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Trade Liberalization, Inequality and Poverty in Brazilian States

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Abstract

Keywords: Trade liberalization; regional inequalities; poverty.

1 Introduction.

The impact of globalization on income distribution has raised considerable debate over the last twenty years, in advanced economies but also more recently in developing and emerging countries. This debate is partially motivated by the complexity of the channels through which globalization - an *all-purpose* term here used to describe trade liberalization and integration to world markets - affects inequality as well as poverty within a country. Indeed, trade reforms affect labor income and employment but also relative prices and hence household production decisions, taxes and public expenditures (see Goldberg and Pavcnik, 2007, 2004; Winters et alii, 2004; Ferreira, Leite and Wai-Poi, 2007 for a survey on the various trade-transmission mechanisms). Much of the discussion in the literature has focused on the influence of a growing exposure to international trade on labor market outcomes, particularly employment and wage inequality, through the relative demand of skilled labor.

However, though ultimately trade reforms should affect household welfare, fewer studies have looked at the impact of globalization on poverty and inequality in total household income (see for example Topalova, 2005; Ferreira, Leite and Wai-Poi, 2007), not to mention consumption (Porto, 2006). This is particularly disturbing for developing countries experiencing relatively high levels of poverty and very unequal distributions according to international standards, as is often the case in Latin America (see WDR, 2006).

The focus of the literature on labor market outcomes, and particularly skill premium, essentially derives from the predictions of the Heckscher-Ohlin-Samuelson (HOS) model that links relative factor endowments, trade specialization and relative factor prices. According to the classical HOS model, the impact of trade liberalization on inequality depends on the country's relative factor endowments. In poor countries, usually considered as relatively well endowed in unskilled labor, trade liberalization should raise relative demand for this factor and consequently lower inequality and eventually reduce poverty. However the predictions of the HOS theory of international trade were challenged by empirical works on some Latin

American countries, where a combination of rising skill premium and a deterioration of their income distribution parallel to trade liberalization episodes seemed to take place (see, for example Robbins, 1996 and Goldberg and Pavcnik, 2007, for studies on various Latin American countries; Goldberg and Pavcnik, 2007 and Attanasio et alii, 2004 for Colombia; Hanson, 2003 for Mexico). Recent research shows that evaluating the impact of globalization on income distribution within a country requires going beyond the scope of the HOS model to take into account other factors such as the initial structure of protection, trade-induced skilled biased technological change, trade in intermediate goods or outsourcing.

The relative lack of attention to the impact of trade liberalization on household welfare as opposed to labor market outcomes may also be attributable to conceptual and measurement difficulties, since comparable household poverty and inequality trends in developing countries are not always feasible or easy to elaborate (see Goldberg and Pavcnik, 2004, 2007). Other motives hinted in the literature have to do with the strong emphasis in U.S. literature on earnings inequality, which may have spilled over and crowded out further issues from research agendas of other countries (see Hanson, 2005).

A recent feature of research on the impact of globalization on income distribution within a country is the inclusion of a spatial dimension. One strand of the literature studies whether incomes or wages are higher in regions with access to larger markets for their goods using new economic geography models (see for example, Hanson, 2005; Redding and Venables, 2004; Fally, Paillacar and Terra, 2008) Another strand of the literature uses what Goldberg and Pavcnik (2007) have called "the differential exposure approach" and studies whether, within a country, regions that were more exposed to trade liberalization experience smaller or larger changes in inequality or poverty than less-exposed regions (see Wei and Wu, 2002 and Topalova, 2005).

Following this last approach, this paper examines the impact of trade liberalization and international trade exposure on income inequality and poverty using data across Brazilian federal units from 1987 to 2005. We seek to measure whether, within Brazil, states[1] that experienced a greater degree of openness in trade during the past two decades exhibited improvements or deteriorations in their income distribution. In other words, are poverty and inequality levels of households in Brazilian states related to "state-specific" trade shocks? To answer this question, we use several measures of trade openness and we disaggregate the effects on rural and urban areas within states.

Brazil is particularly well suited for analyzing the impact of trade liberalization on income distribution and poverty for a number of reasons. First, Brazil undertook a very extensive trade liberalization reform since 1988, with a substantial and widespread reduction in trade barriers and a decline in tariff dispersion. At the end of the eighties, imports were subject to very high tariff barriers as well as important non-tariff barriers. Trade reforms started in 1988 and the average (unweighted) tariff fell from 43% in 1990 to 10.7% in 2005 (CNI, 2005). These large changes in trade protection, as well as other macroeconomic factors, led to a rise in trade openness in Brazil as a whole and in the different Brazilian states (see section 2 below for a more detailed description of the evolution of trade policies and trade patterns).

Second, Brazil is one of the most unequal countries in the world while its level of poverty is very high and well above the norm for a middle income-country. During the period of

[1] Brazil is politically organised as a Federation composed by twenty-six states and one federal district.

interest, both welfare indicators started a slow but significant decline. Still, there are important differences in inequality and poverty between rural and urban areas and across Brazilian states, both in levels and in trends (see section 3 below for a more detailed description of the evolutions of poverty and inequality).

Third, among Latin American countries, Brazil seems to be a special case, at least in the literature that focuses on the effects of trade liberalization on wage and employment outcomes. Contrary to other Latin American countries, the economy-wide skill-premium in Brazil fell between 1988 and 2004[2] (Ferreira, Leite and Wai-Poi, 2007). Table A1 in the appendix reviews recent studies for Brazil, concerning the impact of trade reform on the economy-wide skill premium, on industry-specific wage and skill premiums or employment reallocation. Except for Arbache, Dickerson and Green (2004)[3], the mentioned studies show either no evidence of any impact of trade liberalization or a downward effect on inequality (and poverty, in Ferreira, Leite and Wai-Poi, 2007). One reason that can account for this result is the nature of Brazil's structure of effective protection prior to liberalization and its evolution. Contrary to some other Latin American countries - for example Mexico (Hanson, 2003) or Colombia (Attanasio et allii, 2004), the trade protection pattern in Brazil indicates that pre-liberalization tariffs were higher in industries intensive in skilled labor[4] (Gonzaga et alii, 2006; Ferreira, Leite and Wai-Poi, 2007). Moreover, as emphasized by Goldberg and Pavcnik (2004), the objective of the government was to reduce tariffs across industries to more uniform rates. This means that reductions in tariffs were more important in skill-intensive industries (Gonzaga et alii., 2006). In line with Stolper-Samuelson predictions, this could explain the contribution of trade liberalization to a reduction in inequality.

A technical, but not less important reason to study the Brazilian case is the fact that it benefits from the availability of very high-quality household data sets representative of almost the whole country (only rural areas from a few Northern states are absent from the sample) and covering a period that starts before trade liberalization. It is therefore possible to establish long, reliable and comparable series at the household level, and consequently at the state-level. As often emphasized, studies on a unique country do not suffer from the long list of data quality problems encountered by cross-countries studies (such as differences in data definitions and collection methods leading to problems of comparability between countries and over time). Moreover, Brazil being a large federal country, a relatively important number of intranational observations is available.

It is important to note that this empirical work does not examine the overall effects of trade liberalization on poverty and inequality in Brazil and, therefore, our results are not directly comparable to the ones obtained in studies on Brazil as a whole. As stated above, based on regional data, this paper seeks to answer the question of the impact of trade liberalization on regional outcomes, or more precisely within states. An underlying assumption in this type of analysis is that labor should not be too mobile across states within Brazil at least in the short or medium run (there would be no differential effects throughout the country if wages, and consequently household income levels, were equalized across regions). However, as

[2] In the study of Ferreira et alii (2007a), the ratio of skilled workers' wages over those of the unskilled fell by 31% between 1988 and 2004 (in their work skilled workers are defined as those with 11 or more years of schooling).

[3] One of their results indicates that, within the traded sector, there is no significant impact of increasing openness on wages for those in the top two education groups and a negative impact for lower level education groups.

[4] When adjusted by the industry import penetration rates, this "mildly" positive correlation between tariffs and industry-skill shares is even stronger (Gonzaga et al., 2006).

emphasized by Goldberg and Pavcnik (2007), "failure of this premise to hold in practice does not invalidate the approach; it simply implies that one would *not* find any differential trade policy effects across industries/regions in this case". In the case of Brazil, even though geographical migration is not negligible throughout the period of study, it is not sizeable enough to wipe off the spatial disparities in experiences observed[5].

Our results show that trade liberalization increases poverty at the state level even if, over the period studied, Brazilian states experienced in general a fall in poverty. In other words, Brazilian states that were more affected by tariff reductions experienced smaller reductions in poverty. This result holds for urban areas, but not for rural areas. Regarding income inequality, trade liberalization has no significant effect. But if we consider urban and rural areas separately within states, the influence of a tariff reduction is inequality increasing in urban areas whereas it is inequality decreasing in rural areas. In terms of trade intensity, the results are opposite for export exposure and import penetration. Rising in export exposure seems to have reduced both poverty and inequality quite significantly while a growth in import penetration seems to have increased poverty and inequality.

The remainder of the paper is organized as follows. Section 2 provides a brief description of Brazilian trade reforms (2a) and of the evolution of trade patterns by state (2b) during the past two decades. Section 3 analyzes the trends of poverty and inequality both for Brazil as a whole, as well as by federative unit. Section 4 looks at the impact of trade liberalization and openness on welfare across states since 1987. It first describes how the database was built from various data sources and the variables it includes (4a); then presents the econometric specifications and estimation strategy (4b); and finally analyzes the estimation results (4c). Section 5 concludes.

[5] To get insight of geographical migration in Brazil, Figure A1 in the appendix shows that since 1992 (the first year for which migration questions are available in our household surveys) the percentage of individuals that declare themselves living in the same state for the past 10 years is close to 90%. Only about 5% declare themselves as being living in their state during less than 4 years. We calculate our percentages considering the total population. Other studies, such as for example Fiess and Verner (2003) find a much larger percentage of migrants (they present numbers that go up to 40%). However they only focus on household heads (and not total population), and they classify them as migrants from the moment that they have migrated at least once during their entire lifetime. Indeed in a footnote they indicate that their methodology overestimates migration numbers, with respect to what the Brazilian Census data show.

2 Trade Policy and Trade Patterns in Brazil.

2.a Trade policies.

Brazil has adopted a protectionist trade regime since the fifties in order to develop the national industry. Not only the level of protection was high but the import policy was also particularly complex due to the use of innumerous trade instruments. Such intricacy was reinforced along the decades by the fact that, under some circumstances, trade instruments were used for macroeconomics purposes, without connection with the original industrial and productive rationale.

At the end of the eighties – known as the "lost decade" for Latin-American countries because of macro instability and mediocre economic performance - liberal public policies inspired on the Washington consensus started to be adopted in the region.[6] The types and deepness of economic policies varied from country to country. In Brazil, the recommended policies were neither entirely nor simultaneously implemented, but in general trade and financial liberalization measures were adopted in the early nineties.

Trade reform in Brazil started effectively in 1988, when some non-tariff barriers were suppressed. At that time, the nominal tariff, measured by its simple average across sectors (see Table 1) reached 43%, with a very dispersive distribution and an important incidence of "tariff redundancy"[7]. With the arrival of a new government in 1990, a great package of trade measures was implemented. The main goal of the reform was to rationalize the trade regime and to let the tariff play the role of the main trade instrument. In order to reach this main goal, the reform intended, first, to eliminate the remaining non-tariff barriers (like prohibitions and quantitative controls), second, to suppress the majority of the special import regimes and, third, to reduce the level and dispersion of import tariffs. A schedule for tariff reduction was established and by 1994, nominal tariff would attempt on average 18%, within a range of 0-40%.[8]

The Brazilian trade reform was initiated as a unilateral initiative, which was in accordance with the commitments assumed by the country in the ongoing multilateral negotiations (Uruguay Round). But in 1991, Brazil signed the Mercosur agreement with Argentina, Paraguay and Uruguay. The four countries negotiated the Common External Tariff (CET), which imposed some adjustments to the original liberalization schedule. With the Mercosur agreement, the average tariff reached 12% in 1997 (see Table 1), showing the magnitude of the liberalization process.

The nineties trade reform achieved its main goal of rationalization of Brazilian import tariff structure but, as pointed out by Pereira (2006), it didn't modify the sectoral structure. The structure of trade protection in Brazil reflects the priority of the industrial development given by successive governments. As we can see from Figure 1 and Figure 2, the highest tariffs concern manufacturing sectors – automobiles, apparel and textiles – and the lowest ones concern extractive sectors. The level of protection of agriculture and food sectors – where Brazil benefits from strong comparative advantage – is close to the Brazilian average tariff. As trade reform aimed at reducing the dispersion of tariff structure, the largest tariff cuts

[6] For an analysis of the Latin-American economies after the fifties, see Cano (2000) or Bethell (2001).
[7] "Tariff redundancy" means that for some products there was such a high tariff that the other tariff and non-tariff measures had no additional effect.
[8] For a more detailed analysis of Brazilian trade reform, see Kume, Piani and Souza (2003) or Pereira (2006).

concerned the sectors with initially highest tariff levels. Nevertheless, such sectors remain the most protected.

After the implementation of the CET in 1994, Brazilian tariff structure experienced only small changes, mainly conducted for macroeconomic adjustment purposes. In this sense, the price stabilization after the Real Plan (1994) implied an increase in domestic consumption and, consequently, in imports. This led in 1996 to an imposition of some quantitative and administrative measures. From 1997 onwards, after the Asian financial crisis, the country, together with its Mercosur partners, temporarily raised the CET by 3%.[9] This explains the fact that the tariff level is higher in 2000 relative to 1997. However, in 2005 the Brazilian tariff has reached its lowest level with a simple average tariff of 10.7%.

At the present time, tariffs are still the main import policy instrument of Brazil. Until 1990, non-tariff barriers (NTBs) played an important role as a trade barrier, even if their application was sometimes done in complement with high level tariffs causing a tariff redundancy and having no additional effects on imports (Carvalho, 1992). Since then, NTBs have become a relatively insignificant protectionist instrument. In fact, even though the Brazilian government imposed sanitary measures in 1997, they were not implemented and didn't seem to have played an efficient role in restricting imports. [10]

The question of the endogeneity of trade liberalization is sometimes raised when studying its impact on income distribution. However, Goldberg and Pavcnik (2007) underline that such a concern is "potentially less severe" in several developing countries, among which Brazil. Though some interest groups representing the entrepreneurs (willing to keep their profits) do exert some influence on the trade policy making, in the case of Brazil it was limited to specific sectors – like automobile, electronic and textile (see Abreu, 2004). Furthermore, we know that Brazil committed to an economywide liberalization process and experienced the greatest tariff cuts in the most protected sectors (see Figure 2). So even if trade reforms conduced in the early nineties didn't modify much the Brazilian sectoral structure of protection[11], the cuts in tariffs were very important, leading to more uniform tariff rates and there's no evidence that protectionist demands were motivated by job protection or other social goals. At the end of the nineties, the protectionist measures implemented were motivated by macroeconomic adjustment's requirement.

[9] This measure was abolished in 2003.

[10] Detailed information on NTBs is not available on a disaggregated level to construct time-series across sectors in Brazil, and has not been included in this study. This might not be very problematic since tariffs are the main policy instrument in Brazil, an opinion shared by Pavcnik et alii (2003). Moreover, Goldberg and Pavcnik (2007) emphasized that, whenever available, NTB coverage ratios and tariff rates (and their changes) are positively correlated "indicating that tariffs and NTBs have been used in recent years in developing countries as complements and not substitutes".

[11] Topalova (2005) arguments that stability of Indian structure of protection is an indicator of the trade policy endogeneity.

2.b Trade patterns.

The evolution of international trade flows in Brazil over the last twenty years has been largely influenced by macroeconomic factors. Brazil, as well as the most Latin American countries, faced strong external debt problems during the eighties. The increase of external payments due to rising international interest rates led these countries to adopt restrictive import policies and generous export subsidies, in order to generate trade surpluses. In Brazil, the effect of these policies was reinforced by the launch of new large industrial plants (investments conducted in the framework of the industrial policy in the seventies)[12]. Consequently, exports grew at a faster rhythm than imports (see Figure 3) and Brazil obtained in 1988 the third largest trade surplus of the world (after Germany and Japan).

In 1990 imports began to rise slightly but it was not until 1994, when the macroeconomic plan (Plano Real) was implemented, that imports started to grow rapidly. This plan introduced a fixed exchange rate regime and was successful in diminishing inflation rates and subsequently rising domestic real revenue and domestic demand (adding to the simultaneous effects on imports of the overvaluation of the Brazilian currency and of trade liberalization measures). Trade deficits observed in 1996, 1997 and 1998 resulted from this rapid growth of imports and from a lesser growth of exports.[13] As already noted in subsection 2a, the Brazilian government introduced in 1996 several import restrictions in order to control the rising trade deficit .

Asian and Russian crisis in 1997 and 1998 strongly impacted on external accounts and the Brazilian exchange rate regime became unsustainable. In January 1999, the Brazilian currency was devaluated by about 50% in nominal values. The seeked results on exports and imports were not immediate but managed to stop the trade deficit trajectory. Even though the energetic crisis Brazil faced in 2001 contributed to limit the exports offer, several authors[14] suggest that export volumes were more sensible to the evolution of international demand than to exchange rate. This phenomenon became more evident in 2004, when the real appreciation of the Brazilian currency (about 10% along the year) was not strong enough to reduce the positive effect of international demand on exports. From 2001 to 2004, trade surplus grew from US$ 2 billions to US$ 33 billions.

All these described changes in trade protection and in macroeconomic policies affected trade openness in Brazil as a whole as well as in the different Brazilian states. Figure 4 shows the three usual indicators of international trade exposure – trade openness, import penetration and export to output ratios – for Brazil. Since 1989, trade openness has more than doubled, reaching 26.4% in 2004 (compared to 11.8% in 1989 and 13.8 % in 1998)[15]. For the reasons exposed before, changes were more important from 1998 onwards. The large increase in trade

[12] In fact, Castro and Pires (1985) suggest that the growth of exports from 1984 onwards resulted partially from the entering into operation of some industrial plants that had explicitly been conceived to launch exports. Contrary to Asian countries, Latin American development strategies (and more particularly Brazilian precedent industrial plans) had not considered exports as a priority until the increase of external debt in the eighties.

[13] As pointed out by Kume et alii (2003), the government assumed that trade liberalization would increase the level of competitiveness of Brazilian products and have a positive impact on exports.

[14] See Carvalho and DeNegri (2000), Pourchet (2003) and Ribeiro (2006).

[15] Note that this level continues to be low compared to other Latin American countries partly because of the large size of Brazil.

openness between 1998 and 2004 is mainly due to the growth of exports, with a rise of almost 10% of export exposure compared to around 4% for import penetration.

A detailed picture of trade performances by Brazilian states in 1989 and 2004 is given in Figure 5. The "average" level of trade openness for the twenty-six federative units[16] rose from 8% to 19.6% (standard errors being 0.07 and 0.16 respectively). Trade openness has increased in each state but disparities between the different federative units have also grown[17]. Values observed show a high level of trade integration of some Brazilian states but also important regional inequalities (still in 2004, trade openness ratios vary from 0.9% in Acre to 59.9% in Espírito Santo, with eight states reaching a ratio well above 30%[18]).

Figure 6 maps the separate evolutions of export exposure[19] and import penetration ratios of Brazilian states. Some Brazilian states exhibit a very important rise of export to output ratios[20]. The evolutions are more modest for import penetrations[21], with the two exceptions of Amazonas (with the role of the free-export zone of Manaus) and Espirito Santo[22]. In line with what was observed for Brazil as a whole, it is mainly the growth of exports that accounts for the increase in trade openness in the different federative units.

An important feature of the Brazilian case is its strong geographical concentration of exports and imports. Three states represent more than 50% of total Brazilian exports both in 1989 and 2004[23]: Sao Paulo (35% in 1989 and 32.2% in 2004), Minas Gerais (respectively 13.7% and 10.4%) and Rio Grande do Sul (respectively 10.8% and 10.2%). Geographical concentration of imports is even more important, even if it has fallen since 1989[24]: Sao Paulo (41% in 1989 and 43.1% in 2004), Rio de Janeiro (respectively 23.7% and 10.1%), Rio Grande do Sul (respectively 10.7% and 8.4%) represent more than 60% of total Brazilian imports both in 1989 and 2004.

From this analysis, it follows that integration to world markets was very uneven across the different federative units at the end of the eighties and that these regional inequalities in terms

[16] The number of states considered is twenty-six because Goiás and Tocantins are pooled together in order to get consistent time-series (Tocantins was created in 1988 as a dismemberment of Goiás state).
[17] In four states (Amazonas, Espírito Santo, Parana, Mato Grosso), trade openness rose by more than 25%. In ten states (Rondônia, Acre, Roraima, Amapá, Piauí, Paraiba, Pernambuco, Sergipe, Rio de Janeiro, Distrito Federal) the increase is below 5%.
[18] In particular: Espirito Santo (59.9%), Amazonas (44.8%), Mato Grosso (36.9%), Parana (36.1%), Para (34.8%), Maranhao (34.8%), Sao Paulo (31.2%) et Rio Grande do Sul (31.1%).
[19] According to the *Secretaria de comércio exterior* (SECEX), which collects data on exports of the various Brazilian states, the state that exports is the one where agricultural products are cultivated, ores extracted and manufactured goods produced totally or partially. In this last case, the "exporting" state is the one that has completed the last step of the manufacturing process.
[20] In 1989, only five states reach an export exposure above 10% (Espírito Santo, Para, Maranhão, Minas Gerais, Rio Grande do Sul); in 2004 it is the case of twelve states. Four states are above 25%: Espírito Santo (34.4%, with a rise of 12 percentage points) and Pará (32.5% with a rise of 17.3 percentage points) - two states in which export of iron ore plays a major role - , Mato Grosso (32.5% with a rise of 27.5 percentage points) and Parana (25.3% with a rise of 18.2 percentage points), where soybean exports are very important.
[21] In 1989, import penetration ratios are below 5% in all the Brazilian states except Amazonas, Rio de Janeiro, Espírito Santo and Rio Grande do Sul. In 2004, it is still the case of thirteen states and only eight states have ratios above 10%.
[22] Import penetrations reached in 2004 28.1% in Amazonas (a growth of 15.5 percentage points since 1989) and 28% in Espírito Santo (a growth of 18.9 percentage points since 1989).
[23] Twenty states have a share in total exports below 5% in 2004.
[24] Twenty one states have a share in total imports below 5% in 2004.

of trade integration have increased during the last two decades[25]. This variation across space and over time in trade openness in Brazil might have led to different impacts on inequality and poverty.

3 Poverty and inequality in Brazil

Figures 7a and 7b show respectively the evolution of two of the most common indicators of inequality and poverty, the Gini index and the Headcount ratio, on household income per capita[26]. The trends are provided annually for Brazil as a whole as well as separately for rural and urban areas, over the period 1987 to 2005[27].

The evolution of the Gini index reveals a steady increase of inequality from 1987 to 1989 (where a peak is reached at 0.63), followed by a certain degree of volatility until 1993. Usual explanations of such evolution include high and accelerating inflation over the period, as well as increasing education levels of the population, together with widening returns to schooling (see Ferreira and Paes de Barros, 2004). From 1993 to 2005 an initially slow (with Ginis relatively stable at around 0.60) but steady decline of inequality took place (the Gini index reaching 0.56 in Brazil in 2005). Such decline was more intense in rural areas than in urban zones and particularly significant from 2001 onwards. When looking at poverty indicators over the same period we observe a similar pattern. The headcount ratio displays fluctuating values from 1987 to 1993, again reflecting macroeconomic instability and hyperinflation. From 1993 to 1995, a fall in the poverty headcount is observed. The introduction of the Organic Social Assistance law in 1993, which consisted essentially of unconditional cash transfers to poor old people living in rural areas and to the handicapped, together with the Plano Real, the macro stabilization plan launched in 1994, may be cited among the relevant contributors to this initial poverty reduction (see Ferreira, Leite and Litchfield, 2006; Pero and Szerman, 2009). A period of relative stability in the percentage of poor at around 33% followed from 1995 until 2003 (though in rural areas poverty ratios continued a slow and steady decline). Finally, a persistent and significant fall in poverty ratios took place from 2003 onwards, this time both in urban and rural areas (the headcount index reaching 29% for Brazil in 2005).

A few tentative explanations for these more recent declines in inequality and poverty levels in Brazil have been put forward by the research community, among which: the observed declines in inequality between educational subgroups of population (due to a reduction in the educational heterogeneity of the labor force together with a compression in the distribution of returns to education), a better integration of rural and urban labor markets, a potential reduction of racial inequalities and the increase and better targeting of social transfers, with the adoption and expansion of conditional cash transfer programs (see Ferreira, Leite and Litchfield, 2006; Ferreira, Leite and Ravallion, 2007; Paes de Barros, Foguel and Ulyssea, 2006).

[25] Brazil is a very large country where trade policies but also distance, natural barriers to trade, transport infrastructure or access to major seaports play an important role concerning trade integration of the different federative units.

[26] The poverty line is here fixed at R$100 per capita per month, in Reais 2006. A detailed description of the data set and the construction of different variables is provided in section 3 below.

[27] Note that three years are missing from the data: 1991 1994 and 2000. See footnote 28 in the data section for more details.

Concerning the spatial dimension, when we look at the period of analysis 1987-2005, not only there are important differences in inequality and poverty between rural and urban areas, but also across Brazilian states, both in levels and in trends. Figure 8 and Figure 9 show the initial and final year measures of, respectively, Gini coefficients and headcount ratios in Brazilian states. Though Gini coefficients have fallen in almost all federative units[28], the intensity of the drop varies across states. A similar spatial heterogeneity of experiences is observed when looking at poverty levels. In fact, no convergence across states seems to have taken place during the time frame of analysis.

The aim of this paper is to investigate if the rich spatial variation in welfare outcomes and trends observed in Brazil is linked to the different exposure of Brazilian states to trade liberalization. In order to test this hypothesis and to take into account other tentative explanations, we have elaborated a new database at the state level from different data sources. Our database and estimation strategy are described in the next section.

[28] Inequality declines in all states except Rondonia, Acre, Roraima, Amapa –all four in the Northern of Brazil, a low-income cluster in the country--, plus the wealthy states of Sao Paulo and Distrito Federal. Note that the Brazilian household survey used to calculate welfare indicators is representative of urban and rural zones except in the Northeast region where rural areas are missing (these states are marked with a star in Figures 8 and 9).

4 Impact of trade liberalization and openness on inequalities and poverty

4.a The data set.

The data used in this study come from different sources. The first source is the household level micro-data from the Pesquisa Nacional por Amostra de Domicílios (PNAD), which is conducted annually by the Instituto Brasileiro de Geografia e Estatística (IBGE), Brazil's Census Bureau[29]. The survey, which samples about 300,000 individuals per year, is nationally representative and ensures coverage of both rural and urban areas of all states of the federation, except for the rural areas of the Northern Region, corresponding to the Amazon rainforest[30]. From the PNAD we use individual level information to construct harmonized summary variables on income distribution, employment, education and various other socio-demographic characteristics (detailed below), at our unit of analysis, which is the state or federative unit[31]. When appropriate, we will make the distinction between rural and urban areas within states, for which all summary variables have in turn been constructed[32].

The definition of income used throughout the analysis corresponds to gross monthly household income per capita, measured in 2006 Brazilian Reais, and the sample considered is the total population[33]. Various measures of inequality and poverty have been considered for the sake of robustness. In the case of inequality, we apply two well-known measures, the Gini and the Theil indices. When looking at poverty, again two standard poverty measures belonging to the Foster-Greer-Thorbecke (FGT) family are calculated: the headcount index (here referred to as FGT_0) and the normalized poverty deficit (or FGT_1). The first one captures the proportion of the population living below the poverty line and the second one allows us to account for differences among households in the distance to the poverty line[34]. The poverty line is here set at R$100 per person per month (in 2006 values), though robustness to the choice of threshold has been tested[35]. In an effort to better gauge what is

[29] During the period of analysis, there have been three years in which the PNAD was not carried out: in 1994 for budgetary reasons (1994) and in 1991 and 2000, because they were census years.

[30] The rural areas not covered by the PNAD until 2003 and therefore excluded from our analysis, correspond specifically to the states of Acre, Amapá, Amazonas, Pará, Rondônia and Roraima, which, according to census data, represent about 2.5% of the Brazilian population.

[31] We thank Pierre-Emmanuel Couralet and Jeremie Gignoux for their help in building the variables from PNAD databases with harmonized definitions over time. Detailed information on the harmonizing procedures for each variable used in this paper is available from the authors upon request.

[32] The number of states considered is twenty-six as explained in footnote 16 (Goias and Tocantins are pooled together in order to get consistent time-series state identifiers, since the distinction among the two states was not made in the PNAD before 1992). Due to the excluded rural areas in the Northern region, we can only distinguish between rural and urban areas in twenty states. This means that the number of cross-sectional units will be of twenty-six in urban areas and twenty in rural areas.

[33] Monetary values are inflated to the September 2006 prices using the IBGE deflators derived from the INPC national consumer price index (see Corseuil and Foguel, 2002; Cogneau and Gignoux, 2009).

[34] The general formula of the FGT family of poverty measures is: $FGT_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[(z - y_i)/z\right]^\alpha$ where z is the poverty line, y_i is the household's per capita income level, n is the number of households, q is the number of poor households and α is an parameter determining the weight given to the distance of households to the poverty line.

[35] Though Brazil does not have an official poverty line, an ad-hoc administrative poverty line of about R$100, corresponding to the means-test in Brazil's main new cash assistance program, Bolsa Familia is gaining usage in the research community (see Ferreira et alii, 2006). As a robustness check, a poverty line of R$75 has also been tested.

happening behind these summary statistics, we will also calculate income levels across quintiles (and deciles) of the income distribution and include them in our econometric study.

The PNAD provides us with information at the individual level that can be exploited for our econometric analysis. We are able to observe, among other things, the labor market status of individuals in the population, as well as the industrial sector in which they work[36]. We are also able to observe a list of individual socio-demographic variables usually considered as determinants of income levels. From such individual-level data we construct different control variables, at the level of the state (or the rural/urban areas within states), in particular: the share of individuals in each state by years of schooling (grouped in six categories: none; 1 to 3 years; 4 to 7 years; 8 to 10 years; 11 to 14 years and 15 or more years) , the share of individuals in each race group (information on race is self-declared in the PNAD and distinguishes five groups: indigenous, white, black, Asian and mixed), the share of the agricultural sector[37] in each state, the share of the informal sector, the share of workers by industrial sector, distinguishing in particular between the share of workers in industries protected by tariffs and those that are employed in non-protected industries.

Two additional groups of data sources are mobilized in this study, in order to construct our trade-related variables for the 1987-2005 period. Indeed, in order to represent trade policy changes and trade openness in Brazilian states, we use two different sets of measures. The first set comprises *ex-ante* measures of trade liberalization, built on Brazilian nominal tariff data (we will refer to this set as data on "trade policy"). The second set of measures - import penetration, export exposure and trade openness - is an *ex-post* set of indicators, in other words, outcome variables that reflect the results of changes in trade policies (represented by our first set). They reveal a state's exposure to international trade, or its integration in world markets (we will refer to this set of variables as the "trade performance" dataset)[38].

The data on trade policy are industry-specific nominal tariff rates. These are drawn from Kume, H., Piani, G. and Souza, C.F. (2003) for the 1987-1994 period. For the 1995-2005 years, data were made available by H. Kume[39]. The tariff data series correspond to the nominal level of protection for 31 industry sectors (the sector classification is *Nivel 50*)[40]. These data are a standard source on the Brazilian tariff structure after 1987.

Following the research of Topalova (2005) and Edmonds et alii (2007) on Indian districts, we construct an indicator to measure the influence of trade policy and its change at the state level in Brazil (and at the level of urban and rural areas within states). This indicator, called *LIB*, is a weighted average of national industry-level tariffs, where the weights correspond to the workers in each state employed in the different industries as a share of all workers in the state at the initial year (here 1987).

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[36] Labor-market variables are available from the PNAD for individuals aged ten years or more. We will consider this population for all labor-market variables as well as for education variables in each state. The classification of industrial sectors used in this paper is given in Table A2 of the appendix.

[37] The share of agricultural sector takes into account the number of individuals that declare their industrial sector to be either agriculture or agri-food industries.

[38] Note that these outcome variables are not exclusively influenced by a country's trade policies. Trade flows are also determined by other factors such as transport costs, factor endowments, the country's size and geographical situation, etc.

[39] The authors are grateful to Honorio Kume for kindly providing us with these tariffs data.

[40] These 31 sector-specific ad-valorem tariff levels correspond to weighted averages of more disaggregated product-specific ad-valorem tariffs, where the weights are the value added in each narrowly defined product group.

It is computed as follows:

$$LIB_{st} = \frac{\sum_{k}(L_{sk1987} \times Tariff_{kt})}{L_{s1987}}$$

where *s* stands for the unit of analysis (the Brazilian states), *k* for the sector and *t* for time. $Tariff_{kt}$ refers to the tariff in the sector *k* for the year *t*, L_{sk1987} to the workers employed in the sector *k* for the year *1987* in the unit of analysis *s* and L_{s1987} to the total workers in the unit of analysis *s* for the year *1987*.

The "state level tariff" at time t is then the industry-specific national tariffs at time t weighted by the state-specific employment for the initial year. The state specific employment weights are calculated with data on employment for a year prior to trade reform, here 1987. As emphasized by Edmonds et alii (2007), this ensures that "changes in employment over time that are the result of tariff changes do not affect our measure of exposure to the tariff reforms" (p. 12)[41].

The data on employment by federative unit and industry in 1987 were drawn from the PNAD. Our use of household survey and tariff data with different industry definitions required a concordance between the two datasets. To match the data on tariffs (in the classification *nivel 50*) and employment (in the PNAD classifications), we used the Table A2 of Industry Concordance (in the appendix) developed by Ferreira, Leite and Wai-Poi (2007). As a result of this procedure, we are able to compute our trade liberalization indicator (*LIB*) for a group of 22 industries[42], in a sample of twenty-six states through the period 1987-2005[43].

The dataset on "trade performance" is composed by the following indicators: import penetration (imports as a percentage of output plus net imports), export exposure (exports as a percentage of output) and trade openness (defined as the ratio of imports plus exports on gross domestic product). These ratios are calculated for the period 1989-2004, at the state-level (no urban-rural distinction within states is possible in this case). Trade data on imports and exports of Federative Units in current US dollars are collected by the *Secretaria de comércio*

[41] Some authors raised the question of considering total employment or employment only in sectors in tariff-protected industries. Therefore another indicator *LIB2* was used by Topalova (2005) in which only employment in "tariff- protected" sectors is included.

$$LIB2_{st} = \frac{\sum_{k}(L_{sk1987} x Tariff_{kt})}{\sum_{k} L_{sk1987}}$$

Where *s* stands for the unit of analysis, *k* for the sector and *t* for time.
However the effect of trade policies might be overstated with this second indicator. Consider two states with the same structure of employment in "tariff-protected" industries; the indicator will now have by construction the same value across the two states even if shares of workers in tariff-protected industries is very small. Therefore, the first indicator which reflects both the production structure and intensity in a state will be preferred. However, as a test of robustness, we performed regressions using three estimation strategies: with *LIB*, *LIB2* and *LIB2* as an instrument of *LIB*. All regressions are available from the authors upon request.

[42] The original data provide the tariff levels for 31 sectors at the *nivel 50* industrial classification. We have aggregated the data by taking simple averages of reported tariffs (after verifying the high correlation of both series, unweighted and weighted by import penetration), so that the tariff information now matches the level of industry aggregation in the labor force data (22 industries).

[43] With a distinction between rural and urban areas, the number of unit of analysis is 46 (see footnote 33).

exterior (SECEX), *Ministério do Desenvolvimento, Industria e Comércio Exterior* (MDIC)[44]. The series on gross domestic product by state in current market prices comes from the regional accounts of Brazil established by IBGE (*Instituto Brasileiro de Geografia e Estatística, Diretoria de Pesquisas, Departamento de Contas Nacionais, Contas Regionais do Brasil*). These data were converted in current US dollars, using the annual average exchange rates[45]. The "trade performance" indicators are calculated for global trade but also separately for the agricultural sectors and the extractive and manufacturing industries.

[44] These data series are only available since 1989 (see http://aliceweb.desenvolvimento.gov.br/default.asp).

[45] As the first years of the period under study were characterized by high inflation rates, the choice of the exchange rates matters. Therefore, robustness to this choice was tested through another method of calculation. Using states's GDP series of the IBGE in current market prices, we have calculated the share of each state in the total Brazilian GDP. The GDP of each state was then calculated by applying these shares to Brazil's GDP in current dollars from the database World Development Indicators (WDI, World Bank). The values obtained are very close for the whole period under study.

4.b Econometric specification.

To empirically estimate the effect of trade liberalization on inequality and poverty at the state level (or at the level of rural and urban areas within states), our main econometric specification is of the form:

$$y_{st} = \theta TradeLib_{st} + \sum_i \beta_i X_{ist} + \lambda_s + \gamma_t + \varepsilon_{st} \quad (1)$$

where y_{st} denotes the level of inequality/poverty in state *s* at time period *t*. As described in the data subsection, different income distribution measures are used as our dependent variable: the Gini and the Theil index to capture inequality and the Foster-Greer-Thorbecke measures FGT_0 and FGT_1 to capture poverty levels.

In this study, $TradeLib_{st}$ is the key variable. It is both measured by an ex-ante trade policy indicator (our indicator *LIB* described above) and by ex-post indicators of trade performance (lagged import penetration, lagged export exposure and lagged trade openness). All these indicators represent different ways of capturing the degree of exposure of Brazilian states to trade integration. Hence, θ is the parameter of primary interest.

The vector X_{ist} includes *i* control variables typically assumed to affect levels of poverty and inequality. Our main specification includes as controls: the share of individuals declaring themselves as "white" in each state (to account for racial inequalities); the share of individuals by different levels of years of schooling in each state (to consider the role of educational inequalities), the share of the informal sector in each state and the size of the agricultural sector in each state (both well known determinants of the income distribution)[46]. Finally, λ_s and γ_t are the state and time specific fixed effects respectively and ε_{st} is the error term.

The time period of analysis is 1987-2005 with the "ex-ante trade policy" dataset and 1989-2004 with the "ex-post trade performance" dataset. Our sample covers all the Brazilian states (twenty-six states) with a distinction between urban and rural zones within states (twenty-six urban areas and twenty rural areas) for the estimations with the "trade policy" dataset.

In an effort to better seize how trade liberalization affects the shape of the entire income distribution in each state, instead of just focusing on summary statistics of poverty and inequality, we have also estimated income levels for each quintile (and also by decile) in each state *s* at time *t*, and run the additional set of equations:

$$y_{stj} = \theta TradeLib_{st} + \sum_i \beta_i X_{ist} + \lambda_s + \gamma_t + \varepsilon_{st} \quad (2)$$

Where y_{stj} denotes the relative income level of the j-th quintile (or decile) normalized by the mean, in state *s* at time period *t*. Results on both set of equations (1) and (2), as well as a few robustness checks are discussed below.

[46] Knowing the relevance of social expenditure and transfer programs as determinants of poverty and inequality dynamics, we wanted to include a control variable capturing public expenditures at the state level. Unfortunately no disaggregated series of Federal government expenditures exist for the whole period of analysis. We could only construct series of local social security and social assistance expenditures made by states. These variables only capture a minimal part of public transfers received by households and proved irrelevant.

4.c Empirical results

The effects of trade liberalization on income distribution are first estimated using different versions of equation (1). Table 2 reports the equation results for poverty, using our ex-ante trade policy indicator *LIB* as trade liberalization index. Table 3 reports the same equation for inequality. Both tables report equation (1) estimated first on the global sample that considers all twenty-six Brazilian states during the period of analysis and then on the urban and rural areas of states considered separately. The responses of poverty and inequality indices to our ex-post trade performance indicators are documented in tables 4 and 5 respectively. In this case, as explained, data limitations impede the distinction between rural and urban areas within states. Table 6 presents the results of the influence of trade openness on poverty and inequality decomposing the trade performance indicators by sector (considering separately agriculture and industry).

Concerning the relationship between trade liberalization and poverty, results in Table 2 show a negative effect of our trade policy indicator *LIB* on poverty when the global sample is considered (though only statistically significant when poverty is measured by the poverty gap). If we concentrate on urban areas only, the negative effect of trade liberalization on poverty is highly significant (coefficients on our trade policy indicator *LIB* being even larger), no matter which poverty measure is used. On the other side, no significant effect is observed in rural areas. Our results suggest that at the state level and more specifically in urban areas, trade liberalization is poverty increasing. In other words, even if over the period studied Brazilian states experienced in general a fall in poverty, Brazilian states that were more affected by tariff reductions experienced smaller reductions in poverty (at least in terms of the poverty gap index). Our estimation suggests that, on average a fall of one percentage point in the trade policy indicator *LIB* would lead to an increase in the poverty gap of 0.16 percentage point (and in urban areas, to an increase in the headcount ratio of 0.7 percentage point, and an increase of in the poverty gap of 0.2 percentage point).

We included in equation (1) a few control variables that are considered to be usual determinants of poverty and inequality. Concerning our poverty regressions, we see that the share of individuals declaring themselves as "white" is never significant for the sample on Brazilian states as a whole, as well as for urban and rural areas. On the contrary, education, when significant, lowers significantly poverty at almost all levels, whereas an increase in the share of informal workers leads to a significant rise in poverty at the state level. Finally, the size of the agricultural sector in a state matters; it leads to a significant rise in poverty.[47] As expected, informal jobs and agricultural employment show up as significant determinants of poverty.

Table 3 documents the relationship between trade liberalization and inequality, and we can see that contrasting results emerge. When we consider the global sample, trade liberalization is inequality increasing at the state level, but the effect is only significant using the Theil index. However, opposing and significant patterns emerge when we consider urban and rural areas separately, these patterns being robust to the choice of inequality measure. The

[47] Our variable capturing the size of the agricultural sector is not significant in rural areas, where almost all economic activity concerns agriculture. In any case, our results on the variable of interest *LIB* are robust to the omission of this variable.

influence of a tariff reduction is inequality increasing in urban areas and inequality decreasing in rural zones.

The relationship between our control variables and inequality is less straightforward than in the case of poverty. In particular, the interpretation of schooling levels is not easy. When we look at the distribution of the population among different levels of schooling, the only category for which we obtain a consistent and significant coefficient, whether we look at the global sample or at rural and urban areas separately, concerns the most educated. The share of adults with more than 15 years of schooling unequivocally has a positive and significant effect on inequality (such individuals are eventually those at the highest end of the income distribution). But variables concerning the shares of individuals at lower levels of education are less informative about inequality (their situation in the income distribution being more variable)[48]. An increase in the share of informal workers in a state leads to a rise in inequality, except for rural areas where no significant effect is found. Finally, other control variables (the share of individuals declaring themselves as "white" or the size of the agricultural sector) are insignificant or not robust to the choice of inequality measure.

To sum up, the results shows that trade liberalization increases poverty and inequality in Brazilian states, though these effects are mildly significant. We have investigated whether these results are robust to the choice of the indicator on trade liberalization and alternative indicators -*LIB2* and *LIB2* as an instrument of *LIB*- lead to similar conclusions: when significant, the effect of trade liberalization is poverty or inequality increasing (see Table A3 for poverty and Table A4 for inequality in the appendix). The distinction between rural and urban areas gives more insight on the effect of trade liberalization. In urban areas we observe a negative and always significant effect for both poverty and inequality. In rural zones, the sign of the effect of trade liberalization is reversed (though significant only when looking at inequality).[49]

One tentative explanation for these contrasting results between urban and rural areas could be that urban workers – essentially employed in the manufacturing industries and in the service sector – suffered the most from the liberalization process. It is indeed in industrial sectors that liberalization was more intense with major tariff reductions taking place from 1990 onwards (see sub-section 2a). For agricultural sectors, the reduction in protection was less important from 1990 onwards and indeed Brazil has strong comparative advantages in these sectors. So it is clear that when we only consider rural areas within states, they seem not to have suffered much in terms of poverty from trade liberalization and could even have seen their levels of inequality reduced if anything.

Turning to the effects of our ex-post trade performance indicators, Table 4 presents the results on poverty and Table 5 on inequality. Two noteworthy results emerge. First, for both poverty and inequality, trade openness has no significant impact. However, from the moment we dig into the separate influence of export exposure and import penetration, a very different picture emerges: the rise in export exposure appears to have reduced poverty and inequality quite significantly while the growth of import penetration has increased both income distribution measures. If we evaluate the magnitude of coefficients, concerning poverty, a rise of one

[48] In rural areas, not only the share of adults with 15 years of education or more but also those with 11 to 14 years of schooling have a positive and significant effect on inequality, since on average, education levels are lower in the rural world.

[49] Note that in our inequality regressions, significance of trade liberalization is lost with the alternative measures *LIB2* and *LIB2* as an instrument of *LIB*, both for rural and urban areas.

percentage point in import penetration experienced in a state would lead to an increase in poverty 0.23 percentage point using the headcount index (significance is lost for the poverty gap). For export exposure, a percentage point rise would, on the contrary, lead to a fall in poverty of -0.12 using the headcount ratio (-0.07 with the poverty gap). Concerning inequality, a rise of one percentage point in import penetration increases the Gini coefficient of 0.12 percentage point (0.34 for the Theil index), while a percentage point rise in export exposure would lead to a variation in the Gini coefficient of -0.11 percentage point (-0.33 in the Theil index).

We see that, when significant, import penetration, as it was the case with our trade policy variable, increases poverty at the state level. These two indicators, though they do not measure the same phenomenon and they cover here different time periods have similar effects.[50] But trade integration through rising export ratios clearly contributes to the fall in poverty[51].

Data allowed us to construct export and import ratios separately for agricultural and industrial sectors[52]. In Brazil, agriculture has experienced a rapid growth of exports (551% between 1989 and 2004), much larger than the increase of industrial exports (168% on the same period). On the other side, agricultural imports have grown less than industrial imports (36% against 268%). Concerning trade intensity, export exposure and import penetration ratios are in 2004 considerably stronger for industry (the state's average export exposure ratios for industry and agriculture were respectively 32.4 and 8.5 in 2004; the state's average import penetration ratios reached 37.9 and 22.8). Regression results reported in Table 6 show, once more, an opposite sign for export exposure and import penetration effects on welfare. In the industrial sector as well as in the agricultural sector, export exposure has reduced poverty and inequality while import penetration (when significant) has increased both welfare measures.

Using summary inequality measures such as the Gini or the Theil index we cannot easily tell where about in the income distribution variations are taking place. Table 7 presents the results of the estimations of the set of equations (2) for each quintile[53], both for our ex-ante trade policy indicator *LIB* (using the global sample, as well as urban and rural samples separately) and for the ex-post trade performance indicators. For the sake of simplicity, only the values and standard errors of the coefficients on our variables of interest are reported[54]. Overall, the findings are consistent with our previous results. Though no significant effect is found for trade liberalization in the global sample no matter which quintile regression is considered, there is evidence of growing (falling) inequality in urban (rural) areas linked to trade liberalization, which comes from coefficients sharing a similar positive (negative) sign in all quintiles except the highest one, where the sign is reversed. Distributional changes due to trade liberalization are therefore observed along all income quintiles (and particularly significant for the first, second and fifth quintiles). Concerning our ex-post trade integration variables, the quintile regressions reveal again no significant effect of trade openness. However export exposure increases the relative income levels of all quintiles except the last one that presents the opposite sign, while import penetration increases the relative income

[50] Our data on trade flows start in 1989, and for example, in the agricultural sector the strongest tariff reduction was concentrated between 1987 and 1989.
[51] Growth in export ratios contributes to a fall in inequality as well.
[52] Extractive industries are included in the industrial sectors.
[53] Decile regressions leading to similar results were also estimated and are available from the authors upon request.
[54] Complete quintile regressions are available from the authors upon request.

levels of the upper quintile and decreases the relative income levels of the others quintiles (effects being significant for almost all quintile levels).

Finally, for all equations discussed in the paper, some robustness checks have been performed[55]. Regressions without states that can be considered outliers, such as Distrito Federal or Amazonas have been estimated[56]. Regarding poverty, a different poverty line of R$75 was tested. In both cases results hold.

5 Conclusion

To be completed

[55] All robustness estimations are available from the authors upon request.

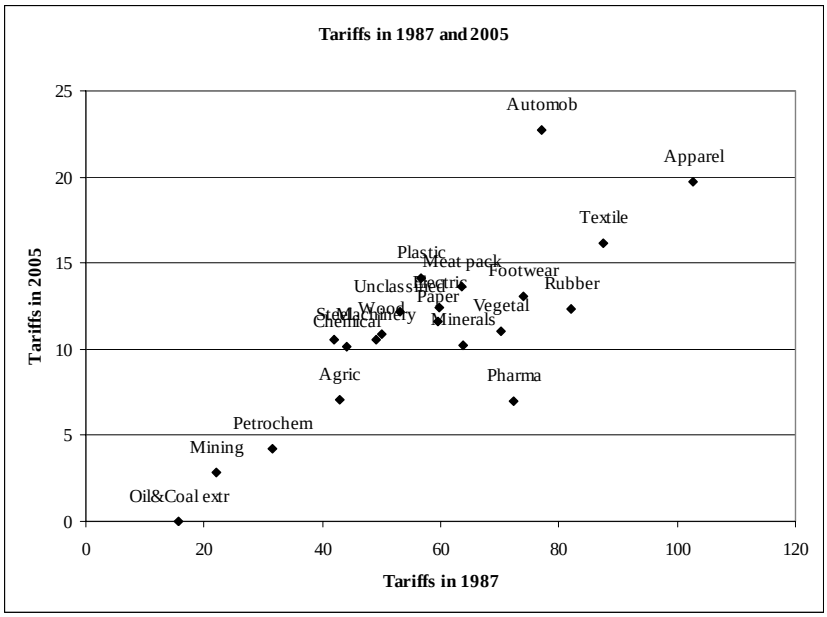
[56] On one hand, Distrito Federal, Brasília, has a very different productive, labor and revenue pattern from the rest of the country as it is a fundamentally administrative city which concentrates the major part of national government activities. Amazonas, on the other hand, benefits form all the special trade regimes allowed by the status of "free trade zone" for Manaus industrial zone.

Table 1: Evolution of the Brazilian Import Tariff

Year	Tariff (1) – Simple average (%)
1990	43,0
1997	12,0
2000	14,2
2005	10,7

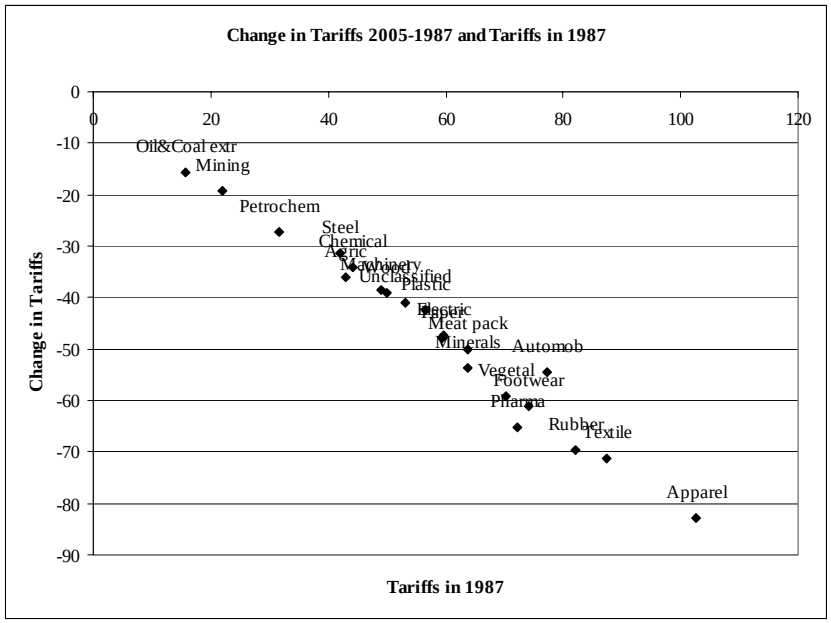
Notes: (1) From 1992 on, Common External Tariff of
Source: CNI (2005).

Figure 1



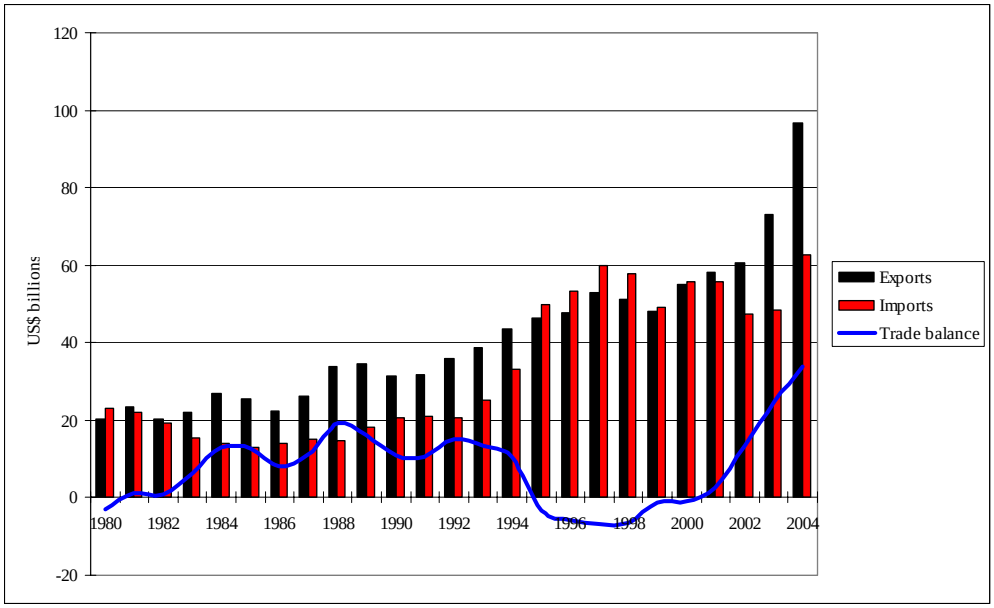
Source: Kume, H., Piani, G. and Souza, C.F. (2003) for the 1987-1994 period; since 1995 data made available by H. Kume.

Figure 2



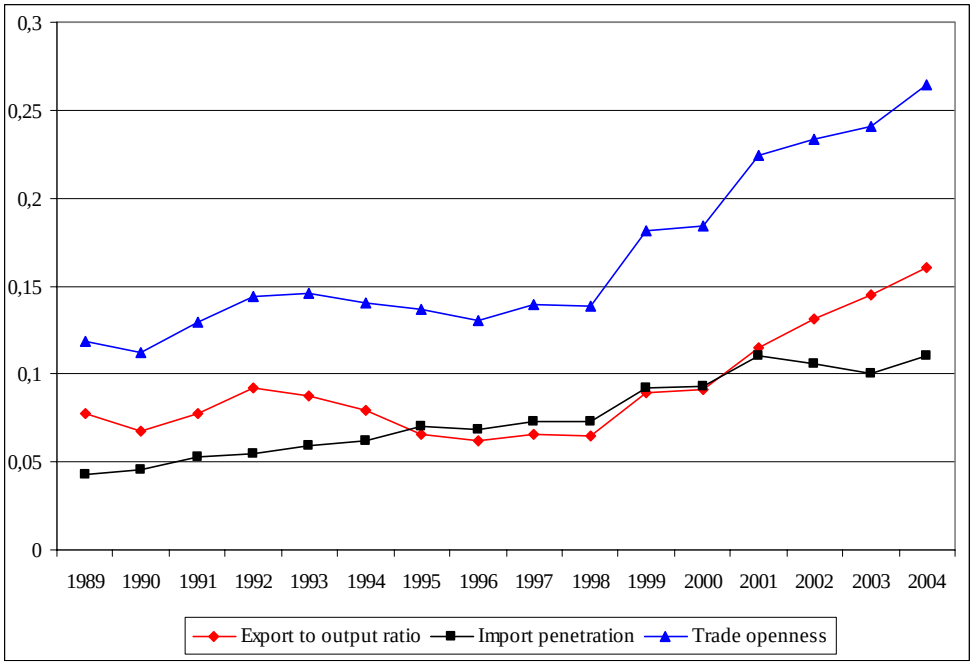
Source: Kume, H., Piani, G. and Souza, C.F. (2003) for the 1987-1994 period; since 1995 data made available by H. Kume.

Figure 3: Evolution of trade flows and balance



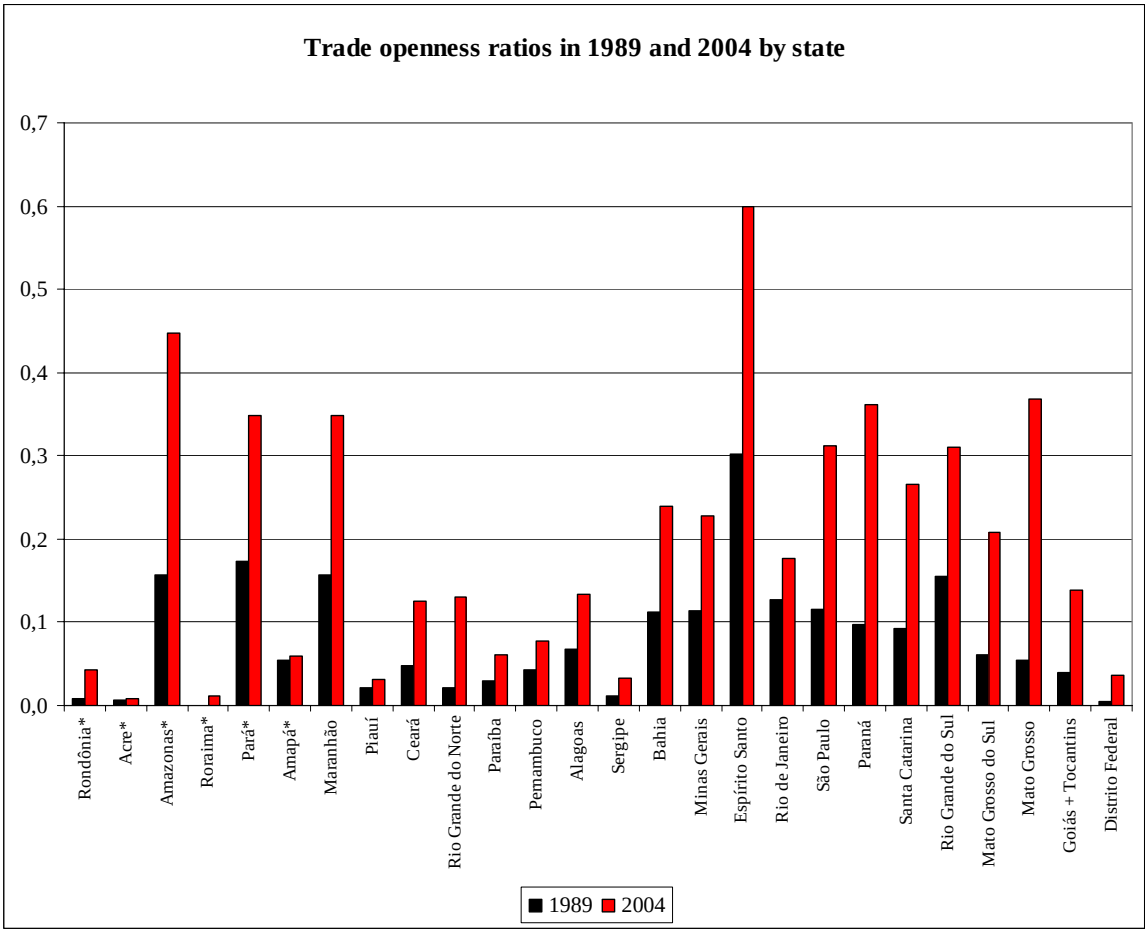
Source: Authors' calculations based on data from SECEX.

Figure 4: Import Penetration, Export to Output Ratio and Trade Openness in Brazil, 1989-2004



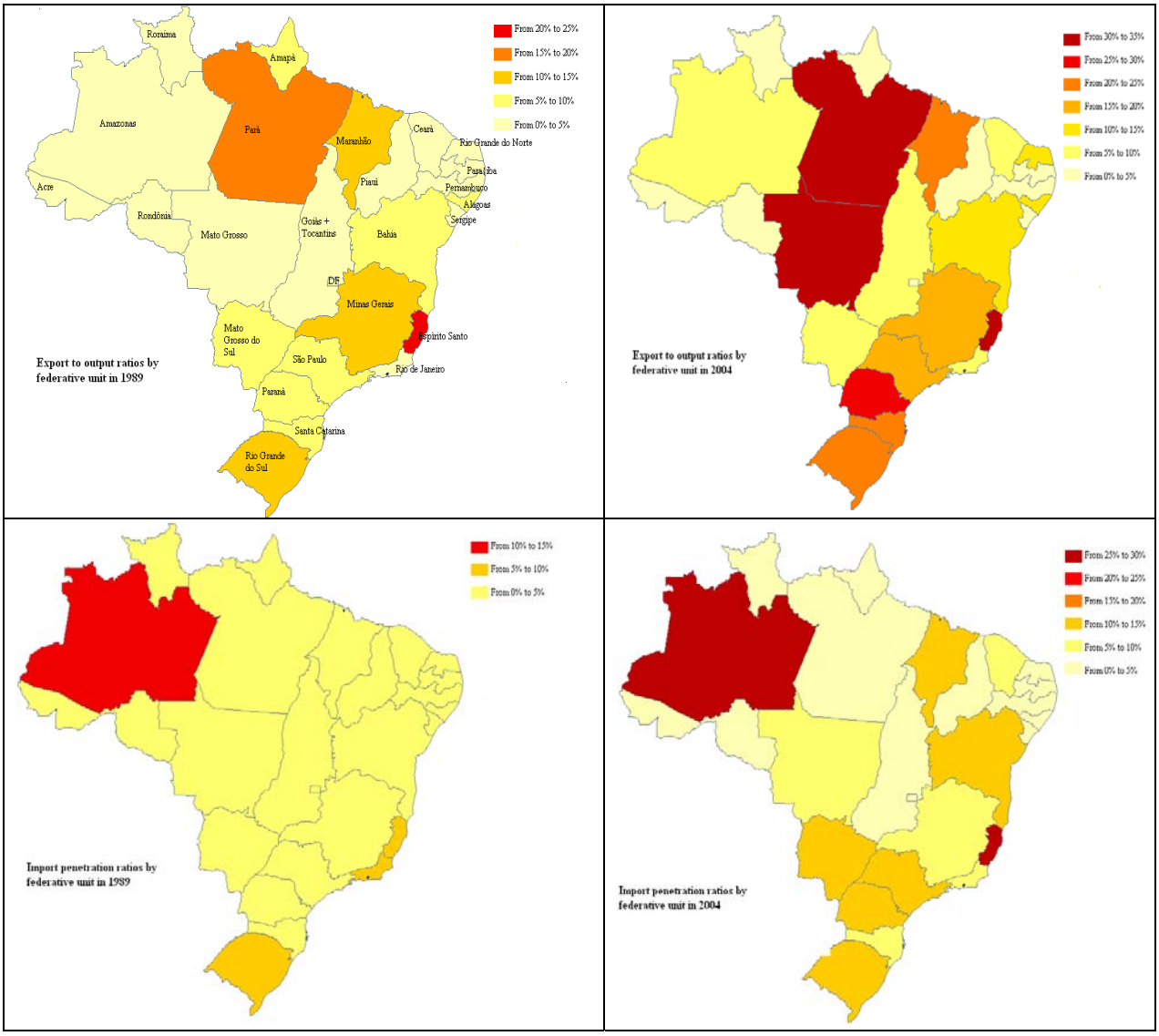
Source: Authors' calculations based on various sources (data from IBGE for production and data from SECEX for trade flows).

Figure 5



Source: Authors' calculations based on various sources (data from IBGE for production and data from SECEX for trade flows).

Figure 6: Import Penetration, Export to Output Ratio by States, 1989 and 2004



Source: Authors' calculations based on various sources (data from IBGE for production and data from SECEX for trade flows).

Figure 7a

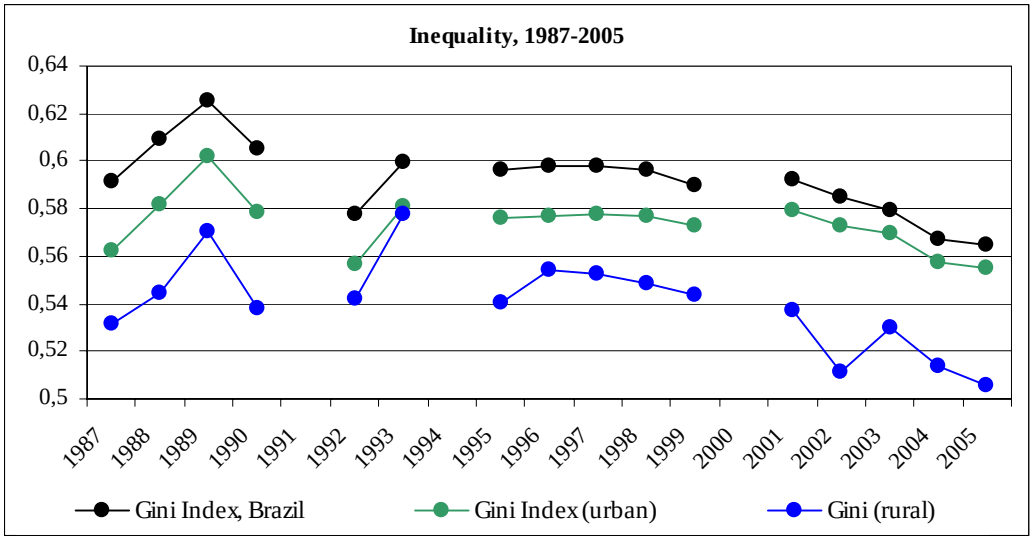
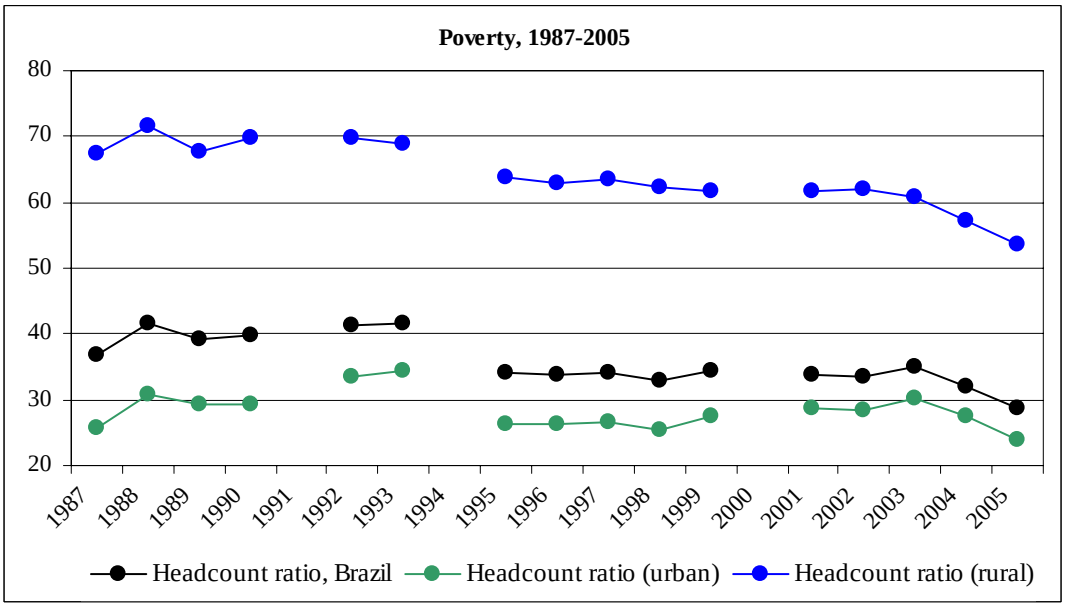
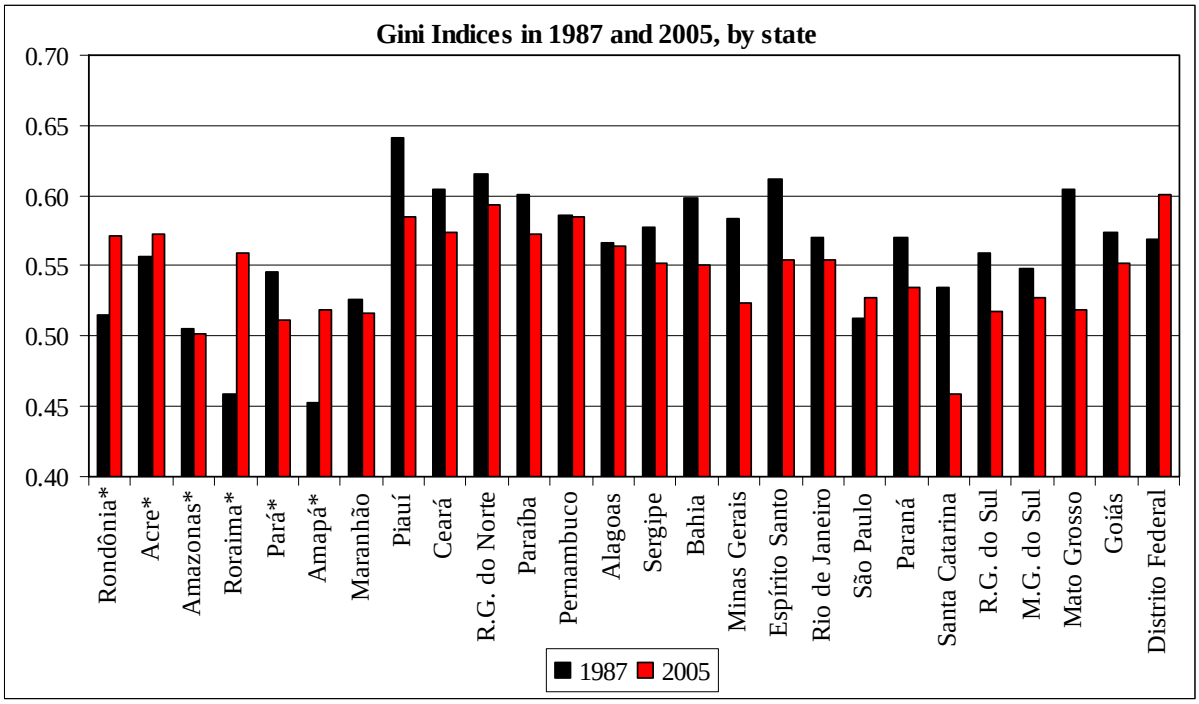


Figure 7b



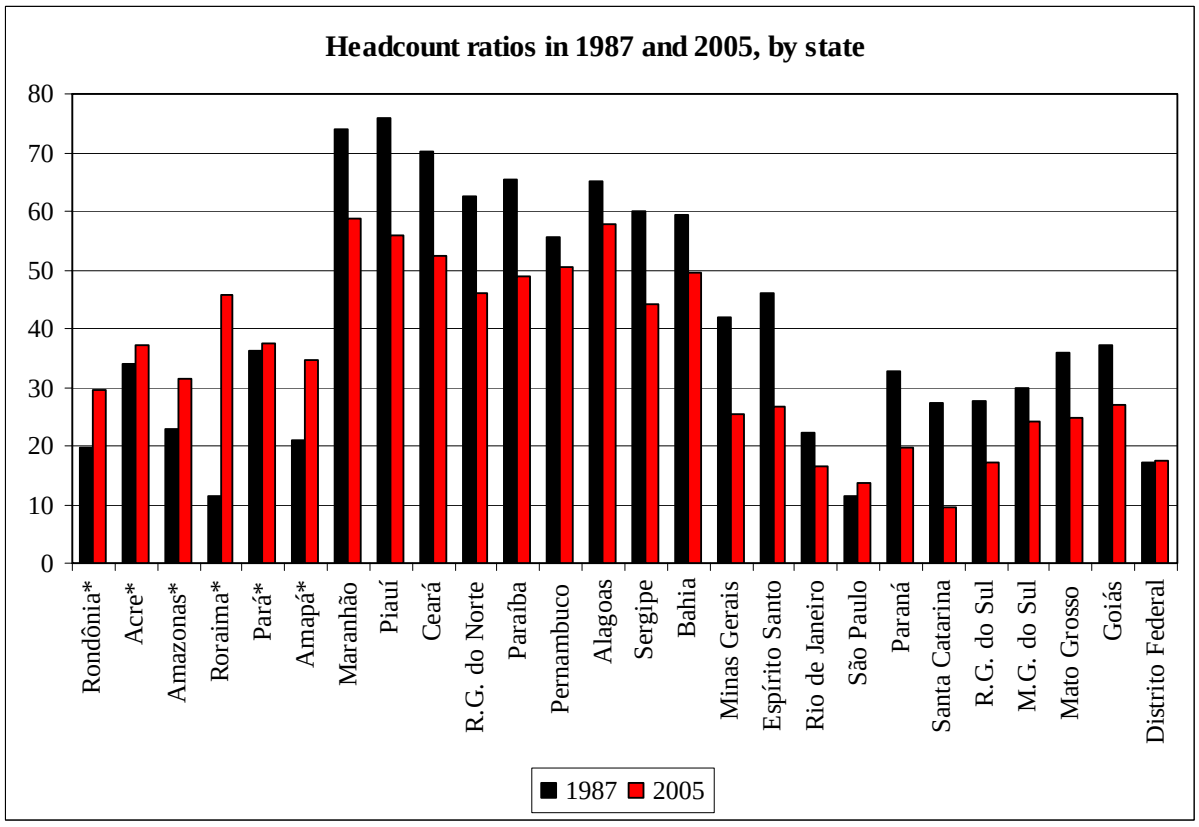
Source: Authors' calculations from PNAD.

Figure 8



Note: Rural areas from states marked with a star (*) are excluded from the analysis, since PNAD survey only covered those regions since 2003.
Source: Authors' calculations from PNAD.

Figure 9



Note: Rural areas from states marked with a star (*) are excluded from the analysis, since PNAD survey only covered those regions since 2003.
Source: Authors' calculations from PNAD.

Table 2: Trade Liberalization and Poverty

Dependent variable	Headcount ratio			Poverty gap		
	Global sample	*Urban sample*	*Rural sample*	*Global sample*	*Urban sample*	*Rural sample*
Trade Liberalization index:						
LIB_{st}	-0.221	-0.665***	0.243	-0.159*	-0.234**	0.160
	(0.161)	(0.157)	(0.321)	(0.089)	(0.097)	(0.197)
% self-declared as "white"	-0.040	-0.073	-0.053	-0.020	-0.030	-0.056
Education levels (%):	(0.056)	(0.050)	(0.057)	(0.040)	(0.030)	(0.052)
with 1 to 3 years of schooling	-0.400**	-0.632***	-0.189	-0.577***	-0.529***	-0.455***
	(0.165)	(0.214)	(0.138)	(0.113)	(0.136)	(0.114)
with 4 to 7 years of schooling	-0.309***	-0.689***	0.163	-0.493***	-0.598***	-0.311***
	(0.103)	(0.122)	(0.118)	(0.070)	(0.079)	(0.090)
with 8 to 10 years of schooling	-1.118***	-0.978***	-1.932***	-0.754***	-0.540***	-1.378***
	(0.254)	(0.229)	(0.348)	(0.147)	(0.132)	(0.254)
with 11 to 14 years of schooling	0.300	-0.314*	0.596	-0.243*	-0.384***	0.136
	(0.212)	(0.188)	(0.408)	(0.133)	(0.117)	(0.279)
with 15 or more years of schooling	-1.655***	-1.412***	-0.326	-0.574*	-0.457**	0.035
	(0.493)	(0.374)	(0.693)	(0.330)	(0.229)	(0.577)
Informal workers (%)	0.439***	0.407***	0.381***	0.257***	0.205***	0.319***
	(0.057)	(0.047)	(0.066)	(0.035)	(0.031)	(0.056)
Size of agricultural sector (%)	0.444***	0.410***	-0.109	0.246***	0.217***	-0.040
	(0.077)	(0.093)	(0.077)	(0.045)	(0.063)	(0.053)
Number of observations	416	416	320	416	416	320
Adjusted R^2	0.789	0.733	0.676	0.760	0.651	0.651

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 3: Trade Liberalization and Inequality

Dependent variable	Gini index			Theil index		
	Global sample	*Urban sample*	*Rural sample*	*Global sample*	*Urban sample*	*Rural sample*
Trade Liberalization index:						
LIB_{st}	-0.133	-0.256***	0.506**	-0.483*	-0.465*	1.834***
	(0.086)	(0.080)	(0.213)	(0.283)	(0.282)	(0.705)
% self-declared as "white"	-0.008	-0.016	0.041	-0.061	-0.125	0.257
Education levels (%):	(0.027)	(0.024)	(0.050)	(0.108)	(0.111)	(0.167)
with 1 to 3 years of schooling	-0.037	-0.169	0.175	-0.266	-0.886**	0.529
	(0.106)	(0.124)	(0.110)	(0.351)	(0.440)	(0.357)
with 4 to 7 years of schooling	0.262***	0.182**	0.177**	0.715***	0.613*	0.130
	(0.065)	(0.084)	(0.076)	(0.260)	(0.323)	(0.256)
with 8 to 10 years of schooling	-0.611***	-0.412***	0.174	-2.121***	-1.393***	0.801
	(0.127)	(0.127)	(0.244)	(0.425)	(0.450)	(0.961)
with 11 to 14 years of schooling	0.375***	0.152	1.070***	1.035**	0.495	2.701***
	(0.119)	(0.128)	(0.280)	(0.457)	(0.510)	(0.954)
with 15 or more years of schooling	1.587***	1.313***	2.813***	3.484***	2.671***	7.559**
	(0.232)	(0.190)	(1.026)	(0.813)	(0.641)	(3.571)
Informal workers (%)	0.186***	0.172***	0.014	0.539***	0.514***	0.060
	(0.035)	(0.033)	(0.049)	(0.146)	(0.132)	(0.181)
Size of agricultural sector (%)	0.112**	0.047	-0.061	0.096	0.099	-0.212
	(0.047)	(0.068)	(0.049)	(0.161)	(0.232)	(0.164)
Number of observations	416	416	320	416	416	320
Adjusted R^2	0.578	0.483	0.399	0.435	0.309	0.254

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1%; ** significant

Table 4: Trade Openness and Poverty

Dependent variable	Headcount ratio		Poverty gap	
Trade performance indicators:				
Openness $_{s(t-1)}$	0.056		0.010	
	(0.050)		(0.030)	
Export-to-output ratio $_{s(t-1)}$		-0.119*		-0.073*
		(0.065)		(0.041)
Import penetration $_{s(t-1)}$		0.229**		0.089
		(0.103)		(0.061)
% self-declared as "white"	-0.043	-0.027	-0.030	-0.022
Education levels (%):	(0.072)	(0.074)	(0.047)	(0.048)
with 1 to 3 years of schooling	-0.164	-0.126	-0.451***	-0.431***
	(0.202)	(0.201)	(0.136)	(0.136)
with 4 to 7 years of schooling	-0.274**	-0.350***	-0.495***	-0.532***
	(0.124)	(0.133)	(0.083)	(0.087)
with 8 to 10 years of schooling	-1.160***	-1.095***	-0.678***	-0.646***
	(0.261)	(0.259)	(0.159)	(0.157)
with 11 to 14 years of schooling	0.128	0.030	-0.357**	-0.403***
	(0.224)	(0.225)	(0.151)	(0.152)
with 15 or more years of schooling	-1.281**	-1.194**	-0.146	-0.100
	(0.529)	(0.526)	(0.348)	(0.347)
Informal workers (%)	0.348***	0.295***	0.228***	0.203***
	(0.059)	(0.059)	(0.044)	(0.044)
Size of agricultural sector (%)	0.360***	0.386***	0.174***	0.185***
	(0.092)	(0.092)	(0.059)	(0.058)
Number of observations	338	338	338	338
Adjusted R^2	0.793	0.799	0.757	0.759

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1%; ** significant

Table 5: Trade Openness and Inequality

Dependent variable	Gini index		Theil index	
Trade performance indicators:				
Openness $_{s(t-1)}$	0.004		0.000	
	(0.023)		(0.085)	
Export-to-output ratio $_{s(t-1)}$		-0.106***		-0.333**
		(0.039)		(0.146)
Import penetration $_{s(t-1)}$		0.116**		0.338*
		(0.050)		(0.175)
% self-declared as "white"	0.034	0.044	0.128	0.160
Education levels (%):	(0.034)	(0.034)	(0.113)	(0.116)
with 1 to 3 years of schooling	-0.240**	-0.212*	-0.639	-0.553
	(0.121)	(0.115)	(0.425)	(0.408)
with 4 to 7 years of schooling	0.214***	0.164**	0.622**	0.470
	(0.076)	(0.074)	(0.298)	(0.288)
with 8 to 10 years of schooling	-0.818***	-0.773***	-2.679***	-2.541***
	(0.135)	(0.130)	(0.432)	(0.408)
with 11 to 14 years of schooling	0.190	0.124	0.558	0.359
	(0.118)	(0.116)	(0.432)	(0.429)
with 15 or more years of schooling	1.738***	1.800***	4.443***	4.632***
	(0.261)	(0.266)	(0.925)	(0.951)
Informal workers (%)	0.124***	0.089**	0.306*	0.199
	(0.039)	(0.039)	(0.163)	(0.171)
Size of agricultural sector (%)	0.106*	0.122**	0.123	0.172
	(0.062)	(0.059)	(0.211)	(0.201)
Number of observations	338	338	338	338
Adjusted R^2	0.541	0.555	0.374	0.386

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 6: Trade Openness, Poverty and Inequality by main sectors

Dependent variable	Poverty		Inequality	
	Headcount ratio	Poverty gap	Gini index	Theil index
Industry				
Export-to-output ratio Ind. $_{s(t-1)}$	-0.059**	-0.037**	-0.048***	-0.143**
	(0.024)	(0.016)	(0.019)	(0.068)
Import penetration Ind. $_{s(t-1)}$	0.056**	0.026*	0.031**	0.067
Agriculture	(0.023)	(0.015)	(0.015)	(0.049)
Export-to-output ratio Agri. $_{s(t-1)}$	-0.034**	-0.023**	-0.026***	-0.062***
	(0.015)	(0.011)	(0.008)	(0.022)
Import penetration Agri. $_{s(t-1)}$	0.063*	0.010	0.033*	0.118**
	(0.037)	(0.025)	(0.019)	(0.060)
% self-declared as "white"	-0.045	-0.034	0.023	0.105
Education levels (%):	(0.076)	(0.049)	(0.035)	(0.120)
with 1 to 3 years of schooling	-0.173	-0.448***	-0.220*	-0.607
	(0.212)	(0.143)	(0.120)	(0.435)
with 4 to 7 years of schooling	-0.328**	-0.533***	0.157**	0.450
	(0.134)	(0.085)	(0.074)	(0.297)
with 8 to 10 years of schooling	-1.110***	-0.661***	-0.754***	-2.468***
	(0.273)	(0.161)	(0.139)	(0.433)
with 11 to 14 years of schooling	0.123	-0.308*	0.196	0.453
	(0.242)	(0.162)	(0.136)	(0.497)
with 15 or more years of schooling	-1.168**	-0.146	1.804***	4.808***
	(0.556)	(0.345)	(0.262)	(0.967)
Informal workers (%)	0.327***	0.221***	0.106***	0.263
	(0.061)	(0.046)	(0.040)	(0.168)
Size of agricultural sector (%)	0.336***	0.162***	0.091	0.072
	(0.088)	(0.056)	(0.060)	(0.209)
Number of observations	299	299	299	299
Adjusted R^2	0.802	0.762	0.577	0.399

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. 3 states are excluded : Acre, Rio grande do Norte and Roraima Regressions are weighted by the square root of the number of people in a state. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table 7: Quintiles – Summary results

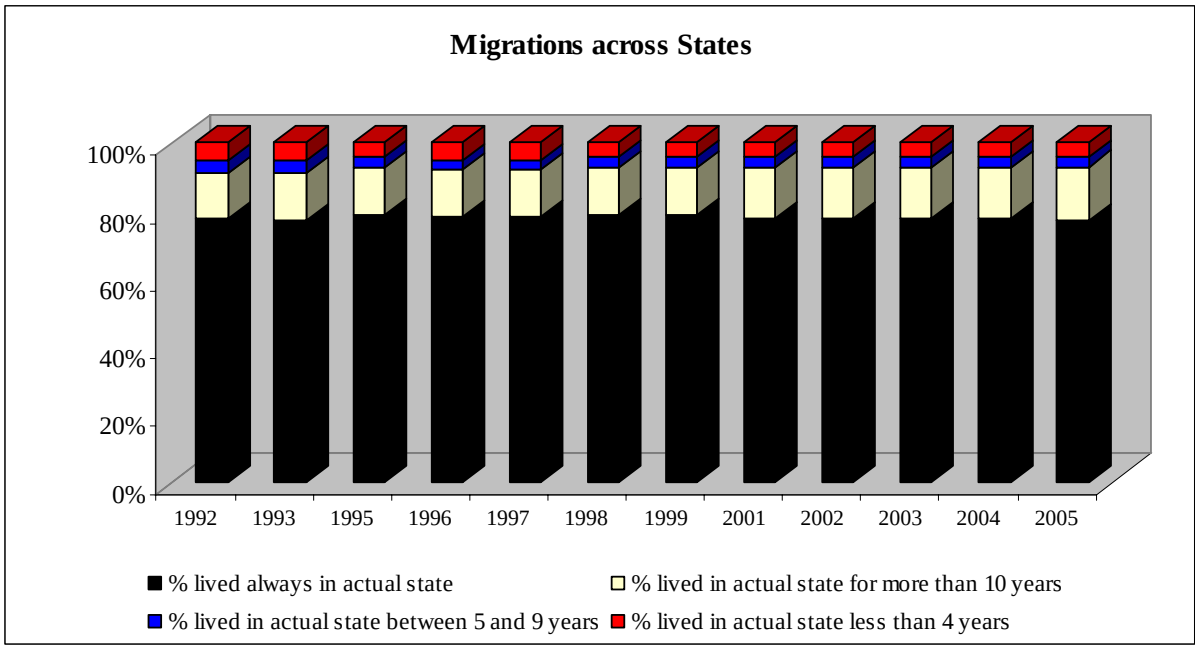
Dependent variable	Quintile1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Global - LIB $_{st}$	0.053	0.133	0.192	0.240	-0.536
	(0.060)	(0.095)	(0.137)	(0.183)	(0.412)
Urban - LIB $_{st}$	0.227***	0.336***	0.310**	0.230	-1.293***
	(0.070)	(0.109)	(0.131)	(0.174)	(0.416)
Rural - LIB $_{st}$	-0.482**	-0.523**	-0.435	-0.427	2.016**
	(0.215)	(0.261)	(0.272)	(0.299)	(0.939)
Openness $_{s(t-1)}$	-0.006	0.014	-0.020	-0.057	-0.018
	(0.021)	(0.028)	(0.038)	(0.050)	(0.123)
Export-to-output ratio $_{s(t-1)}$	0.081***	0.121***	0.110*	0.117	-0.458**
	(0.031)	(0.044)	(0.059)	(0.083)	(0.193)
Import penetration $_{s(t-1)}$	-0.099**	-0.095	-0.148*	-0.235**	0.425*
	(0.044)	(0.060)	(0.078)	(0.103)	(0.241)

Appendix

Table A1

References	Dependent variable, sample and period of analysis	Globalization measures and estimation methods	Key results related to inequality and poverty
Arbache J. S., Dickerson A. and Green F. (2004)	Real hourly wage of employed individuals aged between 18 to 65 inclusive and classified into 6 education levels from 1981 to 1999 (from the PNAD).	- "Before-after methodology" with a dummy 'post-lib' (value of 1 from 1992 onwards). - Effective rate of protection (31 industries, 20 in the traded-goods sector and 11 in the non-traded sector) from 1987 to 1998.	- Wages fell substantially in the traded sector (by more than in the non-traded sector). - Across the whole economy, lower marginal returns to education in the post-liberalisation than the pre-liberalisation period, except for college-educated workers. - Within the traded sector, no significant impact of increasing openness on wages for those in the top two education groups but negative impact for lower level education groups.
Pavcnik N., Blom A., Goldberg P., Schady N. (2004)	Real hourly wage of employees or self-employed workers engaged in full-time work, aged 15–65, classified into 5 education levels from 1987 to 1998 in 18 manufacturing and 2 mining sectors from the PME (cover the six largest metropolitan areas in Brazil).	- Tariffs (original data for 53 sectors aggregated into 20 sectors). - Industry measures of lagged import penetration and lagged export exposure in addition to tariffs - Brazil's tariffs on Mercosur imports. - Lagged exports and imports with Argentina and Uruguay.	- Stable structure of industry wage premiums. - No statistical association between changes in industry wage premiums and changes in trade policy. - No statistical association between sector-specific skill premiums (measured by the return to a completed university education) and tariff reductions. - High export exposure is associated with higher industry wage premium but no statistically significant effect of import penetration (same results for sector-specific skill premiums).
Gonzaga G., Menezes Filho. N., Terra C. (2006)	Real hourly earnings of working individuals in the manufacturing sector. Data from 1981 to 2001 (from the PNAD). Period of analysis of the econometric study: 1988-1995. Skilled workers have at least 11 years of education (high-school).	- Tariffs for 60 industries (PIA classification) between 1988 and 1995.	- Shift of employment from skilled to unskilled intensive sectors. - Increase in each sector of the skilled labor relative share. - Fall of relative prices in skill-intensive sectors. - No clear pattern of tariff reductions with relation to skill intensity but in skill-intensive sectors the tariffs reduction had a larger impact on prices (a higher pass-through from tariffs to prices). The trade liberalization pattern with respect to skill intensity was consistent with that of relative prices changes. - A decline in skilled earnings differentials is mandated by the price variation predicted by trade and it is larger than the observed one (between 23.5 and 25.5% against 15.5%).
Ferreira F. H.G., Leite P. G. and Wai-Poi M., 2007	Real hourly wage of all workers aged 15-65 in agriculture, industry and services, classified into 9 education levels for 1987-1999 (from the PNAD). Skilled workers have at least 11 years of education. Inequality measures for wage and household income per capita: 90th/10th percentile ratio; mean log deviation; the Theil-T index and the Gini coefficient; for poverty, the three standard FGT poverty measures.	Six trade-related variables for 22 industries, across the 1987-1999 period are used: nominal tariffs and effective rates of protection; import penetration and export shares by industry; and import-weighted and export-weighted industry-specific real exchange rates	- Significant contribution of the 1988-1995 trade liberalization episode to the observed reduction in wage inequality in the entire economy through changes in the economy-wide skill premium and substantial employment reallocation across sectors and formality categories (formal, informal, self-employed, employer). - But no effect of trade liberalization on the wage distribution through industry-specific (wage or skill) premia. - These "trade-mandated" reductions in wage inequality did appear to carry through to declines in household income inequality, and in the poverty rate.

Figure A1



Source: Authors' calculations from PNAD.

Table A2: Industry concordance

Trade Industry (Kume et al)	PNAD Code	PNAD Industry	Final Code	Final Industry
Agricultural products	11-42	Various crops, horticulture and forestry	1	Agricultural products
Mining products	50, 53-59	Prospecting and extraction of non-oil/gas/coal minerals	2	Mining products
Oil and coal extraction	51-52	Oil, gas and coal	3	Oil and coal extraction
Non-metallic minerals	100	Non-metal processing	4	Non-metallic minerals
Steel products	110	Steel products	5	Steel, non-ferrous and other metal products
Non-ferrous metallurgy	110	Non-steel metals products	5	Steel, non-ferrous and other metal products
Other metallurgical products	110		5	Steel, non-ferrous and other metal products
Machinery and tractors	120	Manufacture of machines and equipment	6	Machinery and tractors
Electrical equipment	130	Manufacture of electrical and electronic equipment	7	Electrical and electronic equipment
Electronic equipment	130	Manufacture of electrical and electronic equipment	7	Electrical and electronic equipment
Automobiles, trucks and buses	140	Manufacture of vehicles and parts	8	Automobiles, trucks and buses; parts, comp. and other vehicles
Parts, components and other vehicles	140	Manufacture of vehicles and parts	8	Automobiles, trucks and buses; parts, comp. and other vehicles
Wood products and furniture	150, 151, 160	Manufacture of wood products and furniture	9	Wood products and furniture
Cellulose, paper and printing	170, 290	Pulp and paper products, printing and newspapers	10	Cellulose, paper and printing
Rubber products	180	Rubber products	11	Rubber products
Chemical elements	200	Chemical products	12	Chemical elements and products
Oil refining	201	Oil and petroleum products	13	Oil refining and petrochemicals
Chemical products	200	Chemical products	12	Chemical elements and products
Pharmaceutical and perfumery products	210, 220	Pharmaceuticals and toiletries	14	Pharmaceutical and perfumery products
Plastic products	230	Plastics	16	Plastic products
Textile products	240, 241	Textiles	17	Textile products
Apparel	250	Apparel and clothing	18	Apparel
Footwear	251	Footwear	19	Footwear
Coffee industry			21	Meat packing, dairy industry, vegetal and other food products
Processing of vegetal products	280	Tobacco and other vegetal processing	20	Processing of vegetal products
Meat packing	260	Food preparation	21	Meat packing, dairy industry, vegetal and other food products
Dairy industry	260	Food preparation	21	Meat packing, dairy industry, vegetal and other food products
Sugar	17?	Sugar cane extraction?	21	Meat packing, dairy industry, vegetal and other food products
Vegetal products	260		21	Meat packing, dairy industry, vegetal and other food products
Other food products	260, 261, 271	Other foods and drinks	21	Meat packing, dairy industry, vegetal and other food products
Other industries	300	Various scientific instruments	99	Unclassified manufacturing
	340-903	Construction, services, retail, finance, government etc.	22	Nontradables
Omitted	190	Leather and skins		
	202	Manufacture of synthetic materials (nylon etc)		

Source: Ferreira F. H.G., Leite P.G., and Wai-Poi M. (2007)

Table A3

Dependent variable	Headcount ratio			Poverty gap		
	LIB_{st}	$LIB2_{st}$	LIB_{st} - IV	LIB_{st}	$LIB2_{st}$	LIB_{st} - IV
Trade Liberalization index	-0.221	-0.415***	-1.689***	-0.159*	-0.231***	-0.940***
	(0.161)	(0.096)	(0.410)	(0.089)	(0.055)	(0.248)
% self-declared as "white"	-0.040	-0.075	-0.002	-0.020	-0.040	0.001
Education levels (%):	(0.056)	(0.055)	(0.076)	(0.040)	(0.040)	(0.049)
with 1 to 3 years of schooling	-0.400**	-0.346**	-0.404	-0.577***	-0.547***	-0.579***
	(0.165)	(0.151)	(0.265)	(0.113)	(0.106)	(0.162)
with 4 to 7 years of schooling	-0.309***	-0.143	-0.347**	-0.493***	-0.400***	-0.513***
	(0.103)	(0.098)	(0.142)	(0.070)	(0.071)	(0.088)
with 8 to 10 years of schooling	-1.118***	-1.200***	-1.684***	-0.754***	-0.785***	-1.054***
	(0.254)	(0.223)	(0.348)	(0.147)	(0.133)	(0.201)
with 11 to 14 years of schooling	0.300	0.310	-0.100	-0.243*	-0.227*	-0.455***
	(0.212)	(0.203)	(0.281)	(0.133)	(0.122)	(0.162)
with 15 or more years of schooling	-1.655***	-1.766***	-2.013***	-0.574*	-0.627**	-0.765**
	(0.493)	(0.461)	(0.603)	(0.330)	(0.315)	(0.383)
Informal workers (%)	0.439***	0.453***	0.360***	0.257***	0.267***	0.215***
	(0.057)	(0.057)	(0.094)	(0.035)	(0.036)	(0.055)
Size of agricultural sector (%)	0.444***	0.282***	0.375***	0.246***	0.157***	0.209***
	(0.077)	(0.070)	(0.088)	(0.045)	(0.047)	(0.053)
Number of observations	416	416	416	416	416	416
Adjusted R^2	0.789	0.811	0.684	0.760	0.775	0.687

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1% ; ** significant at 5% ; * significant at 10%.

Table A4

Dependent variable	Gini index			Theil index		
	LIB_{st}	$LIB2_{st}$	LIB_{st} - IV	LIB_{st}	$LIB2_{st}$	LIB_{st} - IV
Trade Liberalization index	-0.133	-0.110*	-0.447**	-0.483*	-0.216	-0.878
	(0.086)	(0.056)	(0.222)	(0.283)	(0.235)	(0.937)
% self-declared as "white"	-0.008	-0.019	0.000	-0.061	-0.089	-0.051
Education levels (%):	(0.027)	(0.027)	(0.030)	(0.108)	(0.104)	(0.120)
with 1 to 3 years of schooling	-0.037	-0.023	-0.038	-0.266	-0.236	-0.267
	(0.106)	(0.107)	(0.112)	(0.351)	(0.355)	(0.353)
with 4 to 7 years of schooling	0.262***	0.308***	0.254***	0.715***	0.811***	0.705***
	(0.065)	(0.066)	(0.068)	(0.260)	(0.249)	(0.267)
with 8 to 10 years of schooling	-0.611***	-0.604***	-0.732***	-2.121***	-2.022***	-2.273***
	(0.127)	(0.125)	(0.161)	(0.425)	(0.426)	(0.569)
with 11 to 14 years of schooling	0.375***	0.397***	0.289**	1.035**	1.141**	0.928
	(0.119)	(0.120)	(0.145)	(0.457)	(0.454)	(0.589)
with 15 or more years of schooling	1.587***	1.576***	1.510***	3.484***	3.516***	3.388***
	(0.232)	(0.226)	(0.260)	(0.813)	(0.803)	(0.843)
Informal workers (%)	0.186***	0.194***	0.169***	0.539***	0.567***	0.518***
	(0.035)	(0.035)	(0.039)	(0.146)	(0.143)	(0.160)
Size of agricultural sector (%)	0.112**	0.073	0.097*	0.096	0.029	0.077
	(0.047)	(0.052)	(0.050)	(0.161)	(0.185)	(0.168)
Number of observations	416	416	416	416	416	416
Adjusted R^2	0.578	0.583	0.551	0.435	0.432	0.430

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include state fixed effects and year dummies. Regressions are weighted by the square root of the number of people in a state. *** significant at 1% ; ** significant

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