

Lessmann, Christian

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Foreign Direct Investment and Regional Inequality: A Panel Data Analysis

Christian Lessmann

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Abstract

Foreign direct investments (FDI) are an important determinant of economic growth. Countries try to attract mobile capital in order to foster economic development, albeit FDI might increase regional inequality since the many different regions of a country usually do not receive FDI in equal measure. A conflict emerges between efficiency and redistribution. The aim of this paper is to investigate the impact of foreign direct investment on regional inequalities. First, the Chinese case is analyzed as an introductory example. FDI has increased regional inequalities in China after the economic reforms in the 1980s, but the effect has vanished - if not reversed - since the end of the 1990s. Second, the major contribution of the paper is to analyze cross-country time-series data on FDI and regional inequalities. Based on a unique panel data set of regional inequalities covering 55 countries at different stages of development, I find net FDI inflows to increase regional inequality in low and middle income countries, while there are no negative redistributive consequences in high income economies. The analysis also shows that the observable higher mobility of individuals in high developed countries as well as government policies are likely to mitigate the negative redistributive impact of FDI on regional inequality. Insofar, the cross-country data supports the lessons from the Chinese case with respect to the reducing effect development has on the negative impact from FDI on regional inequality.

JEL-Code: O570, R120, F430.

Keywords: regional inequality, foreign direct investment, panel data.

Christian Lessmann
Technical University Dresden
Faculty of Business and Economics
Germany - 01062 Dresden
christian.lessmann@tu-dresden.de

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1 Introduction

The world is facing a trend in rapid globalization, where international capital flows are accelerating and countries are deepening their trade relationships. One type of international capital flows which has received a lot of attention among academics and policy makers are foreign direct investments (FDI). Especially among policy makers in developing countries, there has been a shift in focus on attracting more FDI. The rationale for increased efforts to attract more FDI stems from the belief that FDI has several positive effects which include productivity gains, technology transfers, the introduction of new processes, managerial skills, and know-how in the domestic market [Alfaro et al. (2004)]. These positive effects of FDI stimulate economic growth, and should thus improve the living conditions of people in the receiving country. Numerous studies analyzing the link between FDI and growth have identified growth stimulating effects, at least under certain circumstances [e.g. Balasubramanyam et al. (1996), Borensztein et al. (1998), Alfaro et al. (2004), Hansen and Rand (2006), Basu and Guariglia (2007), and Alfaro et al. (2010)]. However, little is known about the impact of FDI on regional inequalities within host countries, which will be at the heart of this paper.

There are several examples, such as China or India, where FDI inflows affect the different regions of the countries unequally [Siddharthan (2007)]. In China – discussed later on in detail – FDI has been concentrated on the coastal regions and has been a major force in the strong increase in regional inequalities in the 1980s and 1990s. Similarly, FDI in India has been concentrated on the Western and Southern states and territories, enlarging the income gap between these regions and other parts of the country. Both examples imply that a conflict emerges between growth enhancing effects of FDI and increasing regional inequalities.

The link between FDI, growth and regional inequalities can be illustrated using a simple theoretical framework. Assume a federation consisting of two regions inhabited by immobile households. An influx of FDI in region 1 increases the capital stock raising the marginal product of labor, output and consumption in region 1. Note that the output promoting effects in region 1 emerge if FDI involves the transfer of physical capital as in the case of greenfield investment or capacity extensions as well as if intangible capital (knowledge) is transferred as in the case of mergers and acquisitions. At the same time, nothing happens in region 2 at least as long as we abstract from spillovers.

Hence, region 1 will be richer than region 2 so that FDI increases overall output of the federation, but it also increases interregional inequality. If we relax the assumption of immobile households, region 2 will also benefit from the influx of FDI. Higher wages and consumption in region 1 will induce households to emigrate from region 2 into region 1, increasing the size of the labor force in the latter region. The influx of labor will depress labor productivity, wages and output per capita in region 1, while the opposite happens in region 2. The result is regional convergence, which becomes stronger as migration costs lower. The discussion shows that FDI increases regional inequalities in general, but the effect is smaller, the higher the degree of factor mobility is. Another issue affecting the relationship between FDI and regional inequality might be government policies which influence resource allocation – e.g. subsidies, local tax holidays, etc. – in order to promote a more equal interregional distribution. Importantly, the cases of high factor mobility or government reallocation policies are less relevant for developing economies than for high income countries due to the worse infrastructure and weak fiscal capacities. Thus, the relationship between FDI and regional inequalities should be conditional on the stage of economic development a country is at, where FDI has a stronger increasing effect on regional inequalities in developing economies compared to high-income countries. The aim of this paper is to search for empirical evidence for this hypothesis.

Although the major contribution of this paper is the analysis of panel data, I first discuss the Chinese case as an introductory example. Almost the entire literature on FDI and regional inequalities concentrates on China.¹ Therefore a discussion of the Chinese case substitutes for a discussion of existing empirical literature, and at the same time illustrates how FDI affects regional inequality. The Chinese case shows, that FDI did increase regional inequalities, but these negative effects have vanished since the mid 1990s. In fact, recent data implies that FDI might have contributed to the weak convergence trend among provinces since 2004.

Subsequent to the discussion of the Chinese case I conduct a panel data analysis using a unique data set of regional inequalities in 55 countries for the period between 1980 and 2009. The data set covers high-income as well as low and middle income countries in order that it is well suited to test the impact of economic development on the relationship between FDI and regional inequalities. It turns

¹ To my knowledge, the only empirical study on FDI and *interregional* inequality which does not focus on China, is Bailey and Driffield (2002). The authors analyze the effect of FDI on regional inequality in the UK between 1984 and 1992 finding inward investment to increase regional inequalities.

out, that there is no unconditional effect of FDI on regional inequality, but – in line with the theory – FDI increases regional inequalities in developing economies while it has almost no significant effect on regional inequalities in high-income countries. Instrumental variable regressions, which consider a weak instrument bias, support this major finding. I also try to disentangle the different determinants of the FDI-regional inequality nexus – factor mobility and government policies – using proxy variables for those different determinants. The regressions imply that both factors are decisive.

The paper is related to studies on *interpersonal* inequality and FDI such as Tsai (1995), Feenstra and Hanson (1996), Choi (2006), Basu and Guariglia (2007) and Dreher and Gaston (2008). The important difference between these studies and my analysis is that I focus on *interregional* inequality – that is the differences between the regions of a country. In this regard, this study comes from geographer’s perspective to distribution of economic activity. The distinction is important, since recent studies on the causes of conflict suggest that not vertical inequalities (*interpersonal* inequalities) are related to conflict [see Stewart (2000, 2002)], but horizontal inequalities (*interregional* inequalities) are decisive here [see Deiwi et al. (2012), Buhaug et al. (2012) and Lessmann (2012b)]. Therefore, *interregional* might be the more interesting factor for a society. *Interregional* inequalities are even more important, if they overlap with the geographic location of different ethnic groups [see Kanbur and Zhang (2005)].

The difference between *interpersonal* and *interregional* inequality can also be illustrated based on the simple model presented above. Assume a symmetric two region federation, with both regions inhabited by a similar number of households of different income classes (say due to different skill levels). Therefore, we observe *interpersonal* inequality between and within regions, but no *interregional* inequality. An influx of FDI into one region will unambiguously increase *interregional* inequality, but not necessarily *interpersonal* inequality. If the poor in the FDI hosting region are the beneficiary party – e.g. if they switch from agriculture to a new industry sector –, then *interpersonal* inequalities decrease while *interregional* inequalities increase. In light of this, a study of *interregional* inequalities is interesting, since the effects of FDI inflows can be very different from *interpersonal* inequalities.

The remainder of the paper is organized as follows: Section 2 reviews the literature on the case of China and presents some recent data. Section 3 presents a unique data set on regional inequalities

around the world, which is used in Section 4 to investigate the impact of FDI. Section 5 sums up and concludes.

2 The Chinese case

The role of FDI in China's economic progress has attracted a lot of attention in the literature. Academic work on FDI and regional inequalities mostly deals with China. The reason is that China serves as a kind of natural experiment. Before the 1980s, China did not receive any mentionable amount of FDI, since the country was closed to foreign investors. With the introduction of economic reforms, China attracted more and more FDI which made up almost 1% of the GDP at the beginning of the 1990s [see Wei et al. (2009) for details]. In 1992 Deng Xiaoping started his famous Southern Tour where he made various speeches and generated large local support for his reformist platform. In his speeches, he stressed the importance of economic reforms, and criticized those who were against further economic and openness reforms. The southern tour was the beginning of a rapid increase in FDI inflows which peaked with more than 6% of GDP in 1993/1994. Between 1993 and 1998 China received the largest amount of FDI per year worldwide, and is still among the most important places for foreign investors.

The influx of FDI had a strong positive impact on China's growth performance. In the decade before 1992, annual average GDP p.c. growth was around 7.8%; in the decade after 1992, average growth amounts to approximately 9.2% per year.² China's growth performance appears even more impressive when absolute figures are considered: the GDP p.c. in 1992 was less than 500 US\$ (in 2000 prices) – in 2008, the GDP p.c. had increased to more than 2.000 US\$.

Foreign investments have been a blessing for China's growth performance, but a curse for regional inequality. More than 80% of China's FDI inflows are concentrated in the East [Wei et al. (2009)]. The geographic concentration has several causes. Most importantly, the economic reforms started in the eastern provinces. The regions Guangdong, Fujian, Hainan, Pudong, and 14 coastal cities were declared as designated Special Economic Zones, Development Zones, or Economic and Technology Development Zones. These regions were given preferential policies and were opened gradually to foreign investors. The opening policies moved to the north in the mid-1980s, and

² The data refers to the World Development Indicators 2010.

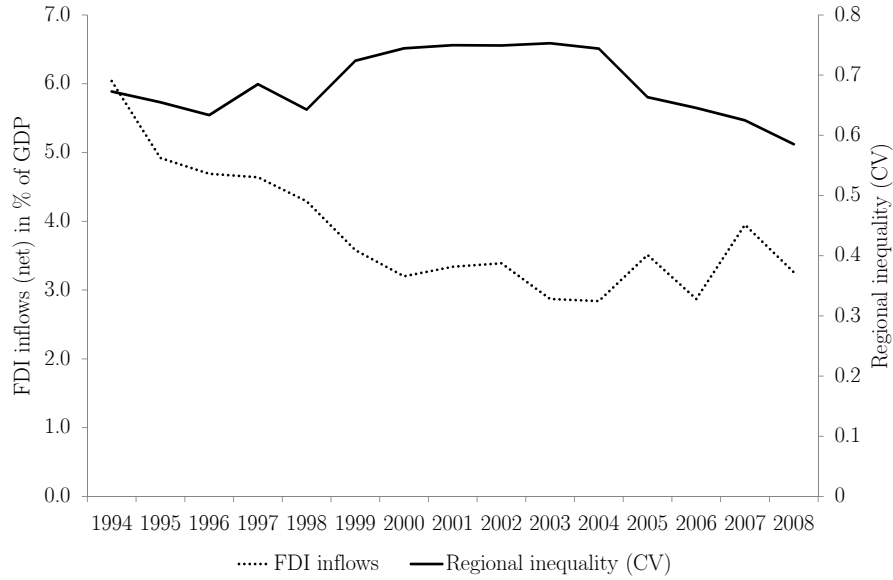


Figure 1: FDI and regional inequality in China (1994-2008)

to the center in the early 1990s. In the late 1990s, China announced a Western Development Programm to restore more balanced regional development.

A number of studies have analyzed the relationship between FDI and regional inequality in China. Chen and Fleisher (1996) investigate province level data over 1978-1993 and find FDI to reduce regional inequality in China overall, but to increase the differential between coast and non-coast regions. Sun and Chai (1998) investigate the effects of FDI on growth in the eastern and western provinces from 1986 to 1992. They find a growth enhancing effect of FDI in the east, but only weak effects in the west and conclude that FDI has contributed to the rise of regional inequality in China. The studies by Fujita and Hu (2001), Bao et al. (2002), Zhang and Zhang (2003), Jones et al. (2003), Fu (2004), Kanbur and Zhang (2005), Wei et al. (2009), and Fleisher et al. (2010) unambiguously support this finding. The most recent data used in these papers is from 2003, therefore a new look at the recent developments will be meaningful. Figure 1 illustrates the coefficient of variation of provincial GDP as well as the FDI/GDP ratio for China as a whole. The figure suggests a negative relationship between FDI and regional inequality for this recent period. In the period from 1994 to 2003, FDI was decreasing while regional inequalities were rising. Since 2003/2004, FDI increased slightly and regional inequalities declined. The correlation coefficient

between the coefficient of variation and the FDI/GDP ratio is -0.37 for the whole period.³

At first glance, this recent development seems to contradict earlier findings.⁴ However, Wei et al. (2009) also relate the coefficient of variation of provincial GDP to the FDI/GDP ratio, finding quite similar results. While FDI increased regional inequality until the mid-1990s, the income gap between coastal and inland regions has slightly declined since then. The authors conclude that the government's Western Development Programm and the Rebuilding Programm of the Northeast Region was the major determinant of the changing trend. What I observe in the more recent data seems to be the continuance of this trend.

The Chinese case supports the main hypothesis of this paper, which states that the level of economic development is a decisive factor for the FDI-regional inequality nexus. At an early stage of economic development, the influx of FDI increased regional inequality in China since investments concentrated on only a few coastal regions. These regions benefited from the increased capital stock, while the central and western regions remained almost unaffected. At a later stage of economic development, at the end of the 1990s, FDI did not have these negative redistributive effects, because the Chinese government implemented policies aiming at a reallocation of resources. Thus, in the meanwhile higher developed Chinese economy, FDI no longer has a negative redistributive effect. The aim of this paper is to test this relationship in a cross-section of countries, which is important in order to generalize country specific experiences.

3 Regional inequalities around the world

Regional inequalities are not only of concern in China, but a widespread phenomenon among several developing and high-income countries. Regional inequalities matter since they are an important determinant of interpersonal income inequality. Yemtsov (2005) and Elbers et al. (2005) estimate that *interregional* inequality explains about one-third of *interpersonal* income inequality. However regional inequalities also matter, as they might be derived from ethnic discrimination and can be

³ Using alternative measures of regional inequality has no effect on the quality of this result. The correlation between the FDI/GDP ratio and the adjusted Gini coefficient of provincial GDP is -0.39, and the correlation between the FDI/GDP ratio and the weighted coefficient of variation is -0.27. See section 3 for a detailed of the calculation of inequality measures.

⁴ Using measures of regional inequality I focus on the concept of σ -convergence which is different from the β -convergence mainly considered in the literature. The concept of σ -convergence can be defined as a group of regions "are converging in the sense of σ if the dispersion of their real per capita GDP levels tends to decrease over time" [Sala-i-Martin (1996), p. 1020]. We observe β -convergence if poor regions grow faster than richer ones. Note that β -convergence does not necessarily implies σ -convergence, e.g. if poor regions overtake [Quah (1993)].

a breeding ground for separatist tendencies and internal conflicts [Kanbur and Venables (2005)]. Knowing more about regional inequalities and its determinants – such as FDI – is thus important for academics as well as policy makers.

Empirical research in this field suffers from the poor availability of reliable data on regional inequalities, which is one reason why the existing literature on FDI and regional inequalities concentrates on China, where data availability is quite good. For comparative cross-country studies – as applied in this paper – one needs regional economic accounts at a widely homogenous territorial level for countries at all levels of economic development. The OECD Regional Statistics or EUROSTAT provide such data since the 1980s/1990s. However, data of developing or emerging economies is scarce and cannot be accessed through one single data base. For this study, the data was collected from several national statistical offices or central banks.⁵ Besides availability of data, measurement of regional inequality is difficult as well. Three different decisions arise: the choice of an appropriate economic indicator, the territorial level to be applied, and an applicable concentration measure.⁶

The majority of cross-country studies on regional inequalities use the regional GDP p.c. as a starting point for calculating disparity measures [see e.g. Sala-i-Martin (1996) or Lessmann (2009)]. This economic account is problematic because it is quite sensitive to biases resulting from commuters or unequal (un-)employment. For this reason, some studies rely on the regional income p.c. [Shankar and Shah (2003)] or the GDP per worker [Gil Canaleta et al. (2004)] which is not an option for my analysis due to missing data for most low and middle income countries. The regional GDP p.c. is thus best suited to investigate regional inequalities in a cross-section of countries.

The different sizes of the regions within countries have also important implications for measuring regional inequalities. In countries with large economic differences and an unequally distributed population, a disparity measure might be difficult to interpret. For example the three large Canadian Territories are much poorer than the regions at the east and west coast, therefore an inequality measure might indicate large economic differences within the country. However, very few people are affected from relative poverty since the three territories are inhabited by only 100,000 people, while Canada has 34 million inhabitants in total. Therefore, it is necessary to use a territorial clas-

⁵ Details of the particular sources of regional data are provided by Table A.1 in the appendix.

⁶ See Lessmann (2009) for a detailed discussion of different measurement concepts of regional inequality.

sification that creates relatively homogeneous regions.⁷ In OECD countries or countries covered by EUROSTAT, this problem can be reduced by using data at territorial level 2 (TL2) or data of the NUTS2 classification. I decided to use NUTS2 for EU members and state level (resp. province level) data or TL2 data for other OECD countries.⁸ For non-OECD countries, data availability has driven the selection of territorial levels. In most cases, the regional level is equivalent to state or province level as in the example of China discussed above. I also calculate a measure of regional inequality that is adjusted for the different population sizes of the regions (weighted coefficient of variation, *WCV*) so that a serious bias due to the application of different territorial levels is less likely. Also the inclusion of country-fixed effects in regression analysis helps in reducing such a bias.

The application of suitable concentration measures is the final concern. Different measures of inequality do not always yield the same country ranking. Especially in a cross-country analysis, the concentration measure should be independent of the number of regions considered, should not be sensitive to shifts in average GDP levels due to growth or inflation, and should satisfy the Pigou-Dalton transfer principle [Dalton (1920), Pigou (1912)]. This principle states that an arithmetical transfer from rich to poor regions reduces inequality [see Sen (1973) and Mehran (1976) for details]. These requirements are satisfied by the coefficient of variation (*CV*), the adjusted Gini coefficient (*GINI*) and the population-weighted coefficient of variation (*WCV*):⁹

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

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

$$WCV : = \frac{1}{\bar{y}} \left[\sum_{i=1}^n p_i (\bar{y} - y_i)^2 \right]^{1/2}. \quad (3)$$

\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.¹⁰ Please see Table A.1 in the appendix for the territorial level applied in each country, the source of the regional data, and available years.

⁷ See Gennaioli et al. (2011) for a study that focuses on regional units with the highest degree of political authority.

⁸ 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.

⁹ See Bendel et al. (1989) for a comparison of standard inequality measures.

¹⁰ 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, since its values range from 0 to $\ln(n)$ [Hale (2003)].

I have calculated these concentration measures based on the regional GDP p.c. for 55 countries covering the period 1980-2009. Note that the frequency of the data varies for countries: in case of the OECD countries the underlying panel is almost balanced, but there are quite large gaps in the data for the developing economies. To get a first impression of the data, country means for the whole observation period are presented in Table 1 classified by income. I will discuss just the coefficient of variation CV and leave it to the reader to compare results of alternative concentration measures. Differences are not very large since the correlation between the different indicators is 0.91 or higher.¹¹

Table 1: Regional inequalities classified by income (World Bank country classification applied)

High income countries GDP p.c. in 2009 > 12,196 US\$				Low and middle income countries GDP p.c. in 2009 < 12,196 US\$			
Country	CV	GINI	WCV	Country	CV	GINI	WCV
Australia	0.15	0.09	0.08	Argentina	0.36	0.18	
Austria	0.21	0.14	0.22	Bolivia	0.30	0.16	0.25
Belgium	0.38	0.19	0.38	Brazil	0.55	0.31	0.48
Canada	0.26	0.16	0.15	Bulgaria	0.23	0.13	0.26
Croatia	0.21	0.18	0.21	Chile	0.48	0.26	0.35
Czech Republic	0.33	0.15	0.31	China	0.68	0.33	0.50
Denmark	0.11	0.09	0.09	Colombia	0.65	0.31	0.43
Finland	0.18	0.11	0.13	Georgia	0.19	0.12	0.19
France	0.18	0.08	0.26	Hungary	0.28	0.17	0.34
Germany	0.19	0.10	0.17	Indonesia	1.23	0.46	0.89
Greece	0.19	0.08	0.16	Iran, Islamic Rep.	0.77	0.33	0.56
Ireland	0.16	0.16	0.13	Kazakhstan	0.83	0.38	0.72
Italy	0.25	0.15	0.26	Lithuania	0.25	0.15	0.25
Japan	0.13	0.07	0.14	Mexico	0.51	0.26	0.55
Korea, Rep. (South)	0.10	0.06	0.07	Mongolia	0.57	0.30	0.67
Latvia	0.44	0.28	0.50	Panama	0.60	0.38	0.46
Malta	0.17	0.14	0.07	Peru	0.51	0.30	0.42
Netherlands	0.16	0.10	0.14	Philippines	0.51	0.29	0.62
New Zealand	0.09	0.08	0.07	Poland	0.19	0.10	0.21
Norway	0.21	0.13	0.22	Romania	0.34	0.17	0.32
Portugal	0.22	0.13	0.26	Russian Federation	0.39	0.23	0.36
Slovak Republic	0.53	0.27	0.37	South Africa	0.35	0.22	0.41
Slovenia	0.18	0.18	0.18	Tanzania	0.32	0.17	0.37
Spain	0.20	0.12	0.20	Thailand	0.88	0.43	0.88
Sweden	0.11	0.06	0.13	Turkey	0.40	0.25	0.42
Switzerland	0.13	0.08	0.13	Ukraine	0.51	0.24	0.58
United Kingdom	0.28	0.12	0.33	Venezuela, RB	0.26	0.15	
United States of America	0.36	0.14	0.17				
<i>Average</i>	<i>0.22</i>	<i>0.13</i>	<i>0.20</i>	<i>Average</i>	<i>0.49</i>	<i>0.25</i>	<i>0.46</i>

The most conspicuous observation is that regional inequalities are on average much higher in low

¹¹ Note that I was not able to get reliable regional population data in case of Argentina and Venezuela, so that I cannot calculate the weighted coefficient of variation for these countries.

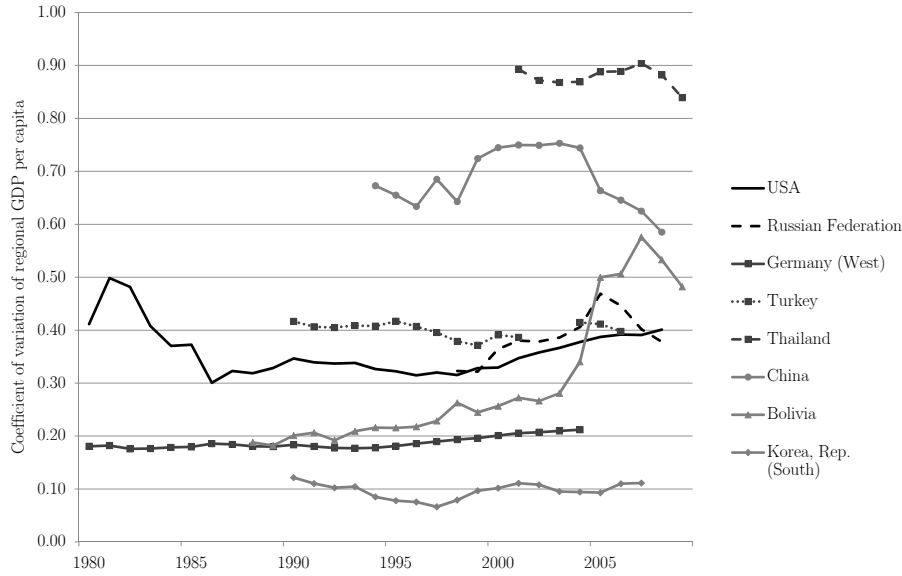


Figure 2: Trends in regional inequality 1980-2009

and middle income countries (average CV : 0.49) compared to high income countries (average CV : 0.22). An explanation is provided by Williamson (1965), who argues that regional inequalities increase in the process of economic development, but they tend to diminish, if high levels of economic development are reached. Turning our attention to single countries, we find New Zealand, South Korea, Sweden, and Denmark as the countries with the lowest levels of regional inequalities in terms of the CV . The data also implies that the concern about regional inequality in China is justified, since China is among the countries with the highest levels of regional inequalities, falling right after Indonesia, Thailand, Kazakhstan, and Iran. For a reliable panel data analysis, it is also important to have data that varies within countries over time.

In order to get a basic idea of the changes in regional inequalities I have plotted the CV in Figure 2 for a sample of countries. I have chosen the United States of America, Russia, Germany, Turkey, Thailand, China, Bolivia, and South Korea to illustrate data of countries from all regions of the world at different stages of economic development. In the U.S. we observe a fairly high variation over time with high levels of regional inequality at the beginning of the observation period followed by a decline in the 1980s and rising inequalities since the end of the 1990s. In Germany, Korea, and Turkey regional inequalities are quite stable over time. In contrast, the volatility in Russia, China, Thailand and Bolivia is high. Internal conflicts in Bolivia, where separatist groups have tried to

gain autonomy in the resource-rich provinces, have caused a rapid increase in regional inequalities since 2005. The dynamics of the regional inequalities in China are also much higher than in other parts of the world, which was another reason for the empirical literature to focus on China. 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 the effects of FDI inflows on regional inequalities.

4 Empirical analysis

The case of China suggests that FDI promotes regional inequality, but as economic development proceeds, the negative redistributive effects of FDI vanish. As discussed in the introductory section, this can be explained within a simple theoretical framework, where the regions of a country benefit differently from FDI inflows. Generally, an influx of FDI, which is unequally distributed among the different areas of a country, should be associated with increasing regional inequalities, but the higher the level of economic development, that is the higher the factor mobility and the more effective the government reallocation policies, the lower the negative redistributive consequences from FDI should be. In this section, I will test this hypothesis based on a unique panel data set.

4.1 Data and methodology

The previous section has presented measures of regional inequality in detail which will be the dependent variable in the forthcoming regression analysis. The discussion of the independent variables still remains, in particular source and definition of FDI data. This analysis assumes that FDI changes the capital stock in host regions affecting regional inequality within countries. Since countries, especially high developed countries also face outflows of capital which affect regions differently, it is necessary to study net FDI (inflows minus outflows) instead of gross values. The definition of FDI, as taken from the International Monetary Fund Balance of Payments database, is the following: FDI are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. To have a variable suitable for a cross-country analysis, FDI are taken as a share of the GDP. In doing so, we follow studies on FDI and growth such as Alfaro et al. (2004) or Basu and Guariglia (2007).

A general problem with FDI data is that one cannot disentangle greenfield investment and capacity extensions from mergers & acquisitions [Bertrand (2004)]. Greenfield investment and capacity extensions directly increase the stock of physical capital in host countries which is obviously compatible with the theoretical considerations stated in the introduction. But also mergers & acquisitions fit in this framework since they increase the stock of intangible capital [de Mello (1999), Bittlingmayer (1996)]. Mergers & acquisitions are expected to induce a transfer of knowledge augmenting the existing stock of knowledge in recipient countries through e.g. labor training, skill acquisition, and introduction of alternative management practices and organizational arrangements. Moreover, one can expect FDI inflows to promote technological upgrading, and hence diffusion, even without significant physical capital accumulation as in the case of mergers & acquisitions. Thus, all kinds of FDI should stimulate regional growth in the recipient region affecting interregional inequalities. Potential differences between greenfield investment, capacity extensions, and mergers & acquisitions would definitely be interesting for this research question, but cannot be considered in cross-country studies due to lacking data [Bertrand (2004)].

A scatter plot of the data gives a first impression. Figure 3 illustrates the relationship between FDI (abscissa) and regional inequality (ordinate) using means of the whole observation period (1980-2009). High income countries are marked by circles and low and middle income countries by quadrangles. The upper left quadrangle is Indonesia, which has the highest regional inequality among all considered countries. If we classify Indonesia as an outlier and disregard it for a moment one might draw a trend line with a positive slope through the quadrangles implying that FDI is positively associated with regional inequality in low and middle income countries. In the group of high-income countries, there is no trend observable at a first glance. Insofar, the data seems to fit to the hypothesis stated above. Of course, this graphical overview does not substitute for a cautious econometric analysis. The scatter plot focuses on between country variations. For a suitable empirical analysis of the theoretical predictions the within country variations have to be taken into account.

I parse my research questions by estimating the variants of a country and time fixed effects panel data model. The observation period for the 55 countries is 1980-2009, whereas the frequency of data is quite high in OECD countries, at least since the transition process in Eastern Europe started, but the data has gaps in low and middle income countries. Thus, the panel data set

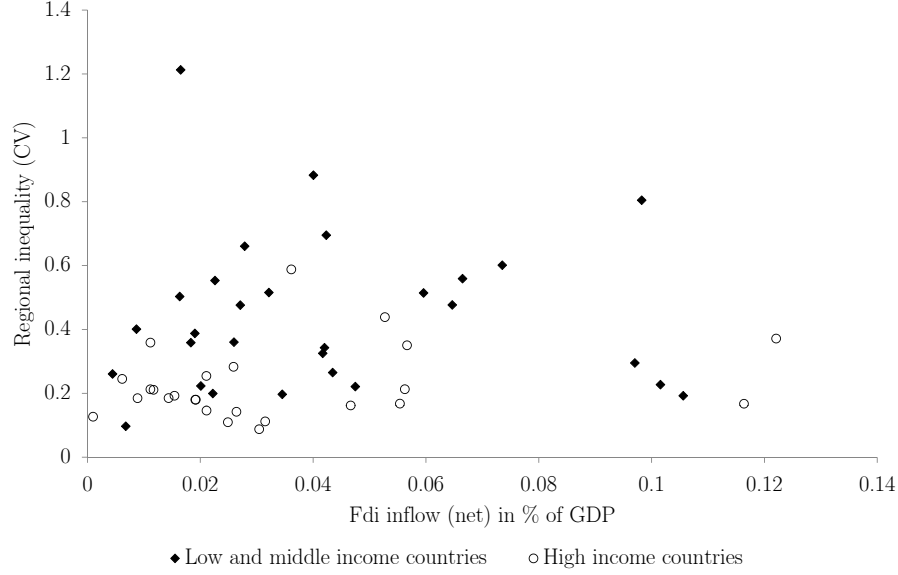


Figure 3: Regional inequality and foreign direct investment (1980-2009)

is unbalanced. To abstract from the short-run effects of FDI on regional inequality and to get rid of business cycle effects, I do not use annual data in the body of the paper. Instead, I build 5-year averages generating 6 periods (1980-1984 until 2005-2009). The basic regression model for N countries and T time periods, where countries are indexed by i and time by t , has the following form:

$$REGINEQ_{i,t} = \alpha_i + \sum_{j=1}^k \beta_j X_{j,i,t} + \gamma_1 GDP_{i,t} + \gamma_2 FDI_{i,t} + \gamma_3 FDI_{i,t} \times GDP_{i,t} + \mu_t + \epsilon_{i,t}. \quad (4)$$

$REGINEQ_{i,t}$ reflects one of the alternative measures of regional inequality (CV , $GINI$, or WCV), α_i are country fixed effects, $X_{j,i,t}$ are k exogenous control variables affecting regional inequality, $GDP_{i,t}$ is the Log of the GDP per capita, $FDI_{i,t}$ represents net FDI inflows as percentage of the GDP, $FDI_{i,t} \times GDP_{i,t}$ is an interaction variable of FDI inflows and the Log of the GDP p.c. ($GDP_{i,t}$), and ϵ_i is a random error term.

Using country fixed effects has several advantages which are important for this analysis. First of all, such regressions focus on within country variations in the data which is the more appropriate approach to testing the theoretical predictions in contrast to the between country variations focused on in a standard cross-section analysis. Moreover, country fixed effects are able to eliminate unobserved heterogeneity between countries [Baltagi (2005)]. This is very important for maintain-

ing the quality of the analysis, since there are numerous factors driving regional inequalities that I cannot control for, because of this an omitted variable bias may affect the quality of estimates. For example, the territorial level is not perfectly homogenous for the whole group of countries in the sample, therefore the degree of (dis-)aggregation of the regions might affect the level and dynamic of the regional inequalities [see section 3 for details]. One might also think of geographic factors such as mountains, coasts, deserts, etc. which are determinants of regional inequality, but difficult to consider in an econometric analysis. All of these country-specific determinants of regional inequalities are captured by the country dummies.

I consider two different estimation procedures: standard OLS and an instrumental variable approach, since it may be argued that ordinary least squares (OLS) estimates suffer from an endogeneity bias. Foreign investors might avoid countries with a high level of regional inequality since they are afraid of the higher risk of internal conflicts such as riots, terrorist attacks, or civil war [Lucas (1990), Janeba (2002)].¹² Or, contrariwise, foreign investors concentrate on countries with rapidly increasing regional inequalities, since they may be an outcome of a dynamic economic prosperity they want to participate in. In both cases, net FDI inflows are an endogenous regressor in the econometric model, which would result in a bias in the OLS coefficient. This also affects the development level as well as the interaction variable of net FDI inflows and income, therefore all these variables should be treated as endogenous. The major problem is, that it is difficult to find suitable instruments for FDI flows in a panel data set. Influential studies such as Porta et al. (1998) and Alfaro et al. (2004) use a country's legal origin as instrument for FDI flows, since investor conditions are related to the distinct legal systems (i.e. common law system versus civil laws system). Such variables are, however, not varying over time and consequently unsuitable for a fixed effects panel data model. I have tried to instrument FDI flows with standard determinants taken from the literature. Blonigen (2005) mentions real exchange rates, tariffs, the macroeconomic conditions, country risk factors and investment conditions, education, and colonial links. However, these variables have turned out to be only weak predictors of net FDI flows in my data set, therefore I have chosen to instrument the potentially endogenous variables with their one-period lagged value. The regression diagnostics imply that the instruments are weak, therefore I use a limited information maximum likelihood (LIML) estimator instead of a standard two-stage-least-square (TSLS) estim-

¹² In line with the theoretical literature, recent empirical studies suggest that regional inequalities increase the risk of internal conflict Buhaug et al. (2012), Deiwiks et al. (2012), and Lessmann (2012b).

ator, which reduces the bias of the estimates [see Anderson (2005) for details]. Section 4.2 discusses details of the instrumental variable regressions.

The set of control variables is the same for all specifications. Following Lessmann (2009), unemployment may be unequally distributed among the regions of a country affecting measures of regional inequality because of this I control for the unemployment ratio. The work of Rodriguez-Pose and Gill (2006) and others suggests that international trade has an impact on regional disparities, so I also control for trade openness using the sum of imports and exports as a share of the GDP. To capture agglomeration effects, I control for the share of urban living population [Krugman and Elizondo (1996)]. The effects concerning a country's size are considered by including the logarithm of the total population, since size in terms of geographic area is time invariant, and hence not possible to be considered in the country fixed effects model. Since farm-based economies at an early stage of economic development might have higher regional inequalities, I also control for the share of employment in the agricultural sector. Sources and definitions of all considered variables are provided in Table A.2 in the appendix; Table A.3 provides summary statistics.

4.2 Estimation results

In the following, I present the main results of my analysis. In this main part of the analysis I focus on the coefficient of variation of regional GDP p.c. (CV) as dependent variable; the alternative disparity measures $GINI$ and WCV are used for robustness tests in section 4.3. Table 2 presents the results of different specifications of equation (4) using the OLS and LIML estimator.

Column (1) and (2) report results of OLS estimations; column (3) and (4) present results using the LIML estimator. In the results presented in column (1) only the income level shows a significant effect. Without the interaction term, the estimations show that there is no unconditional impact of FDI on regional inequality. That is not surprising, since the theoretical framework suggests that the effect varies with the level of economic development. Inclusion of the interaction variable produces significant effects (column 2). The coefficient γ_2 of the FDI variable is positive and statistically significant at a 1% confidence level, while the coefficient γ_3 of the interaction term $FDI_{i,t} \times GDP_{i,t}$ is negative and also significant at a 1% level. This result suggests that the effect of FDI inflows on regional inequality depends on the development level of a country. In low income countries, FDI inflows increase regional inequalities, while FDI inflows do not have a

Table 2: Panel results using the coefficient of variation (five year averages)

Dependent variable: Coefficient of variation of regional GDP p.c. (CV)				
	OLS (1)	OLS (2)	LIML (3)	LIML (4)
Log of GDP p.c.	0.135*** (2.89)	0.141*** (3.28)	0.030 (0.24)	0.198* (1.89)
Unemployment ratio	0.02 (0.08)	0.02 (0.12)	-0.100 (-0.35)	0.173 (0.75)
Trade to GDP	0.059 (0.82)	0.062 (0.87)	-0.037 (-0.30)	-0.098 (-0.90)
Urbanization	-0.398 (-1.47)	-0.523** (-2.21)	-0.201 (-0.49)	-0.772** (-2.08)
Log of population	-0.162 (-0.92)	-0.151 (-0.92)	-0.172 (-0.92)	0.026 (0.16)
Agricultural employment	0.218 (1.50)	0.248* (1.70)	0.175 (1.44)	0.229 (1.55)
FDI net inflow	0.01 (0.06)	3.221*** (3.47)	0.424 (0.58)	6.404* (1.87)
FDI×Log of GDP p.c.		-0.344*** (-3.43)		-0.609* (-1.83)
Country fixed effects	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Obs.	192	192	186	186
N	54	54	52	52
Adj. R-sq	0.352	0.394	0.297	0.211

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

In the instrumental variable regressions, the Log of GDP p.c., FDI net inflows and their interaction are treated as endogenous. Their one-5year-period lagged levels are used as instruments. Table A.4 in the appendix shows the effect of lagged levels of the endogenous regressors on the current inequality index. First stage regression diagnostics are reported in Table A.5 in the appendix.

negative redistributive effect in high income countries. Note that the marginal effect of FDI on regional inequality is calculated below.

The instrumental variable regressions reported in column (3) and (4), respectively, support these findings. The GDP p.c., FDIs and the interaction variable are treated as endogenous variable. The instruments in the first stage of the regression are the one-period lagged levels. For the validity of the instruments, one has to check whether the exclusion restriction is satisfied, that is, the instrument should not affect the dependent variable in the second stage regression equation. Table A.4 in the appendix shows a two-ways fixed effects regression, where the measure of inequality is regressed on the lagged levels of the endogenous variables. It turns out that the instruments (lagged levels) are not significantly related to current inequality (t -values < 0.45). At the same

time, the correlation between the instruments and the endogenous variables is 0.75 or higher. Insofar, the instruments seem to be valid. However, the F statistics of the first stage regressions imply, that even the lagged values are weak instruments. The results are reported in Table A.5 in the appendix. The F statistic of excluded instruments never reaches the critical value, which is around 10 in TSLS estimations [see Stock and Yogo (2005)]. Therefore, I have chosen the LIML estimator instead of TSLS, which reduces the weak instrument bias in instrumental variable regressions. Due to the weak instrument, I only employed just-identified estimations (number of endogenous variables equals number of instruments), since they are median-unbiased. To sum up, the instrumental variable regressions support the OLS findings, but I have to admit that the results may suffer from a weak instrument bias.

The statistical significance of the individual coefficients as reported in Table 2 does not necessarily imply that the marginal effect of FDI inflows on regional inequality is statistically significant [see Brambor et al. (2006)]. I am not particularly interested in the individual statistical significance of either of these terms. Instead, I am interested in their joint significance or, more correctly, the marginal effect of FDI on regional inequality depending on the level of economic development. The marginal effect can be calculated using γ_2 and γ_3 given the log of the GDP p.c. [see equation (4)]:

$$\frac{\partial REGINEQ}{\partial FDI} = \gamma_2 + \gamma_3 \cdot GDPPC \quad (5)$$

The interaction model asserts that the effect of a change in *FDI* inflows on regional inequality depends on the value of the conditioning variable *GDPPC*. While it is possible to calculate the marginal effect using equation (5) and the regression coefficients reported in Table 2, it is not possible to do so for the standard errors. The standard error of interest is:

$$\hat{\sigma}_{\frac{\partial REGINEQ}{\partial FDI}} = \sqrt{var(\gamma_2) + GDPPC^2 \cdot var(\gamma_3) + 2 \cdot GDPPC \cdot cov(\gamma_2 \gamma_3)} \quad (6)$$

The standard errors can be used to calculate confidence bands around the marginal effects. Figure 4 and ?? illustrate how the marginal effect of FDI inflows 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).

The negative slope of the marginal effect is an outcome of the negative coefficient of the interaction variable (γ_3). For low GDP p.c. levels, the marginal effect of FDI on regional inequality is positive, while the effect vanishes with increasing development. The cutoff value of economic development

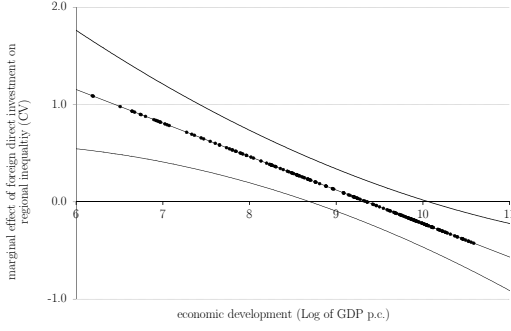


Figure 4: Marginal effect OLS estimates

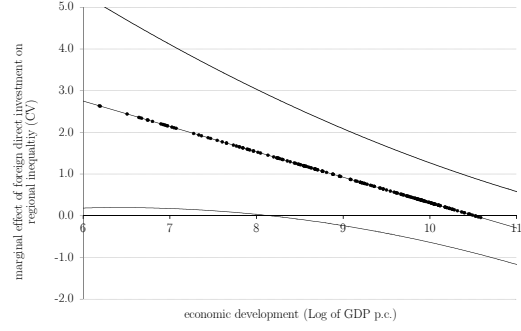


Figure 5: Marginal effect LIML estimates

is the value of the log of the GDP p.c. fulfilling $\partial REGINEQ / \partial FDI = 0$ is 9.4 which corresponds to a GDP of approximately 11,000 US\$ p.c.¹³ Countries poorer than this threshold experience negative redistributive consequences from FDI inflows. Note that the marginal effect calculated from the IV regressions implies that FDI inflows have not significant effect on regional inequalities in high income countries. In low income countries, FDI is harmful for regional equity. To sum up: The results support the hypothesis that FDI inflows foster regional inequality depending on the level of economic development: FDI aggravates regional inequality especially in less developed countries, while the effect is less evident in high-income countries.

4.3 Robustness tests

A number of robustness tests have been carried out in order to study the stability of the main results. The first set of robustness tests show that the results are independent of the measure of regional inequality. Table A.6 in the appendix reports estimations similar to those reported in Table 2 using the Gini coefficient (*GINI*) and the weighted coefficient of variation (*WCV*) as the dependent variable. In both cases, the results support the findings of the previous section.

The second robustness test considers different period averages in order to disentangle the short-run from the long-run effects of FDI on regional inequality. Table A.7 reports the estimation results using the three different measures of regional inequality (*CV*, *GINI*, and *WCV*) with annual data as well as ten-year period averages. In all cases the general finding holds, but it is interesting to take a closer look at the regression diagnostics. The adjusted R-squared increases as the period being averaged increases. For example, in Table 2 above, the R-squared was 0.394 in the fully

¹³ Calculations are based on the OLS estimates reported in column (2) of Table 2.

specified regression (column 2). Column (1) and (2) of Table A.7 show that the R-squared is considerably smaller using annual data (0.300), but much higher using 10-year averages (0.529). Thus, the empirical model is better suited to explain long-run effects of FDI inflows rather than short-run effects.

In a third robustness test the sample is adjusted for extreme observations in order to test whether outliers impact the results. In all estimations discussed from now on, the basic setting uses the *CV* as dependent variable with 5-year period averages similar to the regressions reported above. Table A.8 in the appendix presents the results. In column (1) I have dropped the poorest countries with less than 3,000 US\$ GDP p.c. from the sample; in column (2) I have dropped the richest countries with a GDP p.c. of more than 27,000 US\$. In both cases, the general finding holds, but it is worth mentioning that dropping the richest countries increases the fit of the regressions significantly: the R-squared increase from 0.368 to 0.427. Next, I have dropped the observations that have an FDI to GDP ratio of more than 20% (column 3) and that have an FDI to GDP ratio of less than 1% (column 4). In both sample adjustments the major results hold. Moreover, the regression fit is much improved if the observations with a very small FDI to GDP ratio are dropped (column 4). Note that some countries have also experienced disinvestment periods. The final adjustment of the sample for extreme values is to exclude the countries with very high values of the *CV* – such as Indonesia – (column 5) and very low values of the *CV* (column 6). Again, the main findings hold.

The last series of robustness tests concerns other factors that might affect the relationship between FDI and regional inequality. In particular, the fairly large differences of the territorial level between the countries in the sample might bias estimates since the effects from commuters or regional spillovers are not comparable. For example, with Malta and Slovenia, I consider two very small countries with an area of just 320 and 20,100 square kilometers respectively, because of this it might be not suitable to compare those countries with larger countries such as Canada or China. Thus, I dropped those small countries with less than 3 sub-national units from the data set. As the results reported in column (7) of Table A.8 imply, this adjustment does not change anything in the major findings. I also drop highly fragmented countries with more than 25 sub-national units from the sample (column 8), which does not alter the main finding. In column (9), I have used only OECD countries, since the territorial level is more homogeneous for this sample of countries,

and in column (10) I concentrated on countries from Europe and Central Asia for the same reason. In the sample of (rich) OECD countries, the effect of FDI on regional inequality disappears, which is in line with the main finding presented above. The last robustness test is to exclude federal countries (column 11). There is a fairly vast amount of empirical literature about the impact of decentralization on regional inequalities [e.g. Shankar and Shah (2003), Lessmann (2009, 2012), or Rodríguez-Pose and Ezcurra (2010)], which finds a negative impact of decentralization on regional inequalities. Since most decentralization measures are either time-invariant or not available for a lot of countries in the data set, I report estimates for federal countries only. The estimates support the main findings. Last but not least, column (12) presents results where a non-linear, quadratic effect of the income variable is considered. An alternative explanation for the main finding of this analysis might be, that FDI simply correlates with development itself. Then the interaction variable $FDI_{i,t} \times GDPPC_{i,t}$ is highly correlated with an interaction variable $GDPPC_{i,t} \times GDPPC_{i,t}$, and the main finding is just related to a non-linear effect of income on regional inequalities [see Williamson (1965) and Barrios and Strobl (2009)]. However, the regressions using both interaction variables shows that the coefficient of the $FDI_{i,t} \times GDPPC_{i,t}$ interaction variable has a significant effect even if I control for a possible nonlinearity in the income effect. Note that this does not imply, that the quadratic function of income is not relevant at all, since the marginal effect of income on inequality now also depends on FDI flows [see Lessmann (2011)]. Altogether, the different tests show a robust relationship between FDI and regional inequalities depending on the level of economic development.

4.4 Development-related determinants of the FDI-regional inequality nexus

The empirical analysis shows, that FDI fosters regional inequalities in less developed countries, while there are no significant negative redistributive consequences in high-income economies. I have argued throughout the paper that economic development goes hand in hand with mobility of factors, and more (effective) government policies aimed at reallocation of factors between regions. Countries at a higher stage of economic development have a better infrastructure, more transport facilities, and a higher skilled and more mobile work force than poorer countries. Moreover, highly developed economies have more effective governments and a higher fiscal capacity, which is important for the reallocation of resources between regions. Possible instruments to achieve

a more equal distribution are measures such as tax holidays in disadvantaged regions, subsidies for particular industries, and public investments in productive public goods. A potentially less useful instrument are interregional transfers in terms of formal fiscal equalization programs since these are likely to increase regional inequalities due to the adverse effects they have on convergence promoting migration [see Kessler et al. (2011) for details].

In this section, I will try to disentangle these different arguments: internal migration vs. government policies. The major challenge is to find appropriate variables which approximate these issues. In particular, in case of internal migration, data availability is poor especially in less developed countries. Therefore, I rely mainly on variables that correlate highly with internal migration rates, but I also consider explicitly the internal migration rates for 20 OECD countries.¹⁴ The empirical strategy is to let the proxy variables interact with FDI inflows instead of using the GDP p.c.¹⁵ Please note that we should be cautious concerning a causal interpretation of the results. Due to the poor availability of data, I am not able to provide convincing instrumental variable regression results. The results are reported in Table 3 for internal migration as a determinant for the FDI-regional inequality nexus.

The first proxy variable is the degree of urbanization (column 1). I assume interregional mobility of households to be higher in urban economies. For the 20 OECD countries where internal migration ratios are available, the correlation coefficient between urbanization and internal migration is 0.33, supporting this assumption. As another proxy variable, I use the Gini coefficient of the population distribution among the different regions of a country as conditioning variable (column 2). This measure reflects another kind of agglomeration: while the degree of urbanization may be similar in the different regions of a country, the measure of the population distribution captures whether the population is unequally distributed in a country in general. Canada is an example of a country with a very unequally distributed population. Another proxy for household mobility is the number of cars per 1,000 people (column 3), which highly correlates with the degree of urbanization, though it is negatively correlated with internal migration rates. Next I use the traffic density, which is defined as vehicles (cars, motorcycles, etc.) per kilometer of road (column 4). Interestingly, this

¹⁴ See Bell and Muhidin (2009) for a discussion of problems that emerge using cross country data on internal migration. Focusing on OECD countries reduces these problems, since the regional level is reasonably comparable between countries.

¹⁵ I have also considered an econometric model where the interaction of net FDI inflows enters as additional regressor. However, this does not yield significant effects in the majority of regressions due to the high multicollinearity of the interaction variables. The correlation between the interaction variables is between 0.74 and 0.98.

Table 3: Panel results using migration proxies as conditioning variable

Dependent variable: Coefficient of variation of regional GDP p.c. (CV)					
	(1)	(2)	(3)	(4)	(5)
Log of GDP p.c.	0.104*	0.134**	0.134	0.023	0.489***
	(2.09)	(2.70)	(1.31)	(0.19)	(6.05)
Unemployment ratio	0.040	0.023	-0.359*	-1.025***	1.055***
	(0.17)	(0.08)	(-2.45)	(-4.47)	(4.07)
Trade to GDP	0.018	0.031	0.019	0.065	-0.106
	(0.23)	(0.42)	(0.30)	(0.91)	(-1.37)
Urbanization	-0.497	-0.468	-0.627	-0.951	-0.228
	(-1.97)	(-1.69)	(-1.24)	(-0.95)	(-0.75)
Log of population	-0.167	-0.103	0.256	0.845**	-0.619*
	(-1.00)	(-0.61)	(1.06)	(2.86)	(-2.29)
Agricultural employment	0.231	0.220	-0.217	0.287	1.252***
	(1.59)	(1.41)	(-0.94)	(1.03)	(5.19)
FDI net inflow	1.997**	0.482	0.131	0.617**	1.316*
	(3.00)	(1.51)	(0.31)	(2.81)	(2.53)
FDI×urbanization	-2.319**				
	(-3.44)				
Population concentration		0.326			
		(0.88)			
FDI×pupolation conc.		-1.128			
		(-1.31)			
Cars			-0.001**		
			(-2.78)		
FDI×cars			0.001		
			(0.17)		
Traffic density				-0.002**	
				(-3.35)	
FDI×traffic density				-0.010**	
				(-2.79)	
Internal migration					0.003
					(1.20)
FDI×internal migration					-0.046*
					(-2.28)
Country fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Obs.	192	188	83	66	60
N	54	52	53	20	20
Adj. R-sq	0.395	0.362	0.587	0.671	0.654

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

proxy is almost perfectly correlated with internal migration rates. As already mentioned, I have explicit data on internal migration for 20 OECD countries, which I use in the regressions reported in column (5).

The results imply that internal migration plays an important role in the relationship between FDI and regional inequality. The interaction variable is negative and statistically significant in the case

of the degree of urbanization (column 1), traffic density (column 4), and internal migration rates (column 5). In the case of the population concentration (column 2), the sign of the interaction variable is correct but the t-statistics is too small with a value of 1.31. The number of cars does not affect the relationship between FDI and regional inequality.

The other reason for economic development to be decisive for the relationship between FDI and regional inequalities are government policies. The case of China has demonstrated that governments in FDI hosting countries react to the rising inequalities induced by FDI inflows. In China, the government has implemented special development programs for the lagging western part of the country, which seemed to be quite successful. The instruments through which the government can try to reallocate resources are diverse, so it might be difficult to find a single variable to capture similar issues in different countries. The proxy variables I use for government reallocation policies are an index of government effectiveness, the share of subsidies in total government expenditures, the tax to GDP ratio, and government size defined as government expenditures as a share of the GDP. Table 4 reports the results of the different specifications.

Government effectiveness (column 1) seems to be an important determinant for the FDI-inequality nexus. The results suggest that highly effective governments are able to compensate for the negative redistributive consequences from FDI inflows, although I am not able to identify the particularly effective instruments. A country with an ineffective (e.g. corrupt, kleptocratic or with a low bureaucratic quality) government may not be able or willing to reallocate factors in order to achieve a more equal distribution among the different regions of a country. Government effectiveness – as measured by the index of bureaucratic quality provided by the International Country Risk Guide – seems to be helpful in achieving a more equal factor distribution. Note that this proxy variable is highly correlated with other institutional characteristics as well as economic development itself, because of this it is impossible to identify whether this is actually the driving force. Subsidies are a specific instrument through which a government can affect the allocation of FDI (column 2). I use subsidies as a share of government expenditures as a proxy variable. The interaction variable shows the correct negative sign implying that subsidies decrease the negative redistributive effects from FDI inflows, although the effect is not statistically significant at a conventional confidence levels. The problem with the proxy variable is that I have no information about the type of subsidies or their geographic distribution. The rationale for the next two proxy variables –

tax/GDP ratio and government size (expenditure/GDP ratio) – is that governments need sufficient financial power to be able to affect the allocation of FDI (column 3 and 4). If the government budget is small, I expect less effective government policies concerning the interregional distribution of factors. The estimations suggest that the negative redistributive consequence of FDI inflows on regional inequalities decrease with government size as expected.

I am completely aware of the measurement problems of the variables applied to test the different determinants. However, the regressions imply that both conditioning factors – internal migration and government policies – are important here. Thus, in order to reduce the negative effects of FDI inflows, governments might engage in policies, which aim at increasing factor mobility as well as in redistributive policies through the budget.

Table 4: Panel results using government policy proxies as conditioning variable

	Dependent variable: Coefficient of variation (CV)			
	(1)	(2)	(3)	(4)
Log of GDP p.c.	0.138*** (2.95)	0.075 (0.86)	0.091 (1.13)	0.075 (1.14)
Unemployment ratio	0.006 (0.02)	0.052 (0.19)	0.055 (0.19)	0.422 (1.46)
Trade to GDP	0.079 (1.12)	-0.005 (-0.07)	-0.010 (-0.15)	-0.033 (-0.58)
Urbanization	-0.493** (-2.31)	-0.604 (-0.93)	-0.637 (-1.00)	-0.652 (-1.16)
Log of population	-0.140 (-0.95)	-0.304 (-1.28)	-0.237 (-1.14)	-0.295 (-1.54)
Agricultural employment	0.264** (2.29)	0.337 (0.87)	0.294 (0.86)	0.260 (1.09)
FDI net inflow	1.500** (2.96)	0.874 (1.45)	0.189 (0.22)	2.062** (2.49)
Bureaucratic quality	-0.012 (-0.79)			
FDI×bureaucratic quality	-0.451*** (-3.18)			
Subsidies		0.001 (0.76)		
FDI×subsidies		-0.013 (-1.32)		
Tax/GDP			-0.001 (-0.02)	
FDI×Tax/GDP			-0.004 (-0.09)	
Government size				-0.002 (-0.98)
FDI×government size				-0.052** (-2.46)
Country fixed effects	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Obs.	190	107	109	110
N	53	52	52	53
Adj. R-sq	0.407	0.481	0.468	0.559

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

5 Summary and conclusion

Countries try to attract foreign direct investments (FDI) in order to stimulate economic growth. At the same time, FDI might cause a rise in regional inequality, since capital investments usually distribute asymmetrically among the different regions of a country as the examples of China and India suggest. Increasing *interregional* inequalities may cause conflicts and increase undesirable *interpersonal* inequalities. Against this background, this paper studies the impact of FDI on regional inequality. This is particularly important, since studies on inequality and conflict suggest that vertical inequality – e.g. measured by the Gini coefficient of household incomes – is not robustly related to conflict measures, while horizontal inequality is [see Stewart (2000, 2002), Deiwi et al. (2012), Buhaug et al. (2012) and Lessmann (2012b)]. Economic theory suggests that the level of economic development has an impact on the FDI–regional inequality nexus. The higher the interregional mobility of individuals and the more effective government policies are in reallocating resources between regions, the weaker the negative redistributive consequences from FDI inflows should be. Both conditions are less appropriate for low and middle income countries than high income economies, therefore I hypothesize that the negative impact of FDI on regional inequality decreases with a higher level of economic development.

The existing literature on FDI and regional inequality focuses on China or Chinese provinces; because of this the analysis starts with a review of the well-known Chinese case supplemented by some recent data. After the opening of the economy in the 1980s FDI inflows increased rapidly causing a sharp rise in regional inequality. As a reaction, the Chinese government started in the mid 1990s to channel FDI inflows to less developed western regions. Some recent data shows that this government intervention was successful, as regional inequalities have been falling since this time. Thus, during China’s development from a low to a middle income economy, the negative redistributive consequences from FDI inflows vanished as suggested by the theoretical framework. The Chinese experience creates a motivation to study a cross-section of countries in order to be able to generalize the research findings.

For this purpose, a unique data set of regional inequalities in 55 countries at all stages of economic development for the period 1980-2009 is analyzed in this paper. Panel regressions suggest that the Chinese experience also applies to the broader data set: While FDI fosters regional inequalities in

low and middle income countries, the negative redistributive effects do not occur in high income economies. The estimations also suggest that the fit of the empirical model is much better for medium- and long-term data than for analyzing short run effects. Instrumental variable regressions considering issues related to weak instruments support the major findings.

Finding economic development – as measured by the log of the GDP p.c. – to be an important determinant for the FDI–regional inequality nexus is interesting, but still somewhat unsatisfactory, since one cannot disentangle whether the higher mobility of factors is responsible for this result or government policies. Therefore, I have tried to find suitable approximations for both determinants “mobility of individuals” and “government reallocation policies”. Although the proxy variables are disputable, the estimations imply that both conditioning factors are important. In this respect, the evidence from the cross-section supports the Chinese experience, where government policies were the major determinant of the diminishing the negative impact of FDI on regional inequality [Wei et al. (2009)].

The findings of this study are compatible with the existing literature on FDI and growth. An important contribution is Alfaro et al. (2004) who find the relationship between FDI and growth to depend on the quality of financial institutions: the better the financial institutions of FDI hosting countries, the stronger is the growth enhancing effect of FDI. If we assume in line with Levine and Zervos (1998) that the quality of financial institutions – call it financial development – highly correlates with the level of economic development, then the findings of Alfaro et al. (2004) implies that high developed countries benefit stronger from FDI compared to less developed countries. This result may be driven at least to some extent by the negative redistributive effect of FDI on regional inequality in developing countries as this analysis shows. As discussed by Kanbur and Zhang (2005) regional inequality promotes interpersonal income inequality, which have a dampening effect on economic growth [Alesina and Rodrik (1994)].

In light of the empirical findings, the policy conclusion from this analysis is that if governments aim to alleviate the negative redistributive consequences from FDI inflows as they occur in low and middle income countries, policies pointing at increased mobility of factors – such as enhanced infrastructure provision – seem to be appropriate as well as direct interventions through government expenditures.

References

- Alesina, A. and D. Rodrik (1994). Distributive Politics and Economic Growth. *Quarterly Journal of Economics*, 109(2), pp. 465–90.
- Alfaro, L., A. Chanda, S. Kalemli-Ozcan, and S. Sayek (2004). FDI and economic growth: the role of local financial markets. *Journal of International Economics*, 64(1), pp. 89–112.
- Alfaro, L., A. Chanda, S. Kalemli-Ozcan, and S. Sayek (2010). Does foreign direct investment promote growth? Exploring the role of financial markets on linkages. *Journal of Development Economics*, 91(2), pp. 242–256.
- Anderson, T. (2005). Origins of the limited information maximum likelihood and two-stage least squares estimators. *Journal of Econometrics*, 127(1), pp. 1–16.
- Bailey, D. and N. Driffield (2002). Hymer and Uneven Development Revisited: Foreign Direct Investment and Regional Inequalities. *Contributions to Political Economy*, 21(1), pp. 55–68.
- Balasubramanyam, V. N., M. Salisu, and D. Sapsford (1996). Foreign Direct Investment and Growth in EP and IS Countries. *Economic Journal*, 106(434), pp. 92–105.
- Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. Chichester: Wiley.
- Bao, S., G. H. Chang, J. D. Sachs, and W. T. Woo (2002). Geographic factors and China’s regional development under market reforms, 1978-1998. *China Economic Review*, 13(1), pp. 89–111.
- Barrios, S. and E. Strobl (2009). The dynamics of regional inequalities. *Regional Science and Urban Economics*, 39(5), pp. 575 – 591.
- Basu, P. and A. Guariglia (2007). Foreign Direct Investment, inequality, and growth. *Journal of Macroeconomics*, 29(4), pp. 824–839.
- Bell, M. and S. Muhidin (2009). Cross-National Comparisons of Internal Migration. Human Development Research Papers (2009 to present) HDRP-2009-30, Human Development Report Office (HDRO), United Nations Development Programme (UNDP).
- Bendel, R. B., S. S. Higgins, and D. A. Pyke (1989). Comparison of Skewness Coefficient, Coefficient of Variation, and Gini Coefficient as Inequality Measures within Populations. *Oecologia*, 78(3), pp. 394–400.

- Bertrand, A. (2004). Mergers and Acquisitions, greenfield investment and extension of capacity. Direct investment technical expert group (DITEG), Issue Paper #4,#28,#29, IMF Committee on Balance of Payments Statistics and OECD workshop on international statistics.
- Bittlingmayer, G. (1996). Merger as a Form of Investment. *Kyklos*, 49(2), pp. 127–153.
- Blonigen, B. A. (2005). A Review of the Empirical Literature on FDI Determinants. *Atlantic Economic Journal*, 33, pp. 383–403.
- Borensztein, E., J. De Gregorio, and J.-W. Lee (1998). How does foreign direct investment affect economic growth?1. *Journal of International Economics*, 45(1), pp. 115–135.
- Brambor, T., W. R. Clark, and M. Golder (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*, 14(1), pp. 63–82.
- Buhaug, H., K. Gleditsch, H. Holtermann, G. Østby, , and A. F. Tollefsen (2012). It’s the local economy, stupid! Geographic wealth dispersion and conflict outbreak location. *Journal of Conflict Resolution*, 55(5), pp. 814–840.
- Chen, J. and B. M. Fleisher (1996). Regional Income Inequality and Economic Growth in China. *Journal of Comparative Economics*, 22(2), pp. 141–164.
- Choi, C. (2006). Does foreign direct investment affect domestic income inequality? *Applied Economics Letters*, 13(12), pp. 811–814.
- Dalton, H. (1920). The Measurement of the Inequality of Incomes. *Economic Journal*, 30(119), pp. 348–361.
- Deiwi, C., L. Cederman, and K. Gleditsch (2012). Inequality and conflict in federations. *Journal of Peace Research*, 49(2), pp. 289–304.
- Dreher, A. and N. Gaston (2008). Has Globalization Increased Inequality? *Review of International Economics*, 16(3), pp. 516–536.
- Elbers, C., P. Lanjouw, J. Mistiaen, B. Özler, and K. R. Simler (2005). Are Neighbours Equal? Estimating Local Inequality in Three Developing Countries. In R. Kanbur and A. Venables (editors), *Spatial Inequality and Development*, pp. 37–76. New York: Oxford University Press.

- Feenstra, R. C. and G. H. Hanson (1996). Globalization, Outsourcing, and Wage Inequality. *American Economic Review*, 86(2), pp. 240–45.
- Fleisher, B., H. Li, and M. Q. Zhao (2010). Human capital, economic growth, and regional inequality in China. *Journal of Development Economics*, 92(2), pp. 215–231.
- Fu, X. (2004). Limited linkages from growth engines and regional disparities in China. *Journal of Comparative Economics*, 32(1), pp. 148–164.
- Fujita, M. and D. Hu (2001). Regional disparity in China 1985-1994: The effects of globalization and economic liberalization. *Annals of Regional Science*, 35(1), pp. 3–37.
- Gennaioli, N., R. L. Porta, F. L. de Silanes, and A. Shleifer (2011). Human Capital and Regional Development. NBER Working Papers 17158, National Bureau of Economic Research, Inc.
- Gil Canaleta, C., P. Pascual Arzoz, and M. Rapun Gárate (2004). Regional Economic Disparities and Decentralisation. *Urban Studies*, 41(1), pp. 71–94.
- Hale, T. (2003). The Theoretical Basics of Popular Inequality Measures; Online Computation of Examples. University of Texas Inequality Project.
- Hansen, H. and J. Rand (2006). On the Causal Links Between FDI and Growth in Developing Countries. *World Economy*, 29(1), pp. 21–41.
- Janeba, E. (2002). Attracting Fdi in a Politically Risky World. *International Economic Review*, 43(4), pp. 1127–1155.
- Jones, D. C., C. Li, and A. L. Owen (2003). Growth and regional inequality in China during the reform era. *China Economic Review*, 14(2), pp. 186–200.
- Kanbur, R. and A. Venables (2005). Spatial Inequality and Development. In R. Kanbur and A. Venables (editors), *Spatial Inequality and Development*, pp. 3–11. New York: Oxford University Press.
- Kanbur, R. and X. Zhang (2005). Fifty Years of Regional Inequality in China: a Journey Through Central Planning, Reform, and Openness. *Review of Development Economics*, 9(1), pp. 87–106.
- Kessler, A., N. Hansen, and C. Lessmann (2011). Interregional Redistribution and Mobility in Federations: A Positive Approach. *Review of Economic Studies*, 78(4), pp. 1345–1378.

- Krugman, P. and R. L. Elizondo (1996). Trade policy and the Third World metropolis. *Journal of Development Economics*, 49(1), pp. 137–150.
- Lessmann, C. (2009). Fiscal Decentralization and Regional Disparity: Evidence from Cross-section and Panel Data. *Environment and Planning A*, 41(10), pp. 2455–2473.
- Lessmann, C. (2011). Spatial Inequality and Development - Is there an Inverted-U Relationship? CESifo Working Paper Series 3622, CESifo Group Munich.
- Lessmann, C. (2012a). Regional inequality and decentralization: an empirical analysis. *Environment and Planning A*, 44(6), pp. 1363–1388.
- Lessmann, C. (2012b). Regional inequality and internal conflict: Evidence from panel data. Discussion paper, Technische Universität Dresden.
- Levine, R. and S. Zervos (1998). Stock Markets, Banks, and Economic Growth. *American Economic Review*, 88(3), pp. 537–58.
- Lucas, J., Robert E (1990). Why Doesn't Capital Flow from Rich to Poor Countries? *American Economic Review*, 80(2), pp. 92–96.
- Mehran, F. (1976). Linear Measures of Income Inequality. *Econometrica*, 44(4), pp. 805–809.
- de Mello, J., Luiz R (1999). Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data. *Oxford Economic Papers*, 51(1), pp. 133–51.
- Pigou, A. C. (1912). *Wealth and Welfare*. London: Macmillan.
- Porta, R. L., F. L. de Silanes, and A. Shleifer (2008). The Economic Consequences of Legal Origins. *Journal of Economic Literature*, 46(2), pp. 285–332.
- Porta, R. L., F. L. de Silanes, A. Shleifer, and R. W. Vishny (1998). Law and Finance. *Journal of Political Economy*, 106(6), pp. 1113–1155.
- Quah, D. (1993). Galton's Fallacy and Test of the Convergence Hypothesis. *Scandinavian Journal of Economics*, 95(4), pp. 427–443.
- Rodríguez-Pose, A. and R. Ezcurra (2010). Does Decentralization Matter for Regional Disparities? A Cross-Country Analysis. *Journal of Economic Geography*, 10(5), pp. 619–644.

- Rodriguez-Pose, A. and N. Gill (2006). How does trade affect regional disparities? *World Development*, 34(7), pp. 1201–1222.
- Sala-i-Martin, X. (1996). Regional Cohesion: Evidence and Theories of Regional Growth and Convergence. *European Economic Review*, 40(6), pp. 1325–1352.
- Sen, A. (1973). *On Economic Inequality*. New York: Norton.
- 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(8), pp. 1421–1441.
- Siddharthan, N. S. (2007). Regional Differences in FDI Inflows: China - India Comparison. Discussion paper, institute of economic growth.
- Stewart, F. (2000). Crisis prevention: tackling horizontal inequalities. *Oxford Development Studies*, 28(3), pp. 245–262.
- Stock, J. H. and M. Yogo (2005). Testing for Weak Instruments in Linear IV Regression. In D. W. K. Andrews and J. H. Stock (editors), *Identification and Inference for Econometric Models: A Festschrift in Honor of Thomas J. Rothenberg*, pp. 80–104. Cambridge, UK: Cambridge University Press.
- Sun, H. and J. Chai (1998). Direct foreign investment and inter-regional economic disparity in China. *International Journal of Social Economics*, 25(2-4), pp. 424–447.
- Treisman, D. (2008). Decentralization dataset. <http://www.sscnet.ucla.edu/polisci/faculty/treisman/>.
- Tsai, P.-L. (1995). Foreign Direct Investment and Income Inequality: Further Evidence. *World Development*, 23(3), pp. 469–483.
- Wei, K., S. Yao, and A. Liu (2009). Foreign Direct Investment and Regional Inequality in China. *Review of Development Economics*, 13(4), pp. 778–791.
- Weltbank (2010). World Development Indicators 2009. Washington D. C.
- Williamson, J. G. (1965). Regional Inequality and the Process of National Development: A Description of Patterns. *Economic Development and Cultural Change*, 13(4), pp. 3–45.

- Yemtsov, R. (2005). Quo Vadis? Inequality and Poverty Dynamics across Russian Regions. In R. Kanbur and A. Venables (editors), *Spatial Inequality and Development*, pp. 348–408. New York: Oxford University Press.
- Zhang, X. and K. H. Zhang (2003). How Does Globalisation Affect Regional Inequality within A Developing Country? Evidence from China. *Journal of Development Studies*, 39(4), pp. 47–67.
- ZSi (2009). *European System of Social Indicators*. Bonn: Zentrum für Sozialindikatorenforschung (ZSi).

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 Estadística
Brazil	26 states; 1 federal district	2002–2007	Instituto Brasileiro de Geografia e Estatística
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	Nuts3 regions	2001–2007	Eurostat
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	1991–2004	Cambridge Econometrics
Greece	13 NUTS2 regions	1980–2004	Cambridge Econometrics
Hungary	7 NUTS2 regions	1990–2009	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, and OECD Regional Statistics
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 Estadística
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
Uzbekistan	12 provinces; 1 republic; 1 capital region	2008	Uzbekistan in Figures – UinF
Venezuela	23 states; 1 federal district	2007	Banco Central de Venezuela

Table A.2: Data sources & definitions

Variable	Definition	Source
Coefficient of variation	Coefficient of variation of regional GDP per capita	various sources
Adjusted Gini coefficient	Adjusted Gini coefficient of regional GDP per capita	various sources
Weighted coefficient of variation	Population weighted coefficient of variation of regional GDP per capita	various sources
Log of GDP p.c.	Log of the GDP per capita in 2005 \$ prices	Weltbank (2010)
Unemployment ratio	Unemployment ratio	Weltbank (2010)
Trade to GDP	Sum of imports and exports (total trade) as a share of the GDP	Weltbank (2010)
Urbanization	Share of urban living population in total population	Weltbank (2010)
Log of population	Log of the total population	Weltbank (2010)
Agricultural employment	Employment in agriculture in % of total employment	Weltbank (2010)
FDI net inflow	Foreign direct investments net inflows in % of GDP	Weltbank (2010)
Area	Land area in 10,000 km ²	Weltbank (2010)
Units	Number of regions of a country used to calculate inequality measures	various sources
OECD dummy	Dummy variable for OECD countries	—
Europe and Central Asia (ECA) dummy	Regional dummy using the World Bank country classification	—
Federal dummy	Dummy variable for federal countries	Treisman (2008)
Population concentration	Gini coefficient of the regional population concentration among the different regions of a country	various sources
Cars	Passenger cars per 1,000 people	Weltbank (2010)
Traffic density	Vehicles per km of road	Weltbank (2010)
Internal migration	Migration between the different regions of a country using the NUTS classification	ZSi (2009)
Government effectiveness	Bureaucratic quality index provided by the International Country Risk Guide	Political Risk Services
Subsidies	Subsidies and other transfers in % of expense	Weltbank (2010)
Tax/GDP	Tax revenue in % of GDP	Weltbank (2010)
Government size	Government expenditure in % of GDP	Weltbank (2010)
Real exchange rate	Real effective exchange rate index: $CPI(local)/(CPI(US)*Official\ ER)$	Weltbank (2010)
Tariffs	Average tariff rate, simple mean of all products (%)	Weltbank (2010)
Inflation	log of 1+inflation	Weltbank (2010)
Corruption	Corruption index provided by the International Country Risk Guide	Political Risk Services
Schooling	Gross enrolment rate in secondary schools	Weltbank (2010)
Legal origin	Dummy variable for a French, British, and German legal origin	Porta et al. (2008)

Table A.3: Summary statistics – annual panel data

Variable	Obs.	Mean	Std. Dev.	Min	Max
Coefficient of variation	777	0.29	0.18	0.06	1.24
Adjusted Gini coefficient	777	0.16	0.08	0.04	0.46
Weighted coefficient of variation	764	0.26	0.16	0.04	0.94
Log of GDP p.c.	777	9.16	1.04	5.84	10.59
(Log of GDP p.c.) ²	777	84.94	18.23	34.08	112.18
Unemployment ratio	777	0.08	0.05	0.01	0.31
Trade to GDP	777	0.72	0.36	0.14	1.95
Urbanization	777	0.70	0.13	0.25	0.97
Log of population	777	16.74	1.36	12.87	20.97
Agricultural employment	777	0.12	0.12	0.00	0.75
FDI net inflow	777	0.03	0.06	-0.10	0.93
Area	760	158.86	322.14	0.03	1640.00
Units	777	14.50	11.51	2.00	51.00
OECD dummy	777	0.74	0.44	0.00	1.00
Europe and Central Asia dummy	777	0.68	0.47	0.00	1.00
Federal dummy	777	0.28	0.45	0.00	1.00
Population concentration	762	0.38	0.15	0.07	0.85
Cars	172	311.07	173.42	8.00	613.00
Traffic density	124	44.99	40.04	0.43	207.00
Internal migration	229	16.57	9.98	0.60	38.50
Government effectiveness	661	3.22	0.90	0.00	4.00
Subsidies	384	57.65	13.27	17.30	82.40
Tax/GDP	397	18.66	5.53	7.03	32.20
Real exchange rate	641	95.92	13.25	55.30	140
Tariffs	583	5.14	3.67	0.57	33.30
Inflation	762	1.73	0.97	-1.96	6.85
Corruption	661	4.12	1.41	1.00	6.00
Schooling	593	97.92	19.54	46.7	162.00
Legal origin UK	777	0.17	0.38	0.00	1.00
Legal origin FR	777	0.43	0.50	0.00	1.00
Legal origin GE	777	0.27	0.44	0.00	1.00

Table A.4: Test of exclusion restriction

Dependent variable: coefficient of variation	
Log of GDP p.c.	-0.001
(lagged by one 5-year period)	(-0.01)
Unemployment ratio	-0.211
	(-0.99)
Trade to GDP	0.018
	(0.22)
Urbanization	-0.059
	(-0.15)
Log of population	-0.251
	(-1.47)
Agricultural employment	0.189
	(1.43)
FDI net inflow	0.020
(lagged by one 5-year period)	(0.11)
FDI×Log of GDP p.c.	0.017
(lagged by one 5-year period)	(0.46)
Country fixed effects	yes
Time fixed effects	yes
Obs.	188
N	54
Adj. R-sq	0.269

Table A.5: First stage regression diagnostics

	Dependent variables in first stage of regression:		
	FDI net inflow (1)	Interaction (2)	Log of GDP p.c. (3)
Unemployment ratio	-0.135 (-1.64)	-1.231* (-1.68)	-1.209*** (-4.23)
Trade to GDP	0.095** (-2.52)	0.877** (2.61)	0.213** (2.26)
Urbanization	0.326 (-1.65)	2.670 (1.54)	0.518 (0.87)
Log of population	-0.125** (-1.80)	-1.088* (-1.84)	-0.643*** (-2.76)
Agricultural employment	0.042 (0.74)	0.484 (1.05)	-0.330* (-1.90)
<i>Excluded instruments</i>			
Log of GDP p.c. (lagged)	-0.040** (-2.24)	-0.310* (-1.94)	0.431*** (3.63)
FDI net inflow (lagged)	-1.662 (-1.16)	-21.544* (-1.67)	8.541*** (2.88)
FDI×Log of GDP p.c. (lagged)	0.264 (1.49)	3.184* (1.92)	-0.926*** (-2.98)
Country fixed effects	yes	yes	yes
Time fixed effects	yes	yes	yes
Obs.	186	186	186
N	52	52	52
Adj. R-sq	0.525	0.563	0.906
F Stat	2.08	1.91	7.51
F Stat (p-value)	0.106	0.1313	0.0001

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

Table A.6: Panel results using the adjusted Gini coefficient and the weighted coefficient of variation as inequality measure (five year averages)

	Dependent variable:							
	Adjusted Gini coefficient				Weighted coefficient of variation			
	OLS (1)	OLS (2)	LIML (3)	LIML (4)	OLS (5)	OLS (6)	LIML (7)	LIML (8)
Log of GDP p.c.	0.072*** (3.35)	0.074*** (3.51)	0.007 (0.14)	0.080* (1.82)	0.100** (2.04)	0.107** (2.42)	-0.159 (-1.35)	0.012 (0.14)
Unemployment ratio	-0.021 (-0.18)	-0.020 (-0.19)	-0.070 (-0.53)	0.050 (0.40)	0.147 (0.77)	0.157 (1.04)	-0.160 (-0.58)	0.144 (0.61)
Trade to GDP	0.057* (1.80)	0.058* (1.86)	0.011 (0.18)	-0.016 (-0.28)	0.058 (1.07)	0.061 (1.23)	0.031 (0.27)	-0.033 (-0.33)
Urbanization	-0.223** (-2.10)	-0.266*** (-2.78)	-0.149 (-0.80)	-0.400* (-1.95)	-0.479* (-1.69)	-0.604** (-2.43)	-0.025 (-0.06)	-0.626* (-1.70)
Log of population	0.024 (0.47)	0.028 (0.61)	0.007 (0.07)	0.094 (1.11)	-0.112 (-0.98)	-0.099 (-1.07)	-0.278 (-1.43)	-0.071 (-0.48)
Agricultural employment	0.063** (2.03)	0.074** (2.33)	0.034 (0.81)	0.057 (1.15)	0.015 (0.17)	0.046 (0.49)	-0.050 (-0.69)	0.005 (0.04)
FDI net inflow	0.041 (0.43)	1.169** (2.61)	0.286 (0.72)	2.917* (1.71)	-0.012 (-0.06)	3.208*** (5.42)	0.340 (0.45)	6.678** (2.06)
FDI×Log of GDP p.c.		-0.121** (-2.44)		-0.268 (-1.62)		-0.345*** (-5.21)		-0.644** (-2.06)
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	192	192	186	186	188	188	183	183
N	54	54	52	52	52	52	51	51
Adj. R-sq	0.461	0.484	0.323	0.225	0.428	0.491	0.083	0.108

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

Table A.7: Panel results using different periods and disparity measures

	Dependent variable:					
	CV		GINI		WCV	
	annual (1)	10years (2)	annual (3)	10years (4)	annual (5)	10years (6)
Log of GDP p.c.	0.126** (2.21)	0.155*** (3.17)	0.083*** (2.96)	0.072*** (2.93)	0.079* (1.89)	0.128** (2.31)
Unemployment ratio	0.231 (1.33)	-0.085 (-0.29)	0.062 (0.79)	-0.128 (-0.83)	0.039 (0.18)	0.186 (1.31)
Trade to GDP	0.017 (0.48)	0.026 (0.28)	0.026 (1.30)	0.060* (1.71)	0.086 (1.27)	-0.004 (-0.11)
Urbanization	-0.459 (-1.47)	-0.392* (-1.78)	-0.263** (-2.09)	-0.223** (-2.22)	-0.401* (-1.74)	-0.596* (-1.88)
Log of population	-0.184 (-1.35)	0.032 (0.19)	-0.034 (-0.55)	0.063 (0.98)	-0.037 (-0.31)	-0.204 (-1.54)
Agricultural employment	0.201* (1.96)	0.528*** (5.39)	0.087** (2.47)	0.161*** (5.58)	0.254*** (2.82)	0.074 (0.73)
FDI net inflow	1.148** (2.52)	8.306** (2.47)	0.561** (2.35)	2.792** (2.16)	6.733*** (2.99)	1.390*** (3.89)
FDI×Log of GDP p.c.	-0.116** (-2.50)	-0.874** (-2.63)	-0.055** (-2.28)	-0.299** (-2.33)	-0.738*** (-3.34)	-0.141*** (-3.87)
Country fixed effects	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes
Obs.	777	112	777	112	109	764
N	54	55	54	55	53	52
Adj. R-sq	0.300	0.529	0.386	0.532	0.561	0.391

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

Table A.8: Robustness tests: sample adjustments

Dependent variable: Coefficient of variation of regional GDP p.c. (CV)													
	dropped poorest ^a (1)	dropped richest ^b (2)	dropped FDI>20% (3)	dropped FDI<1% (4)	dropped CV>0.5 (5)	dropped CV<0.2 (6)	dropped REG<3 (7)	dropped REG>25 (8)	OECD only (9)	ECA only (10)	FEDERAL only (11)	non-linear income (12)	
Log of GDP p.c.	0.156* (1.89)	0.097** (2.10)	0.124*** (2.83)	0.130*** (2.97)	0.117** (2.21)	0.170*** (2.81)	0.136** (2.61)	0.152*** (2.78)	0.249** (2.65)	0.243*** (3.87)	0.147** (3.34)	0.214 (1.03)	
(Log of GDP p.c.) ²												-0.005 (-0.33)	
Unemployment ratio	0.270 (1.29)	-0.075 (-0.30)	0.040 (0.18)	0.129 (0.56)	0.033 (0.17)	0.391* (1.69)	0.029 (0.13)	0.084 (0.41)	0.495* (1.86)	0.548** (2.59)	0.134 (0.82)	0.005 (-0.02)	
Trade to GDP	0.081 (1.29)	0.098 (1.36)	0.066 (0.86)	0.083 (1.36)	0.026 (0.52)	0.084 (1.24)	0.058 (0.68)	0.088 (1.22)	0.054 (0.57)	0.141** (2.31)	0.129 (1.66)	0.066 (0.84)	
Urbanization	-0.402 (-1.43)	-0.491* (-1.86)	-0.475** (-2.09)	-0.656** (-2.19)	-0.580** (-2.20)	-0.898*** (-3.48)	-0.588** (-2.56)	-0.605** (-2.37)	-0.601* (-1.92)	-0.399 (-1.39)	-0.658** (-2.69)	-0.526* (-2.21)	
Log of population	-0.089 (-0.83)	-0.238 (-1.24)	-0.183 (-1.12)	-0.368* (-1.84)	-0.031 (-0.30)	-0.326* (-1.78)	-0.156 (-0.87)	0.012 (0.10)	-0.267 (-1.26)	-0.088 (-0.45)	0.096 (0.80)	-0.156 (-0.99)	
Agricultural employment	0.424** (2.09)	0.241 (1.67)	0.241* (1.69)	0.384*** (2.96)	0.104 (1.60)	0.380*** (3.21)	0.249 (1.67)	0.149 (1.29)	0.507* (2.04)	0.501** (2.37)	0.242 (1.60)	0.251 (1.73)	
FDI net inflow	2.541* (1.80)	3.624*** (3.70)	3.529** (2.57)	1.821** (2.21)	3.059*** (3.76)	2.673*** (2.83)	3.313*** (3.58)	3.544*** (4.43)	1.585 (1.05)	2.736** (2.56)	3.491*** (3.50)	2.995** (3.23)	
FDI×Log of GDP p.c.	-0.271* (-1.82)	-0.397*** (-3.92)	-0.346** (-2.33)	-0.212** (-2.44)	-0.320*** (-3.58)	-0.303*** (-3.18)	-0.357*** (-3.66)	-0.380*** (-4.47)	-0.175 (-1.10)	-0.308*** (-2.80)	-0.371*** (-3.02)	-0.321** (-3.21)	
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Obs.	153	162	189	147	164	124	181	156	131	124	141	192	
N	45	52	54	51	44	43	50	44	29	31	41	54	
Adj. R-sq	0.368	0.427	0.388	0.563	0.396	0.576	0.393	0.463	0.400	0.586	0.521	0.391	
Note: <i>t</i> -values are reported in parentheses; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively; ^a : countries dropped with a GDP p.c. <3,000US\$; ^b : countries dropped with a GDP p.c. >27,000US\$.													

Note: *t*-values are reported in parentheses; standard errors are calculated using White correction; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively;^a: countries dropped with a GDP p.c. <3,000US\$; ^b: countries dropped with a GDP p.c. >27,000US\$.