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Trade Liberalization, Inequality, and Poverty in Brazilian States

MARTA CASTILHO
Instituto de Economia da Universidade Federal do Rio de Janeiro, Brazil
IRD, DIAL, Paris, France

and

MARTA MENÉNDEZ and AUDE SZTULMAN *
Université Paris-Dauphine, LEDa, Paris, France
IRD, DIAL, Paris, France

Summary. — This paper studies the impact of globalization on household income inequality and poverty using detailed microdata across Brazilian states from 1987 to 2005. Results suggest that trade liberalization contributes to growth in poverty and inequality in urban areas and may be linked to reductions in inequality (possibly poverty) in rural areas. In terms of observed integration into world markets, we find evidence indicating that in Brazil both state poverty and inequality decrease with rising export exposure but state poverty increases with import penetration.

Key words — trade liberalization, poverty and inequality, Latin America, Brazilian states

1. INTRODUCTION

How globalization affects income distribution remains a keenly discussed topic in today's academic and policy circles. Back in the 1980s, the policy debate essentially concerned industrialized countries seized by rising inequalities and increased international competition on domestic markets. Since then, trade reforms in a number of developing and emerging countries and the growing availability of datasets have led to more studies on the distributional and social effects of international trade on countries from the developing world. The debate is partially motivated by the complexity of the channels through which globalization—an all-encompassing term used here to include trade liberalization and integration into world markets—affects inequality and poverty within a country (see Goldberg & Pavcnik, 2004, 2007; Winters, McCulloch, & McKay, 2004; and Ferreira, Leite, & Wai-Poi, 2007, for an overview of the various trade transmission mechanisms).

In this paper, we study the impact of trade liberalization and international trade on household income inequality and poverty using detailed microdata across Brazilian states from 1987 to 2005. Using data on tariffs (weighted by states' initial shares of employment by industry) and state imports and exports exposure indicators, we seek to gauge whether Brazilian states with greater exposure to trade over these two decades exhibited differential changes in their income distribution, both in terms of poverty and inequality levels.

This paper makes several contributions to the literature on globalization and income distribution. Firstly, this study considers both trade policy variables and international trade flow variables (at the sectoral level) to assess the distributional impacts of trade within a country. The implementation of these two approaches allows us to thoroughly seize the effects of globalization on poverty and inequality and their timing.

Secondly, using subnational units of observation (Brazilian states in our case, together with a distinction between in-state rural and urban areas), this study analyzes the Brazilian economy taking into account regional differences, in particular, the structure of production by state. By adopting this regional approach, our paper adds to the recent strand of research that includes a spatial dimension in its study of the impact of trade liberalization on income distribution in a country (see Wei and Wu (2002) on China; Topalova (2007) on India; McCaig (2011) on Vietnam; Nicita (2004) on Mexico).[1]

Thirdly, the distributional measures considered in this paper are broader than those generally examined in previous studies. Although trade reforms should ultimately affect household welfare, it is only recently that some studies have considered measurements over and above wage inequality and the skill premium (Porto, 2003, 2006; Topalova, 2007; Ferreira *et al.*, 2007; McCaig, 2011). Past publications' focus on the skill premium is not surprising. It stems essentially from the predictions of the classical Heckscher-Ohlin-Samuelson (HOS) model. The HOS model posits that trade liberalization in poor countries should raise relative demand for unskilled labor (usually relatively abundant in these countries) and in turn reduce wage inequality and eventually reduce poverty. The HOS model's predictions have nevertheless been challenged by empirical studies on some Latin American countries, where a combination of a rising skill premium and deteriorating income distribution seemed to occur during periods of trade

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liberalization (see, for example, Robbins (1996) and Goldberg and Pavcnik (2007) for studies on various Latin American countries; Goldberg and Pavcnik (2005) and Attanasio, Goldberg, and Pavcnik (2004) for Colombia; and Hanson (2004) for Mexico). Recent research concludes that we need to go beyond the scope of the HOS model predictions to evaluate the impact of globalization on income distribution within a country (Harrison, McLaren, & McMillan, 2010). [2]

Solely focusing on wages and the skill premium has additional shortcomings when considering developing countries with relatively high levels of poverty and very unequal distributions according to international standards, as is often the case in Latin America (WDR, 2006). Among other things, developing countries have a larger nonwage working population and a large informal sector. Broader welfare measurements to study the impact of trade liberalization have rarely been used, however, due to design and measurement problems and because comparable household poverty and inequality trends in developing countries are not always feasible or easy to produce (Goldberg & Pavcnik, 2004, 2007).

The few empirical studies that have attempted to link trade liberalization with household income inequality or poverty find contrasting results, depending on the methodology and country studied. For example, Topalova (2007) uses a regional approach and finds that trade liberalization from 1987 to 1997 raised poverty, yet had no effect on inequality in rural Indian districts. The author also finds that trade exposure had no impact on district inequality and poverty in urban India. McCaig (2011) obtains similar results from a study of short-run effects on Vietnamese provinces: during 2002–04, provinces more exposed to tariff cuts appear to have experienced lower reductions in poverty, while increased access to US export markets caused greater drops in poverty. However, Porto (2003, 2006) uses a different methodological approach and finds that trade reforms in Argentina had a positive impact on the poor. [3] Porto (2003) shows that trade reforms and better access to foreign markets have a poverty-decreasing effect. Porto (2006) finds evidence of a pro-poor bias of the Mercosur trade agreement on Argentine families in the 1990s. The fact that different conclusions are reached in different countries encourages us to examine the matter with regard to Brazil, a case study that is of particular interest.

Brazil is remarkably well suited to an analysis of the impact of globalization on income distribution and poverty for a number of reasons. Firstly, Brazil embarked on an extensive trade liberalization reform in 1988, including a substantial widespread reduction in trade barriers and a narrowing of tariff dispersion. These major changes in trade protection and other macroeconomic factors led to an increase in trade openness for Brazil and its different states (see Section 2 below for a more detailed description of the changes in trade policies and trade patterns).

Secondly, Brazil, where poverty is very high and well above the norm for a middle income country, is one of the most inegalitarian countries in the world. During the period of interest, both welfare indicators started to decline slowly but significantly. Still, there are large inequality and poverty differences across rural and urban areas and across Brazilian states, in terms of both levels and trends (see Section 2 below for a more detailed description of the progression of poverty and inequality indicators).

Thirdly, among the Latin American countries, Brazil seems to be a special case, at least as far as the studies examining the effects of trade liberalization on wage and employment outcomes are concerned. In Brazil, recent studies find a decline in the economy-wide skill premium since 1988 (Ferreira *et al.*, 2007; Gonzaga, Menezes Filho, & Terra, 2006) [4] and either no evidence or a downward effect of trade liberalization on wage inequality [5] (see Ferreira *et al.*, 2007; Gonzaga *et al.*, 2006; Pavcnik, Blom, Goldberg, & Schady, 2003, 2004). [6]

Finally, Brazil is politically organized as a federation composed of 27 federal units. [7] As a large federal country, a relatively large amount of intranational data is available (in particular, data on exports and imports are available at the state level). It also benefits from the availability of very high-quality household datasets representative of almost the entire country and covering a period starting before trade liberalization. Long, reliable, and comparable annual series can hence be established at household level and consequently at state level. Such rich intranational data series on trade and income distribution variables are rarely available for emerging and developing countries. As often pointed out, in-country studies do not suffer from the long list of data quality problems encountered by cross-country studies (such as differences in data definitions and collection methods leading to comparability problems across countries and time).

This paper shows that Brazilian trade liberalization raised poverty and inequality in urban areas and was inequality (possibly poverty) reducing in rural areas. As Brazilian states generally posted improvements in welfare indicators over the period studied, urban areas that were more exposed to tariff cuts experienced smaller reductions in household poverty and inequality. Rural areas followed an inverse pattern. In terms of observed integration into world markets, growing export exposure appears to reduce both poverty and inequality at the state level quite significantly. Import penetration, although seldom significant, has the opposite impact.

The remainder of the paper is organized as follows. Section 2 provides a brief description of Brazilian trade reforms over the past two decades (Section 2a) and presents descriptive statistics on trade patterns, poverty, and inequality for Brazil as a whole and by federal unit (Section 2b). Section 3 describes the dataset compiled for this study (Section 3a) and the estimation strategy (Section 3b). Section 4 includes an analysis of our findings on the impact on poverty and inequality of both trade liberalization (Section 4a) and international trade (Section 4b). Section 5 presents the conclusion of the study.

2. TRADE, POVERTY, AND INEQUALITY IN BRAZIL

(a) *Trade reforms in Brazil*

Brazilian trade policies have changed considerably over the past two decades. Through to the late 1980s, Brazil had a very restrictive trade regime led by a development strategy based on import substitution and the promotion of national industry. Not only was the level of protection high, but import policies were also particularly complex due to the use of countless trade instruments. This intricate system was reinforced by the fact that, in some circumstances, trade instruments were used for macroeconomic purposes without any connection with the original industrial and productive rationale. At the end of the 1980s—known as the "lost decade" by Latin American countries because of macro-instability and poor economic performance—the region started to adopt liberal public policies inspired by the Washington Consensus. [8]

Trade reform in Brazil effectively started in 1988, when some nontariff barriers were removed. At that time, the nominal tariff, measured by a simple cross-sector average (see Figure 1) stood at 40.4%, with a highly dispersed distribution (standard deviation of tariffs above 15%) and substantial "tariff redun-

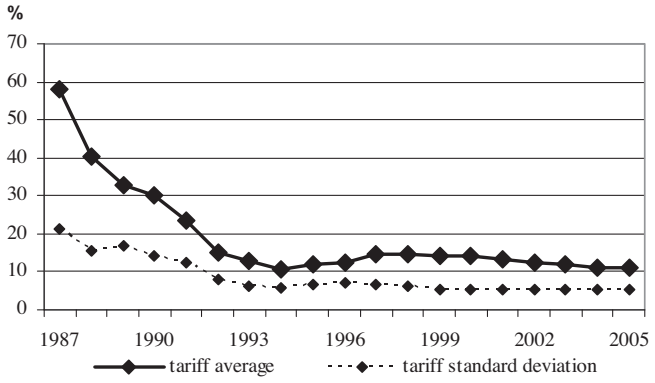


Figure 1. *Evolution of Brazilian tariffs. Source: Authors' calculations from tariffs by sector. Data from Kume et al. (2003) for the 1987–94 period; data as of 1995 made available by H. Kume.*

dancy".[9] With the arrival of the new government in 1990 came a hefty package of trade measures. The main goal of the reform was to rationalize the trade regime and make tariffs the main trade instrument. The reform duly eliminated nontariff barriers still in place (such as prohibitions and quantitative controls), abolished the majority of special import regimes and then reduced the level and spread of import tariffs. A tariff reduction schedule was established with the goal of nominal tariffs standing at an average 18% and ranging from 0% to 40% by 1994. These Brazilian trade reforms were initiated unilaterally in accordance with the country's commitments in the ongoing multilateral negotiations (Uruguay Round). However, in 1991, Brazil signed the Mercosur agreement with Argentina, Paraguay, and Uruguay. The four countries negotiated the Common External Tariff (CET), which called for certain amendments to be made to the original liberalization schedule. Under the Mercosur agreement, the average tariff fell to 12% in 1996 (with the standard deviation of tariffs falling to 7%) in a demonstration of the reach of the liberalization process.[10]

All in all, the 1990s Brazilian trade reforms not only achieved their goal of streamlining the import tariff structure, but also led to extensive tariff cuts and more uniform tariff rates. After the implementation of the CET in 1994, only small changes were made, mainly for the purposes of macroeconomic adjustment. The sharp growth in imports that followed the Real Plan (adopted in 1994) and the subsequent price stabilization called for certain quantitative and administrative measures to be enforced in 1996 to control the growing trade deficit. As of 1997, the Asian financial crisis had a strong impact on external accounts and made the Brazilian exchange rate unsustainable. In 1997, the country, together with its Mercosur partners, temporarily raised the CET by 3%[11] and, in January 1999, the Brazilian currency's face value was devalued by about 50%. While the expected impacts on exports and imports were not immediate, the measures put in place managed to halt the trade deficit's upward spiral. From 2001 to 2004, the trade surplus grew from US$ 2 billion to US$ 33 billion.[12] By 2005, the Brazilian tariff had reached its lowest ever level with a simple average tariff of 11.1%.

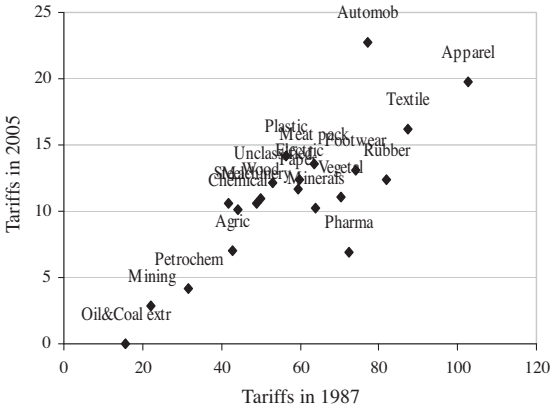
If we take a look at the tariff protection structure by sector for the 1987–2005 period, we can see the extent of the tariff cuts and reduction in spread (see Figure 2). The largest tariff cuts concerned the sectors where initial tariff levels were highest, that is, manufacturing sectors such as automobiles, apparel, and textiles. The smallest tariff cuts were made in the mining sectors, where initial tariff levels were lowest. Protection levels in the agricultural and food sectors—where Brazil has strong comparative advantage—were close to the Brazilian average tariff.[13]

Note that detailed information on nontariff barriers (NTBs) is not available on a disaggregated basis to construct time series across sectors in Brazil and has not been included in this study. This should not cause too much of a problem, considering that tariffs are the main policy instrument in Brazil. Although NTBs may have played a role as a trade barrier through to 1990, they have since become a relatively insignificant protectionist instrument.[14]

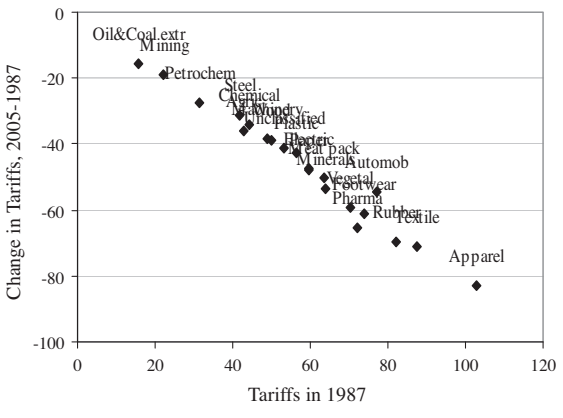
(b) *Trade, poverty, and inequality patterns*

We now present descriptive evidence on international trade, poverty, and inequality indicators in Brazil as a whole and in the different Brazilian states (a detailed description of data sources and variables used is provided in the next Section 3).

Figure 3 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). Changes were more



Tariffs in 1987 vs Tariffs in 2005



Change in Tariffs 2005-1987 vs Tariffs in 1987

Figure 2. *Brazilian tariff levels in 1987 versus tariff levels and changes in 2005. Source: Kume et al.(2003) for the 1987–94 period; data as of 1995 made available by H. Kume.*

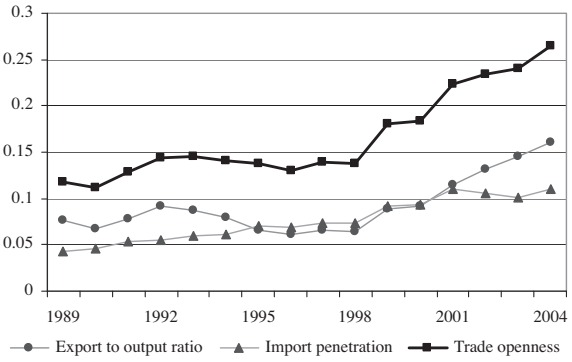


Figure 3. *Trade openness in Brazil, 1989–2004. Source: Authors' calculations based on various sources (data from IBGE for production and data from SECEX for trade flows).*

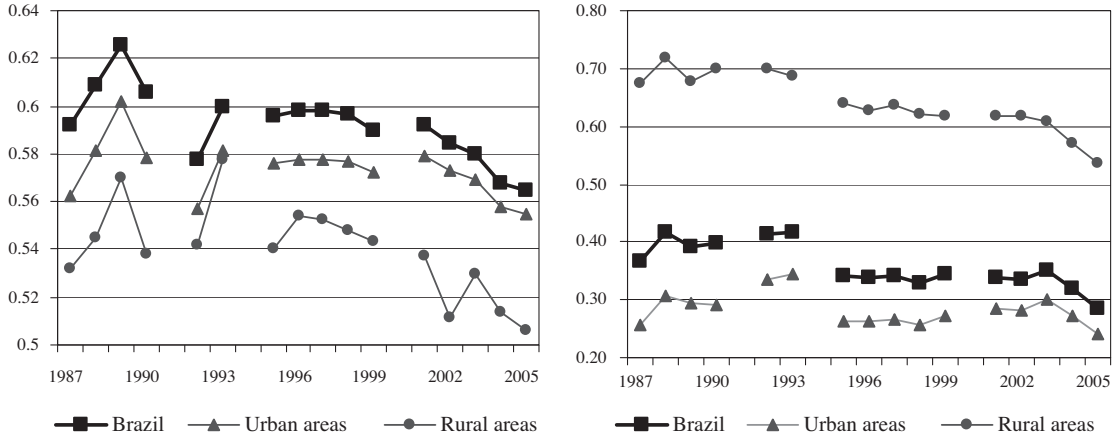
significant from 1999 onward. The large increase in trade openness between 1998 and 2004 is mainly due to growth in export exposure, which rose during this time by nearly 10% compared to around 4% for import penetration.

Figure 4a and b shows, respectively, the evolution of two of the most common indicators of inequality and poverty, the Gini index and the headcount ratio. The trends are presented for Brazil as a whole and separately for rural and urban areas from 1987 to 2005. The Gini index reveals a steady increase in inequality from 1987 to 1989 (with a peak at 0.63), followed by a certain amount of volatility through to 1993. Usual explanations for this trend include high and accelerating inflation over the period, as well as increasing levels of education among the population tied in with rising returns to schooling (see Ferreira & Paes de Barros, 2005). From 1993 to 2005, there was an initially slow but steady downturn in inequality (from 0.60 in 1993 to 0.56 by 2005). This reduction was sharper in rural areas than in urban zones and particularly significant from 2001 onward. We observe a similar pattern in poverty indicators for the same period. The headcount ratio displays fluctuating values from 1987 to 1993, again reflecting macroeconomic instability and hyperinflation. From 1993 to 1995, a fall is observed in the poverty headcount. The introduction of the Social Assistance bylaw in 1993, which consisted essentially of unconditional cash transfers to poor aged people living in rural areas and to disabled persons, together with the Real Plan in 1994, are usually identified as contributors to this initial poverty reduction (Ferreira, Leite, & Litchfield, 2008; Pero & Szerman, 2010). A period of relative stability in the percentage of poor at around 33% followed from 1995 to 2003 (though poverty ratios in rural areas continued a slow, steady downturn). Finally, a persistent and significant drop in poverty ratios took place from 2003 onward, this time both in urban and rural areas (the headcount index standing at 29% for Brazil in 2005). [15]

Brazilian states are very heterogeneous in terms of their exposure to trade and their poverty and inequality patterns. Table 1 provides a summary of descriptive statistics by Brazilian federal units. If we look at the values of trade patterns in 1989 and 2004, they reveal large spatial inequalities with a high level of trade exposure in some Brazilian states. [16] Although trade openness increased in each state during the period under study, disparities between the different federal units also grew. The "average" level of trade openness for the 26 states rose from 8% to 19.6% (standard deviations being 0.07 and 0.16, respectively). In 2004, trade openness ratios ranged from 0.9% in Acre (a state covered mostly by the Amazon jungle) to 44.8% in Amazonas (whose main economic activities are concentrated in the free-export zone of Manaus) and 59.9% in Espírito Santo (a coastal state that comprises some of the country's main ports). A further six Brazilian states posted openness ratios above 30%.

Concerning export-to-output ratios, in 1989 only five states posted export exposure above 10% as opposed to twelve states in 2004, with four states above 25%: Espírito Santo and Pará (two states in which exports of iron ore play a major role) and Mato Grosso and Paraná (where soybean exports are very high). More modest growth is found in import penetration: in 1989, ratios were below 5% in all the Brazilian states except Amazonas, Rio de Janeiro, Espírito Santo, and Rio Grande do Sul. In 2004, only eight states had ratios above 10%, with Amazonas and Espírito Santo posting levels above 25%. In line with the observation for Brazil as a whole, it is mainly growth in exports that accounts for the increase in trade openness in the different federal units.

Note that an important feature of the Brazilian case is its strong geographical concentration of exports and imports. In 2004, only three states [17] accounted for more than 50% of total



4a. Inequality

4b. Poverty

Figure 4. *Household per capita Income Inequality and Poverty in Brazil, 1987–2005. Note: Inequality levels are measured by the Gini index and poverty levels by the headcount ratio. Source: Authors' calculations from PNAD.*

Table 1. *Descriptive statistics*

Region	State	Trade openness (%)		Import penetration ratio (%)		Export exposure ratio (%)		Gini index (%)		Headcount ratio (%)		Share of rural population (%)		Trade Liberalization indicator (LIB) (%)		Mean household *per capita* income (%)	
		1989	2004	1989	2004	1989	2004	1987	2005	1987	2005	1987	2005	1987	2005	1987	2005
Central-West	Mato Grosso do Sul	6.1	20.8	0.0	11.1	6.1	9.5	54.8	52.7	29.7	24.2	23.4	15.2	15.3	2.6	295.0	302.8
	Mato Grosso	5.4	36.9	0.5	6.1	4.9	32.5	60.5	51.9	36.0	24.9	44.2	23.2	20.4	3.5	306.4	289.3
	Goias & Tocantins	4.0	13.9	0.4	4.4	3.6	9.7	57.3	55.2	37.3	27.0	31.5	15.6	17.2	3.0	261.3	289.4
	Distrito Federal	0.4	3.6	0.3	3.3	0.1	0.2	56.9	60.1	17.2	17.4	6.1	5.3	4.4	0.8	489.6	600.5
South	Paraná	9.8	36.1	2.8	12.7	7.1	25.3	57.0	53.4	32.5	19.6	33.1	16.1	22.7	4.0	281.5	362.4
	Santa Catarina	9.3	26.5	1.7	7.3	7.7	20.3	53.5	45.9	27.2	9.7	40.6	17.6	28.1	5.1	296.7	403.5
	Rio Grande do Sul	15.5	31.1	5.6	12.0	10.2	20.3	55.9	51.7	27.6	17.0	30.5	18.8	21.9	3.9	323.6	377.4
Southeast	Minas Gerais	11.4	22.8	0.4	6.0	11.0	17.6	58.4	52.4	42.0	25.3	28.6	15.4	20.4	3.7	242.8	290.2
	Espírito Santo	30.2	59.9	9.2	28.0	22.4	34.4	61.2	55.4	45.9	26.7	37.7	16.8	22.0	3.8	264.6	313.9
	Rio de Janeiro	12.7	17.6	8.9	8.4	3.3	9.2	57.1	55.4	22.2	16.5	7.7	3.4	12.2	2.5	377.2	413.6
	São Paolo	11.6	31.2	4.6	14.8	7.2	16.7	51.3	52.7	11.4	13.7	9.4	5.8	21.5	4.4	440.2	430.6
Northeast	Maranhão	15.7	34.8	2.8	14.3	13.3	21.8	52.6	51.7	74.1	58.6	63.8	34.8	27.4	4.6	94.0	131.2
	Piauí	2.2	3.1	0.0	0.6	2.2	2.5	64.1	58.5	75.8	55.8	53.5	38.2	26.5	4.4	101.7	165.6
	Ceará	4.9	12.6	1.7	5.2	3.2	7.6	60.5	57.4	70.3	52.2	42.9	24.3	22.4	4.0	134.0	174.9
	Rio Grande do Norte	2.2	13.1	0.1	2.8	2.1	10.6	61.5	59.3	62.7	46.1	35.1	28.2	16.9	2.9	163.6	221.8
	Paraíba	3.0	6.1	0.9	2.0	2.1	4.2	60.1	57.3	65.3	48.8	37.5	22.5	20.2	3.5	142.7	197.7
	Pernambuco	4.4	7.8	1.5	4.6	2.9	3.2	58.6	58.5	55.7	50.6	31.0	23.8	21.0	3.7	175.5	190.5
	Alagoas	6.8	13.3	0.9	1.9	5.9	11.6	56.7	56.3	65.0	57.8	43.7	34.8	25.5	4.4	138.7	146.0
	Sergipe	1.2	3.3	0.0	2.2	1.2	1.1	57.7	55.2	60.0	44.0	46.3	18.1	21.8	3.7	164.4	204.3
	Bahia	11.2	23.9	3.7	10.5	7.6	13.7	59.9	55.1	59.4	49.4	46.0	33.5	22.8	3.9	172.2	179.5
North	Rondônia	0.9	4.4	0.3	0.4	0.6	4.0	51.5	57.2	19.8	29.4	–	–	8.2	1.6	349.2	310.3
	Acre	0.7	0.9	0.2	0.1	0.5	0.8	55.7	57.3	33.9	37.3	–	–	5.0	1.0	284.9	262.6
	Amazonas	15.7	44.8	12.5	28.1	1.6	9.5	50.5	50.2	22.9	31.3	–	–	15.8	3.2	297.2	234.6
	Roraima	0.0	1.2	0.0	0.3	0.0	0.9	45.8	56.0	11.5	45.6	–	–	4.9	1.0	420.1	205.5
	Pará	17.4	34.8	2.4	3.3	15.3	32.5	54.6	51.1	36.3	37.5	–	–	10.2	1.9	248.2	211.7
	Amapá	5.4	5.9	0.0	2.3	5.3	3.7	45.2	51.9	20.8	34.5	–	–	3.7	0.7	274.7	257.0

Source: Authors' calculations based on various sources (data from IBGE for production; data from SECEX for trade flows; data from PNAD for poverty, inequality, mean gross monthly *per capita* household income measured in 2006 Brazilian reais, rural population shares), and employment shares; note that rural areas in Northern states are excluded from the analysis since the PNAD survey only covers those regions as of 2003.

Brazilian exports while 20 states had less than a 5% share of total exports. The geographical concentration of imports is even more important, even though it has fallen since 1989: whereas 21 states had less than a 5% share of total imports in 2004, three states [18] accounted for over 60% of total Brazilian imports.

Table 1 also shows considerable inequality and poverty differences across Brazilian states for the 1987–2005 period, in terms of both levels and trends. If inequality fell in almost all federal units [19], the intensity of the drop varied across states. Similar spatial heterogeneity is observed when looking at poverty levels. In fact, no convergence across states seems to have taken place during the timeframe of analysis.

From this analysis, it follows that integration into world markets was very uneven across the different federal units at the end of the 1980s and that these regional inequalities in terms of trade exposure have increased over the last two decades. This variation in Brazilian trade patterns across space and time may well play a role in the different state inequality and poverty trends. This paper sets out to investigate whether the rich spatial variation in welfare outcomes and trends observed in Brazil is linked to the variations observed in Brazilian states' trade indicators. Our data sources and estimation strategy are described in the next section.

3. DATA AND ESTIMATION STRATEGY

(a) *Data description*

The data used in this study were provided by different sources. Household level microdata were gathered from our first source: the *Pesquisa Nacional por Amostra de Domicílios* (PNAD), which is conducted annually by the Brazilian Census Bureau (*Instituto Brasileiro de Geografia e Estatística*—IBGE). [20] The survey, which samples about 300,000 individuals every year, is nationally representative and covers the rural and urban areas of all states in the federation, except for the rural areas of the Northern Region where the Amazon rainforest is found. [21] We use individual-level information from the PNAD to construct harmonized summary variables on income distribution, employment, education, and other socio-demographic characteristics (detailed below) for our unit of analysis, that is, the state. Where appropriate, we make the distinction between rural and urban areas within states, for which all summary variables have been constructed as necessary. [22]

The definition of income used throughout the analysis is gross monthly household income *per capita*, measured in 2006 Brazilian Reais, and the sample considered is the total population. [23] Various measures of inequality and poverty have been considered for the sake of robustness. In the case of inequality, we have applied two common indicators: the Gini and Theil indices. When looking at poverty, two standard poverty indicators from the Foster-Greer-Thorbecke (FGT) metric have been calculated: the headcount index and the poverty gap. [24] The first indicator captures the proportion of the population living below the poverty line and the second helps to account for differences among households in terms of their distance from the poverty line. For the purposes of this study, the poverty line is set at R$100 per person per month (2006 values). [25]

The PNAD provides individual data that can be used 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 sector in which they work. [26] We are also able to consult a list of individual socio-demographic variables considered typical determinants of income levels. From these individual data, we can construct different control variables at state level (or rural/urban areas within states) and, in particular, the share of individuals in each state by years of schooling, grouped into three categories: unskilled (from 0 to 3 years); semi-skilled (from 4 to 10 years) and skilled (11 or more years); the share of individuals in each ethnic group (information on ethnicity is self-declared in the PNAD and defines five groups: indigenous, white, black, Asian, and mixed); the share of the agricultural sector [27] in each state; the share of informal workers; the share of workers by industrial sector; and the share of rural population.

We use two different sets of measures to represent trade policy changes and the trade openness of Brazilian states. The first set includes a trade policy measure, based on Brazilian nominal tariff data. The second set focuses on trade flows and shows the state's exposure to international trade or its integration into world markets.

The trade policy data are made up of industry-specific nominal tariff rates. These are drawn from Kume *et al.* (2003) for the 1987–94 period. Data were provided by H. Kume for 1995–2005. The tariff data series correspond to the nominal level of protection for 31 industry sectors. [28] These data are a standard source for the Brazilian tariff structure.

Given that we adopt a regional approach, we follow Topalova (2007) and construct an indicator to measure the influence of trade policy and its change *at state level* in Brazil (and particularly, in 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 initial share of employment by industry within each state (the initial year in our study is 1987). It is computed as follows:

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

where s denotes the unit of analysis (Brazilian states, with a distinction between in-state rural and urban areas), k the sector, and t time. $Tariff_{kt}$ refers to the tariff in sector k for year t, L_{sk1987} to the workers employed in sector k for year *1987* in unit of analysis s and L_{s1987} to the total workers in unit of analysis s for the year *1987*. [29]

The weights are calculated using employment data on the year prior to the trade reform, that is, 1987, to ensure that employment changes over time caused by tariff variations are not included in our *LIB* measure of exposure to the tariff reforms. The data on employment by federal unit and industry in 1987 were taken from the PNAD. Our use of household survey data and tariff data with different industry definitions called for concordance between the two datasets. To match the data on tariffs (in the *Nivel 50* classification) and employment (in the PNAD classification), we used the Industry Concordance match developed by Ferreira *et al.* (2007). Consequently, we were able to compute our trade liberalization indicator *LIB* for a group of 22 industries in a sample of 26 states for the 1987–2005 period. [30]

The data on trade flows cover import penetration (imports as a percentage of output plus net imports) and export exposure (exports as a percentage of output) indicators. These ratios are calculated at state level. No in-state urban-rural distinction can be made in this case. Trade data on the federal units' imports and exports in current US dollars are collected by the *Secretaria de Comércio Exterior*, *Ministério do Desenvolvimento*, *and Industria e Comércio Exterior* (SECEX/MDIC). [31] The series on gross domestic product by state in current market prices come from Brazil's regional accounts as drawn up by IBGE. These data were converted into current US dollars using the annual average exchange rates. [32] The trade flow indicators were calculated for total trade, but also

separately for the agricultural sector and the industrial sector (the latter including the mining and manufacturing industries) for the 1989–2004 period.

(b) *Econometric specification*

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

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

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 for our dependent variable: the Gini and Theil indices to capture inequality and the headcount ratio and poverty gap indices to capture poverty levels.

In this study, $TradeIndicator_{st}$ is the key variable and we use two measures for it: a measure based on trade policy (our *LIB* indicator described above) and trade flow-based indicators (lagged import penetration and lagged export exposure). The use of these two types of measures (trade policy and trade outcome measures) represents different ways of capturing the extent of trade exposure across Brazilian states. Hence, θ is the main parameter of interest.

Vector X_{ist} includes i control variables. Those typically assumed to affect levels of poverty and inequality are: the share of individuals declaring themselves "white" in each state (to account for ethnic inequalities); the share of individuals by different levels of education in each state (to cover the role of educational inequalities); the share of informal workers in each state; the size of the agricultural sector in each state (both well-known determinants of the income distribution) and the share or rural population in each state. To control for macroeconomic instability our main specification also includes GDP growth rate by state as regressor. Finally, λ_s and γ_t are the state- and time-specific fixed effects, respectively, and ε_{st} is the error term. All estimates use panel-robust (clustered) standard errors, which both correct for heteroskedasticity and potential serial correlation.

This paper draws on regional data to seek 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 in Brazil, at least in the short or medium run (there would be no differential effects across the country if wages, and consequently household income levels, were equalized across regions). However, as emphasized by Goldberg and Pavcnik (2007, p.56), "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 geographic migration is not inconsiderable throughout the period of study, it is not sizeable enough to wipe out the spatial disparities in the experiences observed. [33]

4. ESTIMATION RESULTS

(a) *Trade policy, poverty, and inequality*

The estimated effects of our trade policy indicator *LIB* on poverty are presented in Table 2a. Eqn. (1) is here estimated using both the headcount ratio and the poverty gap index as poverty indicators for the entire 1987–2005 period. The sample is also split into two 8-year sub-periods (1987–96 and 1997–2005) to distinguish, respectively, between the years where trade liberalization essentially took place and the years where trade openness took off.

Table 2a reveals that in urban areas (columns 1 and 2), the negative effect of trade liberalization on poverty is highly significant, regardless of the poverty measure used. On average, a fall of one percentage point in the trade policy indicator *LIB* in urban areas of states would lead to a 0.65 percentage point increase in the headcount ratio, and a 0.28 percentage point increase in the poverty gap. On the other hand, no significant effect is observed in rural areas (columns 3 and 4). By sub-period, we observe that the negative effect on urban poverty is—as expected—concentrated during the 1987–96 sub-period (columns 5 and 6). In rural areas an opposite positive effect on poverty emerges during the 1997–2005 period (though significant only at 10%). [34]

In the estimation of Eqn. (1) we include a few control variables considered to be usual determinants of poverty and inequality. Controls are almost all highly significant and have the expected signs. Education (particularly the semi-skilled, but also the skilled category, in more recent years) and GDP growth rates, appear to reduce poverty. The share of informal workers and the size of the agricultural sector in a state also matter: they lead to a significant rise in poverty. [35] The share of individuals declaring themselves to be "white" is almost always insignificant.

Table 2b presents the relationship between trade liberalization and inequality. When the whole period is considered, our trade policy indicator LIB is inequality decreasing in rural areas (columns 3 and 4). During the initial 1987–96 sub-period (corresponding to the massive trade liberalization years) a short-term inequality increasing effect of tariff reduction is also clearly observed in urban zones (columns 5 and 6). [36] In other words, at least during the years where tariff reduction was more substantial, opposing and significant patterns emerged between rural and urban areas in Brazilian states. During those years, the influence of a tariff reduction is inequality increasing in urban areas and inequality increasing in rural zones. [37]

One tentative explanation for our contrasting effects of trade liberalization on household poverty and inequality 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. Previous research on Brazil has established that trade liberalization led to a downturn in economy-wide wage inequality (Ferreira *et al.*, 2007; Gonzaga *et al.*, 2006). At the same time, recent evidence on labor reallocations in response to trade reforms in Menezes-Filho and Muendler (2011) shows labor displacements from import competing industries in the 1990s, but neither comparative-advantage industries nor exporters seem to have absorbed trade-displaced workers for years. Indeed, more frequent transitions to informal work status and unemployment are observed. These transitions may be sources of poverty and inequality increases and these effects are captured when total household income (not just wages) is considered. Should these adjustments play a relatively greater role in urban areas than other inequality-decreasing mechanisms, they could well be behind our poverty- and inequality-increasing findings in urban areas, and could also help explain the differences between rural and urban results. Although this is beyond the scope of this paper, our results suggest that a better understanding of the effects of trade liberalization on household income distribution should take into account not only the observed changes in labor income, but also whether there have

Table 2a. *Trade liberalization and poverty, by area and sub-period*

Dependent variable	Period 1987–2005				Sub-period 1987–96				Sub-period 1997–2005			
	Urban areas		Rural areas		Urban areas		Rural areas		Urban areas		Rural areas	
	Headcount ratio (1)	Poverty gap (2)	Headcount ratio (3)	Poverty gap (4)	Headcount ratio (5)	Poverty gap (6)	Headcount ratio (7)	Poverty gap (8)	Headcount ratio (9)	Poverty gap (10)	Headcount ratio (11)	Poverty gap (12)
Trade liberalization index:												
LIB_{st}	−0.653***	−0.280**	0.383	0.128	−0.652***	−0.267***	0.093	0.040	−2.760	−0.807	5.946*	2.607*
	(0.224)	(0.109)	(0.417)	(0.274)	(0.168)	(0.090)	(0.327)	(0.218)	(1.901)	(0.808)	(3.225)	(1.557)
% Self-declared as "white"	−0.095	−0.047	−0.044	−0.078	0.024	0.020	0.017	0.013	−0.141	−0.082	−0.251**	−0.163**
Education levels (%):	(0.094)	(0.051)	(0.090)	(0.060)	(0.088)	(0.058)	(0.073)	(0.068)	(0.102)	(0.059)	(0.101)	(0.077)
Semi-skilled	−0.436***	−0.346***	0.076	−0.222***	−0.954***	−0.479***	−0.619**	−0.564**	−0.434**	−0.285***	0.071	−0.129*
	(0.144)	(0.074)	(0.165)	(0.083)	(0.204)	(0.154)	(0.261)	(0.247)	(0.169)	(0.107)	(0.137)	(0.075)
Skilled	−0.213	−0.101	−0.315	0.026	−0.779***	−0.172	−0.184	−0.037	−0.581**	−0.334**	−0.944***	−0.555**
	(0.233)	(0.109)	(0.456)	(0.372)	(0.223)	(0.159)	(0.534)	(0.393)	(0.246)	(0.155)	(0.303)	(0.239)
Informal workers (%)	0.429***	0.196***	0.424***	0.324***	0.404***	0.228***	0.329***	0.321***	0.073	0.011	0.069	0.084
	(0.054)	(0.035)	(0.110)	(0.087)	(0.077)	(0.053)	(0.112)	(0.109)	(0.068)	(0.041)	(0.107)	(0.086)
Size of agricultural sector (%)	0.423**	0.207*	−0.064	−0.030	0.490***	0.316**	0.057	0.006	0.557***	0.270***	−0.169	−0.086
	(0.171)	(0.113)	(0.083)	(0.068)	(0.179)	(0.129)	(0.137)	(0.094)	(0.158)	(0.082)	(0.185)	(0.098)
GDP growth rate	−0.022	−0.017	−0.019	−0.067*	−0.035	−0.024	−0.050	−0.086*	−0.025*	−0.017*	−0.044	−0.096**
	(0.014)	(0.013)	(0.037)	(0.040)	(0.030)	(0.024)	(0.048)	(0.045)	(0.014)	(0.010)	(0.028)	(0.038)
Number of observations	208	208	160	160	208	208	160	160	208	208	160	160
Adjusted R^2	0.732	0.559	0.465	0.383	0.732	0.559	0.465	0.383	0.639	0.550	0.572	0.608

Note: Standard errors (in parentheses) are robust to heteroskedasticity and serial correlation. All regressions include state and year fixed effects. 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 2b. *Trade liberalization and inequality, by area and sub-period*

Dependent variable	Period 1987–2005				Sub-period 1987–96				Sub-period 1997–2005			
	Urban areas		Rural areas		Urban areas		Rural areas		Urban areas		Rural areas	
	Gini index (1)	Theil index (2)	Gini index (3)	Theil index (4)	Gini index (5)	Theil index (6)	Gini index (7)	Theil index (8)	Gini index (9)	Theil index (10)	Gini index (11)	Theil index (12)
Trade liberalization index:												
LIB_{st}	−0.159	−0.193	0.551*	1.906**	−0.208***	−0.327**	0.398	1.544*	−0.432	−4.064	−0.161	2.139
	(0.121)	(0.245)	(0.286)	(0.894)	(0.051)	(0.161)	(0.282)	(0.880)	(1.356)	(3.298)	(2.430)	(8.259)
% Self-declared as "white"	0.002	−0.074	0.056	0.293*	0.015	−0.046	−0.060	−0.058	−0.051	−0.157	0.098	0.378
Education levels (%):	(0.038)	(0.126)	(0.060)	(0.168)	(0.025)	(0.136)	(0.092)	(0.221)	(0.071)	(0.185)	(0.104)	(0.407)
Semi-skilled	0.038	0.229	0.147**	0.135	−0.165**	−0.045	−0.463**		0.079	0.302	0.207***	0.364
	(0.118)	(0.411)	(0.073)	(0.222)	(0.074)	(0.268)	(0.124)	(0.477)	(0.162)	(0.495)	(0.072)	(0.230)
Skilled	0.344***	0.910*	1.085***	3.000***	0.285***	0.368	1.211***	2.754***	0.292	0.604	1.259***	4.371***
	(0.117)	(0.479)	(0.231)	(0.723)	(0.105)	(0.470)	(0.264)	(0.685)	(0.203)	(0.634)	(0.292)	(1.099)
Informal workers (%)	0.157***	0.488***	0.029	0.096	0.216***	0.798***	−0.098	−0.405	0.105*	0.265	0.015	0.177
	(0.050)	(0.145)	(0.048)	(0.177)	(0.045)	(0.160)	(0.063)	(0.290)	(0.061)	(0.219)	(0.062)	(0.263)
Size of agricultural sector (%)	0.052	0.119	−0.026	−0.139	0.005	0.318	−0.098	−0.323	0.046	−0.052	0.038	0.166
	(0.100)	(0.330)	(0.057)	(0.218)	(0.078)	(0.324)	(0.095)	(0.370)	(0.119)	(0.361)	(0.048)	(0.169)
GDP growth rate	0.003	0.019	−0.029	−0.096	0.003	0.059	−0.040	−0.144*	−0.010	−0.049	−0.028	0.017
	(0.012)	(0.049)	(0.022)	(0.080)	(0.019)	(0.081)	(0.025)	(0.082)	(0.010)	(0.042)	(0.063)	(0.186)
Number of observations	416	416	320	320	208	208	160	160	208	208	160	160
Adjusted R^2	0.434	0.275	0.393	0.250	0.508	0.273	0.254	0.120	0.252	0.061	0.390	0.253

Note: Standard errors (in parentheses) are robust to heteroskedasticity and serial correlation. All regressions include state and year fixed effects. 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 openness, poverty, and inequality, by sub-period*

Dependent variable	Period 1987–2005				Sub-period 1987–96				Sub-period 1997–2005			
	Poverty		Inequality		Poverty		Inequality		Poverty		Inequality	
	Headcount ratio (1)	Poverty gap (2)	Gini index (3)	Theil index (4)	Headcount ratio (5)	Poverty gap (6)	Gini index (7)	Theil index (8)	Headcount ratio (9)	Poverty gap (10)	Gini index (11)	Theil index (12)
Trade openness indicators:												
Export exposure$_{s(t-1)}$	−0.170*	−0.076	−0.136**	−0.432**	−0.130	−0.094	0.006	−0.454	−0.218***	−0.097**	−0.164***	−0.483***
	(0.098)	(0.061)	(0.067)	(0.208)	(0.240)	(0.177)	(0.165)	(0.640)	(0.072)	(0.040)	(0.050)	(0.186)
Import penetration$_{s(t-1)}$	0.258*	0.099	0.116	0.334	−0.103	−0.061	−0.039	−0.216	0.218	0.167**	0.165	0.410
	(0.154)	(0.079)	(0.085)	(0.239)	(0.197)	(0.106)	(0.066)	(0.271)	(0.152)	(0.066)	(0.113)	(0.342)
% Self-declared as "white"	−0.024	−0.048	0.084*	0.293**	0.106	0.094	0.052	0.161	−0.225*	−0.157**	−0.041	−0.111
Education levels (%):	(0.113)	(0.060)	(0.051)	(0.147)	(0.128)	(0.094)	(0.061)	(0.199)	(0.115)	(0.071)	(0.074)	(0.212)
Semi-skilled	−0.355***	−0.360***	−0.041	−0.277	−1.309***	−0.720***	0.072	0.529	−0.302**	−0.253***	−0.002	−0.215
	(0.108)	(0.049)	(0.095)	(0.347)	(0.257)	(0.217)	(0.117)	(0.472)	(0.149)	(0.072)	(0.091)	(0.275)
Skilled	−0.203	−0.077	0.287***	0.561	−0.910**	0.280	0.806***	1.838***	−0.278	−0.206	0.240	0.438
	(0.260)	(0.131)	(0.094)	(0.375)	(0.356)	(0.325)	(0.157)	(0.636)	(0.320)	(0.160)	(0.159)	(0.475)
Informal workers (%)	0.319***	0.169***	0.061	0.148	0.280**	0.266***	0.137**	0.467*	0.112	0.033	0.044	0.109
	(0.069)	(0.039)	(0.063)	(0.230)	(0.121)	(0.097)	(0.066)	(0.252)	(0.115)	(0.050)	(0.064)	(0.236)
Size of agricultural sector (%)	0.420***	0.137**	0.121	0.321	0.242*	−0.032	−0.013	0.067	0.367***	0.214***	0.063	0.027
	(0.116)	(0.064)	(0.075)	(0.255)	(0.142)	(0.124)	(0.084)	(0.337)	(0.115)	(0.059)	(0.064)	(0.199)
GDP growth rate	−0.023	−0.028	−0.001	0.021	−0.054	−0.048	0.003	0.134	−0.028**	−0.031**	−0.010	−0.041
	(0.017)	(0.019)	(0.012)	(0.055)	(0.044)	(0.038)	(0.029)	(0.129)	(0.014)	(0.015)	(0.015)	(0.045)
Size of rural population (%)	0.033	0.085	0.054	−0.024	0.070	0.225	0.079	−0.188	0.107	0.067*	0.130*	0.261
	(0.112)	(0.066)	(0.088)	(0.273)	(0.191)	(0.156)	(0.071)	(0.227)	(0.079)	(0.040)	(0.068)	(0.210)
Number of observations	338	338	338	338	130	130	130	130	208	208	208	208
Adjusted R^2	0.783	0.750	0.468	0.302	0.728	0.526	0.241	0.080	0.668	0.691	0.496	0.286

Note: Standard errors (in parentheses) are robust to heteroskedasticity and serial correlation. All regressions include state and year fixed effects. Regressions are weighted by the square root of the number of people in a state.

*** Significant at 1%.

** Significant at 5%.

* Significant at 10%.

been any trade-induced changes in household composition and in the occupational status of all household members. [38]

Note also that trade liberalization was more intense in the manufacturing sectors, with major tariff reductions taking place from 1990 onward (see Section 2). In the agricultural sectors, there was less reduction in protection from 1990 onward and Brazil has strong comparative advantages in these sectors, where an important rise in exports has occurred (see Section 2b). [39] So when only rural areas within states are considered, it is not surprising to find levels of inequality (and possibly poverty) reduced if anything.

Another reason for observed differences in the results on poverty and inequality across urban and rural areas may be related to a differential role of social transfers. In particular, given the major role of conditional cash transfer programs in poverty reduction, we were concerned that if these transfers were correlated with exposure to trade, their omission would result in an omitted variable bias. Unfortunately, our data cannot identify individuals' income sources (and more specifically transfers received) for the entire period of analysis nor can we capture federal expenditures by state. [40] But we do know that conditional cash transfer programs were initially implemented in a few municipalities to be rolled out nationwide in 2001 (essentially with the introduction of the "Bolsa Escola" and "Bolsa Alimentação" programs, then unified and scaled up in the "Bolsa Familia" program in 2003). The fact that our opposing and significant effects across urban and rural areas within states show up more clearly in our first sub-period, is in this sense reassuring. [41]

Our findings for poverty are in line with recent results for Indian districts (Topalova, 2007), even though no parallel significant effect on inequality is found in India. However, the poverty increase due to trade liberalization observed in India occurs in the rural world, while it appears to occur in urban areas in Brazil. Whereas, in the case of India, sectors that have been relatively more affected by tariff reductions are concentrated in rural districts, descriptive evidence for Brazil (Figure 2) shows that trade liberalization was more intense in manufacturing sectors, typically set up in urban zones.

We have investigated whether our results are robust to a variety of specifications. In particular, we have estimated regressions excluding states that can be considered to be outliers, like Distrito Federal and Amazonas. On the one hand, Distrito Federal (Brasília) has a very peculiar productive, labor, and revenue pattern compared with the rest of the country. It is a fundamentally administrative city in which the majority of national government activities are concentrated. Amazonas, on the other hand and as pointed out earlier, benefits from special trade regimes because of the "free trade zone" status held by the Manaus industrial area. As regards poverty, a different poverty line of R$75 was also tested. Additional controls such as average population age by state or shares of female population, which could eventually clean for some issues related to geographic migration, have also been included though proved insignificant. In all cases, our main results hold. [42]

(b) *International trade, poverty, and inequality*

Brazil is one of the few countries in which international trade flows can be observed and measured by federal units, and where the number of units of analysis allows exceptionally for the use of a regression framework to study the effects of import penetration and export exposure on state poverty and inequality. These indicators reflect the degree of integration of Brazilian states into world markets. Note that they differ from our *LIB* measure based on tariff cuts. They are not exclusively influenced by trade policies, as trade flows are also determined by other factors such as transport costs, macroeconomic policies, factor endowments, the country's size, and geographical situation, etc. In the end, the combination of data on tariffs as well as on imports and exports at a subnational level, allows for an all-embracing appraisal of the distributional impacts of trade.

Table 3 presents the impact of trade openness indicators on poverty and inequality for the whole 1989–2004 period as well as for sub-periods 1989–96 and 1997–2004. To capture the effect of international trade, we have included lagged import penetration and lagged export exposure ratios simultaneously. Given that no separate data are available on trade flows in rural and urban areas within states, we can only provide evidence using the state as a whole as the unit of analysis. Specifications including lagged import penetration and lagged export exposure ratios separately for agricultural and industrial sectors were also tested, in an effort to study the influence of trade integration at a more disaggregated level. However, no clear differential effect was observed between the industrial and agricultural sectors in terms of the impacts of trade exposure on poverty and inequality: results are similar to those with no disaggregation here presented.

Two noteworthy results emerge. The rise in export exposure appears to reduce poverty and inequality quite significantly while import penetration growth, though seldom significant, has the opposite effect. Our main observed effect concerns export exposure. If we evaluate the magnitude of the coefficient when the whole period is considered (columns 1 to 4), a one percentage point rise in export exposure leads to a 0.17 fall in poverty based on the headcount ratio. As regards inequality, a one percentage point rise in export exposure decreases the Gini coefficient by -0.14 (-0.43 in the Theil index). As expected, when looking by sub-period, both effects are significant and with higher coefficients in the 1997–2004 sub-period. Indeed, if trade reforms took place in the initial years, trade integration into world markets only started to really increase in 1999.

To sum up, trade integration via rising export ratios clearly contributes to a fall in poverty and inequality. Conversely, a rise in the import penetration ratio, when significant, increases poverty incidence at state level. We see that import penetration yields results consistent with our findings regarding the trade policy-based measure in urban areas where tariff cuts are also related to rising poverty levels.

5. CONCLUSION

Brazil has undergone an extensive trade liberalization reform since 1988, which has significantly changed the economy's level of protection. Since the 1990s, Brazil has also posted a slow but significant downturn in both poverty and inequality indicators, although high levels of inequality and persistent poverty remain, with considerable geographic differences. Can we establish a causal link between changes in trade policies and international trade flows and changes in poverty and inequality across regions in Brazil over the last two decades? Is this effect different in rural and urban areas?

This paper draws on various data sources to quantify the impact of trade liberalization and international trade on household income inequality and poverty across Brazilian states from 1987 to 2005. In particular, we measure whether states more exposed to trade posted relatively smaller or larger changes in household poverty and inequality than less exposed states. Our main contributions to the literature are threefold. First, by using

sub-national units of observation (in our case, Brazilian states together with the distinction between rural and urban areas within states), this paper adds to the recent literature that includes a spatial dimension in the study of trade liberalization effects on income distribution. Second, the availability of long household survey series of remarkable quality allows for various measures of household poverty and inequality at state level to be calculated. This means that the analysis can include how trade affects not only workers, but also their dependents and people involved in nontraded sectors. Last but not least, we consider both trade policy variables and international trade flow variables (at the sectoral level) in an effort to be exhaustive in the assessment of the distributional impacts of trade.

Our results show that, regardless of the nationwide effects of trade liberalization, states' urban areas more exposed to tariff cuts (that is with a greater share of workers in industries with initially high tariffs) experienced smaller reductions in household poverty and inequality. In the rural world, trade liberalization seems to have been inequality (and perhaps poverty) decreasing. These results are nonnegligible and are confirmed by several robustness checks.

Tariff cuts are only one aspect of trade openness. When measures based on international trade flows are considered, our results find significant and opposite effects for import penetration and export exposure ratios. A rise in the export exposure of Brazilian states appears to reduce poverty and inequality quite significantly while growth in import penetration, when significant, increases poverty at the state level—this latter result is in line with the finding for tariff reductions. As rising export ratios have a positive effect on welfare outcomes, the reduction in poverty and inequality in Brazil might be bolstered by the recent Brazilian trade performance. Indeed, Brazil has been posting a trade surplus since 2002 and sharp growth in exports in recent years.

Finally, and although beyond the scope of this paper, our differential effects across urban and rural areas in Brazil should encourage further research on the various trade transmission channels in operation for household income distribution, which may work differently depending on geographic location. The role of trade-induced changes in labor income, but also in household composition and occupational status of all household members could well differ across regions.

NOTES

1. Another recently developed branch of the literature uses new economic geography models to study whether incomes or wages are higher in regions with access to larger markets for their goods (see, for example, Fally, Paillacar, & Terra, 2010).

2. For example, studies have introduced other factors such as trade-induced skill-biased technological change, trade in intermediate goods and outsourcing. The initial structure of protection must also be considered.

3. Porto studies the impact on household poverty by estimating general equilibrium distributional effects (using the channel of prices and wage price elasticities).

4. Note that the result on whether skill premium fell over time is a debated issue and depends, among other things, on how skill is measured. In the works here cited skilled workers are defined as those with 11 or more years of schooling.

5. An exception is the study by Arbache, Dickerson, and Green (2004), which finds rising wage inequality in the trade sector.

6. One reason that could account for this last result is the nature of the Brazilian structure of protection prior to liberalization and how it has changed. Contrary to some other Latin American countries—for example Mexico (Hanson, 2004) and Colombia (Attanasio *et al.*, 2004)—pre-liberalization tariffs in Brazil were higher in industries relatively intensive in skilled labor (Ferreira *et al.*, 2007; Gonzaga *et al.*, 2006). The objective of the Brazilian government was to reduce tariffs across industries to more uniform rates. Consequently, tariff reductions were greater in skill-intensive industries (Gonzaga *et al.*, 2006). In keeping with the Stolper-Samuelson predictions, this could explain how trade liberalization contributed to a reduction in inequality.

7. Namely 26 states plus the Distrito Federal or Federal District.

8. The types and depth of the economic policies varied from country to country. For an analysis of the main Latin American economies after the 1950s, see, for example, Cano (2000) or Bethell (1994).

9. A tariff is redundant when nominal tariff is so high that its reduction does not necessarily modify the quantity of imports.

10. For a more detailed analysis of Brazilian trade reform, see Kume, Piani, and Souza (2003) and Pereira (2006).

11. This measure was abolished in 2003.

12. Several authors (see, for instance, Ribeiro, 2006; Kannebley Jr., Prince, and Scarpelli, 2010) suggest that export volumes are becoming more sensitive to changes in international demand than to the exchange rate. In 2004, the real appreciation in the Brazilian currency (some 10% over the year) was not strong enough to lessen the positive effect of international demand on exports.

13. Although some interest groups representing business people may have exerted some influence on trade policy-making, it was limited to specific sectors in the case of Brazil (see Abreu, 2004). Since Brazil initiated an economy-wide liberalization process and made its greatest tariff cuts in the most protected sectors, the question of the endogeneity of trade liberalization sometimes raised when studying its impact on income distribution should be less of an issue in the Brazilian case, as already underlined by Goldberg and Pavcnik (2007).

14. Goldberg and Pavcnik (2007) find that in developing countries in recent years, NTB coverage ratios and tariff rates (as well as their changes), whenever available, are positively correlated. This indicates that they have been used as complements and not substitutes. In the case of Brazil, Carvalho Jr. (1992) considers that NTBs were usually applied before 1990 as a complement to high level tariffs, causing tariff redundancy without any additional effects on imports. In 1997, the Brazilian government introduced some sanitary measures, but they did not seem to have played an effective role in restricting imports.

15. The research community has put forward a few tentative explanations for these more recent reductions in inequality and poverty levels in Brazil, among which: the observed downturns in inequality among educational subgroups in the population (due to a reduction in the educational heterogeneity of the labor force together with the compression of the distribution of returns to education), improved integration of rural and urban labor markets, a potential reduction in ethnic inequalities, and an increase in and better targeting of social transfers with the adoption and expansion of conditional cash transfer programs (Ferreira, Leite, & Ravallion, 2010; Ferreira *et al.*, 2008; Paes de Barros, Foguel, & Ulyssea, 2006).

16. Brazil being a very large country, trade policies along with distance, natural barriers to trade, transport infrastructure and access to major seaports play an important role in the trade integration of the different federal units.

17. São Paulo, Minas Gerais and Rio Grande do Sul.

18. São Paulo, Rio de Janeiro, Rio Grande do Sul.

19. The only exceptions are the two wealthy states of Distrito Federal and more importantly São Paulo, plus Rondonia, Acre, Roraima, and Amapá—four states in the North of Brazil, a low-income cluster in the country for which only urban data are available.

20. The PNAD skips three of the years in the period of analysis: for budgetary reasons in 1994 and the census years of 1991 and 2000.

21. Rural areas not covered by the PNAD until 2003 and, therefore, excluded from our analysis are specifically in the states of Acre, Amapá, Amazonas, Pará, Rondônia, and Roraima, which, according to census data, represent about 2.3% of the Brazilian population. The PNAD surveys report that about 77% of the population was living in urban areas in 1987, a share that reached 86% by 2005, not including the six states mentioned above.

22. The number of states considered in this study is 26. Tocantins was created in 1988 from the northern part of the state of Goiás, but the distinction between the two states was not made in the PNAD until 1992. Due to the exclusion of rural areas in the Northern region before 2003, the number of cross-sectional units is 26 in urban areas and 20 in rural areas.

23. Monetary values have been inflated to September 2006 prices using the IBGE deflators derived from the INPC national consumer price index (see Cogneau & Gignoux, 2009; Corseuil & Foguel, 2002).

24. The general formula of the FGT family of poverty measures is: $FGT_\alpha = \frac{1}{n}\sum_{i=1}^{q}[(z-y_i)/z]^\alpha$ 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 a parameter determining the weight given to the distance of households from the poverty line. An α equal to zero gives us the headcount ratio and an α equal to one represents the poverty gap.

25. Though Brazil does not have an official poverty line, an ad-hoc administrative poverty line of about R$100 (2006 values), corresponding to the means test in Brazil's new cash assistance program, Bolsa Familia, is gaining usage in the research community (see Ferreira *et al.*, 2008).

26. Labor market variables are available from the PNAD for individuals aged 10 years and over. We consider this population for all labor market variables and education variables in each state. Note that definitions on all socie-economic variables used in this study have been harmonized, since methodological changes have taken place in the PNAD surveys during the period of analysis. The authors are grateful to Pierre-Emmanuel Couralet and Jeremie Gignoux for their help in building the harmonized data series.

27. The share of agricultural sector takes into account the number of workers that declare their sector to be either agriculture or agri-food industries.

28. These 31 sector-specific ad valorem tariff levels correspond to the weighted averages of more disaggregated product-specific ad valorem tariffs, where the weights are the value-added in each narrowly defined product group. The authors are grateful to Honorio Kume for kindly providing us with tariffs data.

29. In our trade policy measure *LIB*, workers in nontraded industries are assigned a tariff of 0, and as a consequence, the magnitude of trade policy effects may, by construction, be understated. Some authors (Edmonds, Pavcnik, & Topalova, 2010; Topalova, 2007) propose to instrument by a second indicator (this one overstating trade policy effects), where the employment shares would be calculated solely for employment in "tariff-protected" industries. In our case, when we compare the F-statistic on the excluded instruments of the first stage regression with Stock and Yogo (2005) critical values, the instrument appears to be weak. Thus, our preferred indicator, though conservative, remains our *LIB* measure.

30. The original data provide the tariff levels for 31 sectors at the *Nivel 50* industrial classification level. 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). Initial and final year values of our LIB measure by state are included in Table 1.

31. These data series are only available as of 1989. Note that according to the SECEX, an exporting state is where agricultural products are grown, ores mined, and manufactured goods produced totally or partially. In this latter case, the "exporting" state is the one that completes the last step in the manufacturing process.

32. Given that the first years in our period of study posted high inflation rates, the choice of exchange rates matters. So robustness to this choice was tested by another calculation method. Using states' GDP series from the IBGE in current market prices, we calculated the share of each state in total Brazilian GDP. Each state's GDP was then calculated by applying these shares to Brazil's GDP in current dollars provided by the World Development Indicators database (WDI, World Bank). The two methods find very similar values for the entire period under study.

33. We use the PNAD surveys to gain an insight into geographic migration in Brazil: between 1992 (first year with migration information in the PNAD surveys) and 2005, nearly 90% of individuals say they have lived in the same state for the past ten years. Only about 5% say they have lived in their state less than four years. These percentages are obtained considering the total population. Other studies, such as Fiess and Verner (2003), find a much higher percentage of migrants (they present figures of up to 40%). However, they only look at household heads (not the total population) and they classify them as migrants if they have migrated at least once during their entire lifetime. Indeed in a footnote, they indicate that their methodology overestimates migration numbers compared with the Brazilian Census data.

34. This result may suffer from omitted variable bias (see further discussion in the text).

35. 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 for the variable of interest *LIB* are robust to the omission of this variable.

36. Concerning our control variables we obtain a consistent positive and significant coefficient on the share of skilled population in a state (10 or more years of schooling): the higher this share is, the higher inequality appears. An increase in the share of informal workers raises inequality in urban areas only (no significant effect is found in rural areas). Lastly, other control variables (the share of individuals declaring themselves to be "white", the size of the agricultural sector, GDP growth rates) are insignificant or not robust to the choice of inequality measure.

37. In rural areas, the effect is significant at 10% using the Theil index (more sensitive than the Gini coefficient to changes in the tails of the distribution) and at 15% using the Gini index. Control variables in all regressions, when significant, have the expected signs.

38. To our knowledge, the only study that has endeavored to investigate the implications for household income distribution of trade-driven changes in wages is Ferreira *et al.* (2007). Using earnings-based simulations and taking Brazil as a whole, they observe that reductions in wage inequality appear to extend to declines in household income poverty and inequality. However, as the authors recognize, their "earnings-based simulations are not the most suitable way for understanding differences between full household income distributions" (p. 31), as the indirect impacts of trade on family composition or on the occupational decisions of household members other than the spouses are not considered. Although our framework of analysis is not comparable, since our units of analysis are Brazilian states and not Brazil as a whole, our differential results across urban and rural areas should encourage additional research on the various trade-transmission channels that operate for household income distributions. Ferreira *et al.* (2007) point, for example, to the use of more general specifications of micro-simulation models (Bourguignon, Ferreira, & Lustig, 2004) to study the welfare impacts of trade reforms.

39. The average tariff for agricultural products stood at less than 10% from 1989 onward, whereas the average tariff for all products was over 30% in 1989 and remained above 10% thereinafter.

40. We were only able to construct series of local social security and social assistance expenditures made by states. But these variables only capture a minimal share of the public transfers received by households and proved irrelevant. Besides, the role that the establishment of rural pensions may have played in rural areas cannot be taken into account, because the PNAD surveys do not identify these sources of income for the entire period of analysis.

41. Re-running regressions only excluding the 2001–05 period provides similar results.

42. All nonincluded estimations are available from the authors on request.

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