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Income Distribution and the Demand for Imports in Brazil

David Riker*

Jessica Vila-Goulding*

U.S. International Trade Commission

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Address correspondence to:
Office of Economics
U.S. International Trade Commission
Washington, DC 20436 USA

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ABSTRACT

Changes in a country's income distribution can alter its pattern of international trade. We examine the effect of the recent decline in income inequality in Brazil on the country's demand for imports of final consumer goods from the United States and the rest of the world. We estimate a set of product-specific import demand models without restriction on the income elasticity of demand. Then we use the models to estimate the contribution of changes in Brazil's income distribution to the country's imports of several final consumer products between 2001 and 2009.

Keywords: Income inequality, international trade, Brazil, gravity model

JEL Codes: F10, F14, I32

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1. Introduction

Brazil exhibits an unusually high degree of income inequality, though the inequalities have narrowed significantly over the last decade. This reduction in income inequality can have a significant effect on the demand for imported consumer goods that are income elastic. When the demand for imported consumer products has an income elasticity that is greater than one, a reduction in income inequality will reduce the rate of increase in the demand for some imported products (luxury goods) relative to what it would be at the same aggregate income level but with a more even distribution of income.

There is an extensive economics literature that relates international trade to a country's income distribution. Traditionally, this literature has focused on the effects of trade on the income distribution, often in the context of factor content studies of international trade flows like Chakrabarti (2000), Panagariya (2000), and Bensidoun, Jean, and Sztulman (2005). Castilho, Menendez, and Sztulman (2011) specifically focus on the implications of trade on the income distribution in Brazil. They find that Brazil's trade liberalization after 1988 raised income inequality in urban areas but reduced it in rural areas.

On the other hand, there is a more limited literature focusing on effects in the opposite direction. That is, the impact of countries' income inequalities on the pattern of their international trade, specifically their imports of luxury goods. As Mitra and Trindade (2005) explain, this second issue is rarely addressed in models of international trade because it is precluded by the common modeling assumption that consumers in different countries have homothetic preferences and the income expansion paths of their import demands are linear. This restriction on import demands is convenient since it limits the data requirements of the trade models.[2] Nevertheless, the validity of the restriction should be tested. Mitra

[2] Under this assumption, the income distribution within each country does not affect the pattern of international trade.

and Trindade (2005) show that non-unitary income elasticities of import demand can significantly change the predicted pattern of international trade. They can even create a separate, demand-side reason for trade. Their model is an extension of the gravity model that allows for non-unitary income elasticities. Dalgin, Trindade, and Mitra (2008) provide empirical support for this extended gravity model of trade. In their study, they classify SITC four-digit products as either luxury goods or necessity goods.[3] Then, they aggregate the trade flows into these two groups. Their estimates indicate that greater income equality, measured by the countries' GINI coefficients, has a significant positive effect on the countries' imports of luxury goods. However, the result holds only for developed countries like the United States, not for the developing countries in their estimation sample, which includes Brazil. They infer that the products that they identify as luxury goods based on the expenditure shares of consumers in the United States are probably not the same set of products that are luxury goods in the developing countries. For this reason, they conclude that their model is much less applicable to the imports of developing countries.

Our paper contributes to this second branch of the literature by quantifying the impact of changes in the income distribution of Brazil over the past decade on the country's demand for imports of several final consumer products. We estimate a set of product-specific econometric models of import demand that does not restrict the income elasticity to be equal to one and therefore allows for luxury goods.[4] We estimate separate econometric models for several HS four-digit products that are clearly final consumer goods.[5] The four products comprise items that we expect to be luxury goods (imported passenger vehicles and refrigerators) and necessity goods (imported retail pharmaceuticals and soap products). The estimation uses a panel of the imports of Brazil and nine other comparable countries in Latin America and the Caribbean, from fifty different countries of origin between 2001 and 2009.

[3] Francois and Kaplan (1996) is another earlier econometric study that estimates non-homotheticity in import demands. They use a different methodology for classifying luxury goods based on product differentiation.

[4] Luxury goods are conventionally defined as products with an income elasticity of demand that is greater than one.

[5] The import data are from the World Bank's WITS database, which is derived from COMTRADE.

Following Dalgin, Trindade, and Mitra (2008), our econometric analysis adopts a gravity model framework and allows for non-unitary income elasticity of import demand. However, there are substantial differences. First, our model does not impose a classification of products into luxury and non-luxury goods. Second, it does not aggregate across the specific products. Third, it allows for greater variation in the income elasticities of the specific products.

We have organized the paper into four parts. Section II provides an overview of recent trends in income inequality in Brazil. Section III derives a model of import demand that incorporates non-homothetic preferences and income distributions. Section IV discusses methodological issues and data sources used, and it reports a set of econometric estimates of the parameters of the models. We in turn use these estimates to calculate the part of the change in Brazilian imports between 2001 and 2009 that is attributable to the change in the country's income distribution over the period. In Section V, we summarize our conclusions.

2. Income Inequality in Brazil

Historically, Brazil exhibited an unusually high degree of income inequality, ranking among the top five to ten most unequal nations in the world, depending on the source and the metric used in the international comparisons. Table 1 reports the global rankings for the fifty most unequal countries in the world based on data from the World Bank's World Development Indicators database.

In the 1980s and the first half of the 1990s, Brazil's income inequality was reflected in a high average GINI coefficient of 0.59. During the country's transition from its military regime to a democratic government, policy efforts to address the severe income inequality of the nation remained limited. According to Neri (2012), the adoption of currency stabilization plans, inflation-targeted monetary policies, educational reforms, and social transfers would plant the seeds for what would be known in the 2000s as the period of inequality fall. The significant reductions in inequality over the last decade have

been attributed primarily to the education system reforms and social welfare policies implemented in the mid-1990s.

In addition to increasing federal spending on education, the education policy reforms of the mid-1990s also synchronized the roles of federal, state and municipality governments. This improved framework allowed for enhanced control and monitoring of education quality. According to Souza (2012), new priority shifts towards primary and secondary education led to greater access opportunities for the unprivileged and increased school attendance rates overall.

In 2003, the new welfare program Bolsa Familia introduced the distribution of direct cash transfers to low income and poor families with the aim of reducing poverty. The benefits were set conditional on a family's compliance with specific health and education requirements. These include mandatory school attendance for school-age children and adolescents, as well as compliance with regular physical check-ups, vaccinations and pre and post-natal care. Soares (2010) reports that more than 9.2 million households (16.2% of all households) benefitted from Bolsa Familia in 2009, up from 5.8 million (11.8% of all households) in 2003. The latest data show the number of eligible households amounted to more than 13 million in 2011.[6]

As the Brazilian population attained more and better education, access to formal labor employment flourished and, in turn, unemployment declined, as we illustrate in Table 2. This trend, coupled with the welfare program Bolsa Familia, resulted in household per capita income growth and income inequality reductions between 2001 and 2009.

The pronounced decline in Brazil income inequality brought forth upward social mobility. According to Neri (2010), nearly 30 million people had climbed into middle class (or "C" class) in Brazil between 2003 and 2009. This translates into approximately 95 million people of middle class status, or about 51% of the population. These remarkable improvements in the living standards of the Brazilian

[6] Source: http://socialsecurityextension.org/gimi/gess/ShowTheme.do?tid=1805.

population motivate our interest in quantifying how income distribution changes in Brazil have affected the country's imports.

To first measure the effects of income distribution changes in Brazil from 2001 to 2009, and then estimate their effects on the country's imports, we employ income share deciles from the Brazilian national household survey, Pesquisa Nacional por Amostra de Domicilios (PNAD). This survey is conducted by the IBGE, the national statistics office of Brazil. PNAD is available annually (except for 1980, 1991, 1994 and 2000) and covers more than 100,000 households per year. Souza (2012) comments that one of the main appeals of this survey for the study of Brazil's income distribution is the relatively minor revisions in methodology since the survey was first released in 1976. In addition to consistency over time, PNAD's broad coverage tracks income from informal labor sources. This is an advantage over standard GDP per capita metrics. It provides more accurate measures of income per capita and its growth over time. Neri (2010) explains that while GDP per capita grew 2.9% during 2003-2009, income per capita calculated from PNAD grew 4.7% a year. This substantial variation supports our emphasis on the PNAD survey as our main source of data on Brazil's income distribution. One of PNAD's drawbacks, however, is its sample design, which assigns greater weight to larger Brazilian municipalities. Nevertheless, Souza (2012) concludes that this limitation does not constrain the survey's ability to track key income inequality and distribution patterns.

The PNAD's income deciles data for Brazil reveal significant improvements in the income distribution of the country during the 2001-2009 period. Table 3 reports the share of income in each decile of Brazil's population. The share of income accruing to the richest fifth of the population fell from 62.6% in 2001 to 58.3% in 2009, a decline of 4.3 percentage points. After aggregating deciles into quintiles, we also observe a redistribution of 0.7 percentage points to the fourth quintile, as well as a 1.1, 2.2, and 0.3 percentage points gain in the third, second and first quintiles, respectively. In a comparison of PNAD's data with World Bank's income quintiles for Brazil, the PNAD data indicate greater distribution improvements in the second quintile, while the World Bank data indicate that greater gains

accrued in the third quintile. Figure 1 shows the movement of Brazil's GINI coefficient between 1981 and 2009.

Other Latin American and Caribbean countries exhibited similar reductions in income distribution over the last decade. In Argentina, El Salvador, Paraguay and Peru, the share of income held by the richest fifth of the population also fell 6.5%, 3.7%, 4.9% and 4.8%, respectively. However, in Colombia, Costa Rica, Dominican Republic, Honduras and Uruguay, the share held by the richest fifth either remained unchanged or increased. Figure 2 shows the evolution of the GINI Index for the ten Latin American and Caribbean countries that we analyze in more detail below.

3. A Model of Income Inequality and Import Demand

In this section, we present a model of consumer demand for specific imported products. We assume that the consumers' preferences have the same form within each country (but may vary across countries) and have an income elasticity that is potentially greater than one. Equation (1) represents the FOB value of imports of the specific product from country of origin o to individual consumer i in destination country d in year t.[7]

$$M_{iodt} = \frac{\alpha_d \, \delta_{ot}}{f_{od}} \, (Y_{idt})^{\beta} \qquad (1)$$

The log-linear functional form in (1) is consistent with a Cobb-Douglas model, which has an elasticity of substitution of one between products from different countries.[8] Cobb-Douglas is the demand structure in traditional gravity models of international trade. The variable Y_{idt} is the income of individual i in country d in year t.[9] The variable f_{od} is an ad valorem internal trade cost for products imported from

[7] We omit the subscript for the product, since (1) is a product-specific model.

[8] Equation (1) generalizes the model by allowing for the parameter α_d to vary by country.

[9] Technically, Y_{idt} is the total expenditures of individual i, which we assume are equal to his or her disposable income.

country o to country d. It is a combination of freight costs, which are increasing in the distance between the two countries, and other trade frictions that vary by destination country but are relatively constant over time. The parameter α_d is a country effect that allows for different preferences for the product across the destination countries. The parameter δ_{ot} is a country-year effect that accounts for fluctuations in the economy of the country of origin. The parameter β is the elasticity of import demand with respect to the income of consumer i. We expect that it will be positive, and it may be greater than one.

The individual's marginal expenditure on the imported good varies with the individual's income level if $\beta > 1$, but not if $\beta = 1$. If $\beta > 1$, then each additional dollar of the individual's total expenditures increases the individual's expenditure on the imported good by more than on dollar. In this case, the product is a luxury good by definition, and a zero-sum distribution of income from richer individuals with higher total expenditures to individuals with lower total expenditures will reduce the average expenditure on the imported product.

Since we do not observe import expenditures at the individual level, we aggregate the expenditures of the individual consumers in (1) and then convert this sum into average expenditures per capita.[10] The total expenditures per capita in country d on imports of the product from country o is the average of the expenditures of the individual consumers within country d.

$$\frac{M_{odt}}{N_{dt}} = \frac{\sum_i M_{iodt}}{N_{dt}} = \frac{\alpha_d \, \delta_{ot} \, \sum_i (Y_{idt})^{\beta}}{f_{od} \, N_{dt}} \qquad (2)$$

[10] In some cases, it may be possible to observe product expenditures at the level of individual consumers. However, since our model focuses on import demand, the individual expenditures data would have to be specific to imports. For example, imported passenger vehicles are generally more likely to be regarded by consumers as luxury goods, especially in developing countries, while domestic substitutes may not. Our model neither impose this asymmetry, nor rules it out.

In equation (3), we factor out the per capita income term $\left(\frac{Y_{dt}}{N_{dt}}\right)^{\beta}$.[11] The variable N_{dt} is the population in country d in year t. We also assume that the ad valorem international trade cost f_{od} is a parametric function of the international distance, $\frac{1}{\gamma}\ (K_{od})^{\rho}$.

$$\frac{M_{odt}}{N_{dt}} = \alpha_d\ \delta_{ot}\ \left(\frac{Y_{dt}}{N_{dt}}\right)^{\beta}\ \left[(N_{dt})^{\beta-1} \sum_i\ (s_{idt})^{\beta}\right] \gamma\ (K_{od})^{-\rho} \qquad (3)$$

The variable K_{od} is the distance from country o to country d in kilometers, and the elasticity of trade costs with respect to distance, ρ, is positive. The variable Y_{dt} is equal to $\sum_i Y_{idt}$. The variable s_{idt} is the income share of the individual i in country d in year t.

When $\beta = 1$, equation (3) simplifies to (4).

$$\frac{M_{odt}}{N_{dt}} = \alpha_d\ \delta_{ot}\ (Y_{dt})\ \gamma\ (K_{od})^{-\rho} \qquad (4)$$

Equation (4) is a traditional gravity model of international trade, expressed in per capita terms. The country-year effect δ_{ot} serves as a control for the level of aggregate income in the country of origin o in year t. In this case, the per capita income measure $\frac{Y_{dt}}{N_{dt}}$ is the only income data for the destination country that is needed. On the other hand, if $\beta \neq 1$ for the specific product, then the country's expenditures on imports of the products depends on the detailed income distribution within the destination country.

4. Estimates of the Impact of the Reduction in Brazil's Income Inequality

In order to econometrically estimate the value of β, the income elasticity of demand for each product, we pool together data on the per capita imports and per capita income from fifty countries of

[11] In principle, we could allow the parameter β to vary with characteristics of the individual, including the individual's income level. However, we have imposed the parameter restriction that $\beta_i = \beta$ for all individuals for practical estimation reasons. First, it allows us to factor out the aggregate income term in (3). Second, it allows us to pool across countries and over time when econometrically estimating this important parameter of the model.

origin over nine years. First, we simply test whether β is equal to one, which is a restriction imposed in most models of international trade. Equation (5) is the specification for our product-specific econometric models.

$$\frac{M_{odt}}{N_{dt}} = \alpha_d \left(\frac{Y_{dt}}{N_{dt}}\right)^{\beta} \delta_{ot} \ \gamma \ (K_{od})^{-\rho} \ \varepsilon_{odt} \qquad (5)$$

The additional variable ε_{odt} is the error term of the model. It includes measurement error in per capita imports. Under the null hypothesis that $\beta = 1$, the error term does not include the income distribution and population terms in square brackets in (3). By testing the null hypothesis, we are assessing the qualitative importance of income inequality to the trade flows even relying on measures of the extent of income inequality in each country. This is useful, since it is difficult to collect reliable data on income inequality that is comparable across countries and over time.

In our econometric analysis, we assume that the income per capita of the destination country, Y_{dt}, is not correlated with shocks to the demand for the specific import product, or that the correlation is small, since none of the products comprise a large share of the destination country's economy. Therefore, we treat this variable, as well as the international distances, as exogenous explanatory variables in the econometric analysis.

The simplest way to estimate the value of the income elasticity β is to transform (5) into a linear equation by taking the natural log of both sides and then applying Ordinary Least Squares (OLS). However, the problem with estimating gravity models in logs is that the many observations with zero bilateral trade flows are dropped from the estimation. To address this concern, we also consider two alternative estimators. Santos Silva and Tenreyro (2006) recommend the use of Poisson models to estimate log-linearized economic models like (5).[12] Our Poisson models include the same set of explanatory variables and the same log-linear functional form but different assumptions about the

[12] They demonstrate that OLS estimates of the coefficients of log-linearized models will be biased if there is heteroskedasticity in the error terms, as is often the case in cross-sectional estimation involving many different countries.

distribution of the error terms. In the Poisson models, the dependent variable is the value of imports per capita, in levels rather than logs. While the assumptions about the error term in the Poisson model are arguably more appropriate than OLS, they are still restrictive. The Poisson model assumes that the variance of the error term is equal to its mean. Our third alternative estimator, the negative binomial pseudo maximum likelihood (NBPML) estimator, generalizes the Poisson model by relaxing this restriction.

We focus our econometric analysis on several HS four-digit products that are final consumer goods. The four products are a combination of products that we expect are luxury goods (imported passenger vehicles and refrigerators) and necessity goods (imported retail pharmaceuticals and soap products).[13] Tables 4, 5, 6, and 7 report the OLS, Poisson, and NBPML estimates based on the specification in (5) for each of the four products. Within each table, the estimates of β are fairly similar for the three estimators. They are significantly greater than one for imports of passenger cars and refrigerators. They are not significantly different from one for imports of retail pharmaceuticals and soap products. In all of the models, the measure of international distance has a significant negative effect on imports. All of the models include country-year fixed effects for the country of origin and country fixed effects for the destination country. These fixed effects are significantly different from zero according to the *F* tests reported in the tables.

If $\beta > 1$, then the estimate of β based on (5) is biased, since this specification omits the income share terms in (3). The direction of bias depends on the correlation between average income levels and income inequality. Table 8 reports the correlation between income per capita and two alternative measures of income inequality, the GINI coefficient and the share of income earned by the top fifth of the country's population, for ten countries. These are the ten countries in the Latin America and the Caribbean region for which the World Bank reports annual income inequality measures for the period

[13] Some of these products are durable goods. In principle, the demands for durables can depend on past and expected future income. However, modeling these dynamics is beyond the scope of this paper.

from 2001 to 2009. Both of the correlations are negative for almost all of the countries, and are small for the rest. The strongest negative correlations between income per capita and the income inequality measures are for Brazil. Based on these correlations, we expect that income inequality is negatively correlated with per capita income *within* the destination countries and that estimates of β based on (5), absent the omitted income inequality terms, are biased downward. For this reason, we expect that they are a lower bound estimate of the income elasticity β.

Finally, we use the parameter estimates from Tables 4 and 5 to calculate the effect of the change in Brazil's income distribution between 2001 and 2009 on the country's imports of the two consumer products with non-unitary income elasticity, based on the formula in (6). This is derived from the model in (3).

$$\%\Delta M_{odt} = \left(\frac{\sum_i \left(s_{id,2009}\right)^{\beta} - \sum_i \left(s_{id,2001}\right)^{\beta}}{\sum_i \left(s_{id,2009}\right)^{\beta}} \right) \times 100 \qquad (6)$$

This is a counterfactual calculation: it is an estimate of how much larger Brazil's imports of the specific products would have been in 2009 if the income shares were still at 2001 values, relative to the value that actually prevailed in 2009. Unlike most comparative statistic analyses, the calculation in (6) is not a derivative. It is a comparison of two expenditure levels, one based on the actual income distribution in 2009 and all other factors in (3) at their 2009 values and a counterfactual one based on the income distribution in 2001 but with all other factors at their 2009 values. This calculation isolates the incremental effect of a change in the income distribution, for a given level of aggregate income.

Table 9 reports the estimated effects. These are the percentage changes in the demand for imports from the United States and also from the other countries of origin. In the context of the model in (3), the change in Brazil's income distribution, holding all else fixed, will have an equiproportional impact on imports from all countries of origin. In all of the cases (both products and all three estimators), the decline in Brazil's income inequality had a negative impact on Brazil's imports. The largest effects

were for the NBPML estimates, which we regard as the best of the three estimates for the methodological reasons identified above. Holding all other factors constant, we estimate that the decline in income inequality in Brazil between 2001 and 2009 had a negative contribution to the growth in the demand for imports of passenger vehicles by at least 2.3% and reduced the demand for refrigerators by at least 1.8%. On the other hand, the income elasticity of demand for imports of retail pharmaceuticals and soap products is not significantly different than one. Between 2001 and 2009, Brazil's imports of the two products grew substantially. Therefore, while these negative percentage changes reduced the growth of Brazil's imports, they were not large enough to completely offset that growth.[14]

5. Conclusions

The last decade has seen a significant reduction in income inequality in Brazil, and we expect that this trend will continue. The reduction in income inequality has slowed the growth in import demands for two of the products that we examined. Our econometric results indicate that the demand for imported passenger vehicles and refrigerators in most developing countries in the Latin America and Caribbean region exhibit income elasticities that are significantly greater than one. Therefore, the growth in demand for these imports slows as the income inequality in the destination country is reduced. We estimate that the decline in income inequality in Brazil between 2001 and 2009 reduced the demand for imports of passenger vehicles by at least 2.3% and reduced the demand for refrigerators by at least 1.8%. On the other hand, the income elasticity of demand for imports of retail pharmaceuticals and soap products is not significantly different than one. Therefore, the changes in income inequality in the destination countries did not contribute significantly to changes in their imports of these two products.

The econometric models do not directly address the effect of reductions in trade restrictions like tariffs, but they do have some general implications for models of the economic effects of trade

[14] Brazil's imports of passenger vehicles grew by 165% between 2001 and 2009 (ANFAVEA Brazilian Automotive Industry Yearbook). Its imports of refrigerators grew by 147% over the same period (WITS).

liberalization. As we discussed in the Introduction, there is an extensive literature that addresses how trade liberalization affects factor returns and income distributions. Changes in the distribution of income within a country will in turn affect the demands for any imports that have income elasticities greater than one, as we have demonstrated in this paper. This is an additional channel through which trade liberalization affects international trade flows.

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Table 1: GINI Coefficient for the 50 Most Unequal Countries in the World

Country	World Bank GINI Coefficient	Latest Year Available	Country Rank
South Africa	0.67	2006	1
Seychelles	0.66	2007	2
Comoros	0.64	2004	3
Haiti	0.60	2001	4
Angola	0.59	2000	5
Honduras	0.58	2007	6
Bolivia	0.57	2007	7
Central African Republic	0.56	2008	8
Colombia	0.56	2010	9
Brazil	**0.55**	**2009**	**10**
Guatemala	0.54	2006	11
Lesotho	0.53	2003	12
Rwanda	0.53	2005	13
Nicaragua	0.52	2005	14
Mexico	0.52	2008	15
Paraguay	0.52	2008	16
Chile	0.52	2009	17
Panama	0.52	2009	18
Zambia	0.51	2004	19
Sao Tome and Principe	0.51	2001	20
Swaziland	0.51	2001	21
Cape Verde	0.51	2002	22
Costa Rica	0.50	2009	23
Ecuador	0.49	2009	24
Dominican Republic	0.48	2007	25
Kenya	0.48	2005	26
Peru	0.48	2009	27
Bhutan	0.47	2003	28
The Gambia	0.47	2003	29
Congo	0.47	2005	30
Nepal	0.47	2004	31
Madagascar	0.47	2005	32
El Salvador	0.47	2008	33
Malaysia	0.46	2009	34
Argentina	0.46	2009	35
Jamaica	0.46	2004	36
Mozambique	0.46	2008	37
Uganda	0.44	2009	38
Macedonia	0.44	2008	39
Venezuela	0.44	2006	40

Table 1 (Continued): GINI Coefficient for the 50 Most Unequal Countries in the World

Country	World Bank GINI Coefficient	Latest Year Available	Country Rank
Cambodia	0.44	2007	41
Philippines	0.44	2006	42
Dem. Republic of Congo	0.44	2006	43
Ghana	0.43	2006	44
Turkey	0.43	2005	45
Nigeria	0.43	2004	46
Sierra Leone	0.43	2003	47
Thailand	0.42	2004	48
Côte d'Ivoire	0.42	2008	49
Russia	0.42	2008	50

Source: World Bank, World Development Indicators

Table 2: Education and Employment Statistics of Brazil between 1992 and 2009

Year	Literacy Rates (7-14 Years) %	Literacy Change (7-14 Years) year-over-year, %	Employment Rate (18+ years) %	Employment Change year-over-year, %	Unemployment Rate %
1992	86.6		65.8		6.5
1993	88.6	2.0	66.0	0.1	6.2
1995	90.2	1.6	66.4	0.4	6.1
1996	91.3	1.1	64.1	(2.3)	7.0
1997	93.0	1.7	64.4	0.3	7.8
1998	94.7	1.7	63.6	(0.8)	9.0
1999	95.7	1.0	63.8	0.2	9.6
2001	96.5	0.8	63.5	(0.3)	9.3
2002	96.9	0.4	64.4	0.9	9.1
2003	97.2	0.3	64.0	(0.4)	9.7
2004	97.2	0.0	65.0	1.0	9.0
2005	97.4	0.2	65.4	0.4	9.4
2006	97.7	0.3	65.7	0.3	8.5
2007	97.7	0.0	65.5	(0.2)	8.2
2008	98.0	0.3	66.3	0.8	7.2
2009	98.1	0.1	65.5	(0.8)	8.4

Source: IBGE/PNAD, Pesquisa Nacional por Amostra de Domicilio 1992/2009.

Table 3: Distribution of Income in Brazil in 2001 and 2009

Income Deciles	Percentage of Income in Each Decile in 2001	Percentage of Income in Each Decile in 2009
Top One Percent	13.6	12.6
Top Five Percent	33.7	30.8
Top Ten Percent	46.9	43.0
Ninth Decile	15.7	15.3
Eighth Decile	10.0	10.1
Seventh Decile	7.3	7.9
Sixth Decile	5.7	6.2
Fifth Decile	4.5	5.1
Fourth Decile	3.4	4.3
Third Decile	3.0	4.3
Second Decile	2.5	2.8
First Decile	1.0	1.0

Source: IBGE.

Table 4: Econometric Model of Imports of Passenger Cars (HS Code 8703)

Dependent Variable: Annual imports per capita of the product, by country of origin and destination

Explanatory Variable	OLS Estimation	Poisson Estimation	NBPML Estimation
Income per Capita	1.2503 (0.1072)*	1.330 (0.1178)	1.3462 (0.1019)*
Log of International Distance	-1.1864 (0.0737)	-1.1480 (0.0885)	-1.1733 (0.0765)
Fixed Effects for Country of Destination	F = 26.85 P = 0.0000	F = 242.25 P = 0.0000	F = 326.47 P = 0.0000
Fixed Effects for Country of Origin	F = 219.34 P = 0.0000	F = 13,121.68 P = 0.0000	F = 12,053.54 P = 0.0000
Number of Observations	3,643	7,065	7,065
R-Squared	0.6736		
Wald Test that the Parameters are Jointly Zero		χ^2= 10,359.87 P = 0.0000	χ^2= 13,955.20 P = 0.0000

Notes: Robust standard errors reported in parentheses.

Table 5: Econometric Model of Imports of Refrigerators (HS Code 8418)

Dependent Variable: Annual imports per capita of the product, by country of origin and destination

Explanatory Variable	OLS Estimation	Poisson Estimation	NBPML Estimation
Income per Capita	1.0703 (0.1078)*	1.2753 (0.0863)*	1.2753 (0.0863)*
Log of International Distance	-2.1169 (0.0891)	-1.5051 (0.0512)	-1.5050 (0.0512)
Fixed Effects for Country of Destination	F = 22.69 P = 0.0000	F = 368.39 P = 0.0000	F = 368.51 P = 0.0000
Fixed Effects for Country of Origin	F = 260.14 P = 0.0000	F = 36,956.70 P = 0.0000	F = 31.560.70 P = 0.0000
Number of Observations	4,308	7,065	7,065
R-Squared	0.5841		
Wald Test that the Parameters are Jointly Zero		χ^2= 44,123.28 P = 0.0000	χ^2= 38,302.80 P = 0.0000

Notes: Robust standard errors reported in parentheses.

Table 6: Econometric Model of Imports of Retail Pharmaceuticals (HS Code 3004)

Dependent Variable: Annual imports per capita of the product, by country of origin and destination

Explanatory Variable	OLS Estimation	Poisson Estimation	NBPML Estimation
Income per Capita	1.1052 (0.0854)	0.9993 (0.0620)	0.9990 (0.0614)
Log of International Distance	-1.7400 (0.0763)	-0.8540 (0.0278)	-0.8557 (0.0279)
Fixed Effects for Country of Destination	F = 41.06 P = 0.0000	F = 881.63 P = 0.0000	F = 944.71 P = 0.0000
Fixed Effects for Country of Origin	F = 170.12 P = 0.0000	F = 10,855.02 P = 0.0000	F = 10,776.92 P = 0.0000
Number of Observations	5,150	7,065	7,065
R-Squared	0.6372		
Wald Test that the Parameters are Jointly Zero		χ^2 = 15,734.18 P = 0.0000	χ^2 = 14,909.42 P = 0.0000

Notes: Robust standard errors reported in parentheses.

Table 7: Econometric Model of Imports of Soap Products (HS Code 3401)

Dependent Variable: Annual imports per capita of the product, by country of origin and destination

Explanatory Variable	OLS Estimation	Poisson Estimation	NBPML Estimation
Income per Capita	0.6929 (0.1428)	0.9343 (0.1485)	0.9343 (0.1484)
Log of International Distance	-2.6750 (0.0990)	-1.4855 (0.0559)	-1.4856 (0.0559)
Fixed Effects for Country of Destination	F = 22.70 P = 0.0000	F = 400.03 P = 0.0000	F = 400.07 P = 0.0000
Fixed Effects for Country of Origin	F = 144.15 P = 0.0000	F = 7,046.21 P = 0.0000	F = 13,029.24 P = 0.0000
Number of Observations	3,370	7,065	7,065
R-Squared	0.5889		
Wald Test that the Parameters are Jointly Zero		χ^2 = 15,044.61 P = 0.0000	χ^2 = 20,838.64 P = 0.0000

Notes: Robust standard errors reported in parentheses.

Table 8: Correlation between Income per Capita and Income Distribution Measures

Country	Within-Country Correlation between Income per Capita and the Top Quintile	Within-Country Correlation between Income per Capita and the GINI Coefficient
Argentina	-0.671	-0.678
Brazil	-0.917	-0.973
Colombia	-0.540	-0.406
Costa Rica	0.227	-0.107
Dominican Republic	-0.688	-0.772
El Salvador	-0.820	-0.868
Honduras	0.159	0.194
Paraguay	-0.785	-0.791
Peru	-0.862	-0.826
Uruguay	0.065	-0.082

Source: World Bank's World Development Indicators.

Table 9:

Estimated Percentage Reduction in Imports Due to the Reduction in Brazil's Income Inequality between 2001 and 2009

Product	Based on OLS Estimates	Based on Poisson Estimates	Based on NBPML Estimates
Passenger Vehicles	1.58%	0.78%	2.30%
Refrigerators	0.40%	1.76%	1.76%

Figure 1: GINI Coefficient Evolution of Brazil between 1981 and 2009

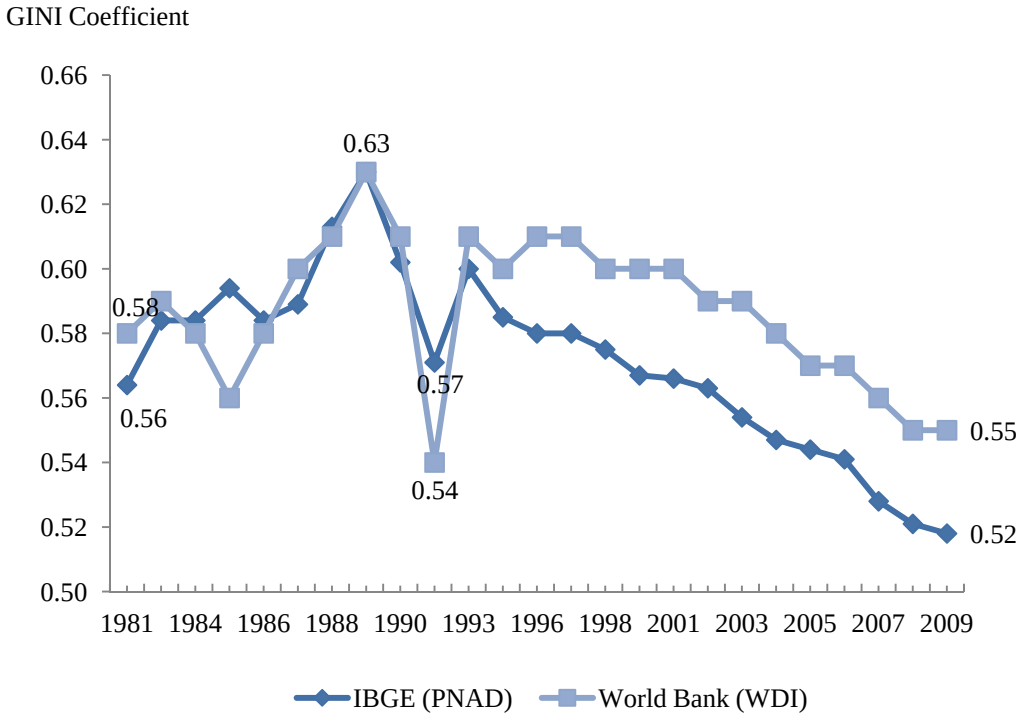
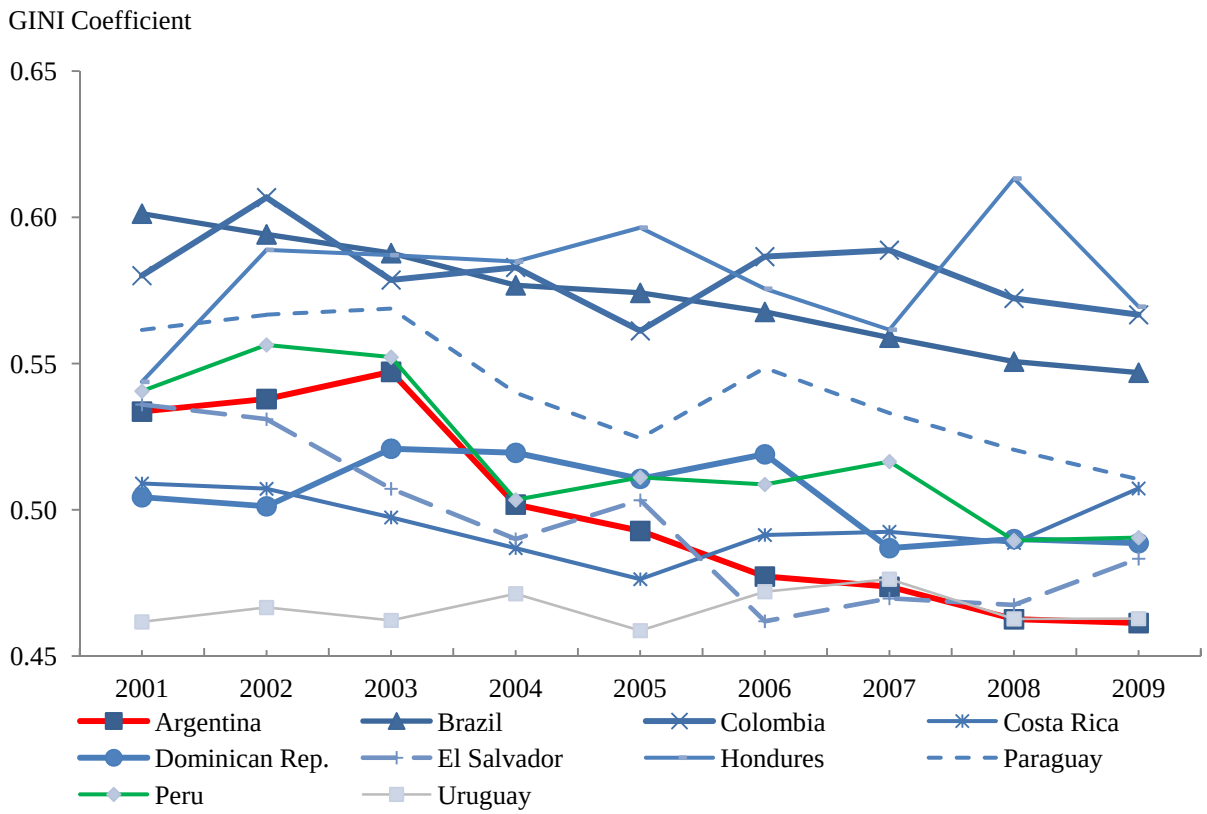


Figure 2: GINI Coefficient for Ten Selected Latin American and Caribbean Countries



Source: World Bank, World Development Indicators