accounts, I have calculated the population-weighted coefficient of variation

[1] NUTS – Nomenclature of Territorial Units for Statistics. Note that I have used the NUTS3 territorial level in case of Latvia, Lithuania, and Malta, since NUTS2 level data is not provided.

(WCV) following the suggestions of Petrakos et al. (2005):

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

where $\bar{y}$ is the country's average GDP p.c., y_i is the GDP p.c. 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. I have also calculated the adjusted Gini coefficient and the coefficient of variation [see Lessmann (2009)]. All empirical results using those measures as dependent variable are available from the author upon request.[2] The new data set of regional inequalities considers 54 countries for the period 1980–2009. Note that the frequency of the data varies by country: in the case of the OECD countries the underlying panel is almost balanced, but there are quite large gaps in the data for some developing economies, as can be seen from Table A.1 in the appendix, which shows all data sources and periods available for each country. To illustrate the main results of my calculations, Table 1 presents means of WCV for the entire observation period. In Europe & Central Asia the country with the lowest

Table 1: Regional Inequalities around the world (1980-2009)

Country	WCV	Country	WCV	Country	WCV
Europe & Central Asia				*Latin America & Caribbean*	
Austria	0.22	Romania	0.32	Bolivia	0.25
Belgium	0.38	Russian Federation	0.36	Brazil	0.48
Bulgaria	0.26	Slovak Republic	0.37	Chile	0.35
Croatia	0.21	Slovenia	0.18	Colombia	0.43
Czech Republic	0.31	Spain	0.20	Mexico	0.55
Denmark	0.09	Sweden	0.13	Panama	0.46
Finland	0.13	Switzerland	0.13	Peru	0.42
France	0.26	Turkey	0.42	Average	0.42
Georgia	0.19	Ukraine	0.58	*East Asia & Pacific*	
Germany	0.17	United Kingdom	0.33	Australia	0.08
Greece	0.16	Average	0.29	China	0.50
Hungary	0.34			Indonesia	0.89
Ireland	0.13	*North America*		Japan	0.14
Italy	0.26	Canada	0.15	Korea, Rep. (South)	0.07
Kazakhstan	0.72	United States of America	0.17	Mongolia	0.67
Latvia	0.50	*Middle East & North Africa*		New Zealand	0.07
Lithuania	0.25	Iran, Islamic Rep.	0.56	Philippines	0.62
Netherlands	0.14	Malta	0.07	Thailand	0.88
Norway	0.22	*Sub-Sahara Africa*		Average	0.44
Poland	0.21	South Africa	0.41	*South Asia*	
Portugal	0.26	Tanzania	0.37	India	0.37

regional inequality based on the population-weighted coefficient of variation (WCV) is Denmark (0.09); the country with the highest regional inequality is Kazakhstan (0.72). Obviously, regional inequalities are higher in less-developed economies. Despite that, Belgium (0.38) and the United

[2] Note that the Theil index is not applicable for cross-section analysis with large variations in the number of sub-national units of the countries considered [see Hale (2003) for details.]

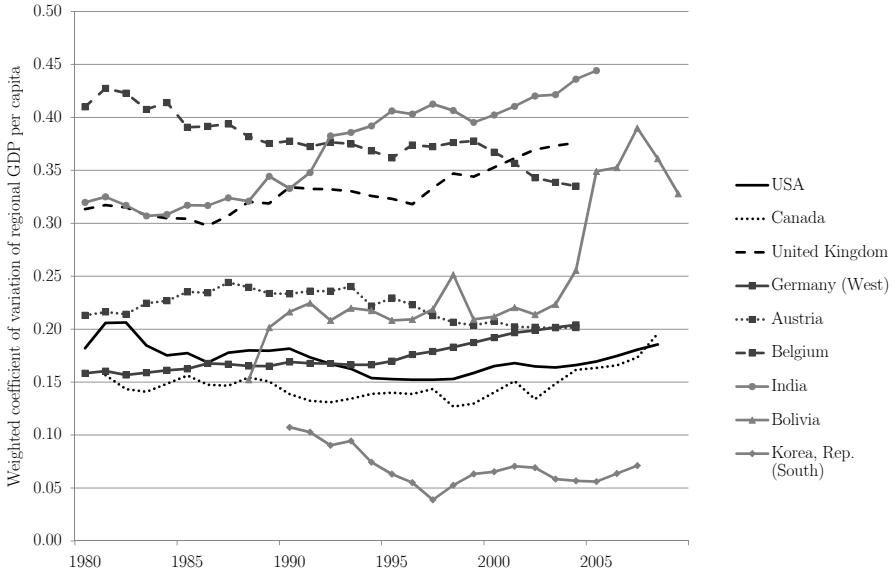

Figure 1: Trends in regional inequality 1980-2009

Kingdom (0.33) are rich countries with quite high regional disparities, implying that development is an important but not the only determinant. The unweighted average of countries in Europe & Central Asia is 0.29. Turning to the North American region, it is noticeable that Canada and the United States of America have regional inequalities which are smaller than those of the core European countries, although their level of economic development is similar. In the country groups Latin America and the Caribbean, the first observation is that inequalities are on average much higher than in Europe & Central Asia, supporting the aforementioned development-inequality hypothesis. Within the group East Asia & Pacific, there are large differences in regional inequality, which also can also be attributed to large differences in economic development. New Zealand and South Korea have an even smaller level of regional inequality than Denmark.

For an empirical analysis, it is also important to have data varying within countries over time. To get a first idea of the changes of regional inequality I have plotted WCV in Figure 1 for a sample of countries. I have chosen the United States of America and Canada as Anglo-American countries; the United Kingdom; Germany, Austria, and Belgium as core European countries; and India, Bolivia, and the Republic of Korea as representatives of other parts of the world. In the U.S. and Canada, we observe some variation over time, with high levels of regional inequality at the beginning of the observation period, followed by a decline in the 1990s, and rising inequalities since 2000. In the U.K., regional inequalities are almost consistently increasing. In Germany and Austria, the level of regional inequalities is similar, but inequalities are increasing in Germany and decreasing in Austria. Belgium faces high regional inequalities, which are decreasing over time. This is an interesting fact for the following discussion on decentralization and regional inequality, since Belgium faces at the same time a strong decentralization trend. India shows high and strongly

increasing regional inequality, and so does Bolivia, while South Korean equality has a stable level with high volatility. So far, we can say from the analysis that inequalities vary between countries as well as over time, which is important for the investigation of its determinants.

3 Decentralization and regional inequality

The previous section has given an overview on the main facts of regional inequality. As stressed in the introduction, regional inequalities are not just an outcome of geography or economic development, but are also affected by state interventions. In particular, the federal design of countries may play an important role in regional inequalities. In this section I discuss the theoretical background as well as existing empirical studies.

3.1 Theoretical background

A growing share of the global population, reaching nowadays about 40% [Watts (2008)], is living in federal countries. In this process, countries are not just decentralizing responsibilities and budgetary power to local levels of government, but are also shifting in the direction of political federalism by adopting (quasi)federal constitutions, as in the case of Spain and Belgium. A federation is formed as a system of sub-national units with free markets and some degree of political autonomy incorporated into one national entity. This organizational form has two main advantages: On the one hand, economic and social integration guarantee free trade and factor mobility to exploit the efficiency gains from common markets. On the other hand, decentralized decision making may improve the fit of local policies to the needs of a heterogeneous population with different regional tastes [Oates (1972)].

Besides these efficiency gains from decentralization, politicians and researchers are concerned about potential negative redistributive consequences, since "unfettered fiscal decentralization is likely to lead to a concentration of resources in a few geographical locations and thus increase fiscal disparities across sub-national governments" [Martinez-Vazquez and McNab (2003), p. 1605]. Several arguments are important here. According to Prud'homme (1995), fiscal decentralization weakens the budgetary power of the central government, thereby reducing the scope to redistribute resources from the richer to the poorer regions. At the same time, decentralization often involves fiscal competition, which may be at the expense of poor regions. Prud'homme argues that richer regions will have a larger tax base than poorer regions and will therefore either collect more taxes and provide more local public goods, or provide the same quantity and quality of public goods at lower tax rates. In any case, mobile factors will prefer richer jurisdictions, "enlarging the tax base and increasing the gap in income between regions" [Prud'homme (1995), p. 203]. Prud'homme concludes from his analysis that "decentralization can be the mother of segregation". As the study by Dowding and John (2008) shows, geographic mobility of households is not the only channel through which interregional competition is stimulated, but households may also turn to private provision of their needs if they are dissatisfied with local policies. This may also decrease the local

tax base, resulting again in a vicious circle, as proposed by Prud'homme.

Another issue concerning the relationship between decentralization and regional inequalities is the redistribution aspect. According to Oates (1972), sub-national governments have no suitable redistributive instruments. If sub-national governments raise taxes in order to equalize – say between individuals or between regions – such programs are not likely to succeed, because mobile factors can easily move to other jurisdictions, undermining the goals of such programs [Pauly (1973)]. Hence, if governments aim to equalize living standards across regions, the tax-transfer scheme should be implemented at a higher, centralized government level [Musgrave (1959)]. Regional inequality might also be a direct consequence of decentralization. In a standard Tiebout framework, decentralization implies that public goods provision is stratified due to the different preferences of a heterogeneous population [Tiebout (1956)]. Thus, "there is clearly a tension between pursuing goals of equality in service provision and greater decentralization and choice" [Besley and Ghatak (2003), p. 245].

Besides the potential negative redistributional effects of decentralization, there are also arguments for equity-promoting consequences, most of them related to enhanced efficiency of local public policies. Following the decentralization theorem, sub-national authorities can better provide the economically efficient quantity and quality of local public goods, since they are better informed about local needs [Oates (1972)]. This greater public efficiency at the local level might stimulate regional growth and convergence [Oates (1993)]. Based on this line of reasoning, Rodríguez-Pose and Ezcurra (2010) give an example of how decentralization may affect more- and less-developed regions of a country differently. The aim of sub-national governments is to mobilize local resources in order to promote allocative and productive efficiency, but the endogenous potential (or capacity) for using resources varies between regions. If we assume – in line with Barankay and Lockwood (2007) – that highly developed regions are closer to the efficiency frontier, then the margin of improvement will be greater in less-developed regions. "Under these circumstances, decentralization may be a catalyst for economic convergence"[Rodríguez-Pose and Ezcurra (2010), p. 624]. Moreover, decentralization gives sub-national governments the opportunity to actively pursue economic development policies which fit the strengths and weaknesses of their regions better than central government policies do. With a certain degree of sub-national autonomy, local officials get the opportunity to attract mobile capital to their particular regions, e.g., by granting tax privileges or offering other forms of assistance [Martinez-Vazquez and McNab (2003)]. Decentralization is also accompanied by inter-jurisdictional competition, forcing governments to represent citizen interests and to preserve markets, since competition acts as a disciplinary device to punish sub-national government officials for inappropriate market intervention [Weingast (1995), Qian and Weingast (1997)]. For example, local governments can be removed if they fail to achieve standards of wealth and growth comparable with those of the rest of the country, lest people "vote with their feet" instead. According to Qian and Weingast (1997), decentralization gives less-developed regions an important 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 competition can therefore reduce regional inequality without centrally-mandated

redistribution"[Qian & Weingast (1997), p. 87]. This view is supported by some anecdotal evidence of U.S. states. After the War of Secession, regional inequalities were high, since the defeated South had fallen far behind the North. But local growth-enhancing policies (e.g., providing more flexible labor market conditions) helped the poor South to catch up with the rich North, decreasing regional inequality [McKinnon (1997)]. The European Union as a confederation of member states provides, in Ireland, a somewhat similar example showing how important autonomy is for successful regional politics. During the 1990s Ireland converged rapidly toward core European economic prosperity, since it had the autonomy to levy much lower taxes. In fact, Ireland has not just approached, but overtaken the core of Europe. Baldwin and Krugman (2004) argue that the Irish autonomy in decision making was a crucial factor in overcoming the disadvantages caused by its peripheral location. Centralization or harmonization would have prevented this convergence process. The reversal of fortune in recent years after the global financial crisis may raise questions about the sustainability of the rapid growth of Ireland. The negative economic development since 2008 points at a correction of the Irish economy, but it seems unlikely that Ireland will lag badly behind the core in future. Altogether, the discussion shows that decentralization can strengthen regional growth and contribute to a more equal factor distribution.

The existing literature discusses the efficiency-enhancing effects of decentralization, which might also promote equality among regions. Recent studies, however, challenge efficiency gains from decentralization in developing countries. Tanzi (1996) discusses the effects of decentralization in developing countries, stressing that decentralization might cause coordination problems, excessive regulation, higher administrative costs or poor quality of local bureaucrats. Moreover, decentralization might increase corruption and cronyism in developing countries, undermining potential efficiency gains [Bardhan (2002), Lessmann and Markwardt (2010)]. Hence, while many of the assumptions that link decentralization to lower regional inequality may be valid for highly developed countries, this may not be the case in developing economies [Rodríguez-Pose and Ezcurra (2010)]. Another argument for development being decisive for the impact of decentralization on regional inequality is related to the higher redistributive capacity in rich countries. Rich countries may offset the negative redistributive consequences of decentralization through interregional redistribution policies, for which a high fiscal capacity is important.

Based on the theoretical discussion, the overall effect of decentralization on regional inequality is ambiguous: negative redistributional consequences may be offset by efficiency gains at the local level. The aim of the discussion of the theoretical literature was to show this ambiguity, which is related to the fact that there does not exist one single theoretical framework. Thus, the aim of the following sections is to investigate the relationship between decentralization and regional inequalities empirically. Moreover, the discussion suggests that the development stage might be important, since efficiency gains from decentralization are less likely in developing countries compared to industrial economies. The empirical analysis aims at testing this issue using interaction variables of decentralization and income.

3.2 Related empirical studies

Empirical literature on the relationship between decentralization and regional inequality is scarce and inconclusive. Existing studies can be grouped as single-country case studies, cross-country studies of highly developed countries, and cross-country studies using data on both highly developed and less-developed countries. Single-country studies are Kim et al. (2003) for Korea, Kanbur and Zhang (2005) and Qiao et al. (2008) for China, Silva (2005) for the Philippines, Bonet (2006) for Colombia, Akai and Hosio (2009) for the United States, and Calamai (2009) for Italy. In the Chinese case, decentralization has increased regional inequality, and a similar result was obtained for Colombia and the Philippines. In Korea the effect is ambiguous, but in the U.S. and Italy decentralization has decreased regional inequalities. Thus, country-level evidence is mixed, but the findings point at different effects for developed and developing countries, where developing countries experienced increasing regional inequalities in the decentralization process, while decentralization has contributed to regional convergence in high-income economies. This piece of evidence has to be tested in a broader data set, which is one of the major contributions of this paper. Concerning cross-country studies, Gil Canaleta et al. (2004), Ezcurra and Pascual (2008), and Lessmann (2009) analyze the impact of decentralization on regional inequalities based on OECD countries, finding regional inequalities decreasing in the degree of decentralization. Shankar and Shah (2003), Rodríguez-Pose and Gill (2004), and Rodríguez-Pose and Ezcurra (2010) also take some developing countries into account. Shankar and Shah (2003) find lower regional inequalities in federal countries, Rodríguez-Pose and Gill (2004) found a positive relationship between rising sub-national expenditure shares and increasing regional inequalities, and Rodríguez-Pose and Ezcurra (2010) provide some evidence of decentralization to increase regional inequality in developing countries, but no robust relationship for highly developed countries.

The overall mixed evidence can be attributed to differences in country samples, decentralization measures, and estimation methods. In the cross-section studies, the number of countries varies from 11 [Rodríguez-Pose and Gill (2004)] to 26 [Rodríguez-Pose and Ezcurra (2010)], which is too few to explain between-country differences in regional inequalities. Most studies use the degree of expenditure decentralization – defined as the share of sub-national expenditures in total government expenditures – as the decentralization measure, but only Lessmann (2009) and Rodríguez-Pose and Ezcurra (2010) take indicators into account which reflect the political autonomy of sub-national governments at least to a certain extent. Thus, some important arguments of the theoretical literature related to the decision-making autonomy of sub-national governments have only sparsely been tested. Concerning the estimation procedures, only the most recent cross-country studies by Ezcurra and Pascual (2008), Lessmann (2009), and Rodríguez-Pose and Ezcurra (2010) make use of panel data, which has several advantages. In particular the inclusion of country fixed effects allows consideration of unobserved heterogeneity between countries, which is very likely to be important for regional inequalities due to geographic, political, or ethnic differences. However, these studies suffer also from a serious problem which may be caused by endogeneity [see section 4.3 for details]. (Central) governments might react to changes in regional inequalities with changes

in the federal structure. Thus, decentralization has to be treated as an endogenous regressor, which is difficult in small country samples. The aforementioned panel data studies use lagged decentralization measures as instruments for contemporary levels of decentralization, which is quite problematic, since decentralization is in many countries a persistent phenomenon, so that decentralization measures do not vary much over time. The problem with the endogeneity bias is that the endogenous variable is correlated with the error term, violating the iid assumption. If one uses the lagged value of a decentralization measure as instrument for the current value, the instrument will also be highly correlated with the error, and therefore the endogeneity bias is still present. The underlying data set of my analysis considers more than twice as many countries as the existing literature, so that there is much more cross-country variation in the data, making it easier to find appropriate instrumental variables. To sum up, this paper aims to overcome the shortcomings of the existing literature by using a much larger data set, which includes a number of middle- and low-income countries. I use various measures reflecting political and fiscal decentralization, and I consider some more appropriate econometric methods.

4 Empirical analysis

4.1 Data and methodology

Before explaining the methodology and the results of the regression analysis, let me first introduce the data. Two groups of variables are particularly important for this study: measures of regional inequality and decentralization measures. The first have been discussed in detail in section 2, so it remains to present the decentralization variables. The theoretical discussion showed that the particular federal design matters for the relationship between decentralization and regional inequality. Several measurement concepts are used in the literature to find appropriate approximations [see, e.g., Treisman (2002) and Rodden (2004)]. In general, decentralization is viewed as the devolution of authority towards sub-national governments, with total government authority over society and economy perceived as fixed. Attempts to define and measure decentralization have focussed on fiscal authority rather than political autonomy. In our context, I am interested in both issues, since the degree of local autonomy should be important.

Decentralization measures reflecting fiscal authority can be approximated by using measures of fiscal decentralization, which can be calculated from the IMF Government Finance Statistics. Those measures include the degree of expenditure decentralization ($EXPDEC$) and the degree of revenue decentralization ($REVDEC$), which relate expenditures (revenues) of sub-national governments to total government expenditures (revenues). Both measures are commonly used in the decentralization literature. However, those indicators do not necessarily reflect sub-national government autonomy in decision-making, since the central government may also determine spending at the local level through its own legislation. To capture these effects, a commonly used measure based on budgetary accounts is the so-called vertical imbalance ($VIMB$). This measure relates central government transfers to sub-national government expenditures, and is therefore a measure

of the transfer dependence of sub-national governments. Note that a high value of this measure indicates little local financial autonomy, while all other decentralization measures are defined such that a high value represents a high degree of decentralization. The vertical imbalance measure is in particular interesting in our context, since it also reflects to some extent the importance of inter-governmental transfers, which often redistribute between regions in order to equalize living standards and to reduce regional inequalities. A last measure of fiscal decentralization is the degree of tax decentralization, which relates the tax revenues of sub-national governments to total government revenues ($TAXDEC$). It represents an alternative fiscal indicator of sub-national governments' financial autonomy, incorporating the degree of inter-jurisdictional competition. Note, however, that all these measures are imperfect in that they do not reflect the political dimension of the underlying decision-making process [see, e.g., Ebel and Yilmaz (2002) and Schakel (2008)]. Assume for example that the central government shifts the responsibility for a particular task to lower levels of government and it provides the necessary financial assistance by a corresponding matching grant. In this case a decentralization index based on budgetary accounts might indicate a high degree of decentralization, although sub-national governments have no autonomy in decision-making. Decentralization measures taking account of this problem were developed by Rodden (2004) and Stegarescu (2005), but are not applicable here, since they only cover OECD countries.[3] Note that all decentralization measures are only available until 1998, since there was reorganization in the IMF statistics in 2001. More recent data is not comparable to the long-time-series data used for this analysis.

To capture the dimension of political decentralization I refer mainly to decentralization measures provided by Daniel Treisman [see Treisman (2008)]. A first measure of political decentralization is a dummy variable for those countries which have a federal constitution ($FEDERAL$).[4] A decentralization measure reflecting the vertical fragmentation of governments is the number of vertical government tiers ($TIERS$), which ranges from 1 to 6. Most OECD countries have 3 or 4 levels of government according to this indicator. The theoretical literature on decentralization and regional inequality stresses sub-national governments' efficiency, which may increase with the degree of local autonomy. For this purpose, Treisman created several dummy variables based on the constitutions of countries. A sub-national legislature is said to have *residual authority* if the constitution assigns to it the exclusive right to legislate on issues that are not specifically assigned to one level of government ($RESID$). Another measure captures the *autonomy* of a sub-national legislature. It is said to exist if the constitution reserves exclusive decision-making power on any specific task ($AUTON$). I also combine those two measures into a joint indicator of sub-national autonomy ($AUTRES$). Treisman also provides data on local elections (*electoral decentralization*), which is important in making electoral accountability arguments. One measure is a dummy variable which

[3] See Lessmann (2009) for an empirical analysis of decentralization and regional inequality using those decentralization measures.

[4] A country has to fulfil the following criteria to be counted as a federal country: It must have at least two levels of government, which share parts of the executive and legislative authority; sub-national governments have a representation in the federal parliament (second chamber); there is a duty to obtain their consent on constitutional amendments; a constitutional jurisdiction solves disputes between organs of state; institutions foster collaboration [see Watts (2008)].

becomes one if there are elections at the lowest government level ($BOTEL$); a second measure is again a dummy variable, which is one if there are elections at the second lowest government level ($SECEL$). I combine these measures into a new dummy variable indicating whether there are elections at any sub-national level of government or not ($BOSEC$). The last measure of political decentralization comes from Hooghe et al. (2010). This so-called *regional authority index* (RAI) is a measure of the political and fiscal authority of regional governments and is derived from rankings in eight sub-categories: institutional depth, policy scope, fiscal autonomy, representation, lawmaking, executive control, fiscal control, and constitutional reform. See Schakel (2008) for a detailed comparison of the different decentralization measures used in the literature.

Beside measures of fiscal and political decentralization, I use the share of sub-national government employment in total government employment as a further decentralization indicator ($EMPLDEC$), which cannot be assigned to either of the preceding two categories. The data for that is also provided by Treisman (2008). In this case, the analysis is purely exploratory, since there is no theoretical prediction concerning the impact of public sector employment decentralization on regional inequality. Data sources and definitions of all considered variables are provided in Table A.2 in the appendix.

4.2 Estimation design

The empirical analysis of this study is carried out in three steps. The first step is to relate the decentralization measures to regional inequality in a cross-section of countries, using long-period averages from 1980 to 2009. The basic empirical model has the following form:

$$WCV_i = \alpha + \sum_{j=1}^{k} \beta_j CONTROL_{j,i} + \gamma DEC_i + \epsilon_i. \tag{2}$$

WCV_i reflects my measure of regional inequality in country i, α is a constant, $CONTROL_{j,i}$ are k exogenous control variables affecting inequality, DEC_i represents one of the various decentralization measures, and ϵ_i is a random error term. Note that all decentralization measures enter equation (2) separately. One might also combine different measures of political decentralization with measures of fiscal (or other kinds) of decentralization, since there might occur interaction effects on regional inequality. For instance, political autonomy may be more effective when accompanied by fiscal autonomy. This would, however, strongly increase the number of regressions to be performed (14 different decentralization measures), and is thus beyond the scope of this paper, but may be a fruitful avenue for future research. Admittedly, the federal dummy and the regional authority index consider aspects of both-political and fiscal decentralization. The baseline results provide us a first impression of how decentralization might impact disparities. Since countries might react with a change in the level of decentralization in response to increasing or decreasing disparities, I also treat decentralization as an endogenous regressor to incorporate a potential endogeneity bias. Thereby, I refer to a cross-section of countries instead of panel data, since the major determinants of decentralization are time-invariant factors. The second step of the analysis

is to estimate panel data models, where the estimation equation takes the form

$$WCV_{i,t} = \alpha_i + \sum_{j=1}^{k} \beta_j CONTROL_{j,i,t} + \gamma DEC_{i,t} + \mu_t + \epsilon_{i,t}. \quad (3)$$

In the case of the time-varying measures of fiscal decentralization I include country fixed effects (α_i), but for the others I use random effects (time-indexed by t). The regressions use the original annual frequency of the data as well as 5-year period averages. The third step of the analysis is to investigate whether the level of economic development has an effect on the relationship between decentralization and regional inequality. For this purpose, I estimate a panel data model using interaction variables of decentralization and the log of the GDP per capita ($GDPPC$):

$$WCV_{i,t} = \alpha_i + \sum_{j=1}^{k} \beta_j CONTROL_{j,i,t} + \gamma_1 DEC_{i,t} + \gamma_2 DEC_{i,t} \times GDPPC_{i,t} + \mu_t + \epsilon_{i,t}. \quad (4)$$

Note that the GDP per capita and its square also enter the regression as controls; therefore the interaction model is fully specified [Brambor et al. (2006)]. The estimations are again based on random effects and fixed effects models using annual data as well as period averages.

The set of control variables is the same in all specifications. One idea which can be derived from a look at the data (see section 2) is a potential link between regional inequality and economic development. Kuznets (1955) and Williamson (1965) provide a detailed discussion. In his seminal paper, Kuznets conjectured that as countries develop from farm-based economies to industrial economies, income inequality first increases, then peaks, and then decreases. Thus, the trajectory of this relationship has an inverted U shape – what we now call the *Kuznets curve*. Williamson has adopted this idea for the case of interregional inequality. He argues that industrialization was driven by the discovery and utilization of natural resources such as coal or iron. Since those natural resources are normally not equally distributed within countries, economic prosperity in the industrialization process is also unequally distributed, and therefore regional inequalities rise in this process. Later, the more attractive employment opportunities in the booming regions attract workers from abroad, depressing wages in the settled regions but increasing wages in the home regions. Thus, a natural convergence process starts in which regional inequality falls, leading again to an inverted-U relationship. To test this theory, I control for the log of the GDP per capita ($GDPPC$) as well as its square ($GDPPC^2$). Moreover, I control for the number of regions which have been used to calculate the inequality measures ($UNITS$), since the territorial level is not always comparable over all countries considered. Controlling for the number of regions should compensate any measurement error caused by heterogeneity (see section 2 for details).[5] In addition, I control for the size of a country, considered as the log of the area in square kilometers ($AREA$), which might also affect regional inequality. Related studies such as Lessmann (2009) have shown that the unemployment ratio ($UNEMPL$) causes regional inequalities, so I also control for this. Since Rodriguez-Pose and Gill (2006) and others propose an effect of international trade on regional disparities, I control for the sum of imports and exports as a share of the GDP ($OPENNESS$). A

[5] I have also experimented with average size of regions (number of units divided by area) and other indicators for fragmentation, but the number of units turned out to be the most important determinant.

particularly important determinant of regional economic inequality may be the heterogeneity of the population living in the different parts of a country. The different regions are often inhabited by different ethnic groups. Examples include Belgium with the Dutch-speaking Flemings living in the northern part and the French-speaking Walloons in the south, or India with the Indo-Aryans in the north and Dravidians in the south. The ethnic diversity may result in ethnic discrimination or conflict, promoting the divergence of regions. Thus, I control for the degree of ethnolinguistic fractionalization ($ETHNO$) as calculated by Alesina et al. (2003). To capture agglomeration effects, I also control for the urban share of population ($URBAN$). I have also tested the effect of government size on regional inequalities as suggested by Rodríguez-Pose and Ezcurra (2010), but the results have been consistently insignificant. A more detailed discussion of the control variables used in the literature can be found in Lessmann (2009).

4.3 Cross-section results

In this section I present the baseline results from OLS regressions. I use long-period averages of all variables for 54 countries, covering the period from 1980 to 2009. The results are presented in Table 2.[6] The different specifications suggest a negative impact of decentralization on regional inequality. Most decentralization variables have a negative coefficient, which is statistically significant from zero for the federal dummy (column 1), the degree of expenditure decentralization (column 9), and the degree of revenue decentralization (column 10). The regression results do not point at systematical differences between measures of political and fiscal decentralization, which instead seem to affect regional inequality in the same direction. The regressions explain around 70% of the variation in regional inequalities between countries, as indicated by the adjusted R-squared.

Interestingly, my selection of control variables supports the theoretical findings concerning the inverted-U relationship between regional inequality and economic development. Moreover, fragmentation is positively correlated with regional inequality, as is geographical size. Countries with high levels of unemployment face lower regional inequality. A possible explanation for this somewhat counterintuitive result is unemployment insurance: This social insurance – as it exists in most countries considered – redistributes indirectly between rich and poor regions, so that inequalities fall. A similar result is found by Kaufman et al. (2003) for Canadian provinces. More-open economies have higher regional inequalities, and also, more-heterogeneous countries as reflected by the degree of ethnolinguistic fractionalization are more heterogeneous in regional economic activity. Finally, I find countries with a higher urban share of population to have lower regional inequality.

4.4 Endogeneity

The baseline findings are, however, just a first step of this analysis, since endogeneity might bias the estimates. Different channels are important here. Assume, for example, that a federal government

[6] Robustness tests using the coefficient of variation and the Gini coefficient as dependent variables support the general findings. These results can be obtained from the working paper version [see Lessmann (2011)].

Table 2: Cross-section results

	Dependent variable: Weighted coefficient of variation of regional GDP p.c., 1980–2009													
	Political decentralization								Fiscal decentralization					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
GDPPC	0.591**	0.697**	0.477*	0.534**	0.481*	0.639**	0.486**	0.491**	0.147	0.226	0.450	0.509*	0.765**	0.001
	(2.68)	(2.64)	(1.84)	(2.10)	(1.99)	(2.34)	(2.14)	(2.12)	(0.52)	(0.84)	(1.52)	(1.76)	(2.49)	(0.00)
$(GDPPC)^2$	−0.036***	−0.043***	−0.030**	−0.034**	−0.030**	−0.040**	−0.032**	−0.032**	−0.011	−0.016	−0.030*	−0.034**	−0.047**	−0.003
	(−2.87)	(−2.87)	(−2.03)	(−2.33)	(−2.19)	(−2.59)	(−2.44)	(−2.43)	(−0.70)	(−1.04)	(−1.80)	(−2.05)	(−2.64)	(−0.16)
UNITS	0.114***	0.105***	0.112***	0.119***	0.117***	0.107***	0.111***	0.109***	0.095***	0.091***	0.099***	0.093***	0.115***	0.079***
	(4.83)	(3.76)	(4.06)	(4.51)	(4.31)	(4.11)	(4.45)	(4.32)	(3.58)	(3.57)	(4.06)	(4.04)	(3.58)	(3.78)
AREA	0.038***	0.026*	0.027*	0.028*	0.031**	0.029**	0.027*	0.026*	0.033*	0.037**	0.019	0.020	0.032**	0.007
	(2.88)	(1.96)	(1.85)	(1.83)	(2.15)	(2.19)	(1.96)	(1.91)	(1.85)	(2.07)	(1.18)	(1.28)	(2.23)	(0.58)
UNEMPL	−0.013**	−0.011**	−0.010**	−0.015***	−0.011**	−0.013**	−0.009*	−0.009*	−0.010*	−0.012**	−0.012**	−0.012**	−0.013*	−0.004
	(−2.44)	(−2.35)	(−2.10)	(−2.80)	(−2.10)	(−2.33)	(−1.80)	(−1.79)	(−2.01)	(−2.46)	(−2.14)	(−2.36)	(−1.96)	(−0.90)
OPENNESS	0.003***	0.003***	0.003***	0.003***	0.003***	0.002***	0.002***	0.002***	0.003***	0.003***	0.003***	0.003***	0.003***	0.001*
	(3.95)	(3.25)	(3.32)	(3.43)	(3.53)	(2.96)	(3.20)	(2.95)	(2.96)	(3.06)	(3.11)	(3.23)	(3.35)	(1.76)
ETHNIC	0.248**	0.220**	0.254**	0.234**	0.272**	0.147	0.106	0.110	0.204**	0.217**	0.221**	0.230**	0.210*	0.102
	(2.40)	(2.22)	(2.25)	(2.03)	(2.51)	(1.39)	(1.09)	(1.14)	(2.37)	(2.59)	(2.21)	(2.40)	(1.71)	(0.83)
URBAN	−0.003**	−0.004**	−0.004**	−0.004**	−0.004**	−0.004**	−0.003*	−0.003*	−0.003	−0.003*	−0.003	−0.003	−0.004**	−0.001
	(−2.11)	(−2.54)	(−2.55)	(−2.44)	(−2.63)	(−2.57)	(−1.89)	(−1.81)	(−1.60)	(−1.75)	(−1.48)	(−1.58)	(−2.69)	(−0.74)
FEDERAL	−0.088**													
	(−2.67)													
TIERS		0.009												
		(0.29)												
AUTON			−0.028											
			(−0.54)											
RESID				−0.030										
				(−0.66)										
AUTRES					−0.056									
					(−1.48)									
BOTEL						−0.011								
						(−0.16)								
SECEL							0.012							
							(0.36)							
BOSEC								0.001						
								(0.01)						
EXPDEC									−0.365**					
									(−2.16)					
REVDEC										−0.411**				
										(−2.57)				
TAXDEC											−0.068			
											(−0.68)			
VIMB												0.148		
												(1.42)		
EMPLDEC													−0.039	
													(−0.37)	
RAI														−0.002
														(−0.49)
Constant	−2.742***	−2.970**	−2.061*	−2.306*	−2.168*	−2.616**	−2.037*	−2.041*	−0.629	−1.004	−1.702	−2.032	−3.296**	0.277
	(−2.78)	(−2.49)	(−1.69)	(−1.87)	(−1.90)	(−2.13)	(−1.96)	(−1.92)	(−0.47)	(−0.77)	(−1.23)	(−1.50)	(−2.46)	(0.16)
Obs.	54	53	50	50	51	49	47	47	47	47	47	47	44	34
Adj. R^2	0.69	0.65	0.67	0.69	0.69	0.65	0.62	0.62	0.71	0.72	0.68	0.69	0.63	0.38

Note: t-values are reported in parentheses; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

faces increasing regional inequalities. This might cause the government to centralize the budget in order to have more scope for redistributive policies. Of course, also the opposite reaction might occur, if the central government believes that decentralized decisions are necessary for regional convergence. That's one possible reason for measures of fiscal decentralization being endogenous. Another reason can be a mechanical association of measures of regional inequality and measures of fiscal decentralization caused by the normal business cycle, which is in particular important for panel analysis focussing on within-country variation. Consider a federation consisting of two jurisdictions, a rich region and a poor region. Suppose further that the sub-national governments associated with the two regions finance their expenditures mainly through flat taxes on property, but the central government has a progressive tax structure under which income in the rich region faces a higher marginal tax rate than does income in the poor region. What happens in this model if the rich region – for example, due to a local industry that depends to a larger extent on exports, in contrast to the industry of the poor region – has lower growth rates in the recession phases of the business cycle than the poor region? The answer is that regional inequalities decrease in times of recession, but also the degree of fiscal decentralization changes. Sub-national revenues are unchanged (given equal tax rates on property), yet federal revenues fall, given that the income in the rich region is taxed at a lower rate now. If this happens, we should observe an increase of the degree of revenue decentralization as a result of the business cycle, which also affects regional inequalities. This is for example the case in Germany, where the eastern part of the country has much less volatile growth rates and government revenues while the western states are richer at the cost of higher volatility. Thus, decentralization – in particular, measures of fiscal decentralization – have to be treated as endogenous variables.

I provide different approaches to reduce the potential endogeneity bias. The first is to use cross-country data with long-period averages, since the mechanical association of regional inequality and decentralization measures is less important in regressions using between-country variations than in those using panel regressions, which focus on the within-country variation. This empirical strategy was not an option in the existing literature, since the underlying data sets – with a maximum number of 26 countries – are too small for reliable cross-section estimations. The findings aim at a negative impact of decentralization on regional inequality, as discussed above. The second approach uses instrumental variable (IV) regressions in a two-stage least squares (TSLS) procedure using exogenous determinants of decentralization measures. Again this is possible due to the higher number of observations in my data set. Finally, the third approach is to apply panel estimations with long-period averages, considering country fixed effects (if possible).

IV regressions are quite difficult in this context, since I need exogenous determinants of decentralization, which are independent of the level of regional inequalities. Standard instruments for decentralization as used in the literature are the size of a country and the degree of ethnolinguistic fractionalization [see, e.g., Wasylenko (1987), Arikan (2004), or Lessmann and Markwardt (2010)]. However, these instruments are not applicable in my context, since they are linked to regional inequality through other channels than decentralization. Therefore, I propose several new instruments for the different measures of decentralization, which are related to the institutional structure,

colonial origin, and the composition of the society. Note that I use different sets of instruments for the different decentralization measures, depending on the first-stage regression diagnostics.

One of the instrumental variables is the share of the population that speaks a major European language (*LANG*). This variable reflects the influence of western European countries [Hall and Jones (1999)], which I expect to be positively correlated with decentralization. Historically, the federal idea dates back to the *Alte Eidgenossenschaft* in Switzerland (1291–1798) and can be seen as a European invention which diffused all over the world through colonial activities and settlers [Acemoglu et al. (2002)]. Thus, countries with a historical link to western Europe are expected to have a higher degree of decentralization. Also, the level of and experience with democracy are an important determinant of the federal structure of a country. To get a better representation of local tastes in politics, democratic countries have organized the government in smaller units, implying an increase in the degree of (political) decentralization. Therefore, I use different indicators of democracy as instrument, including the number of years of democracy since 1800 (*DEMO18*), the democracy index of the Polity2 data set (*DEMO*), the overall Polity2 index (*POL2*), and the number of years of uninterrupted democracy since 1950 (*IDEMO*). Moreover, the existence of a common or civil law system might be a useful instrument. A common law system – as it exists in the U.S. or the UK – can be seen as a kind of decentralized structure, where local courts decide on legal issues that become common law for the whole federation in the process of adjudication, whereas the civil law is developed at a central level. Therefore, I use a dummy variable for a common law (*LAW*) system as further instrument for decentralization. Related to this idea is the use of the legal origin of a country as instrument [Porta et al. (2008)]. Those countries which have a German legal origin (*LEGOR*) are expected to be more decentralized. The last instrument is the share of Protestants in the total population (*PTANTS*). The Protestant churches are less hierarchically structured than other denominations, they promote individualism, and they support the protection of minorities [Treisman (2000)]. These values and norms are reflected by the society and encourage decentralization, which is a well-suited government structure to realize these fundamentals. In contrast, the Catholic Church and Islam have a hierarchical, centralized structure with one or few religious leaders at the head – the pope or the mufti. This structure carries over to social and governmental organization. Thus, I expect countries with a high share of Protestants to be more decentralized. The validity of this instrument is also supported by Strumpf and Oberholzer-Gee (2002), who show that US states with more heterogeneous societies have a higher degree of decentralization. The results of the IV estimations, where I make use of the different instruments case by case, are presented in Table 3.

The upper part of the table presents the results of the second-stage regressions, comparable to the results reported in Table 2 above; the lower part reports first-stage regression diagnostics and the considered instruments. As the second-stage regression results show, the coefficients of the different measures of political and fiscal decentralization are negative and statistically significant at conventional confidence levels in several cases. Interestingly, considering a potential endogeneity bias yields stronger results in support of a decreasing effect of decentralization on regional inequality than do the baseline regressions. In the IV regressions also, several indicators of polit-

Table 3: Cross-section results using the IV approach

	Dependent variable: Weighted coefficient of variation of regional GDP p.c., 1980–2009													
	Political decentralization								Fiscal decentralization					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
GDPPC	0.586**	0.423	0.173	0.877	0.345	0.735**	0.621	0.594*	0.178	0.296	0.516*	0.623**	0.867***	0.246
	(2.55)	(0.89)	(0.61)	(1.40)	(1.38)	(2.28)	(1.57)	(1.80)	(0.58)	(1.03)	(1.90)	(2.39)	(2.62)	(0.62)
$(GDPPC)^2$	−0.035***	−0.029	−0.011	−0.049	−0.020	−0.046**	−0.040*	−0.038**	−0.014	−0.021	−0.035**	−0.041***	−0.052***	−0.019
	(−2.66)	(−1.09)	(−0.69)	(−1.41)	(−1.39)	(−2.57)	(−1.79)	(−2.09)	(−0.74)	(−1.24)	(−2.25)	(−2.73)	(−2.76)	(−0.85)
UNITS	−0.015***	−0.016*	−0.006	−0.029	−0.008	−0.013*	−0.011	−0.009	−0.010**	−0.012**	−0.014*	−0.016**	−0.013*	−0.006*
	(−2.61)	(−1.74)	(−0.81)	(−1.14)	(−1.06)	(−1.71)	(−1.10)	(−1.14)	(−1.98)	(−2.33)	(−1.93)	(−2.39)	(−1.82)	(−1.71)
AREA	0.003***	0.003*	0.002*	0.004*	0.003**	0.001	0.001	0.001	0.002***	0.002***	0.002***	0.002**	0.003*	0.001
	(2.92)	(1.83)	(1.70)	(1.67)	(2.52)	(1.01)	(0.44)	(0.60)	(2.67)	(2.77)	(2.81)	(2.50)	(1.94)	(0.77)
UNEMPL	0.331***	0.250*	0.428***	0.638	0.429***	0.004	0.177	0.060	0.194**	0.211***	0.225**	0.251***	0.158	0.051
	(2.73)	(1.76)	(2.79)	(1.33)	(2.64)	(0.03)	(1.11)	(0.47)	(2.54)	(2.77)	(2.28)	(2.67)	(1.34)	(0.48)
OPENNESS	0.008***	0.011*	0.006	0.016	0.008***	0.006***	0.007***	0.007***	0.006***	0.006***	0.006***	0.005**	0.009***	0.004**
	(3.21)	(1.94)	(1.54)	(1.32)	(2.72)	(2.61)	(2.61)	(2.90)	(2.65)	(2.89)	(2.80)	(2.52)	(2.91)	(2.55)
ETHNIC	−0.003	−0.007	−0.003	0.001	−0.004*	−0.005**	−0.001	−0.002	−0.003*	−0.003*	−0.002	−0.002	−0.004**	0.001
	(−1.52)	(−1.52)	(−1.62)	(0.21)	(−1.75)	(−2.27)	(−0.10)	(−0.91)	(−1.68)	(−1.72)	(−1.28)	(−1.12)	(−2.04)	(0.15)
URBAN	0.033*	0.016	0.024	0.046	0.046**	0.023	0.014	0.014	0.022	0.019	0.012	0.014	0.032*	−0.020*
	(1.90)	(0.90)	(1.51)	(0.73)	(2.00)	(1.36)	(0.72)	(0.80)	(1.39)	(1.32)	(0.79)	(1.00)	(1.71)	(−1.85)
FEDERAL	−0.217**													
	(−2.47)													
TIERS		−0.205												
		(−0.90)												
AUTON			−0.282*											
			(−1.80)											
RESID				−0.908										
				(−1.01)										
AUTRES					−0.306*									
					(−1.92)									
BOTEL						−0.323**								
						(−2.32)								
SECEL							−0.315*							
							(−1.74)							
BOSEC								−0.169**						
								(−2.50)						
EXPDEC									−0.373*					
									(−1.84)					
REVDEC										−0.319*				
										(−1.72)				
TAXDEC											−0.212			
											(−0.84)			
VIMB												0.391		
												(1.53)		
EMPLDEC													−0.372*	
													(−1.78)	
RAI														0.002
														(0.45)
Constant	−2.528**	−0.451	−0.653	−4.487	−1.797	−2.269	−2.136	−1.831	−0.395	−0.862	−1.620	−2.318*	−3.428**	−0.260
	(−2.55)	(−0.16)	(−0.51)	(−1.33)	(−1.53)	(−1.57)	(−1.28)	(−1.26)	(−0.30)	(−0.69)	(−1.35)	(−1.96)	(−2.41)	(−0.15)
Obs.	45	45	48	48	49	48	46	46	41	41	41	41	37	28
Adj. R^2	0.543	0.229	0.323	0.316	0.324	0.406	0.113	0.284	0.691	0.701	0.629	0.625	0.457	0.340
First-stage regression diagnostics														
A.P. F-statistic	5.81	0.74	7.54	0.72	4.24	5.61	1.90	4.92	14.19	16.23	2.63	2.74	3.08	3.68
Prob > F	0.00	0.48	0.01	0.40	0.05	0.01	0.16	0.01	0.00	0.00	0.07	0.06	0.04	0.05
Partial R^2	0.27	0.04	0.10	0.01	0.07	0.16	0.08	0.15	0.45	0.53	0.14	0.13	0.27	0.28
Hansen J	0.03	0.26	0.00	0.00	0.00	0.00	0.17	0.24	3.55	3.90	3.99	2.29	2.19	1.39
Hansen J (p)	0.98	0.61	–	–	–	0.99	0.68	0.62	0.17	0.14	0.14	0.32	0.53	0.24
Excluded instruments	LANG LEGOR DEMO	LANG DEMO18	DEMO	DEMO	DEMO	LAW POL2	LAW POL2	LAW POL2	LEGOR POL2 LANG	LEGOR POL2 LANG	LEGOR POL2 LANG	LEGOR POL2 LANG	LEGOR PTANTS LANG IDEMO	LANG DEMO18

Note: t-values are reported in parentheses; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

ical decentralization (*AUTON*, *AUTRES*, *BOTEL*, *SECEL*, and *BOSEC*) and the degree of public sector employment decentralization (*EMPLDEC*) turn out to have a significant negative effect. Turning to the first-stage regression diagnostics, the Angrisk–Pischke multivariate F-test of excluded instruments, which is a test of underidentification or of weak identification, indicates that the instruments are meaningful ($F > 10$) for the degree of expenditure decentralization (column 9) and for the degree of revenue decentralization (column 10). In the case of the indicator of subnational government autonomy (column 3), the F-statistic is close to 10; in the case of the federal dummy (column 1) and the indicator of bottom-tier elections (column 6), it is larger than 5, so that we can trust the instruments at least to some extent. The other regressions might suffer from a weak instrument bias. Nevertheless, the IV regressions support the result of a negative impact of decentralization on regional inequality.

4.5 Panel evidence

The cross-section estimates have a major drawback in that there may exist other country-specific factors effecting regional inequality which cannot be considered by the control variables, due to the limited number of degrees of freedom or to unobservability. This problem may bias estimates, although the adjusted R-squares indicate a quite good fit of the empirical model. Panel data models, however, can help to overcome this problem, since they allow one to investigate within-country variations by including country fixed effects incorporating unobserved heterogeneity [Baltagi (2005)]. Unfortunately, the use of panel data is not a free lunch in this context, since there are no instruments for decentralization available which vary over time. Remember the instruments used in the previous section. Thus, I can deal with the problem of unobserved heterogeneity by using panel data, but it is not possible to consider a potential endogeneity problem convincingly. An ad hoc solution to this problem, which I adopt from the convergence literature and which reduces a potential endogeneity bias at least to some extent [see, e.g., Barro and Sala-i-Martin (1995, ch. 11) or Barrios and Strobl (2009)], is using lagged values of the potentially endogenous regressor. This is, however, only possible in those cases where the decentralization measures vary over time (fiscal decentralization and regional authority index).

My empirical approach to the panel data analysis is twofold. First, I use the original annual frequency of the data set, providing me with almost 800 observations between 1980 and 2009. Second, I consider potential business cycle effects by building 5-year period averages. This should also help to deal with the second source of endogeneity as discussed above. In both data sets, I estimate random effects and fixed effects models. Measures of political decentralization are not varying over time, so that it is impossible to include country fixed effects. The only way to deal with this problem is to use random effects or to estimate a cross-section as in the previous section. In contrast to measures of political decentralization, the measures of fiscal decentralization vary over time, so that I can include country fixed effects here. The estimation results of equation (3) are reported in Table 4, considering the annual panel.[7] Note that, due to space limitations, I

[7] Table A.3 in the appendix reports results considering 5-year period averages, which support the findings based on

just report coefficients of the decentralization measures; all control variables are similar to the cross-section estimations.

Table 4: Panel results (annual data)

	Dependent variable: Weighted coefficient of variation of regional GDP p.c.					
	Random effects			Fixed effects		
	Coeff.	Obs.	Adj. R^2	Coeff.	Obs.	Adj. R^2
FEDERAL	−0.068**	782 [54]	0.51	–	–	–
	(−2.18)					
TIERS	0.026	777 [53]	0.46	–	–	–
	(0.85)					
AUTON	−0.051	752 [50]	0.47	–	–	–
	(−1.49)					
RESID	−0.013	762 [50]	0.51	–	–	–
	(−0.47)					
AUTRES	−0.068**	770 [51]	0.50	–	–	–
	(−2.27)					
BOTEL	−0.079**	736 [49]	0.47	–	–	–
	(−2.02)					
SECEL	−0.037	715 [47]	0.40	–	–	–
	(−1.23)					
BOSEC	−0.041**	715 [47]	0.41	–	–	–
	(−1.97)					
EXPDEC	−0.120***	371 [37]	0.48	−0.156**	371 [37]	0.42
	(−3.33)			(−2.55)		
REVDEC	−0.168***	371 [37]	0.47	−0.143	371 [37]	0.40
	(−3.16)			(−1.36)		
TAXDEC	−0.005	374 [37]	0.41	0.004	374 [34]	0.40
	(−0.27)			(0.14)		
VIMB	−0.004	372 [36]	0.45	−0.015	372 [36]	0.40
	(−0.23)			(−0.65)		
EMPLDEC	−0.180*	687 [44]	0.44	–	–	–
	(−1.77)					
RAI	−0.001	608 [34]	0.46	−0.002	608 [34]	0.51
	(−1.42)			(−0.58)		

Note: t-values are reported in parentheses; number of countries reported in square brackets; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively. All regressions include the following controls: *GDPPC*, $GDPPC^2$, *UNITS*, *AREA*, *UNEMPL*, *OPENNESS*, *ETHNIC*, and *URBAN*.

The random effects estimates based on the annual panel report a negative and significant effect of the federal dummy (*FEDERAL*), the autonomy variable (*AUTRES*), two variables of electoral decentralization (*BOTEL*, and *BOSEC*), the degree of expenditure decentralization (*EXPDEC*), the degree of revenue decentralization (*REVDEC*), and the degree of public sector employment decentralization (*EMPLDEC*). Turning to the fixed effects estimates, I find a significant effect only for the degree of expenditure decentralization (*EXPDEC*). Table A.3 in the appendix provides the results using 5-year period averages. Interestingly, the coefficient of the degree of expenditure de-

the annual panel, although significance levels are lower due to the smaller number of available degrees of freedom.

centralization ($EXPDEC$) and the coefficient of the degree of revenue decentralization ($REVDEC$) are significant, while the others are not. Thus, the degree of political decentralization seems to be less important in explaining the within-country variation in regional inequalities than measures of fiscal decentralization. Altogether, I conclude from the panel estimations that unobserved heterogeneity is obviously not a major source of bias in the estimates, so that the cross-section results are meaningful.

4.6 Interaction effects – Considering the development stage

The theoretical discussion points at different effects of decentralization on regional inequalities in developing or emerging economies in contrast to highly developed countries. The reason is that the efficiency-enhancing effects, which may contribute to regional convergence, are more likely to occur in highly developed countries, due to a better institutional environment. To test this hypothesis I estimate an interaction model as given by equation (4). The regressions include the log of the GDP per capita (and its square) as control, and I also let it interact with the different decentralization measures. The results, based on the annual panel data set, are reported in Table 5.[8] Again, I only report the coefficients of interest, due to space limitations, but note that all control variables are included in the regressions.

The regressions show a positive and significant coefficient of the decentralization measures and a negative and significant interaction term in most specifications. However, I am not particularly interested in the individual statistical significance of either of these terms. Instead, I want to know their joint significance or, more correctly, the marginal effect of decentralization on regional inequality depending on the level of economic development.[9] The marginal effect can be calculated using γ_1 and γ_2 given the GDP p.c. [see equation (4) above]:

$$\frac{\partial WCV}{\partial DEC} = \gamma_1 + \gamma_2 \cdot GDPPC. \tag{5}$$

Hence, my interaction model asserts that the effect of a change of the degree of decentralization on regional inequality depends on the value of the conditioning variable GDP p.c. While it is possible to calculate the marginal effect using equation (5) and the results obtained in Table 5, it is not possible to do so for the standard errors, at least in the case of continuously defined decentralization measures such as the degree of expenditure decentralization. The standard error of the marginal effect is in this case

$$\hat{\sigma}_{\frac{\partial WCV}{\partial DEC}} = \sqrt{var(\gamma_1) + GDPPC^2 \cdot var(\gamma_2) + 2 \cdot GDPPC \cdot cov(\gamma_1\gamma_2)}. \tag{6}$$

The standard errors can be used to calculate confidence bands around the marginal effects. Note that if $cov(\gamma_1\gamma_2) < 0$, as is often the case, the marginal effect can also be significantly different from zero for certain values of the conditioning variable if the coefficients γ_1 and γ_2 are insignificant. Thus, the calculation of marginal effects and respective significance levels is crucial for a

[8] Table A.4 in the appendix reports results of the 5-year averaged panel data set which support the major findings as discussed below.

[9] For an excellent overview on dos and don'ts in interaction models see Brambor et al. (2006).

Table 5: Panel results using interaction variables (annual data)

	Dependent variable: Weighted coefficient of variation of regional GDP p.c.					
	Random effects			Fixed effects		
	Coeff.	Obs.	Adj. R^2	Coeff.	Obs.	Adj. R^2
FEDERAL	0.543***	782 [54]	0.54	–	782 [54]	0.43
	(3.93)					
FEDERAL×GDPPC	−0.068***			−0.101**		
	(−4.56)			(−2.07)		
TIERS	0.811***	777 [53]	0.46	–	777 [53]	0.51
	(3.81)					
TIERS×GDPPC	−0.094***			−0.133***		
	(−4.47)			(−3.94)		
AUTON	0.518***	752 [50]	0.45	–	752 [50]	0.45
	(3.33)					
AUTON×GDPPC	−0.063***			−0.153***		
	(−3.82)			(−2.76)		
RESID	0.798***	762 [50]	0.59	–	762 [50]	0.42
	(4.46)					
RESID×GDPPC	−0.087***			−0.086		
	(−4.56)			(−1.67)		
AUTRES	0.584***	770 [51]	0.53	–	770 [51]	0.44
	(4.04)					
AUTRES×GDPPC	−0.073***			−0.128**		
	(−4.69)			(−2.58)		
BOTEL	0.271	736 [49]	0.46	–	736 [49]	0.48
	(1.22)					
BOTEL×GDPPC	−0.043*			−0.083		
	(−1.68)			(−1.37)		
SECEL	0.633***	715 [47]	0.42	–	715 [47]	0.51
	(3.89)					
SECEL×GDPPC	−0.077***			−0.075		
	(−4.11)			(−1.26)		
BOSEC	0.411***	715 [47]	0.41	–	715 [47]	0.51
	(3.59)					
BOSEC×GDPPC	−0.053***			−0.066		
	(−3.98)			(−1.37)		
EXPDEC	1.110***	371 [37]	0.52	0.773	371 [37]	0.43
	(2.42)			(1.22)		
EXPDEC×GDPPC	−0.139***			−0.102		
	(−2.73)			(−1.49)		
REVDEC	1.608***	371 [37]	0.52	1.311	371 [37]	0.42
	(3.15)			(1.54)		
REVDEC×GDPPC	−0.193***			−0.154		
	(−3.55)			(−1.65)		
TAXDEC	0.041	374 [37]	0.40	−0.365	374 [37]	0.41
	(0.17)			(−0.87)		
TAXDEC×GDPPC	−0.005			0.040		
	(−0.19)			(0.90)		
VIMB	−0.317*	372 [36]	0.46	−0.086	372 [36]	0.41
	(−2.26)			(−0.64)		
VIMB×GDPPC	0.035**			0.008		
	(2.33)			(0.54)		
EMPLDEC	1.292***	687 [44]	0.41	–	687 [44]	0.43
	(4.84)					
EMPLDEC×GDPPC	−0.180***			−0.221		
	(−5.53)			(−2.39)		
RAI	0.049***	608 [34]	0.50	0.039	608 [34]	0.53
	(5.62)			(1.51)		
RAI×GDPPC	−0.005***			−0.004		
	(−5.84)			(−1.61)		

Note: t-values are reported in parentheses; number of countries reported in square brackets; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively. All regression include the following controls: *GDPPC*, $GDPPC^2$, *UNITS*, *AREA*, *UNEMPL*, *OPENNESS*, *ETHNIC*, and *URBAN*.

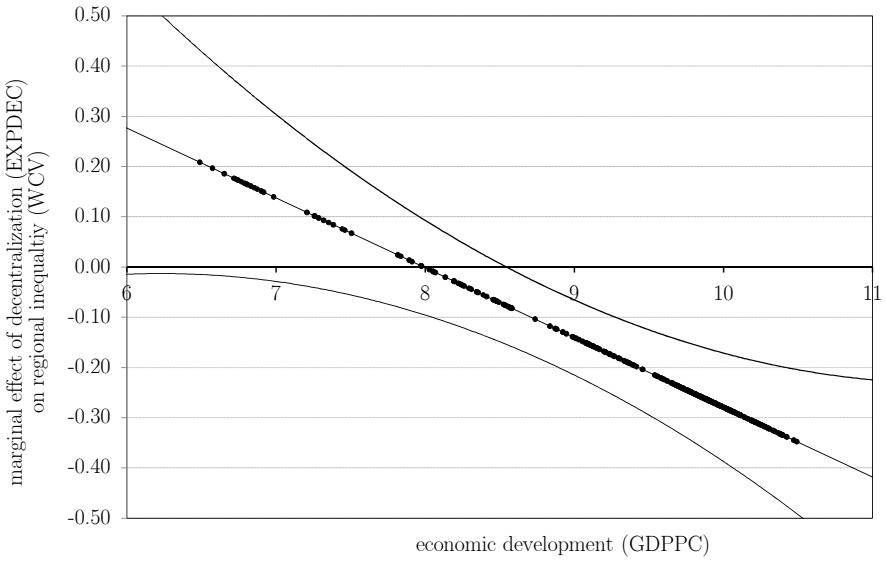

Figure 2: Marginal effect of decentralization (EXPDEC) on regional inequality (WCV)

correct interpretation of the estimation outcome. Figure 2 illustrates how the marginal effect of the degree of expenditure decentralization on regional inequality varies with the level of economic development, and it comprises confidence bands for the 10 percent significance level as calculated by equation (6). I concentrate on the degree of expenditure decentralization because this is the most common indicator in the existing literature on decentralization and regional inequality. The negative slope of the marginal effect is an outcome of the negative coefficient of the interaction variable (γ_2). For low GDP p.c. levels, the marginal effect of decentralization on regional inequality is positive, while for high GDP p.c. levels it is negative. The cutoff value of economic development, which is the value of log GDP p.c. for which $\partial WCV/\partial DEC = 0$, is 7.98, which corresponds to a GDP of approximately US$2,900 per capita. Countries poorer than this threshold might experience negative redistributional consequences from expenditure decentralization, while richer countries benefit. The results reported in Table 5 suggest that the general finding of poor countries suffering from decentralization while rich countries benefit from regional inequality holds for a wide range of econometric specifications. Moreover, using 5-year period averages, as in the results reported in Table A.4 in the appendix, produces more robust results in the fixed effects specifications. Therefore, the hypothesis of an effect of economic development on the relationship between decentralization and regional inequality can be confirmed, in line with Shankar and Shah (2003) and Rodríguez-Pose and Ezcurra (2010). In addition, I find no systematic differences between the various decentralization measures.

5 Summary and conclusion

This paper analyzes the impact of political and fiscal decentralization on regional inequalities. Theoretical considerations imply that decentralization might increase regional inequality, for example due to a weakened redistributional capacity of the central government [Prud'homme (1995)], but at the same time the efficiency-enhancing effects of decentralization might also promote regional growth and convergence [Qian and Weingast (1997)]. Existing studies on decentralization from other research fields emphasize that the efficiency-enhancing effects of decentralization are more likely to occur in highly developed countries, since decentralization might cause coordination problems, excessive regulation, and corruption in developing countries, undermining the potential efficiency gains [Tanzi (1996)]. Hence, the impact of decentralization on regional inequality may depend on the level of economic development: high-income countries with adequate institutions and high redistributional capacities might benefit from decentralization, while in developing countries the negative redistributional consequences of decentralization might offset potential efficiency gains, resulting in higher regional inequalities.

To investigate this research question, I have collected a unique data set on regional inequality covering 54 countries between 1980 and 2009. The data shows that there is an inverted-U relationship between regional inequality and economic development, supporting Kuznets (1955) and Williamson (1965). Moreover, I find a slight overall increase in regional inequalities in the world. In contrast to the existing literature, the new data set allows me to apply IV techniques in a cross-section of countries, which are best suited to solve the potential endogeneity problems of decentralization in this context. Former studies have ignored endogeneity or used lagged levels of decentralization measures as instruments, which are not convincing due to the persistence of decentralization over time. The econometric analysis implies that political and fiscal decentralization both have a negative effect on regional inequalities. My interpretation of this finding is that the efficiency-enhancing effects of decentralization overcompensate negative redistributional consequences. Furthermore, results of interaction models suggest that decentralization increases regional inequality in less-developed countries, whereas decentralization contributes to lower inequalities in highly developed countries. In general, there is no robust difference between measures of political and fiscal decentralization.

In light of the global decentralization trend, the findings of this study have important implications for the design of governments. Several observers suspect increasing regional inequalities in decentralizing countries and demand the implementation of interregional transfer schemes. This study shows that this effect should not be a concern in highly developed countries, since decentralization decreases regional inequalities. However, the decentralization initiatives taking place in developing countries – promoted by international development agencies such as the World Bank – may indeed have negative redistributional consequences justifying the implementation of additional redistributional instruments. The question which instruments are suitable for this purpose is impossible to answer based on this study. In particular, policy makers have to decide whether to redistribute between individuals or regions. Regional inequalities contribute to interpersonal inequalities,

so that it might be more efficient to redistribute between individuals using tax-transfer schemes instead of redistributing between regions [Musgrave (1959)]. A related study by Hansen et al. (2010) finds that interregional transfers increase regional inequalities if people are mobile, so that interpersonal transfers seem to be more suitable for achieving a more equal income distribution.

Finally, it is important to note that the empirical results of this paper support earlier studies, of which the majority find decentralization to decrease regional inequality in high-income countries (based on OECD data), but results are mixed if developing countries are taken into account. A clear theoretical explanation for this result is still lacking. Thus, future research should concentrate on the different possible transmission channels.

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Table A.1: Sources of regional data by country

Country	Territorial level	Period	Source
Argentina	23 provinces; 1 capital region	1991–2002	Dirección Provincial de Estadística
Australia	8 TL2 regions	1990–2008	OECD Regional Statistics
Austria	9 NUTS2 regions	1980–2004	Cambridge Econometrics
Belgium	11 NUTS2 regions	1980–2004	Cambridge Econometrics
Bolivia	9 departments	1988–2009	Instituto Nacional de Estadistica
Brazil	26 states; 1 federal district	2002–2007	Instituto Brasileiro de Geografica e Estatistica
Bulgaria	6 TL2 regions	1995–2007	OECD Regional Statistics
Canada	12 provinces and territories (Northwest Territories including Nunavut)	1981–2004	Statistics Canada
Chile	13 regions	1996–2006	National Statistics Institute
China	30 provinces, autonomous regions, and cities	1994–2008	National Bureau of Statistics of China
Colombia	33 departments	1990–2007	Departamento Administrativo Nacional de Estadística
Croatia	3 TL2 regions	1990–2007	OECD Regional Statistics
Czech Republic	8 TL2 regions	1990–2007	Cambridge Econometrics and OECD Regional Statistics
Denmark	3 NUTS2 regions	1980–2004	Cambridge Econometrics
Finland	6 NUTS2 regions	1980–2004	Cambridge Econometrics
France	22 NUTS2 regions	1980–2004	Cambridge Econometrics
Georgia	9 provinces	2003–2009	National Statistics Office of Georgia
Germany	30 NUTS2 regions (West)	1980–2004	Cambridge Econometrics
Greece	13 NUTS2 regions	1980–2004	Cambridge Econometrics
Hungary	7 NUTS2 regions	1990–2007	Cambridge Econometrics and OECD Regional Statistics
India	28 states and union territories	1980–2005	Directorate of Economics & Statistics of respective State Governments, and Central Statistical Organisation
Indonesia	33 provinces	2004–2008	Badan Pusat Statistik
Iran, Islamic Rep.	28 provinces	2000–2003	Statistical Center of Iran
Ireland	2 NUTS2 regions	1980–2004	Cambridge Econometrics
Italy	20 NUTS2 regions	1980–2004	Cambridge Econometrics
Japan	10 TL2 regions	1990–2005	OECD Regional Statistics
Kazakhstan	16 regions and cities	1998–2009	Agency of Statistics of the Republic of Kazakhstan
Korea, South	7 TL2 regions	1990–2007	OECD Regional Statistics
Latvia	6 NUTS3 regions	1996–2007	EUROSTAT
Lithuania	10 NUTS3 regions	1995–2007	EUROSTAT
Malta	2 NUTS3 regions	2000–2007	EUROSTAT
Mexico	32 states; 1 capital region	1980–2006	Instituto Nacional de Estadística y Geografía
Mongolia	21 provinces; 1 capital region	2000–2006	National Statistical Office

Table A.1 continued

Country	Territorial level	Period	Source
Netherlands	12 NUTS2 regions	1986–2004	Cambridge Econometrics
New Zealand	2 TL2 regions	2000–2003	OECD Regional Statistics
Norway	7 NUTS2 regions	1980–2004	Cambridge Econometrics
Panama	9 provinces	2002–2007	Instituto Nacional De Estadistica
Peru	24 departments	2001–2009	Instituto Nacional de Estadística e informática – Dirección Nacional de Cuentas Nacionales
Philippines	17 districts	2002–2008	National Statistics Office
Poland	16 NUTS2 regions	1990–2007	Cambridge Econometrics and OECD Regional Statistics
Portugal	7 NUTS2 regions	1980–2004	Cambridge Econometrics
Romania	8 NUTS2 regions	1995–2007	EUROSTAT
Russian Federation	7 federal regions	1998–2008	Federal State Statistics Office
Slovak Rep.	4 TL2 regions	1990–2007	Cambridge Econometrics and OECD Regional Statistics
Slovenia	2 NUTS2 regions	1995–2007	EUROSTAT
South Africa	9 provinces	2001–2008	Statistics South Africa
Spain	18 NUTS2 regions	1980–2004	Cambridge Econometrics
Sweden	8 NUTS2 regions	1980–2004	Cambridge Econometrics
Switzerland	7 NUTS2 regions	1980–2004	Cambridge Econometrics
Tanzania	21 administrative regions	2002–2007	National Bureau of Statistics
Thailand	7 geographic regions	2001–2009	National Statistics Office Thailand
Turkey	26 TL2 regions	1990–2006	OECD Regional Statistics
U.S. of America	51 states	1980–2008	U.S. Department of Commerce, OECD Regional Statistics
Ukraine	27 districts	2004–2008	State Statistics Committee of Ukraine
United Kingdom	37 NUTS2 regions	1980–2004	Cambridge Econometrics
Venezuela	23 states; 1 federal district	2007	Banco Central de Venezuela

Table A.2: Data sources and definitions

Variable	Definition	Source
CV	Coefficient of variation of regional GDP per capita	various sources
GINI	Adjusted Gini coefficient of regional GDP per capita	various sources
WCV	Population-weighted coefficient of variation of regional GDP per capita	various sources
GDPPC	Log of the GDP per capita in 2005 dollars.	WDI 2010
UNITS	Number of regions considered for the calculation of measures of regional inequality.	various sources
AREA	Log of area in square kilometers.	WDI 2010
UNEMPL	Unemployment ratio.	WDI 2010
OPENNESS	Sum of imports and exports (total trade) as a share of the GDP.	WDI 2010
ETHNIC	Ethnolinguistic fractionalization is computed as one minus Herfindahl index of ethnolinguistic group shares, and reflects the probability that two randomly selected individuals from a population belonged to different groups.	Alesina et al. (2003)
URBAN	Share of urban population in total population.	WDI 2010
FEDERAL	Dummy for countries with a federal constitution.	Treisman (2008)
TIERS	Number of vertical government tiers.	Treisman (2008)
AUTON	Local jurisdictions have a certain amount of *autonomy* regarding a given question if the constitution reserves exclusive decision-making power on that question.	Treisman (2008)
RESID	A sub-national legislature is said to have *residual authority* if the constitution assigns it the exclusive right to legislate on issues that are not specifically assigned to another level of government.	Treisman (2008)
AUTRES	Sub-national governments have autonomy and/or residual autonomy.	Treisman (2008)
BOTEL	Dummy variable, which is one if a country has elections at the lowest tier of government.	Treisman (2008)
SECEL	Dummy variable, which is one if a country has elections at the second lowest tier of government.	Treisman (2008)
BOSEC	Sum of *BOTEL* and *SECEL*	Treisman (2008)
EXPDEC	The degree of expenditure decentralization relates the sum of sub-national (state & local) government expenditures to total government expenditures.	IMF GFS
REVDEC	The degree of revenue decentralization relates the sum of sub-national (state & local) government revenues to total government revenues.	IMF GFS
VIMB	Grant share of sub-national government expenditures.	IMF GFS
TAXDEC	Share of sub-national government tax revenues in total government revenues.	IMF GFS
EMPLDEC	Share of sub-national government employment in total government employment.	Treisman (2008)
RAI	Regional authority index.	Hooghe et al. (2010)
LANG	Population share speaking a primary language of western Europe – English, French, German, Portuguese, and/or Spanish.	Hall and Jones (1999)
DEMO18	Number of years of democracy since 1800. A country is assumed to be democratic if the the polity2 index provided by the PolityIV project is positive	Marshall and Jaggers (2009)
DEMO	Democracy index as provided by the PolityIV project	Marshall and Jaggers (2009)
POL2	Polity2 index as provided by the PolityIV project	Marshall and Jaggers (2009)
IDEMO	Dummy variable for countries with uninterrupted democracy (polity2 index > 0) since 1950	Marshall and Jaggers (2009)
LAW	Dummy variable for the English common law system.	CIA World Factbook
LEGOR	Dummy variable for countries with a German legal origin	Porta et al. (2008)
PTANTS	Population share belonging to a Protestant church.	La Porta et al. (1999)

Table A.3: Panel results (5-year averages)

	Dependent variable: Weighted coefficient of variation of regional GDP p.c.					
	Random effects			Fixed effects		
	Coeff.	Obs.	Adj. R^2	Coeff.	Obs.	Adj. R^2
FEDERAL	−0.054	189 [54]	0.63	–	–	–
	(−1.27)					
TIERS	0.014	187 [53]	0.60	–	–	–
	(0.44)					
AUTON	−0.022	179 [50]	0.59	–	–	–
	(−0.45)					
RESID	−0.004	182 [50]	0.60	–	–	–
	(−0.09)					
AUTRES	−0.048	183 [51]	0.60	–	–	–
	(−1.13)					
BOTEL	−0.063	175 [49]	0.56	–	–	–
	(−1.24)					
SECEL	−0.025	170 [47]	0.53	–	–	–
	(−0.57)					
BOSEC	−0.030	170 [47]	0.53	–	–	–
	(−1.05)					
EXPDEC	−0.277***	123 [44]	0.53	−0.190**	123 [44]	0.52
	(−3.15)			(−2.60)		
REVDEC	−0.360***	123 [44]	0.53	−0.290**	123 [44]	0.52
	(−3.07)			(−2.25)		
TAXDEC	0.046	123 [44]	0.50	0.054	123 [44]	0.50
	(1.55)			(1.47)		
VIMB	0.014	122 [43]	0.50	0.022	122 [43]	0.49
	(0.38)			(0.59)		
EMPLDEC	−0.094	162 [44]	0.59	–	–	–
	(−0.71)					
RAI	−0.002	133 [34]	0.48	−0.002	133 [34]	0.55
	(−0.83)			(−0.79)		

Note: t-values are reported in parentheses; number of countries reported in square brackets; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively. All regression include the following controls: *GDPPC*, $GDPPC^2$, *UNITS*, *AREA*, *UNEMPL*, *OPENNESS*, *ETHNIC*, and *URBAN*.

Table A.4: Panel results using interaction variables (5-year averages)

	Dependent variable: Weighted coefficient of variation of regional GDP p.c.					
	Random effects			Fixed effects		
	Coeff.	Obs.	Adj. R^2	Coeff.	Obs.	Adj. R^2
FEDERAL	0.271	189 [54]	0.63	–	189 [54]	0.50
	(1.28)					
FEDERAL×GDPPC	−0.036			−0.078		
	(−1.52)			(−1.51)		
TIERS	0.520**	187 [53]	0.58	–	187 [53]	0.59
	(2.51)					
TIERS×GDPPC	−0.060***			−0.124***		
	(−2.61)			(−3.57)		
AUTON	0.203	179 [50]	0.58	–	179 [50]	0.52
	(0.85)					
AUTON×GDPPC	−0.025			−0.143***		
	(−0.94)			(−2.75)		
RESID	0.635*	181 [50]	0.63	–	181 [50]	0.49
	(1.89)					
RESID×GDPPC	−0.069*			−0.062		
	(−1.89)			(−1.07)		
AUTRES	0.321	183 [51]	0.61	–	183 [51]	0.51
	(1.41)					
AUTRES×GDPPC	−0.042			−0.103*		
	(−1.61)			(−1.95)		
BOTEL	−0.001	175 [49]	0.56	–	175 [49]	0.56
	(−0.00)					
BOTEL×GDPPC	−0.008			0.045		
	(−0.26)			(0.69)		
SECEL	0.577**	170 [47]	0.55	–	170 [47]	0.60
	(2.01)					
SECEL×GDPPC	−0.070**			−0.074		
	(−2.08)			(−1.37)		
BOSEC	0.298	170 [47]	0.54	–	170 [47]	0.59
	(1.61)					
BOSEC×GDPPC	−0.039*			−0.047		
	(−1.78)			(−1.08)		
EXPDEC	0.344	123 [44]	0.53	1.305**	123 [44]	0.58
	(0.42)			(2.15)		
EXPDEC×GDPPC	−0.070			−0.167**		
	(−0.77)			(−2.44)		
REVDEC	0.632	123 [44]	0.53	1.195	123 [44]	0.58
	(0.74)			(1.19)		
REVDEC×GDPPC	−0.108			−0.157		
	(−1.21)			(−1.54)		
TAXDEC	0.543	123 [44]	0.50	0.120	123 [44]	0.55
	(1.25)			(0.20)		
TAXDEC×GDPPC	−0.055			−0.007		
	(−1.16)			(−0.12)		
VIMB	−0.594	122 [43]	0.49	−0.236	122 [43]	0.55
	(−1.55)			(−0.63)		
VIMB×GDPPC	0.068			0.029		
	(1.63)			(0.70)		
EMPLDEC	0.964***	162 [44]	0.57	–	162 [44]	0.50
	(2.83)					
EMPLDEC×GDPPC	−0.131***			−0.203**		
	(−2.92)			(−2.50)		
RAI	0.053***	133 [34]	0.53	0.030	133 [34]	0.61
	(2.96)			(1.01)		
RAI×GDPPC	−0.006***			−0.003		
	(−3.06)			(−1.11)		

Note: t-values are reported in parentheses; number of countries reported in square brackets; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively. All regression include the following controls: *GDPPC*, $GDPPC^2$, *UNITS*, *AREA*, *UNEMPL*, *OPENNESS*, *ETHNIC*, and *URBAN*.