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TRADE AND REGIONAL INEQUALITY

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ABSTRACT

Trade and regional inequality*

This paper examines the relationship between openness and within-country regional inequality across 28 countries over the period 1975-2005. In particular, it tests a) whether increases in trade lead to rising inequalities, b) whether these inequalities recede in time, and c) whether increases in global trade affect the developed and developing worlds differently. Using static and dynamic panel data analysis, it is found that while increases in trade per se do not lead to greater territorial polarisation, in combination with certain country-specific conditions, trade has a positive and significant association with regional inequality. States with higher inter-regional differences in sectoral endowments, a lower share of government expenditure, and a combination of high internal transaction costs with a higher degree of coincidence between the regional income distribution and regional foreign market access positions have experienced the greatest rise in territorial inequality when exposed to greater trade flows. Hence, changes in trade regimes have a more polarising and enduring effect in low- and middle-income countries, whose structural features tend to enhance the trade-inequality effect and whose levels of internal spatial inequality are, on average, significantly higher than in high-income countries.

JEL Classification: F11, O18, R12 and R58
Keywords: developed countries, developing countries, regional inequality and trade

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1. Introduction

The World Bank 2009 World Development Report *Reshaping Economic Geography* (WDR 2009) put trade at the heart of the holy trinity of factors promoting growth. "Cities, migration, and trade have been the main catalysts of progress in the developed world over the past two centuries [and] these stories are now being repeated in the developing world's most dynamic economies" (World Bank, 2009: 20). Although promoting trade is acknowledged to lead to greater territorial disparities (World Bank, 2009: 6 and 12), this may not matter in the medium- and long-term as "evidence from today's industrial countries suggests that development has largely eliminated rural-urban disparities" (World Bank, 2009: 62). Hence, from this perspective, the best way to deal with territorial inequality is not through 'spatially balanced growth', which has been a "mantra of policy makers in many developing countries" (ibid: 73), but through the promotion of growth resulting from increases in trade and economic integration.

This approach to promoting economic development rests on three assumptions for which existing scholarly literature provides no firm answer. Namely that a) increases in trade lead to rising territorial inequalities; b) that these inequalities subsequently recede as a country develops; and c) that the emergence of spatial disparities does not represent a threat to future development, implying that developing countries should be more concerned about the promotion of growth rather than worry about inequalities (ibid: 12). However, and despite the surge of attention on the relationship between globalisation, the rise of trade, and inequality, whether these assumptions hold remains very much unanswered.

Most of the work conducted so far on the link between trade and inequality has been concerned with the impact of increasing global market integration on inter-personal income inequality, both in the developed and the developing worlds (e.g. Wood, 1994; Ravallion, 2001; Alderson and Nielsen, 2002; Williamson, 2005). The spatial dimension of inequality, by contrast, has attracted far less attention. This means that, as Kanbur and Venables (2005) underline, both the theoretical and empirical relationship between greater openness and spatial inequality remains vague (see also Brülhart, 2011). There are almost as many studies pointing towards a link between trade and spatial convergence as those identifying spatial divergence (Brülhart, 2011), and the direction and dimension of this relationship is far from uniform and varies from one country to another and according to the data and methods used.

Although the number of single-country case studies delving into this question has grown significantly in recent years, scant cross-country evidence exists of a general causal linkage between greater trade openness and market integration, on the one hand, and intra-national spatial inequality, on the other.[1] This may be because the literature on the evolution of within-country spatial inequalities has tended – following the path opened by Williamson (1965) in his account of the relationship between spatial disparities and the stage of economic development – to focus on the internal and not the external forces of agglomeration and dispersion. From this

[1] Brülhart (2011) limits the number of cross-country analyses to 11, virtually all using urban primacy data (e.g. Ades and Glaeser, 1995; Nitsch, 2006; Brülhart and Sbergami, 2008), rather than regional data.

perspective economic development matters for the evolution of spatial inequalities, which tend to wane as a country develops. Hence, the factors that explain the evolution of regional inequality are considered to be internal to the country itself, while external factors are, at best, regarded as playing a supporting role in this process. And when they are taken into consideration, the outcome is rather inconclusive. As Milanovic puts it (2005: 428) "country experiences differ and […] openness as such may not have the same discernable effects on countries regardless of their level of development, type of economic institutions, and other macroeconomic policies". Moreover, a large percentage of the literature dealing with the relationship between trade and spatial inequality has concentrated on developed countries – and, in particular, on the spatial effects of EU integration (e.g. Niebuhr, 2006; Barrios and Strobl, 2009) – meaning that the findings, as inconclusive as they are, may be irrelevant to middle- and low-income countries.

Finally, it is far from certain that the supposed temporality and benign long-term implications of any potential growth in within country regional disparities resulting from changes in trade patterns will materialise. In particular, any rise in inequalities may risk becoming permanent especially where increasing polarisation takes place during periods of low growth or in countries with an already high level of territorial disparities. In these cases, rises in trade may come to reinforce pre-existing social, political, cultural, or ethnic divides. Under these circumstances, increasing regional inequality may lead to an enduring fragmentation of internal markets and to social, political, and/or ethnic tensions which may threaten the very growth and prosperity that greater trade is supposed to bring about.

This paper delves into the assumptions about the link between trade and regional inequality present in the WDR 2009 and for which the existing literature offers no conclusive answers. More specifically, the aim of this paper is to determine a) whether changes in trade matter for the evolution of spatial inequalities, b) whether openness to trade affects developed and developing countries differently, and c) whether there is a dynamic element to this association. The analysis covers the evolution of regional inequality across 28 countries – including 15 high-income and 13 emerging countries – over the period 1975-2005.

In order to achieve this, the paper combines the analysis of internal factors – in the tradition of Williamson – with that of change in real trade as a potential external factor which may affect the evolution of within-country regional inequality. Internal factors considered include both Williamson's (1965) level of development, as well as a series of other factors identified by the new economic geography theory (NEG) as drivers of spatial inequality. The analysis is conducted by running unbalanced static panels with country and time fixed effects, in order to address, first, whether changes in trade patterns are connected to changes in spatial inequalities in the short-term (a) and whether this process affects the developed and emerging worlds differently (b). The second part of the analysis consists of a dynamic panel estimation, differentiating between short-term and long-term effects, as a way to assess whether this relationship changes with time (c).

The paper is structured in five additional sections. Section 2 introduces a necessarily brief overview of the existing theoretical and empirical literature. This is followed in Section 3 by a presentation of the data and its main trends. Section 4 outlines the theoretical framework and presents the variables included in the analysis, while Section 5 reports the results of the static and dynamic analyses, distinguishing between the differential effect of trade on regional inequality in developed and developing countries, and presents a series of robustness checks. The conclusions are condensed in Section 6.

2. Trade and regional inequality in the literature

As mentioned in the introduction, the link between changes in trade and the evolution of regional disparities has hardly captured the imagination of geographers and economists. In contrast with the spawning literature on trade and interpersonal inequality, there has been, until recently, a dearth of studies focusing on the within-country spatial consequences of changes in trade patterns. The emergence of the NEG theory has somewhat contributed to alleviate this gap in the literature, especially from a theoretical perspective. A string of NEG models concerned with the spatial implications of economic openness and trade (e.g. Krugman and Livas-Elizondo, 1996; Monfort and Nicolini, 2000; Paluzie, 2001; Crozet and Koenig-Soubeyran, 2004; Brülhart *et al.*, 2004) have been published in recent years. In this literature the causal effect of globalisation on the national geography of production and income is conceptualised in terms of changes in cross-border market access that affect the interplay between agglomeration and dispersion forces which, in turn, determine industrial location dynamics across domestic regions.

Because of the two-sector nature (agriculture/manufacturing) of most of these models, the central question has been whether increasing cross-border integration leads to a greater intra-national concentration of manufacturing activity, and thereby growing regional inequality. However, as a consequence of the use of different sets of assumptions and of the particular nature of the agglomeration and dispersion forces included in the models (Brülhart *et al.*, 2004), contradicting and/or ambiguous conclusions have been derived from this type of analyses (e.g. Krugman and Livas-Elizondo, 1996 vs. Paluzie, 2001).

Empirical studies have not contributed to resolving this conundrum. Most of the empirical analyses have concentrated – in part as a result of the scarcity and lack of reliability of sub-national comparable datasets across countries – on single country case studies. Two countries feature prominently in empirical approaches. First and foremost post-reform (post-1978) China, where an expanding number of studies have focused, *inter alia*, on the trade-to-GDP ratio and/or FDI inflows in order to explain either overall regional inequality or the growing coast-inland divide (Jian *et al.*, 1996; Yang, 2002; Zhang and Zhang, 2003; Kanbur and Zhang, 2005). These studies tend to run time-series OLS regressions with the measure of provincial inequality on the left-hand side and openness to trade and/or investment, among a list of variables, on the right. Most of these analyses have found a significant positive effect of the rise of trade on regional inequality. Mexico has also featured prominently among those interested on the impact of trade on the location of economic activity. Using a number of measures which range from changes in trade ratios (Sánchez-Reaza and Rodríguez-Pose, 2002; Rodríguez-Pose and Sánchez-Reaza, 2005), sometimes controlling for location and sector (Faber, 2007), FDI (Jordaan, 2008a and 2008b), retail sales (Adkisson and Zimmerman, 2004), or retail trade (Ford et al., 2009), these studies generally report that increases in trade and greater economic integration in NAFTA have resulted not just in important differences in the location of economic activity, but also in significant rises in wage (Chiquiar, 2008) and income inequality between border regions and the rest of Mexico.

Other interesting single-country research has focused on the Canadian case, finding that rising import competition from low-income countries has had an important effect on wage inequalities, especially affecting Québec and the Prairie provinces (Breau and Rigby, 2010).

Cross-country panel data analyses examining the link between changes in trade patterns and the evolution of regional disparities are rarer. A large number of these studies have been concerned with the impact of European integration on trade patterns and how these, in turn, influence regional inequality. Among these studies, the work of Petrakos *et al.* (2005) and that of Barrios and Strobl (2009) can be highlighted. Petrakos *et al.* (2005) resort to a measure of relative intra-European integration for a sample of 8 EU member countries, measured as national exports plus imports to and from other EU countries divided by total trade, rather than using overall trade-to-GDP ratios. Running a system of seemingly unrelated equations, they find mixed explanatory results for this variable and conclude that European integration affects countries differently. Barrios and Strobl (2009) run fixed effects OLS analyses for the EU15 over the period 1975-2000. Their aim is to explain how a measure of regional inequalities within each country is influenced by the trade-to-GDP ratio, as well as by trade over GDP in PPP terms. For the latter, they find a significant positive effect on regional inequalities among EU15 countries over the period 1975-2000.

The studies covering a more diverse sample of countries – involving both developed and developing ones – are even fewer. Two such studies are Milanovic (2005) and Rodríguez-Pose and Gill (2006). Milanovic (2005) addresses the evolution of regional inequalities across the five most populous countries of the world: China, India, the US, Indonesia, and Brazil over varying time spans during the period 1980-2000. The results of his static fixed effects and dynamic Arellano-Bover panel analyses point to an absence of a significant causal relationship between openness and regional inequalities. Rodríguez-Pose and Gill (2006) map two sets of binary relationships – first between nominal trade openness and regional inequality, and second between a trade composition index and regional inequality – for eight countries, including Brazil, China, Germany, India, Italy, Mexico, Spain, and the US, over varying time spans between 1970-2000. They conclude that it is not trade openness *per se* which has any bearing on the evolution of regional inequality, but its combination with the evolution of the manufacturing-to-agriculture share of exports which influences which regions gain and which lose from greater economic integration over time. As trade shifts from the primary sector to manufacturing, by virtue of manufacturing being more geographically concentrated – especially in emerging countries – than agriculture or mining, within country regional disparities tend to increase and they do so at a faster pace in the developing than in the developed world. They find indicative support for this hypothesis based on the coincidence between changes in of the evolution of their trade composition index and changes in regional inequalities across countries.

Given the diversity of results in both theoretical and empirical analyses, one would be hard pressed to generalise from the existing literature. The relationship between trade and regional inequalities thus remains wide open, both from a theoretical and empirical perspective.

3. Overall trade and regional inequality: Empirical evidence.

This paper revisits the question of the link between trade and regional inequality, using an unbalanced panel dataset comprising 28 countries over the period 1975-2005. The 28 countries in the analysis are presented in Table 1 and include eleven countries in Western Europe, six in Central and Eastern Europe, four developed countries outside Europe, and seven countries in the developing world. The criterion for the choice of countries is exclusively based on the existence of reliable and comparable regional GDP per capita data series. This tends to bias the sample towards developed countries, in general, and developed countries in the EU, in particular, raising potential questions about whether the results based on such a subset of countries can be generalised. While this is a reasonable concern, the current database is significantly more comprehensive than those used by previous studies dealing with regional inequality from a comparative perspective.[2] In addition, with 13 of the 28 countries in the sample among the ranks of emerging countries – nine are still classified as low- or middle-income countries by the World Bank, while four others (the Czech Republic, Hungary, Poland and Slovakia) have only recently been reclassified as high-income countries – it could be claimed that emerging economies are well represented in the database.

Another factor that limits the choice of countries is the fact that the number and nature of regional units should not vary over time. In countries with a certain tradition of political or fiscal decentralization, the subnational units with the greatest level of autonomy have been chosen. This includes states in countries such as Austria, Brazil, India, Mexico or the US, provinces in the case of Canada, China or South Africa, or regions in France, Italy or Spain. In countries with no tradition of decentralization, administrative divisions – generally NUTS2 level regions for European Union countries – have been used. In a few cases where the number of regions was limited, I have resorted to smaller territorial units.[3] In all cases, the number of territorial units has remained stable during the period of analysis, either disregarding the creation of new states or provinces – e.g. the provinces of Gorontalo, West Sulawesi or West Papua in Indonesia – or, more exceptionally, extrapolating the GDP per head of new states to periods prior to their creation, as in the cases of the recently created Indian states of Chhattisgarh or Jharkhand. Keeping the number of territorial units stable has, however, limited the time span of the analysis in countries which have undergone a complete overhaul of their territorial system, such as most Central and Eastern European countries after the fall of the Iron Curtain or South Africa after the demise of *apartheid*. Changes in regional accounting systems provide an additional barrier for the length of the data series considered. The number and denomination of territorial units for each country is included in Table A1 in appendix.

Table 1 groups the countries in the sample according to whether they have experienced increasing, stable, or decreasing spatial disparities, using the evolution of

[2] Barrios and Strobl (2009), for example, limit their analysis to European countries, while Rodríguez-Pose and Gill (2006) cover four developed and four emerging countries.

[3] One such example is Belgium, where the three existing regions (Brussels, Flanders and Wallonia) have been substituted by ten provinces and the city of Brussels.

the population-weighted coefficient of variation,[4] over the time span covered by the data.

Insert Table 1 around here

The majority of the countries included in the sample have experienced a rise in regional disparities over the period of analysis. In 18 out of the 28 countries considered spatial inequalities increased, while seven countries witnessed relative stability[5], and only three – Belgium, Brazil, and South Africa – saw a reduction in disparities. The rate of change varies enormously across countries (Figure 1). Countries such as Bulgaria, Hungary, India, Poland, Romania, the Slovak Republic or China since the early 1990s have witnessed a very rapid rise in disparities, while the rate of increase has been more moderate in places such as Australia, Spain, the UK or the US. Rates of decline in inequalities also vary hugely, with Belgium and Brazil experiencing the strongest decline in territorial inequalities. There is also no apparent difference between the trajectories of developed and emerging countries. Some of the low- and middle-income countries included in the sample have seen spatial disparities increase – e.g. Bulgaria, India, Indonesia, Mexico, Thailand – while this has not been the case in Brazil and South Africa (Figure 1). However, the level of territorial inequalities differs widely among countries and especially between countries in the developed and developing worlds. Regional disparities in Thailand are nineteen times higher than those found in Australia (Figure 1). The order of magnitude is ten to one between China and Mexico, on the one hand, and Australia, on the other, and seven to one in the case of Brazil and India.

Insert Figure 1 around here

Is there a general relationship between the evolution of trade openness and spatial inequalities? In order to assess whether this is the case, a simple binary association between annual measures of real trade openness and regional inequality for each country is performed. Figure 2 plots the regression coefficient of the log Gini index of regional GDP per capita[6] on the log of the share of exports plus imports in GDP

[4] The population-weighted coefficient of variation, c, is defined by the equation

$$c = \frac{\sqrt{p_i (x_i - \mu)^2}}{\mu}$$

where x_i and p_i are respectively the per capita income and the population share of region *i* ($i = 1,2,...,n$) in a given year, while $\mu = \sum_{i=1}^{n} p_i x_i$.

[5] It is often the case that overall stability trends during the period of analysis hide significant variations in the evolution of regional inequality. Two such cases are Canada and China. In both countries, albeit for very different reasons, regional disparities decreased during the 1980s, but have tended to grow – and in the case of China, particularly rapidly – since the early 1990s.

[6] The Gini index is defined as follows: $G = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} p_i p_j \left| x_i - x_j \right|}{2\mu}$ where x_i and p_i are respectively the per capita income and the population share of region *i*, while $\mu = \sum_{i=1}^{n} p_i x_i$.

adjusted to purchasing power parities (PPP) by country. In Figure 3 the same regression coefficients are presented, having replaced the annual measures by three-year averages, as multiannual averages may be better than annual data at picking up any potential lagged effects, thus correcting for yearly fluctuations.

Insert Figures 2 and 3 around here

Figures 2 and 3 show no dominating pattern. There is a huge diversity in both the sign and the dimension of the coefficient, with some countries sporting a positive relationship between trade and the evolution of regional disparities and others a negative one. There consequently seems to be, as indicated by Milanovic (2005) and Rodríguez-Pose and Gill (2006), no evidence of the presence of a simple linear relationship between trade and regional inequality that holds across different types of countries. A more subtle observation concerns the sequence of countries from left to right. On the whole, wealthier countries (Finland, Sweden, Canada, Netherlands, Japan) tend to be located on the left-hand side of both figures, displaying a negative association between increases in trade and regional disparities, while poorer countries tend to be found towards the right-hand side of Figures 2 and 3 (India, Romania, Poland). This relationship is, however, far from linear, with some high-income countries (Spain, Italy, UK, Greece) displaying a positive binary association between trade and spatial inequality.

4. Theoretical model and empirical variables

There are limitations, however, in what can be inferred from simple binary associations, as they only offer limited information about the mechanisms at play. Many other factors may be affecting the evolution of within-country regional disparities. In order to address this issue, in the following paragraphs a formal econometric specification with additional controls and conditioning variables is formulated. It is aimed at testing whether there is a significant association between openness and spatial inequality and whether this association – if it exists – changes with time and affects developed and developing countries in a different way.

4.1. The basic model

With few exceptions (e.g. Milanovic, 2005), the bulk of studies on the determinants of regional inequalities are based on static one-yearly specifications. However, regional inequality is bound to be a time-persistent phenomenon with a high degree of inertia. This makes overlooking time considerations problematic. Theory, however, provides no clear (if any) insights concerning the temporal dimension of internal spatial adjustments to changes in external market access. Hence, rather than guessing an appropriate adjustment timeframe, the paper tackles potential inertia by formulating a dynamic model with past levels of spatial inequality on the dependent variable side. The use of dynamic panels – complementing static panels – has the advantage of introducing the distinction between short-term and long-term effects.

Taken this into consideration, the following general model is formulated:

$$\text{Inequality}^*_{it} = \alpha + \sum\beta x_{it} + \varepsilon_{it} \quad (1)$$

Where *Inequality*$^*_{it}$ is the level of inequality in country i at time t and x_{it} is a vector of independent variables conditioning the spatial distribution of income in any given country *i* at time *t*. This model does not contemplate inertia in the system. Using Brown's (1952) classical habit persistence model, equation (1) is transformed into equation (2):

$$\text{Inequality}_{it} - \text{Inequality}_{it-1} = \lambda\, (\text{Inequality}^*_{it} - \text{Inequality}_{it-1}),\ 0<\lambda<1 \quad (2)$$

where the actual observed change of the spatial configuration (*Inequality*$_{it}$ - *Inequality*$_{t-1}$) is a fraction λ of the adjustment that would have taken place under instantaneous adjustment.

Parameter λ ranges between 0 and 1 and represents the speed of adjustment. If λ is close to 1, then the adjustment is almost instantaneous and the relationship between the theoretical determinants x_{it} and the actual observed spatial outcomes *Inequality*$_{it}$ is static. If λ is below 1 then the difference between the observed spatial outcomes and their inertia-free theoretical counterpart *Inequality*$^*_{it}$ becomes significant, creating the need to control for partial adjustment in a dynamic model. Rearranging and substituting for *Inequality*$^*_{it}$, we obtain:

$$\text{Inequality}_{it} = \lambda\, (\alpha + \sum\beta x_{it} + \varepsilon_{it}) + (1- \lambda)\ \text{Inequality}_{it-1},\ 0<\lambda<1 \quad (3)$$

Equation 3 presents the basic specification followed in the dynamic panel regressions. On the left hand side of the equation is the dependent variable, representing the observed inequality. On the right, we find the theoretical determinants of the inertia-free spatial configuration plus the previous period's value of the dependent variable. The latter effectively controls for potential inertia and partial adjustment. By fixing the previous spatial outcome *Inequality*$_{it-1}$, the short-term effect of any independent variable x_{it} is given by its revealed regression coefficient when running equation (3). Conceptually, this coefficient represents the product λβ. The assumption for the long-run is that a country's spatial configuration reaches a stable equilibrium, making the current and the previous year's inequality levels close to identical. Setting *Inequality*$_{it-1}$ equal to *Inequality*$_{it}$ in equation 3, the long-term effect of any independent variable on the spatial configuration can thus be obtained by dividing the observed regression coefficient λβ by the speed of adjustment parameter λ.

4.2. The conditioning variables

Having set the basic model, the task now is to identify an appropriate set of conditioning variables capturing the relationship between trade openness and internal spatial inequality in the form of equation 1. This is done in two stages. The first one draws on recent NEG models, while the second reaches beyond a purely market access driven framework.

In an NEG core-periphery framework and as a consequence of NEG's basic two sector assumption and of the absence of intra-industry linkages, distinguishing whether or not greater accessibility to foreign markets promotes economic growth is tricky. The introduction of cross-border intra-industry linkages and of a multi-sector industrial scenario gives rise to additional pull factors towards highly accessible regions once trade is liberalised and allows export market potential, intra-industry supply potential, and import competition to affect domestic sectors differently, depending on the comparative advantages revealed by market integration (Faber, 2007). Sectors characterised by a revealed comparative advantage and/or cross-border intra-industry linkages will thus grow faster in regions with good foreign market access, whereas import competing sectors gain in relative terms in regions with higher 'natural protection', in the form of poor market access. Faber (2007) finds empirical support for this trade-location linkage across 43 industrial sectors in post-NAFTA Mexico over the period 1993-2003.

The implications of this possible divergence of sectoral location patterns under cross-border market integration are important in order to understand whether and how market accessibility affects regional performance. Regions with high relative foreign market access will attract the winners of integration and also shed declining sectors, resulting in higher medium- to long-term regional growth rates than in regions with limited and/or constrained foreign market access.

In conditions of increasing trade and economic integration two additional country-specific factors may determine the evolution of regional inequalities. First is the degree of variation of foreign market accessibility among regions within any given country. If, given the discussion above, it is assumed that relative foreign market access drives regional attractiveness for expanding sectors, the locational pull will be strongest in countries characterised by stark regional differences in cross-border market accessibility. The strength of this factor is further conditioned by the degree of coincidence between the existing regional income distribution and the distribution of relative foreign market access. When relatively wealthy regions are also those with a greater degree of accessibility, increases in trade are likely to exacerbate previously existing inequalities. In contrast, when poorer regions have a market accessibility advantage relative to better off regions, the net outcome of increases in trade is likely to be a reduction in regional disparities and within-country territorial convergence. Hence, it can be safely assumed that *greater trade openness will have a more polarising effect in countries characterised by a) higher differences in foreign market accessibility among its regions and b) with a high degree of coincidence between the regional income distribution and accessibility to foreign markets.* The presence of a strong coincidence between regional income distribution and accessibility to foreign markets is a sufficient, rather than a necessary condition in order to generate greater inequality, as trade openness may also exacerbate previously existing inequality even in cases when wealthier regions have less foreign market accessibility than poorer regions. Differences in endowments or in adaptive capacity between rich and poor regions may more than compensate for differences in accessibility.

Stepping outside the NEG framework, other factors may come into play in determining the link between trade and regional inequality. Among these factors differences in the distribution of human capital and skills and infrastructure affect trade patterns as well as economic growth. It can therefore be envisaged that *the greater the regional differences in endowments and sectoral specialisation, the greater the spatial impact trade openness.*

The role of government policies may also enhance or attenuate the spatial effects of trade. Governments with a greater social and territorial redistributive capacity through public policies will be in a better position to counter any potential tendency of increases in trade patterns leading to greater geographical polarisation. Budgetary or regional policy transfers from prosperous to lagging regions will offset rises in regional inequality, making *the effect of trade openness on spatial inequality likely to be more severe in countries with a weaker redistributive capacity by the central government and/or with fewer provisions for interregional transfers.*

A fourth conditioning factor concerns the degree of labour mobility, especially within-country mobility. Depending of the conditions of any particular country, inter-regional worker mobility may either contribute to greater agglomeration, as workers concentrate in core areas offering higher salaries or greater job opportunities, or to greater territorial cohesion, if workers follow firms seeking lower costs in peripheral areas (Puga, 1999). Hence, *the effect of trade on regional inequality will depend on the degree of inter-regional labour mobility and the specific conditions of the country.*

A final factor is the quality of institutions, which vary significantly from one region to another. Poorer and/or lagging regions are likely to suffer the most from inadequate institutions. Problems of institutional sclerosis, clientelism, corruption, and pervasive rent seeking by durable local elites, which beset many lagging areas, are likely to contribute to trade bypassing these regions in favour of those with more 'appropriate' institutions. "Informal institutions in these places are often similarly dysfunctional, resulting in low levels of trust and declining associative capacity, and restricting the potential for effective collective action" (Farole et al., 2011: 1098). *'Inappropriate' institutions will thus represent an important barrier for trade, leading to a more severe spatial effect of trade in countries with a significant gap in institutional capacity among its regions*.

Unfortunately, due to lack of comparable and reliable data on inter-regional labour mobility and institutions across the 28 countries covered in the analysis, the latter two hypotheses cannot be tested. It therefore has to be assumed that labour mobility and institutions are not systematically correlated with any of the other regressors, implying that there is no omitted variable problem in leaving out these conditioning interactions.

There is also a need to control for other factors which may affect the relationship between trade and spatial inequality. The key element in this realm relates to Williamson's (1965) classical account of the linkage between spatial disparities and the stage of economic development. In Williamson's account, within-country spatial inequalities are fundamentally the result of the level of national economic development (proxied in this case by real GDP per capita and its growth). As countries prosper inequalities tend to diminish, making economic growth a primary driver of changes in spatial inequalities. Williamson's theory is built-in into the WDR 2009. There it is stated that not only has "development […] largely eliminated rural-urban disparities" (World Bank, 2009: 62), but also that "high urban shares and concentrated economic density go hand in hand with small differences in rural-urban well-being on a range of indicators" (ibid.: 62). As economic growth is also likely to be correlated with changes in trade (Sachs and Warner, 1995), a control for real GDP per capita and its interaction with the country's development stage is included in the analysis.

4.3. The empirical model, data and method

The above discussion leads to the transformation of equation (1) into the following empirical specification (4). Table A1 in the appendix presents the actual values of the structural conditions across the 28 countries.

$$\ln \text{Inequality}^{*}_{it} = \alpha + \beta_1 \ln(\text{GDPcap}_{it}) + \beta_2 [\ln(\text{GDPcap}_{it}) \cdot \text{Development}_i] + \beta_3 \ln(\text{Trade}_{it}) + \beta_4 [\ln(\text{Trade}_{it}) \cdot \text{Development}] + \beta_5 [\ln(\text{Trade}_{it}) \cdot \ln(\text{Government}_i)] + \beta_6 [\ln(\text{Trade}_{it}) \cdot \ln(\text{Sectors}_i)] + \beta_7 [\ln(\text{Trade}_{it}) \cdot \ln(\text{MarketAccess}_i) \cdot \ln(\text{Coincidence}_i)] + \varepsilon_{it} \quad (4)$$

where:

Inequality$_{it}$ represents the level of within-country regional inequality in country i in year t, measured using the Gini index of regional GDP per capita.

GDPcap$_{it}$ denotes real GDP per capita in PPP in constant US$ (2000) for country i in year t.

Development$_i$ is a dummy variable which takes the value of 1 if country i is a developing or transition economy and 0 otherwise. The categories were assigned on the basis of historical World Bank classifications. Each country was assigned to its most frequent classification over the time period covered in the dataset. This variable is, in turn, subdivided into three components:

a) *High-income*$_i$ is another dummy variable which takes the value of 1 if country i has been most frequently classified as high-income country and 0 otherwise.
b) *Middle-income*$_i$ is a dummy variable which takes the value 1 of if country i has been most frequently classified as upper-middle income country and 0 otherwise.
c) *Low-income*$_i$ is a dummy variable which takes the value of 1 if country i has been most frequently classified as low (or lower-middle) income country and 0 otherwise.

Trade$_{it}$ represents the total imports and exports in current US$ divided by GDP in PPP current US$ for country i in year t.

Sectors$_i$ is a variable aimed at capturing the degree of inter-regional sectoral differences that exist across countries, proxied by the standard deviation of the share of agriculture in regional GDP, averaged across the time periods under study for country i.[7]

[7] Ideally a finer sectoral disaggregation in order to capture in a more precise way the variation of modern sector endowments between domestic regions should have been used, perhaps including the sub-sectors of the service sector. But given the diversity of countries included in the panel, the share of agriculture in regional GDP over time was the best comparable indicator available.

$Government_i$ denotes the size of government in country i, proxied by the share of non-military government expenditure in total GDP averaged across time periods under study. It is assumed that inter-regional transfer programmes and social expenditures are linearly related to the level of government expenditure in total GDP and that, in most countries, there will be a certain progressiveness in-built in the territorial distribution of investment.

$MarketAccess_i$ denotes the degree of inter-regional differences in foreign market access across countries. Taking into account existing data constraints in the countries covered in the sample, two alternative measures of market access are used. The first variable ($Surface_i$) is each country's surface area in square kilometres. However, surface area is a rather crude measure of market access, especially in view of the huge diversity in population density among countries. Hence an alternative composite measure of internal market access polarisation ($MAPolaristaion_i$) is constructed. The $MAPolaristaion_i$ index adopts the following form:

$$MAPolarisation_i = Surface\ Index_i + Infrastructure\ Index_i \qquad (5)$$

where

$$Surface\ Index_i = (surface_i / maximum\ surface\ in\ sample) \cdot 100 \qquad (6)$$

and,

$$InfrastructureIndex_i = \left[\frac{road_i + railway_i}{\sqrt{\dfrac{population_i}{density}}} \right] \cdot 100 \qquad (7)$$

where:

$surface_i$ represents the surface area in square kilometres of country i;
$road_i$ depicts the kilometres of paved road in country i;
$railway_i$ the kilometres of railway lines in country i;
$population_i$ represents the total population of country i;
density depicts the mean population density of the countries included in the sample.

The logic behind the use of the $MAPolaristaion_i$ variable is that both the level of absolute internal distances ($Surface\ Index_i$) and the population density adjusted infrastructural endowments ($Infrastructure\ Index_i$) determine the degree of inter-regional variation in access to foreign markets. The first concerns the internal transport distances, the second proxies for the average transportation costs of a country. A one-to-one weighting was chosen under the assumption that the proxy for quality and quantity of transport infrastructure will not only reflect average transport costs but also the number and availability of international transhipment and customs facilities along a country's coasts and borders.

$Coincidence_i$ reflects the degree of coincidence between relative regional market access positions and regional income per capita levels across countries. Two alternative measures of coincidence between both factors are used. The first ($Coincidence25_i$) is the ratio of the average GDP per capita levels of the regions in the top 25 percent in terms of foreign market access over average regional GDP per capita. The second ($Coincidence50_i$) calculates the same ratio on the basis of the regions in the top 50 percent in terms of relative foreign market access. In order to insure consistency with the dependent measure of regional inequality which treats each region as one observation, the coincidence ratios are also computed disregarding regional population sizes.

The question is of course how to determine relative market access positions. In the absence of adequate and comparable datasets of regional transport costs to an equivalent selection of international trade points – ports, airports and main terrestrial border-crossing – in each country, the method used consists in first identifying the trade entry points accountable for at least 70% of the country's total trade, as well as the top quarter or half of the regions in terms of border or coast location in closest proximity to the main trade routes. In the cases where two regions were close in terms of border/coast accessibility to the main trade routes, the region with the higher number of international ports or border crossings was chosen. The main trade entry regions for each country are presented in Table A1 in Appendix.

This geography based construction of the coincidence measures also addresses a potential endogeneity issue. Assuming that perfect data about each region's foreign market access in terms of actual transport cost weighted market potential are available, it is highly likely that high degrees of regional inequality are associated to higher degrees of coincidence, because regional prosperity tends to be a driver of market access when measured in terms of human-built infrastructure. Relying on physical proximity and border or coast location instead is not subject to this potential endogeneity issue. As in the case of the previous structural conditioning variables, the coincidence measures are averaged across periods for each country.

The data sources for each of the variables are presented in Table A2 in Appendix.

Finally ε represents the error term.

In order to assess the original questions of whether trade and the remaining variables included under equation (4) affect regional inequalities and whether this relationship changes over time, both static OLS with country and time fixed effects, as well as dynamic panels are run. The static analysis aims at discovering the association (or lack of it) between trade and the evolution of regional disparities. In the case of the dynamic regressions, general method of moments (GMM) estimation, following Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), are applied in order to distinguish between short- and long-term effects. The problem with running OLS on panels that include the lagged dependent variable is that it will be correlated with the error term even after getting rid of the unobserved country heterogeneity therein. To adjust for this bias, Arellano and Bond (1991) have proposed a first difference GMM estimator using lagged values of the dependent and predetermined variables and differences of the strictly exogenous ones as instruments. The system GMM estimator involves variables in levels instrumented with lags of their own first differences to exploit additional moment conditions (Arellano and Bover, 1995; Blundell and Bond, 1998).

Another potential problem is that the interaction specifications are estimated without including the full set of main effects, that is the models are non-saturated. Estimating non-saturated models has the risk of leading to coefficients which may just be attributable to some omitted levels or lower-order interactions.[8] However, there are two reasons for running models which do not include an individual parameter for all possible values taken by the explanatory variables. The first reason is related to the structure of the data. Some of the variables included in the analysis vary over time. These comprise the dependent variable (inequality), as well as the main independent variable of interest (trade) and GDP per capita. Other variables, however, because of either theoretical reasons or as a result of the problems of trying to gather comparable data for 28 countries over a long period of time, are time-invariant. These include the development and income dummies, polarisation, coincidence, and the government variables. This implies that time variation is achieved through the interaction of time-variant and time-invariant variables and that the estimated models are almost as close to saturated as they can be, given the data are available. The other reason is that "saturated models generate a lot of interaction terms, many of which may be uninteresting or imprecise" (Angrist and Pischke, 2008: 38), making it sensible to omit some of the interaction terms. In the case of the current analysis, the only way of making the model more saturated is by introducing the interaction of GDP per capita with all the other variables. Doing this does not alter the coefficients significantly, but makes the model less parsimonious and dilutes its link to the theoretical discussion.

5. The impact of trade on regional inequality

5.1. Static analysis

In this section the results of running the different specifications of equation (4) are presented. Table 2 introduces the results for the static OLS with country and time fixed effects. The standard errors are clustered by country. Given that all unobserved invariant country and time heterogeneity has been eliminated from the model, the coefficients can be interpreted as the partial effects that annual variations of independent variables around the country mean have had on annual variations of spatial inequality around the country mean.

Insert Table 2 around here.

When trade is considered as a free-standing variable (Table 2, Regression 1), no association whatsoever between changes in trade patterns and the evolution of regional disparities is found. This coincides with the results of other studies which have looked at the simple association between trade and regional inequality (e.g. Rodríguez-Pose and Gill, 2006). This lack of association changes when, as specified in the diverse hypotheses, trade is considered in interaction with a series of country-specific factors. Here, the results of the static panel highlight the presence of a weak, but positive and highly significant effect of the dimension of real trade on spatial inequality when pooling across all countries. Having controlled for the internal growth effect and its different slopes across developed and developing countries, a one percent increase in real trade openness is on average associated with a 0.17 percent increase of the Gini index of regional inequality (Table 2, Regression 2). The results also indicate that this effect is significantly stronger in developing countries than in developed ones (Table 2, Regression 3), and that, among emerging countries,

[8] This point has been stressed by one of the referees.

the higher the aggregate level of wealth, the weaker the effect of trade on interregional disparities (Table 2, Regression 3).

Regressions 4 to 9 take us beyond the simple binary relationship between trade and inequality and introduce the conditioning structural variables identified in the previous section. All the coefficients have the expected sign – rises in trade are associated with lower regional inequalities in countries with large governments and with higher inequalities in cases of strong inter-regional sectoral differences, when there are important differences in market access and when these coincide with geographical disparities in income per capita – and all are significant at the one percent level. Poorer countries with lower government expenditure, higher variations in regional sectoral structures, and a spatial structure dominated by high internal transaction costs coupled with a higher degree of coincidence between prosperous regions and foreign market access are thus bound to experience greater rises in regional inequality when opening to foreign trade. This effect rises with the overall level of trade and declines as the wealth of the country increases.

Interestingly, when all conditioning interactions are added together (Table 2, Regression 10), the binary *Development* dummy interaction effect becomes insignificant. The same is the case for the *Government* expenditure interaction. These changes could simply be the result of collinearity between the *Development* dummy and the *Government* variable. But this is not the case. The *Government* variable remains significant once the *Sectors* interaction is dropped, meaning that the problem of collinearity arises between the *Government* and *Sectors* interactions, but not between *Development* and *Government*. This suggests that the proposed structural variables account to a great extent for the apparent differences in the association between trade and within-country spatial inequalities across developed and developing countries.

In order to test whether the weak binary *Development* dummy interaction of the trade impact also holds at a less aggregate categorical level, the panel is divided into high-, middle- and low-income countries, according to the World Bank's classification, using the high-income group as the reference category. Table 3 reports the results of this type of analysis.

Adding greater nuance to the developed/developing country division leads to an increase in the significance of development dummy interactions (Table 3, Regression 2), in comparison to those reported in Regression 3 in Table 2. The results suggest that variations in levels of trade openness have a significantly higher association with average variations in spatial inequality in middle- and low-income countries than in high-income ones in the short-term. There tends to be, in contrast, less difference between the impact of changes in trade on spatial inequality between low- and middle-income countries (Table 3, Regression 2).

Insert Table 3 around here

When instead of testing for different slopes of the trade effect on spatial inequality across groups, the effect of trade changes as countries grow is examined – by interacting trade openness with the countries' real GDP per capita (Table 3, Regression 3) – the resulting coefficient points, as already noted in Table 2, towards a weakening of the positive association between increases in trade and within-country spatial inequalities as countries become wealthier. Overall, Table 3 confirms the differential impact of trade on regional inequalities in developed and developing countries. Trade has had a higher impact on spatial inequality in developing countries and this effect tends to diminish with economic development at a slower pace than in developed countries.

An important final point concerns the striking difference between the coefficient results for the internal GDP per capita determinant of spatial inequality in the tradition of Williamson, and the external trade induced factor. The negative and frequently significant coefficient of the interaction term is particularly surprising. This suggests that real trade openness appears to have had a more polarising effect in developing countries than wealth. The important question in this context is of course what are the underlying structural factors behind the observed differences in the trade effect.

These results highlight that, as already inferred by Rodríguez-Pose and Gill (2006), the room for growth in spatial inequalities is much greater in the developing than in the developed world as a) developing countries tend to be characterised by structural features that potentiate the polarising effect of trade openness, b) they already have much higher existing levels of spatial inequality, and c) their level of trade openness is, on average, still only a fraction of that among developed countries.

5.2. Dynamic analysis

Table 4 presents the short- and long-run results of the dynamic panel regressions. The results were computed using the xtabond2 command in STATA (Roodman, 2006). Reported results correspond to the 1st difference Arellano-Bond GMM estimation. The reason for this is that the usually preferred Arellano-Bover system GMM was repeatedly rejected by the Sargan test of over-identification, indicating that its additional assumptions on the data generating process did not hold.

Insert Table 4 around here

As this section of the paper is fundamentally interested in the medium- to long-term implications of trade for regional disparities, the explanation will be focused on the long-term parameters.

The first result is entirely expected. When switching to dynamic panels with the lagged level of inequality included on the right-hand side, most of the differences in current within-country spatial inequality levels are explained by previous levels of within-country inequality. The high degree of inertia inferred from the coefficient of the lagged level of regional inequality is normal for this type of analyses and renders the effect of trade openness on regional inequality less relevant than in the static analysis (Table 4, Regression 1). The same is the case for the binary *Development* dummy interaction term in Regression 2 (Table 4). The speed of adjustment parameter is around 0.3, suggesting the presence of a strong difference between short- and long-term effects of all included independent factors (Table 4). Regional inequality tends to be path dependent and does not change radically from one year to the next.

Regressions 3 to 9 (Table 4) introduce the structural conditions in the dynamic model. Here, some of the partial effects of the static fixed effect model are confirmed in the medium- and long-term. This is the case of sectoral differences. The presence of strong inter-regional sectoral differences not only affects regional inequality in the medium-term, but also contributes to making trade significant and a key factor in increasing regional inequalities (Table 4, Regression 4). Moreover, countries with a strong level of market polarisation and where market access is concentrated in the richest regions are also likely to witness an increase of regional inequality in the medium- and long-run (Table 4, Regression 6). This effect is particularly strong in developing economies, where increases in trade will have a significantly stronger effect in those countries where trade entry points coincide with the richest regions (Table 4, Regressions 9 and 10). As this is the case in the majority of countries in the developing world, trade is likely to have a long-lasting effect on the persistence and the increase of regional disparities in the emerging world.[9] Other spatial variables, by contrast, keep the same signs of the static analysis, but display insignificant coefficients.

5.3. Robustness tests

In order to check whether these results are robust to differences in specifications, the Gini index of regional inequality is replaced by alternative inequality measures. The specifications in Tables 2 to 4 are thus run replacing Gini coefficient of within-country regional inequality as the dependent variable with two alternative measures: the Theil index and the population-weighted coefficient of variation. The results are robust to the change in specification and can be provided upon request.

Another robustness check, given the limited number of observations in a panel including 28 countries relative to the time of the analysis, is to use a bias-corrected least squares dummy variable (LSDV) estimator (Kiviet, 1995; Bun and Kiviet, 2003), instead of a instrumental variable GMM estimation. This approach also allows accommodating for unbalanced panels (Bruno, 2005). By resorting to this method, the aim is to check whether the results from the Arellano-Bond GMM estimation in Table 3 prove robust to an alternative estimator. The results are displayed in Table 5. Standard errors have been derived by setting the number of bootstrap repetitions to 200.

Insert Table 5 around here

[9] In all of the emerging world countries included in the sample, trade entry points coincide with some of the richest regions in the country. This is particularly the case in China, Indonesia, Brazil or Thailand, where Beijing or Shanghai, Djakarta, São Paulo or Rio de Janeiro, or Bangkok, respectively, represent the key economic agglomerations and the main hubs for imports and exports. A similar structure is observed in many developing countries outside the sample. In many Sub-Saharan African countries – e.g. Senegal, Guinea, Ivory Coast, Ghana, Togo, Benin, Nigeria, Angola, Mozambique, Tanzania – the richest cities are located in ports which channel trade flows to the rest of the country. Only in a limited number of cases (i.e. India's largest port, Kandla, in Gujarat, or Mexico's ports of Manzanillo or Lázaro Cárdenas, in Colima and Michoacán respectively) trade points do not coincide with the richest and most dynamic regions. But it is extremely rare to see a major port, airport or trade route in one of the poorest regions in a country. Gioa Tauro in impoverished Calabria, in southern Italy, is one of these exceptions.

Table 5 reveals that the size and sign of the coefficients of interest remain similar to those presented in Table 4. The speed of adjustment parameter slightly decreases to below 0.25 as indicated by the higher coefficient of the lagged level of regional inequality. However, none of the previously found significance levels is confirmed. This makes it difficult to draw any firm conclusions on the dynamic adjustment process between openness and regional inequality from our data.

6. Conclusion

The aim of this paper has been to improve our understanding of the relationship between changes in trade patterns linked to global market integration, on the one hand, and within-country spatial inequalities, on the other, both from a theoretical and an empirical perspective. This is particularly relevant given the recent emphasis of the WDR 2009 that increases in trade may lead to greater growth at the expense of increases in territorial disparities, but that this is a temporary condition as greater development would eventually weaken within-country spatial inequality.

The paper is based on a model which combines regional spatial characteristics with a series of country features. The spatial characteristics include the degree of inter-regional variation in access to foreign markets and whether these differences in foreign markets coincide with differences in income. The conditioning country features include the degree of inter-regional sectoral variation, the level of government expenditure, the degree of labour mobility and institutions. Lack of data on the two latter categories allows testing for the former two conditions only. In order to examine whether development weakens spatial inequalities, the paper also controls for the internal growth effect and its interaction with the country's development stage. The influence of these variables on the evolution of within-country regional inequality is then tested using both static and dynamic panels.

The results show that trade – when considered in combination with country-specific factors – matters for the evolution of regional inequalities. There is a weak association between both factors in static panel analyses, which improves significantly as the conditioning variables are included in the analysis. This implies that, while changes in trade make a difference for the evolution of spatial disparities, the impact of changes in trade is more polarising in countries with higher inter-regional sectoral differences, lower shares of government expenditure, and a combination of higher internal transaction costs with higher degrees of coincidence between wealthier regions and foreign market access. However, the spatial country variables cease to be significant once controlling for lagged levels of inequality in dynamic panels, meaning that no firm conclusions can be extracted regarding the dynamic timeframe of spatial adjustments and the distinction between short- and long-term effects of trade openness.

The key result is that changes in trade patterns seem to affect the evolution of regional inequality in developing countries to a much greater extent than in developed ones. The spatially polarising effect of trade also decreases at a significantly slower pace in developing countries than in developed ones. And trade, in contrast to what was suggested by Williamson (1965), seems to have a greater sway on the evolution of regional inequality than economic growth. This means that economic growth –

whether directly provoked by changes in trade or not – cannot offset the potentially negative effects for territorial equality of increases in trade in the developing world.

Policy-makers in the developing world – as well as international organisations – may thus need to tread carefully when thinking about the potential implications of greater market openness for their countries. While greater openness to trade is likely to yield rewards in terms of growth and the absolute welfare of local citizens, it may also bring the unwelcome consequence of greater territorial polarisation. While, as pointed out in the WDR 2009, this may not necessarily be bad in the short-term, enhancing territorial inequality in countries with already high levels of spatial polarisation and where territorial differences may pile on top of pre-existent social, cultural, ethnic, and/or religious grievances, can contribute flare up tensions which could ultimately undermine the very economic benefits that trade is suppose to bring about. Hence, it is convenient to bring the territorial implications of trade into the trade policy equation. This may imply trade policies aimed at promoting growth not just focused on generating greater agglomeration, as these can have unintended effects that may ultimately limit their influence on development.

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Figure 1. Evolution of regional inequality in a selected sample of countries (measured by the population-weighted coefficient of variation).

Figure 2: Regression Coefficients of Regional Inequality on Real Trade Openness

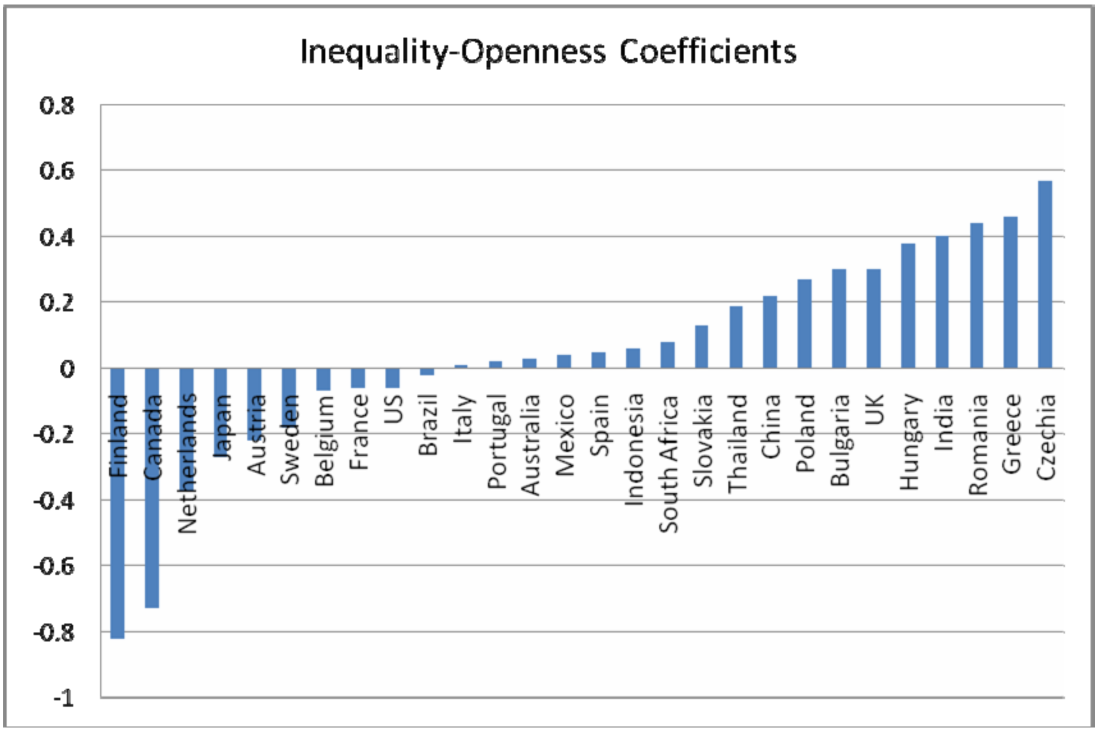

Figure 3: Regression Coefficients of Regional Inequality on Openness for 3-year averages

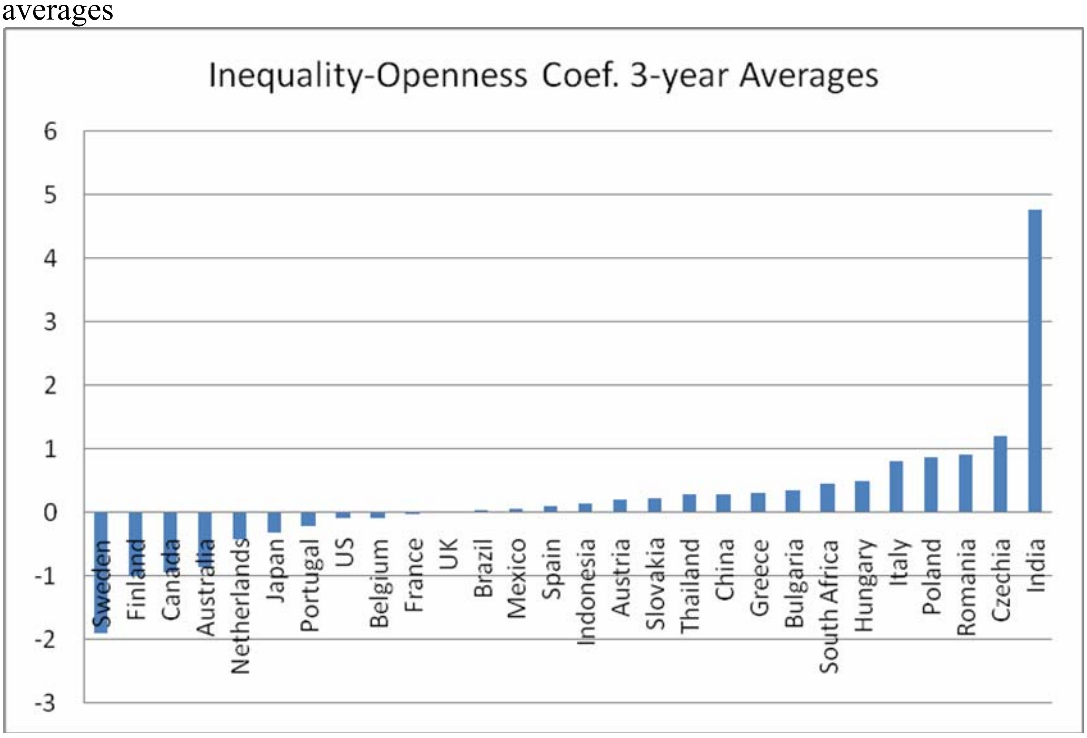

Table 1: Increasing versus decreasing regional inequality

Increasing Regional Inequality	Stable Regional Inequality	Decreasing Regional Inequality
Australia (1990-2005)	Austria (1988-2004)	Belgium (1977-1996)
Bulgaria (1995-2004)	Canada (1981-2005)	Brazil (1989-2004)
Czech Republic (1995-2004)	China (1978-2004)	South Africa (1995-2005)
Finland (1995-2004)	Italy (1995-2004)	
France (1982-2004)	Japan (1975-2004)	
Greece (1979-2004)	Netherlands (1986-2004)	
Hungary (1995-2004)	USA (1975-2005)	
India (1993-2002)		
Indonesia (2000-2005)		
Mexico (1993-2004)		
Poland (1995-2004)		
Portugal (1995-2004)		
Romania (1998-2004)		
Slovakia (1995-2004)		
Spain (1980-2004)		
Sweden (1994-2004)		
Thailand (1994-2005)		
UK (1994-2004)		

Table 2: Static panel with country and time fixed effects

Dependent variable: Gini coefficient	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
GDPcap	.1680	.2433**	.2766**	.2657**	.3049***	.1799	.1791	.2251**	.2418**	.3607***
GDPcap*Development		-.1223**	-.1721**	-.1523**	-.1992***	-.0540**	-.0404**	-.1025**	-.0998**	-.2363***
Trade	.0725	.1728**	.1042**	-.4840	.8620**	1.7055**	1.770**	1.1955**	1.2968**	2.1162***
Trade*Development			.1237**							.1160
Trade*Government				-.3337**						-.0932
Trade*Sectors					.2081***					.2358***
Trade*Coincidence50*MAPolarisation						.7888***				
Trade*Coincidence25*MAPolarisation							.8889***			
Trade*Coincidence50*Surface								.1544***		
Trade*Coincidence25*Surface									.1351***	.1272***
Constant	-1.510	-3.631	-3.811	-3.729	-3.968	-3.297	-3.317	-3.699	-3.841	-4.592
R^2 (within)	0.003	0.227	0.2327	0.2527	0.2577	0.2503	0.2622	0.2775	0.2885	0.359
Observations	435	435	435	435	435	435	435	435	435	435
F-test for country dummies	Prob>F =0.640	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000

*, **, *** correspond to 10, 5, and 1% significance levels respectively computed with heteroskedasticity adjusted standard errors;
Time and country fixed effects included.

Table 3: Trade effect in developed and developing countries

Dependent variable: Gini coefficient	**1**	**2**	**3**	**4**
GDPcap	.2766**	.4628***	.1427	-.0954
GDPcap*Development	-.1721**	-.3489***	-.2438***	.3507*
Trade	.1042**	-.0587	.9534**	2.8924***
Trade*Development	.1237**			-3.2878***
Trade*GDPcap			-.0814**	-.2888***
Trade*GDPcap*Development				.3508***
Trade*Middle-Income		.3963***		
Trade*Low-Income		.3523***		
Constant	-3.811	-5.027	-2.262	-1.951
R^2 (within)	0.2327	0.2968	0.2347	0.2681
Observations	435	435	435	435
F-test for country dummies	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000	Prob>F =0.000

*, **, *** correspond to 10, 5, and 1% significance levels respectively computed with heteroskedasticity adjusted standard errors; Time and country fixed effects included.

Table 4: Dynamic panel with 1st difference Arellano-Bond GMM

Dependent variable: Gini coefficient										
Short-term parameters	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Lagged Inequality	.7132***	.7188***	.6917***	.6917***	.7126***	.7154***	.7112***	.7090***	.7099***	.6917***
GDPcap	-.0102	.0002	.006	.0216	-.0165	-.0106	-.0168	-.0137	.0040	.0037
GDPcap*Development	.0303	.0243	.0141	-.0038	.0289	.0261	.0338	.0311	.0166	.0133
Trade	.0158	.0200	-.2429**	.2631**	-.1196	-.0803	.0862	.1187	.0232	.1172
Trade*Development		-.0116								-.0486
Trade*Government			-.1384**							-.0636
Trade*Sectors				.0726**						.0596
Trade*Coincidence50*MAPolarisation					-.0110					
Trade*Coincidence25*MAPolarisation						.0694				
Trade*Coincidence50*Surface							.0009			
Trade*Coincidence25*Surface								.0174		
Trade*Coincidence25*Development									.7210**	.5898*
Observations	379	379	379	379	379	379	379	379	379	379
Sargan Test	Prob>chi2 =0.9355	Prob > chi2 =0.9407	Prob>chi2 =0.8894	Prob>chi2 =0.9147	Prob>chi2 =0.9493	Prob>chi2 =0.9484	Prob>chi2 =0.9541	Prob>chi2 =0.9461	Prob>chi2 =0.9530	Prob>chi2 =0.9395
2nd Order Autocorrelation	Pr>z= 0.5032	Pr >z= 0.4920	Pr>z= 0.5262	Pr>z= 0.5343	Pr>z= 0.5011	Pr>z= 0.4886	Pr>z= 0.5333	Pr>z= 0.5252	Pr>z= 0.4877	Pr>z= 0.4958
Long-term parameters	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
GDPcap	-.0356*	.0007	.0195	.0701	-.0574*	-.0372*	-.0582	-.0471*	.0138	.0120
GDPcap*Development	.1056	.0864	.0457**	-.0123	.1006	.0917	.1170	.1069*	.0572	.0431
Trade	.0551	.0711	-.7879	.8534*	-.4161	-.2822	.2985	.4079	.0800**	.3801*
Trade*Development		-.0413								-.1576
Trade*Government			-.4489							-.2063
Trade*Sectors				.2355**						.1933
Trade*Coincidence50*MAPolarisation					-.0383					
Trade*Coincidence25*MAPolarisation						.2439**				
Trade*Coincidence50*Surface							.0031			
Trade*Coincidence25*Surface								.0598		
Trade*Coincidence25*Development									2.4853***	1.9131***

*, **, *** correspond to 10, 5, and 1% significance levels respectively computed with heteroskedasticity adjusted standard errors;
Trade, sectors, government, and spatial variables entered the instrument matrix as strictly exogenous.
Time fixed effects included.

Table 5: Dynamic panel with bias corrected LSDV (Arellano-Bond as initiating estimator)

Dependent variable: Gini coefficient	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Lagged Inequality	.7695***	.7732***	.7625***	.7562***	.7717***	.7712***	.7658***	.7637***	.7688***	.7601***
GDPcap	-.0043	-.0114	-.0057	.0019	-.0017	-.0033	-.0007	.0003	-.0102	-.0076
GDPcap*Devevelopment	.0447	.0553	.0544	.0366	.0394	.0413	.0423	.0414	.0540	.0507
Trade	.0073	.0172	-.0514	.1725	-.1524	-.0948	.0582	.1017	.0198	.3415
Trade*Development		-.0231								-.0509
Trade*Government			-.0306							.0416
Trade*Sectors				.04884						.0697
Trade*Coincidence50*MAPolarisation					-.0675					
Trade*Coincidence25*MAPolarisation						.1047				
Trade*Coincidence50*Surface							-.0081			
Trade*Coincidence25*Surface								.0144		
Trade*Coincidence25*Development									.5699	.5615
Observations	379	379	379	379	379	379	379	379	379	379

*, **, *** correspond to 10, 5, and 1% significance levels respectively, computed with 200 bootstrap repetitions;
Trade, sectors, government, and spatial variables entered the instrument matrix as strictly exogenous.
Time fixed effects included.

Table A1: Number of regions and structural conditions by country

Country	No of regions	Developme nt	High-income	Middle-Income	Low-Income	Governme nt	Sectors	MAPol	Main trade entry points	Coin25	Coin50
Australia	8 states	0	1	0	0	0.16	0.02	145.09	New South Wales, Victoria	1	1.05
Austria	9 Länder	0	1	0	0	0.18	0.02	83.72	Vienna	1.06	1.07
Belgium	11 provinces	0	1	0	0	0.2	0.01	87.77	Brussels, Antwerpen, West Flanders	0.95	1.1
Brazil	26 states	1	0	1	0	0.17	0.07	182.44	São Paulo, Rio de Janeiro, Paraná	0.59	0.65
Bulgaria	6 NUTS2 regions	1	0	0	1	0.14	0.06	98.83	Yugozapaden, Severoiztochen	1.15	1.12
Canada	12 provinces	0	1	0	0	0.2	0.03	174.58	Ontario, British Columbia	1	0.91
China	31 provinces	1	0	0	1	0.13	0.07	182.86	Shanghai, Tianjin, Beijing, Guandong, Zhejiang, Shandong	1.73	1.32
Czech Rep	8 NUTS2 regions	1	0	1	0	0.2	0.03	95.42	Prague	0.88	1.15
Finland	5 NUTS2 regions	0	1	0	0	0.21	0.02	96.04	South Finland	1.18	1.13
France	22 Régions	0	1	0	0	0.2	0.02	57.36	Ile-de-France, Provence-Alpes-Côte d'Azur, Haute Normandie	0.97	0.99
Greece	13 NUTS2 regions	0	0	1	0	0.11	0.06	90.3	Attica, Central macedonia, West Greece	0.93	1
Hungary	7 regions	1	0	1	0	0.09	0.04	93.96	Central Hungary	1.1	0.76
India	28 states & 4 union territories	1	0	0	1	0.09	0.11	118.73	Delhi, Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu	1.17	0.97
Indonesia	30 provinces	1	0	0	1	0.06	0.11	116.06	Jakarta, East Java	1.18	1.29

Country	No of regions	Development	High-Income	Middle-Income	Low-Income	Government	Sectors	MAPol	Main trade entry points	Coin25	Coin50
Italy	21 regions	0	1	0	0	0.17	0.02	87.69	Lazio, Lombardy, Liguria, Calabria	1.25	1.22
Japan	47 prefectures	0	1	0	0	0.15	0.02	74.53	Tokyo, Chiba, Kanagawa, Osaka, Aichi, Hyogo, Fukuoka	1.02	1.03
Mexico	31 states + DF	1	0	1	0	0.1	0.05	117.73	Mexico D.F, Veracruz, Colima, Tamaulipas	1.41	1.04
Netherlands	12 provinces	0	1	0	0	0.21	0.02	91.47	North Holland, South Holland	1.07	1
Poland	16 voivodeships	1	0	1	0	0.18	0.04	88.1	Mazowieckie, Pomorskie	1.06	1.01
Portugal	5 continental NUTS2	0	1	0	0	0.16	0.07	96.02	Lisboa, Norte	1.41	1.13
Romania	8 NUTS2 regions	1	0	0	1	0.08	0.07	97.6	Bucarest, South East	0.97	0.95
Slovak Rep	4 oblasti (NUTS2)	1	0	1	0	0.19	0.02	96.4	Bratislava	1.85	1.33
South Africa	9 provinces	1	0	1	0	0.17	0.02	104.42	Gauteng, Western Cape, Kwazulu-Natal	1.03	1
Spain	17 autonomous regions	0	1	0	0	0.16	0.03	84.48	Madrid, Catalonia, Valencia, Andalusia	1.02	1.07
Sweden	8 NUTS2 regions	0	1	0	0	0.25	0.02	83.1	Stockholm, West Sweden	0.97	0.95
Thailand	75 provinces	1	0	0	1	0.08	0.13	104.8	Bangkok, Chonburi	1.92	1.46
UK	37 NUTS2 regions	0	1	0	0	0.17	0.03	83.34	London, Essex, Hampshire	1.1	1.05
US	50 states + DC	0	1	0	0	0.12	0.02	96.43	New York, California, Texas, Louisiana, Georgia, Florida	1.05	0.98

Table A2: Variables and sources of data

Variable	Source of data
Inequality	National statistical offices, and Eurostat Regio database
GDPcap	Word Development Indicators
Development	Historical Series of World Bank classifications
High-income	Historical Series of World Bank classifications
Middle-income	Historical Series of World Bank classifications
Low-income	Historical Series of World Bank classifications
Trade	UN Comtrade and World Development Indicators
Government	World Development Indicators
Coincidence	UN Comtrade, World Port Database, own calculations