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Openness, Inequality, and Poverty: Endowments Matter*

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Abstract

Using tariffs as a measure of openness, this paper finds consistent evidence that the conditional effects of trade liberalization on inequality are correlated with relative factor endowments. Trade liberalization, measured by changes in tariff revenues, is associated with increases in inequality in countries well-endowed in highly skilled workers and capital or with workers that have very low education levels. Similar, though less robust, results are also obtained when decile data are used instead of the usual Gini coefficients. Taken together, the results are strongly supportive of the factor-proportions theory of trade and suggest that trade liberalization in poor countries where the share of the labor force with little education is high raises inequality. Simulation results also suggest that relatively small changes in inequality as measured by aggregate measures of inequality like the Gini coefficient are magnified when estimates are carried out using decile data.

JEL classification: F11, F16, D3

Keywords: International Trade, Income Distribution, Poverty.

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1. Introduction

The relation between openness, inequality and poverty within countries continues to be subject to considerable controversy in the debate about globalization and in the academic literature where the relative importance of the different transmission channels linking openness to inequality and poverty remains elusive. First, detailed case studies decomposing the sources of the evolution of income inequality within countries reveal very different patterns across countries. As to trade liberalization and openness--usually understood to mean the ease with which goods and services, factors of production (e.g. capital, labor and skills) move across countries as transaction costs fall-—they are often used interchangeably and captured by a trade-to-GDP ratio which captures many other features of a country's exposure to trade. Second, whether from specific trade liberalization episodes or from cross-country studies, the evidence on the relation between trade liberalization and inequality is conflicting.[1] Third, in most cross-country studies, identification comes from cross-country variability in the inequality measure and no attempt is made to control for the source of the data on inequality.

If one were asked to point towards an emerging consensus, it would probably be that increasing openness has been reflected in a growing wage gap between skilled and unskilled wages. Moving to the association between openness and overall

[1] Bourguignon, Ferreira and Lustig eds. (2005, table 10.1) show the variety of underlying changes in inequality across four countries. Using four household surveys spanning the period of Mexican tariff liberalization, Nicita (2004) explores systematically the channels by which the Mexican trade liberalization affected households. He finds differential pass-through effects across commodities and strong effects on spatial inequality and concludes that, overall, tariff liberalization might have been associated with a reduction in poverty, but that inequality increased. Case study evidence is not considered further in this paper. Also see Galiani and Porto (2006) for a country study on trade liberalization and wage inequality in Argentina.

inequality (usually measured by the Gini coefficient) the evidence remains very mixed: many studies find no evidence of openness on inequality, or that openness increases inequality at all levels of development.[2]

More intriguing to many is the lack of robustness towards expectations from the standard factor-endowment-based trade model (Heckscher-Ohlin – HO for short): conflicting evidence that greater openness reduces (increases) inequality in developing (developed) countries and very qualified support for the hypothesis that endowments matter along the expected lines (see below), not to mention little support for robust results between trade liberalization and inequality.[3] The lack of correlation between factor endowments and inequality should also come as a surprise to scholars working on the institutional foundations of development who generally find strong evidence that endowments matter in the evolution of a country's inequality (Hoff (2004)).

Perhaps this should not come as a surprise and not concern us too much if, via other channels such as growth, increased openness reduces poverty. After all, HO theory should only be expected to inform us about the relation between endowments and factor rewards in response to a reform-induced change in relative factor demands rather than between endowments and overall income inequality which is determined by many other factors. And, as pointed out by Baldwin (2004, p. 517) in his review of the trade liberalization and growth literature, since trade liberalization is rarely applied in isolation, it makes little sense to try and isolate its effects from those of associated policies.

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[2] Barro (2000), Lundberg and Squire (2003) and Milanovic (2005) find that openness increases inequality whereas Edwards (1997), Ravallion (2001) or Dollar and Kraay (2002) find no significant relationship.

[3] See Anderson (2005) for a survey of the conflicting evidence on openness and inequality, and Winters et al. (2004) for a survey of the evidence on trade liberalization and poverty. Spilimbergo et al. (1999), Milanovic (2005) and Bensidoun et al. (2005) are the studies most closely related to ours.

In contrast to this agnosticism, following an exhaustive review of the evidence on trade liberalization and poverty, Winters et al. (2004, p. 108) conclude that trade liberalization might be the easiest poverty-alleviating reform to accomplish, and the most powerful direct mechanism to alleviate poverty in a country. If so, knowing more about the links between trade policy and inequality is important since, from a political-economy perspective, knowledge about the links between openness and inequality will inform about the feasibility of policies that increase openness and are likely to reduce poverty.

We bring new evidence on this issue using two data sets covering a larger sample of developing countries than most previous studies. We introduce fixed-effects (FE) so that identification of the effects of globalization is confined to variations in that country's variables. We also broaden the range of control variables to address omitted variable bias. In this set up, we find rather consistently that trade liberalization is associated with increases in inequality. Second, unlike most previous studies, we find that endowments matter along the lines suggested by the standard HO theory arguments reviewed in section 2. We find consistently that trade liberalization is associated with increases in inequality in countries that are relatively well-endowed with capital and with highly skilled workers while it associated with decreases in inequality in countries relatively well-endowed in primary educated (unskilled) workers and in arable land. On the other hand, as suggested by Wood (1994, 2002), we find that trade liberalization is associated with increases in inequality in countries relatively well-endowed with workers lacking basic education.

The paper is organized as follows. Section 2 discusses the main channels linking openness and trade liberalization to inequality identified in the literature along with the two

data sets used in this paper. Using data over the period 1980-2000, section 3 establishes that the correlation between trade liberalization and inequality follows patterns predicted by factor-proportions theories. These results are largely confirmed with a 'high quality' data set (based on deciles) covering the period 1988-98 in section 4. Section 5 concludes.

2. Transmission Channels and Data

2.1 Transmission Channels

The debate on the channels through which openness might affect inequality has largely revolved around the role of openness-induced changes in relative factor demands and their consequent expected effects on factor rewards. For natural-resource-rich countries, though they do not deal directly with trade liberalization, Leamer et al. (1999), provide plausible scenarios and some evidence as to why the development paths of such countries could lead to rising inequality.

Concentrating on accumulable endowments where rent effects should be minimal, Wood (2002) provides a convenient summary of the different channels via which globalization might affect wage inequality (see also Kremer and Maskin (2003)). As all forms of transaction costs fall with globalization, factor mobility (capital via FDI and Northern K-workers in the terminology of Wood) is enhanced, leading to greater cooperation of Northern K-workers who travel to work with skilled workers in the South. In the South, workers with little or no-education (and hence low wages) would then be expected to be confined to non-traded activities. Trade liberalization would then not only lead to rising wages for skilled workers in the North and in the South, but under

plausible assumptions, it would also lead to an increase in wage inequality in the South.[4]

Feenstra and Hanson (1996) interpret globalization as an increase in FDI (rather than a movement of K-workers) leading to a rising volume of trade in intermediates (see Hummels et al. (2001) for supporting evidence) as the process of production leads to a fragmentation of production. Again, in a HO framework where a continuum of intermediates are produced by the North and the South, and where the North is relatively well-endowed in skilled labor and capital (with capital and skilled labor complementary factors in production), Feenstra and Hanson, echoing Wood, show that an increase in FDI can lead to rising wages for skilled workers in the North and the South as FDI raises the skill-intensiveness of production in both countries.[5]

In reality, other channels beyond changes in factor rewards will affect inequality when a country becomes more outward-oriented. At the simplest level, in the Ricardo-Viner model changes in relative prices lead to changes in the purchasing-power of households, and if the poor consume the exported good intensively, trade liberalization could increase income inequality. Several exercises using simulation models reported in Hertel and Winters eds. (2006) quantify the potential magnitude of some of these channels, notably the

[4] In a two-sector model (tradables and non-tradables) with capital and two categories of workers (skilled and unskilled), in which the three household categories are not diversified in their factor-ownership holdings and the unskilled are confined to the non-tradable sector, Bensidoun et al. (2005) show formally that an increase in the wage of skilled labor (brought about by increased openness) will increase the value of the Gini index if the share of unskilled labor is large enough.

[5] Arguing that much trade is between rich countries and that much trade can be viewed as the production of a single product manufactured by outsourcing of components made and assembled in different countries, Kremer and Maskin (2003) develop a model in which globalization (again an increase in FDI) can plausibly lead to an increasing wage gap between skilled and unskilled workers in both the North and the South. The key mechanism in their model is that globalization leads to more cross-matching than self-matching (workers with the same skill levels working together).

poverty implications of tariff reductions on the purchasing power of households with different expenditure patterns.

More importantly, there are other context-specific transmission channels (see Winters et al. (2004) for discussion) which cannot be captured in a cross-country exercise seeking to extract common elements that are likely to hold across a range of countries. For example, as shown by Nicita (2004) in his detailed case study of tariff liberalization in Mexico during the 90s, price pass-through effects were substantially different across commodities, and the poverty effects of trade liberalization varied substantially across regions.

2.2 Framework and Data

Using panel data, the literature has usually estimated a relation of the form:

$$INQ_{it} = \alpha_0 + \alpha_1 \overline{Y}_{it} + \beta_1 OPEN_{it} + \sum_l \delta_l Z_{it} + \varepsilon_{it} \qquad (1)$$

where INQ_{it} is the measure of inequality, $\overline{Y}_{it}$ is average income per capita (either from the national accounts or from household surveys), $OPEN_{it}$ is a measure (eventually lagged to control for endogeneity) that proxies for the country's outward-orientation[6], and Z_{it} is a vector of control variables. In the discussion above, there is no role for income as an explanatory variable. Its inclusion rests on some variant of a Kuznets-type relationship and for relative endowments, but also for structural changes (other than endowments but including increased financial integration) that are associated with rising GDP per capita and could affect the transmission of globalization-related effects to households.

[6] Greater outward-orientation goes beyond integration in goods markets. It includes integration in capital markets, as well as behind-the-border measures. Insofar as a reduction in transaction costs affect countries equally, these can be ignored. See further discussion below.

Note the absence of country fixed effects in (1). For example, in their widely-cited study examined below, Spilimbergo et al.(1999) do not control for country-specific features that could account for differences in inequality such as labor market specificities emphasized by Rama (2002)), productivity differences (see Easterly (2004)), or institutions (Barro 2000). Nor do more recent studies (e.g. Milanovic (2005)) typically use such controls for heterogeneity.[7] Insofar as omitted factors do not change over time, the inclusion of fixed effects controls for such idiosyncratic factors. Since our data set covers a rather long period, and inevitably some of the relevant omitted variables will change over time, this needs to be kept in mind when interpreting results. Likewise, the validity of the results rests on the assumption that the data reflect a sufficiently stable relationship (this is why we exclude all transition economies from our samples) and that the same dynamics can be imposed on all countries, an assumption that is less likely to hold, but about which little can be done.

We use two data sets. The first set of results is based on five-year average data spanning the 1975-2000 period relying on the extensively used Deininger and Squire (D-S) data set (augmented to include the year 2000 by the availability of the WIDER (2004) data). The second is the more recent high-quality data set World Income Distribution (WYD) also at approximately five-year intervals which covers the 1988-1998 period. Using two data sets provides further robustness checks, and the second data set is helpful when trying to quantify effects of trade liberalization on poverty. Table 1 shows that our sample has a good representation across

[7] Among the studies that control for heterogeneity, Edwards (1997, 43 countries, 70s and 80s) finds no evidence that openness or trade liberalization increases inequality. When including fixed effects, Barro (2000, 84 countries for 1960-90, table 6) finds no correlation between inequality and openness, echoing Ravallion's correlations between average household incomes and inequality across 117 growth spells (Ravallion (2001), table 1).

regions, and that the developing countries are adequately represented.[8]

Table 1: Countries in the sample[a]

	Sample for the study on 1980-2000		Sample for the study on 1988-1998	
Regions	Number of countries	Number of obs.	Number of countries	Number of obs.
Developed	20	66	19	51
Africa & Middle East	14	42	10	23
Asia	10	36	11	29
Latin American	17	54	15	43
Total	**61**	**198**	**55**	**146**

List of countries is reported in Annex 1 and 2.

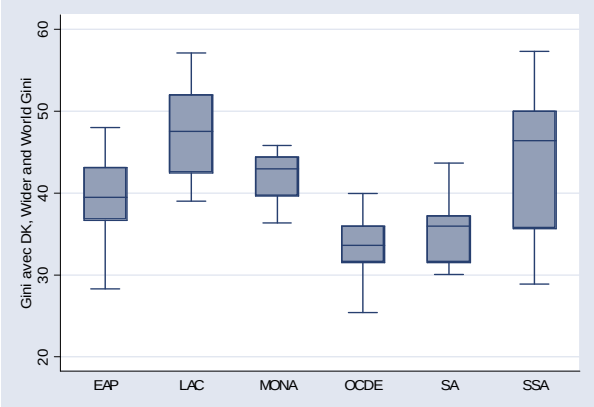
[a] Transition and ex-USSR countries are excluded. Countries with less than two observations are also dropped from the sample

Regarding the variable used to capture a country's outward-orientation, we use lagged tariffs i.e. $TAR_{i,t-5}$, (computed as the ratio of tariff revenues to imports) as a measure of trade openness. This is a more direct measure of openness than those often used previously (i.e. a trade output ratio, a 'trade adjusted ratio' obtained as a residual from an estimated relation of openness, or the Sachs-Warner index). As a consequence, our sample does not include the 1960-80 period covered in some of the earlier studies. Since most trade liberalization in developing countries started in the early eighties, this may not be too damaging.

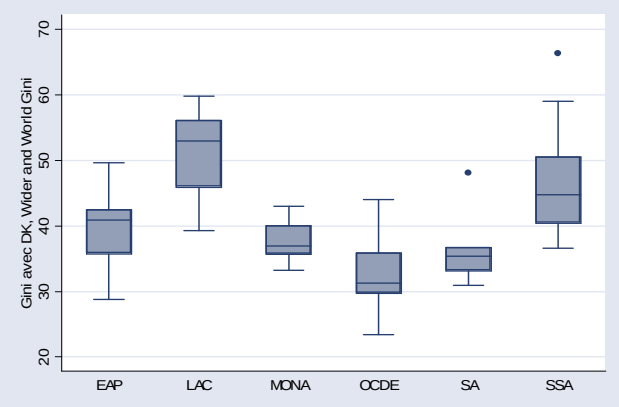
Figure 1 describes the main characteristics of the data at the regional level. The relative patterns of inequality remain unchanged across regional groupings, being the highest in Latin America and SSA throughout. Within regions, tariff dispersion fell and, except for the Middle East and North Africa (MENA) region, average tariffs declined during the sample period.

[8] Only countries with economy-wide inequality measures ('high-quality' indices according to D-S) are retained in the sample. As a reference for comparison among the studies that concentrate on openness and inequality, the often-cited study by Spilimbergo et al. (1999) had 17 developed and 17 developing countries in their sample.

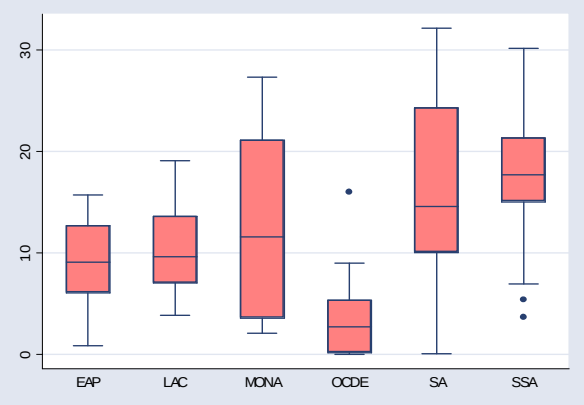
Figure 1: Box Plots on Gini, Tariffs and GDP per capita ($PPP) : 1980 and 1995



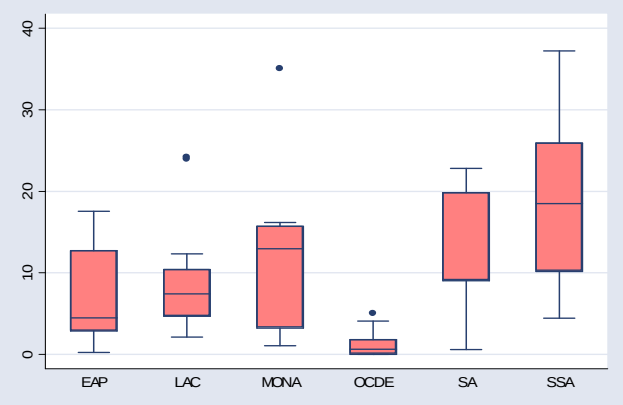
Gini: 1980



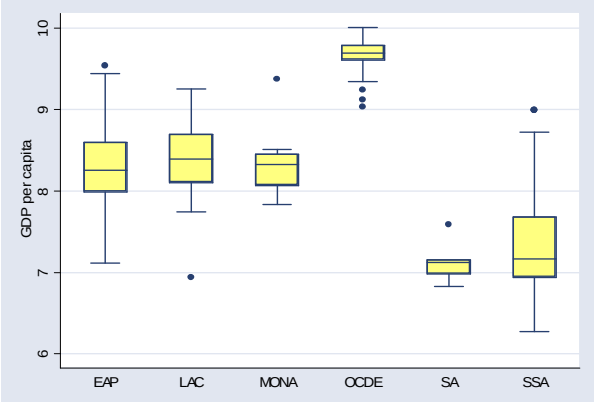
Gini: 1995



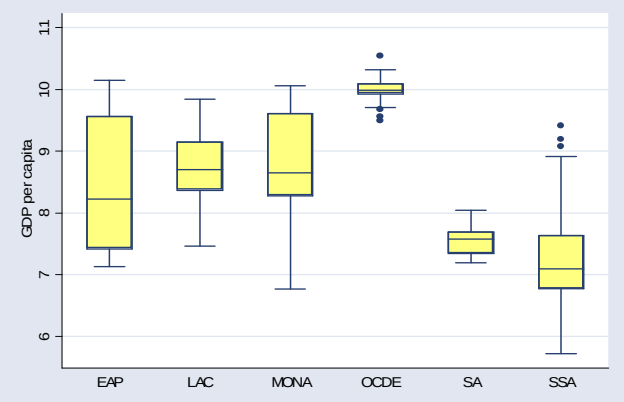
Tariffs: 1980



Tariffs: 1995



GDP per cap. ($PPP): 1980



GDP per cap. ($PPP): 1995

Table 2 gives regional averages for the two main variables of interest, the inequality measure and our measure of openness, tariffs computed from customs data (see the annex

for data sources and data manipulations). There is little variation in the average measure of inequality within regions and persistent differences across regions while the measure of protection indicates (on average) a downward trend in all regions except Africa. Since much of the trade reforms in the eighties often consisted of replacing NTBs with tariffs, what appears as an increase in protection could in fact represent either a reduction, or no increase in protection. In selecting tariffs as our measure of openness, we take refuge in the often-made observation that the average tariff level is an adequate approximation of the restrictiveness of a country's trade regime, and arguably less controversial than other measures often used, which in any event, are not available, over time (e.g. measures of NTBs).[9] Of course, having a measure of tariff spreads across industries or between agriculture and manufactures would be helpful. Unfortunately such data are not available over time for a sufficiently large sample of countries. However, as shown by Pritchett and Sethi (1994), because of widespread exemptions, tariff revenues do not increase proportionately with tariff rates suggesting limited further information from having information on tariff spreads.

[9] According to Rodrik (2000), (p. 3): "Tariff and non-tariff averages are reasonably accurate in ranking countries in terms of trade policy openness, and in showing changes in openness over time". Goldberg and Pavcnik (2004) reach the same conclusions and conclude that tariffs capture relatively well the combined effects of trade policy changes. They also note that the preoccupation about the endogeneity of tariffs is lessened by the fact that many countries moved towards a reduction in protection and more uniformity in their tariff structures when they became full members of the GATT/WTO. Moreover, the use of a synthetic index to measure the restrictiveness of a trade regime still has appeal especially during the 70s and 80s when many countries still had a multiplicity of trade barriers in their foreign exchange regimes.

Table 2: Inequality and Tariffs

Region	Year	Gini	Tariffs	Region	Year	Gini	Tariffs
Developed Countries	1980	33.4	2.9	Latin America	1980	47.6	10.6
	1985	31.8	2.1		1985	48.1	13.6
	1990	33.1	1.7		1990	47.3	10.2
	1995	32.7	1		1995	49.8	7.1
East Asia	1980	40.9	6.7	Middle East	1980	42	19.8
	1985	40.7	8.1		1985	38.7	17.4
	1990	39.3	8.7		1990	38	19.1
	1995	39.2	6.4		1995	37.7	12.2
South Asia	1980	35.7	19.1	Africa	1980	44.6	16.7
	1985	35.9	27.1		1985	46.7	18.2
	1990	36.2	25.3		1990	50.5	18.1
	1995	37.8	15.2		1995	46.3	17.9

We checked the correlation between our tariff measure for openness with other proxies often used. In general, the correlation is rather weak, although reassuringly, the correlation with the carefully constructed Wacziarg and Welch (2003) index is quite high $(\rho = -0.56)$.[10] In the end, the strongest justification for using tariffs is their widespread availability and the likelihood that error measurements will be less than with other proposed measures.[11]

The main weakness in the data set is the absence of a measure of financial openness. Miniane (2004) provides a summary of available indices of financial market integration. It turns out that even for the WYD data set which only covers the 1988-98 period, about 2/3 of the countries in our data set would not have a measure of financial market integration. We have therefore decided not to tackle the issue of financial market integration (using FDI as in e.g. Milanovic (2005),

[10] Unfortunately, for statistical analysis, the Wacziarg and Welch (2003) index is a binary variable. Tariffs are also strongly positively correlated [correlation coefficient in brackets] with other measures of trade barriers such as taxes on input and capital used by Barro & Lee (2002)[0.31]. Among the model-based estimates, tariffs are most closely correlated with the gravity-based index of Hiscox & Kastner (2002) [0.47] and the residuals from adjusted trade ratios estimated econometrically by Leamer (1987) [-0.43], but weakly with the Pritchett (1996) index [-0.08].

[11] Because tariffs do not take into account NTBS, we also correlated several frequency indices of NTBs with our tariff measure at the HS-6 level using Jon Haveman's treatment of TRAINS data. Correlations (available upon request) for different tariff ranges and the overall NTB frequency index ranges between 0.20 and 0.30 confirming high tariffs barriers are effectively correlated with high indices of NTBs.

would not be appropriate since it is largely an outcome variable).

3. Trade Liberalization and Inequality: Endowments matter

We start exploring the basic HO prediction that trade liberalization should reduce inequality in low-income countries and increase it in high income countries. Next, we bring in factor endowments which we interact with the tariff variable to isolate the effects of differing endowments on inequality. Throughout this section, the data covers the period 1980-2000 and the Gini coefficient is the inequality measure.

3.1 Openness, Income and Inequality

We start with the traditional specification:

$$INQ_{it} = D_i + YR_t + \alpha_1 \overline{Y}_{it} + \beta_1 TAR_{i,t-5} + \beta_2 (TAR_{i,t-5} * \overline{Y}_{it}) + \sum_l \delta_l Z_{it} + \sum_{k=1,3} \gamma_k DS_{ikt} + e_{it}, \quad \text{i=1,...,76, t=1,..., 4} \qquad (2)$$

In(2), the index of inequality is regressed on a set of country dummies D_i, a set of year dummies to control for any common period shocks , on income per capita measured in PPP, $\overline{Y}_{it}$, tariffs (lagged one-period to control for endogeneity), $TAR_{i,t-5}$, dummy variables, DS_{ikt}, to control for the source of inequality data (dummy variables for gross vs. net income, income vs. expenditure, and households vs. individuals), and on a set of control variables, Z_{it}. All the variables are expressed in logarithms.

As mentioned above, all data are five year averages (this helps to control for autocorrelation and measurement error), giving us up to four observations across time. The use of

country fixed-effects reduces considerably the variance in inequality to be explained so that measurement errors are exacerbated even though taking five year averages should attenuate this problem (see Pritchett (2000)). Having more data points within countries, as in e.g. Galani and Porto (2006) who study the trade-liberalization wage-inequality relation in Argentina over thirty years would clearly be a superior identification strategy, but such an option is not yet in the cards.

Should an increase in openness (here lower values for TAR_{it-5}) raise inequality, it would be reflected in $\hat{\beta}_1 < 0$, while the relationship expected from a 'basic' factor-endowment (or HO) interpretation (with capital and labor as the sole endowments) would call for $\hat{\beta}_1 > 0, \hat{\beta}_2 < 0$ since lowering tariffs in high-income countries would be expected to increase inequality with a turning point at $\bar{Y} = -\frac{\beta_1}{\beta_2}$.

Estimates in table 3 column 1, with no fixed effects, correspond to those usually found in the literature (e.g. Barro (2000), Ravallion (2001), Rama (2002)). Under this specification, trade liberalization raises inequality in poor countries, but reduces it in rich countries (i.e. with income per capita higher than 4,414$ PPP in column 1), in contradiction with HO expectations. The estimates also indicate less inequality in low inflation countries and in countries with a higher share of population between 40 and 59 years old. The sign and coefficient estimates in column 1 are robust to the inclusion of year dummies (results not reported) which are included in the other estimates.

Table 3: Inequality, income and openness

	OLS	OLS	OLS+FE	FE (PCSE)
	1	2	3	4
	Gini	Gini	Gini	Gini
GDPpc	-0.05	-0.06c	0.04	0.02
	(1.10)	(1.86)	(0.46) – [0.60]	(0.40)
Tar_{t-5}	-4.23c	-3.98b	2.96	3.27c
	(1.91)	(2.05)	(1.25) - [1.47]	(1.69)
TAR_{t-5}*GDPpc	0.50c	0.49b	-0.34	-0.37
	(1.90)	(2.15)	(1.20) - [1.40]	(1.61)
Educ.Lab.	0.05	0.00	-0.05	
	(0.77)	(0.06)	(0.56) - [0.73]	
Mature	-0.45a	-0.44a	-0.09	
	(5.25)	(5.57)	(0.55) - [0.71]	
Ethnicity	0.02	0.02b		
	(1.43)	(2.07)		
Civ.Lib.	0.07	0.09b	0.02	
	(1.40)	(2.32)	(0.40) - [0.50]	
Inflation	0.06b	0.07a	0.02	0.02c
	(1.91)	(3.56)	(1.46) - [1.95]	(1.91)
Gross/Net Income		-0.01	-0.02	-0.02
		(0.37)	(0.85) - [1.15]	(1.23)
Income/Expenditure		0.24a	0.15a	0.15a
		(6.44)	(3.20) - [4.91]	(4.89)
Households/Individual		-0.00	0.06b	0.06a
		(0.02)	(2.36) - [3.46]	(3.43)
Constant	5.22a	5.03a	3.40a	3.36a
	(16.87)	(18.30)	(5.73) - [6.99]	(8.15)
Fixed Effects	No	No	Yes	Yes
Year Effect	No	Yes	Yes	Yes
Observations	217	217	217	217
R-squared	0.44	0.60	0.91	0.90
#of Countries	66	66	66	66

Absolute value of z statistics in parentheses
c: Significant at 10%; b significant at 5%; a significant at 1%
In column 3, Absolute value of z statistics in parentheses (based on robust Huber-White standard errors) and in brackets (based on Panel-corrected standard errors (PCSE))
PCSE: Panel-corrected standard errors (Beck and Katz (1995))

Adding dummy variables for the source of income inequality data in column 2 improves considerably the fit while increasing the significance of the coefficients discussed above. In particular, the results contrary to HO predictions continue to hold at a higher (now 5%) level of significance (the turning point is now 3,600$). The signs on the dummies to control for the source of data on income inequality have the expected: Gini coefficients based on income (households) are higher than those based on expenditure

(individuals). Our first finding is that all studies should control for the source of income inequality data (a point already made by Ravallion (2001) and Bensidoun et al. (2005)). Since coefficient values on these dummies are always significant under our preferred estimation with FE and similar to those reported here in tables 4 and 6, we do not comment on this result any further.

Column 3 introduces fixed-effects (FE) into the estimation. Now, the sign of the coefficients for $\left(\hat{\beta}_1, \hat{\beta}_2\right)$ are reversed and are coherent with factor endowments even though the coefficients are not significant at the 10% confidence interval with the standard heteroskedasticity-corrected (White) coefficients. Significance is slightly improved when we report panel-corrected standard errors in (these are in brackets in column 3) and borderline significance is reached in column 4 when insignificant variables are excluded.[12] Our second conclusion is that results from studies that do not control for effects of omitted variables via FE are biased and that proxies for factor endowments effects behave according to expectations.[13]

This reversal between OLS and within estimates OLS can be understood from the data patterns in figure 1. Since the richest countries (OCDE) have the smallest tariffs and the lowest level of inequality through time while SSA countries have the lowest income par capita, the highest tariffs and the highest level of inequality, a level estimation will show that

[12] The Breusch Pagan test and the White test indicate heteroskedasticity in the error process ($\sigma^2_{it} \neq \sigma^2$). We carried out our estimates using two estimators: the standard heteroskedasticity-consistent White (1984) estimator and the panel-corrected standard errors (PCSEs) estimator proposed by Beck and Katz (1995) which is shown to be as good or slightly superior to the robust estimator in Monte-Carlo studies for small samples (see Beck and Katz (1996, table 2). Since both estimators give very similar results, in subsequent tables we only report results based on PCSEs. Ethnicity is dropped from the FE estimates because it is time-invariant.

[13] Since we are mostly interested in endowments (which are all strongly correlated with income), we have not attempt to control for the endogeneity of income when estimating (3).

countries with low tariffs and high income per capita will have the lowest income inequality. However, such a relationship does not account for the impact of trade liberalization on inequality.

Changes in inequality could be due to the effects of other ongoing reforms such as concurrent stabilization policies. For example, Wacziarg and Welch (2003) show that trade liberalization often occurs during periods of systemic reforms including macro stabilization. Stabilization--here proxied by a reduction in inflation--is associated with a reduction in inequality (as in e.g. (e.g. Dollar and Kraay (2002), Edwards (1997)). However, including this control does not alter the relationship, nor does the introduction of other control variables that carry the expected signs.[14]

3.2. Trade Liberalization, Endowments, and Inequality

We now introduce relative endowments directly (rather than using income per capita as a proxy) interacting them with the openness measure as in previous studies (e.g. Bourguignon and Morrisson (1990), Spilimbergo et al. (1999) and Fisher (2001)). This allows us to test whether the conditional correlation of protection on inequality is sensitive to factor endowments. Results are reported in table 4.

$$INQ_{it} = D_i + YR_t + \beta_1 TAR_{it-5} + \sum_{m=1,6} \phi_{1m} RE_{imt} + \sum_{m=1,6} \phi_{2m} (TAR_{it-5} * RE_{imt}) + \sum_l \delta_l Z_{it} + \sum_{k=1,3} \gamma_k DS_{ikt} + e_{it} \quad (3)$$

[14] Ethno-linguistic fragmentation and less civil liberties increases inequality; financial depth and a high share of mature worker both reduce inequality. Spurious correlation from omitted variable bias could still be present. For example, trade liberalization could increase investment (see evidence in Wacziarg and Welch (2003)) which in turn could be correlated with inequality. Barro (2000) finds little correlation between inequality, and growth and investment in his sample, but Lundberg and Squire (2003) find support for a link in a simultaneous examination of inequality and growth.

As suggested by factor-endowment-based theories, relative endowment ratios, RE_{imt}, are computed relative to the corresponding sample mean per capita endowment.[15] The ratios are weighted by the trade share in GDP to account for the endowments of closed countries that do not compete in the world markets with other factors (to help comparisons, we use the formula in Spilimbergo et al. (1999), see annex A4).

Since when we included fixed effects, most of the control variables, Z_{it} that vary little over time lost significance, so we start by including only inflation and the dummies for the source of inequality data, both of which keep the same signs and significance levels as in columns 4 and 5 of table 3. Here with factor endowments entering directly in the specification, we are particularly interested in the values of the interaction coefficients, ϕ_{2m}. A negative (positive) sign for these coefficients implies that a given trade liberalization increases (reduces) inequality more in countries relatively well-endowed in the corresponding endowment.[16]

We include six endowments. Labor is broken down into three categories along the lines suggested by the discussion in section 2 and indicated in (3): non-educated labor, i.e. those who have never been to school or have not completed primary school (NO); primary-educated or labor with a basic education (BS); and those that have an education level beyond

[15] We also constructed relative endowments using trading partner countries as weights. Results were largely unaffected and are not reported here.

[16] As a first exercise, not reported here, we replicated the same specification as Spilimbergo et al. (1999) confirming their results (i.e. a result in conformity with factor-endowment predictions for human capital but in contradiction with predictions for physical capital when using their openness variable ('adjusted' trade ratio instead of tariffs). However, when using our preferred measure tariffs, increases in inequality are associated with relatively abundant endowments in capital following a reduction in tariffs (i.e. the coefficient on the interaction between relative endowment in capital per unit of labor, K/L, and the lagged tariff, is negative). To our knowledge, this plausible set of results has not been found in previous studies. However, with tariffs, the significance for the human capital endowment interactive term with tariffs disappears.

high-school (SK). Such a breakdown suggested by the discussion in section 2, was carried out recently by Bensidoun et al. (2005) in a slightly different context.[17,18]

As to remaining endowments, Wood (2003) suggests that arable land per worker (AT/L) (as in Spilimbergo et al. (1999), Fisher (2001) or Leamer et al. (1999)) is not sufficient to encompass natural resources and suggests using land per worker (T/L). Whereas arable land per worker captures factor intensities in the production of food and raw materials, it does not include mining and fuels which are the less equally-distributed resources. This may explain why several studies find that a strong endowment in arable land is associated with increases inequality during trade liberalization (Spilimbergo et al. (1999) and Perry and Olarreaga (2006)). Thus we use a direct measure of endowments in mining and fuels MF/L (captured by production in minerals, fuels and coal), next to the measure of arable land.

[17] Bensidoun et al. (2005) argue that the Heckscher-Ohlin model is too restrictive, relying on factor-price-equalization (FPE) and hence identical production techniques in equilibrium. Using a more general approach that relaxes the FPE assumption (but still relies on other restrictive assumptions like homothetic preferences and unchanged production techniques following trade liberalization), they show that factor price changes are correlated with the factor content of trade, leading them to test their model using constructed estimates of the labor-capital content of net exports instead of factor endowments on a similar D-S inequality data set for 53 countries. However, their results are not strictly comparable with ours (different sample with no SSA countries and a different definition of variables).

[18] The index of human capital endowment (average years of schooling) is now replaced by these three different categories of skill levels. We take the NO variable from the Barro and Lee (2000) data set which is available on a five-year basis that corresponds to the 5-year averages used for all our variables.

Table 4 Inequality, factor endowments and openness

	(1)	(2)	(3)	(4)	(5)
	Gini	Gini	Gini	Gini	Gini
MinFuel per Labor (MF/L)					0.12b
					(2.26)
Arable Land per Labor (AT/L)	0.26	0.17	0.18	-0.03	-0.08
	(1.59)	(1.01)	(1.04)	(0.20)	(0.58)
Capital per Labor (K/L)	-0.01	-0.03	-0.07	-0.00	0.00
	(0.21)	(0.77)	(1.58)	(0.04)	(0.02)
NoEd. per Labor (NO/L)	0.12a				
	(3.20)				
BasEd. per Labor (BS/L)		0.06			
		(1.03)			
SkillEd. per Labor (SK/L)			0.12a		
			(3.88)		
SK/BS				0.07b	0.06c
				(2.05)	(1.67)
NO/(SK+BS)				0.12a	0.14a
				(3.32)	(3.68)
TAR_{t-5}	-0.30	-0.21	0.16	-0.55	-0.67
	(0.64)	(0.43)	(0.38)	(1.30)	(1.62)
(MF/L) * (TAR_{t-5})					-0.05
					(0.32)
(AT/L) * (TAR_{t-5})	0.05	0.11	-0.37	0.30	0.50
	(0.10)	(0.21)	(0.85)	(0.67)	(1.05)
(K/L) * (TAR_{t-5})	-0.50a	-0.28	0.31	-0.52a	-0.59a
	(2.76)	(1.57)	(1.52)	(2.63)	(2.99)
(NO/L) * (TAR_{t-5})	-1.39a				
	(2.76)				
(BS/L) * (TAR_{t-5})		0.13			
		(0.31)			
(SK/L) * (TAR_{t-5})			-0.73a		
			(3.21)		
(SK/BS) * (TAR_{t-5})				-0.73a	-0.66b
				(2.78)	(2.50)
(NO/(SK+BS)) * (TAR_{t-5})				-0.94a	-1.07a
				(3.19)	(3.61)
Inflation	0.03b	0.04a	0.03b	0.02	0.02
	(2.53)	(2.69)	(2.56)	(1.33)	(1.37)
Gross/Net Income	-0.01	-0.01	-0.01	-0.02	-0.02
	(0.82)	(0.81)	(0.28)	(0.94)	(1.04)
Income/Expenditure	0.15a	0.14a	0.14a	0.10a	0.11a
	(5.43)	(5.31)	(5.04)	(3.76)	(3.87)
Households/Individual	0.06a	0.06a	0.06a	0.07a	0.06a
	(2.92)	(3.28)	(3.04)	(3.50)	(3.40)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	202	202
# Countries	64	64	64	61	61

Panel-corrected standard errors (Beck and Katz (1995));
Absolute value of z statistics in parentheses
c significant at 10%; b significant at 5%; a significant at 1%

The first three columns of Table 4 test the significance of endowments relative to labor. Column 1 confirms the expectation that trade liberalization in countries with relatively high endowments in K/L and NO/L is associated with a greater increase in inequality (negative coefficients for both interaction terms with lagged tariffs). Column 2 results also conform with factor endowment predictions since the coefficient on BS/L interacted with lagged tariffs is positive, but the K/L interaction term loses significance. The same expected pattern also holds in column 3 with SK/L.[19] The result that trade liberalization is associated with greater increases in inequality in countries abundant in highly-educated labor is consonant with Galiani and Porto's (2006) identification of an increasing skill premium in periods of trade liberalization in Argentina.

Column 4 controls for the skill composition of the labor force by including these three levels of education in ratio form to avoid perfect multicollinearity with the country dummies: SK/BS, SK/L, and NO/(SK+BS).[20] One can verify that, as predicted by factor endowment trade theories, during a trade liberalization, countries with a relatively (to the sample average) strong endowment in SK/BS experience a greater increase in inequality, while, after having controlled for skill endowments, countries relatively poorly endowed in labor with some qualification (i.e. with high values of NO/(SK+BS) experience an increase in inequality during a trade liberalization. Column 5 shows that the proxy for mineral resources is associated with increases in inequality (as is a relatively strong endowment in SK/BS and in NO/(SK+BS)). In sum, globally the results in table 4 are supportive of factor-based predictions in almost all cases.

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[19] Owing to the high correlation between SK/L and K/L $(\rho = 0.84)$, the coefficient on K/L changes sign and is almost significant statistically.
[20] Thanks to Adrian Wood for this suggestion.

Table 5 quantifies the effects of a 5 percentage points reduction in tariffs on Gini coefficient value for different quartiles of the distribution of endowments. As, an example, tariff reduction increases the value of the Gini coefficient by 0.4% for countries in the bottom quartile of the distribution of (K/L), while it increases inequality by 6.0% for those in the top quartile. A similar pattern holds for (SK)/(BS), with the strongest effect for the ratio (NO)/(SK+BS). Since countries with a high share of non-educated population are also likely to be poorly endowed in capital, the two effects almost cancel each other.

Table 5: Tariff Reduction, inequality and factor endowments
(see table A7b for full results)

Variable	Percentile	5 percentage points tariff reduction*
(K/L)	0.25	0.4
	0.75	6.0
(SK/BS)	0.25	1.1
	0.75	4.7
(NO/(SK+BS))	0.25	-0.4
	0.75	5.4

* Percentage change in Gini coefficient

We carried out several robustness checks. First, adding income (which serves as a proxy for omitted variables that would exert an influence on inequality during trade liberalization) is not significant and does not alter the results above. Likewise, including several macroeconomic and institutional variables largely preserves those results (and the included macroeconomic variables often have the predicted signs, sometimes at statistically significant levels). For example, an improvement in civil liberties or an increase in government expenditure is associated with decreases in inequality (see results in table A6). Second, similar results are obtained when we apply our preferred specification to quintile data from the WIDER database (45 countries instead of 61). Results are reported in table A7. Third, in the absence

of plausible instruments for tariffs which might be endogenous[21], we test for reverse causality by regressing inequality on future rather than past tariffs, the results become mostly insignificant suggesting that reverse causality is not a problem. Fourth, the results are also robust to the exclusion of a small number of observations signaled as outliers by a test on residuals. The pattern of signs is also broadly similar when we exclude one region at a time (see table A8). Finally, we replaced tariffs with alternative indices of trade liberalization (see results in table A9). The sign (and often the significance) of our interactions terms are robust to the use of various trade ratios (see columns 2, 3 and 4). However, when we use the openness measures of Hiscox and Kastner (2002), Spilimbergo et al. (1999), and Pritchett (1996), few coefficients of the interaction terms remain significant, although the signs remain the same (except in 4 cases). Overall, the results are moderately robust to alternative openness measures.

4. Openness, Inequality and Poverty: Further Results

Arguably, in spite of controls for the type of survey, the data set used so far is of lesser quality than the more recent World Income Distribution (WYD)[22] data set that is drawn almost entirely from household surveys thereby allowing us to define welfare aggregates and recipient units consistently across countries and time. The WYD data set which also provides information on income levels by deciles presents two advantages. First, it allows us to check for the robustness of our results in general, and also to the choice of inequality measure since we can work directly with decile data. Second,

[21] Using past values of *differences* in tariffs as an instrument makes little sense. Moreover, the average length of our sample (3.3 periods) makes it unsuitable for GMM estimations.
[22] WYD can be downloaded from http://econ.worldbank.org/projects/inequality.

it is more appropriate to carry out estimates of the effects of trade liberalization on inequality and especially on poverty, both because the quality of the data is presumably higher, but also because the calculations can also be carried out directly from the household sample mean income per capita, $\bar{m}_{it}$, rather than from GDP per capita from national accounts.

Indeed, it has been argued that income measures from household survey data that is representative of the entire economy is a more reliable estimate of GDP than the corresponding measures from the national accounts. In particular, even though survey-based estimates of income have their own problems, Deaton (2005, p.18) argues that: "If we need to measure poverty in a way that will convince those who are skeptical of the idea that average growth reaches the poor, there is little choice but to use the surveys".[23] In our sample the correlation between annual income growth over 1988 and 1998 measured from the surveys, g_H, and its equivalent from national income, g_{PPP}, is surprisingly low, ($\rho = 0.2917$). Moreover regressing g_H on g_{PPP} gives (std. errors in parenthesis): $g_H = 0.029 + \underset{(0.357)}{0.706}\, g_{PPP}$; $R^2 = 0.0851$.

Following the approach and specification in (3), we regress the share of the j-th decile in country i, θ_{ij} (which is defined as the ratio between the absolute income of the j-th decile, (y_{ijt}), and the sample mean income, ($\bar{m}_{it}$) on $TAR_{i,t-5}$, the same set of relative endowments (RE_{it}), their interaction with $TAR_{i,t-5}$, and a set of controls (Z_{it}) including country and time dummies leading to the following equation to be estimated for each decile[24]:

[23] See Deaton (2005) for a deeper discussion on this issue.
[24] As before, we take the logarithm for all continuous variables.

$$\theta_{ij} \equiv \frac{y_{ijt}}{\bar{m}_{it}} = D_i + YR_t + \alpha_{1j}\bar{m}_{it} + \beta_{1j}\, TAR_{i,t-5} + \sum_{m=1,3} \phi_{1m} RE_{imt} + \sum_{m=1,3} \phi_{2m}(TAR_{i,t-5} * RE_{imt}) + \sum_l \delta_{jl} Z_{ilt} + DS_{it} + e_{ijt} \quad (4)$$

Table 6 reports the results for the bottom three and top three deciles (full results available in table A11).

Table 6: Inequality (by decile), factor endowments and openness

	$\ln\theta_1$	$\ln\theta_2$	$\ln\theta_3$	$\ln\theta_8$	$\ln\theta_9$	$\ln\theta_{10}$	lngini
$Tariffs_{t-5}$	14.65a	6.08a	3.25a	-0.32	-0.7990a	-0.43	-1.14
	(3.88)	(4.12)	(3.23)	(0.93)	(2.66)	(0.49)	(1.47)
Mean income	-0.20	-0.13	-0.08	-0.05a	-0.0436b	0.13a	0.09b
	(1.48)	(1.62)	(1.23)	(2.76)	(2.51)	(2.99)	(2.06)
(K/L)	0.63b	0.19	0.11	0.06c	0.0341	-0.18a	-0.12c
	(2.27)	(1.35)	(0.97)	(1.92)	(0.89)	(2.61)	(1.65)
(AT/L)	0.76	0.03	0.07	0.43a	0.2673b	-0.69a	-0.27
	(0.83)	(0.08)	(0.27)	(4.57)	(2.08)	(3.01)	(1.30)
(MF/L)	-0.88b	-0.30c	-0.19c	-0.06b	-0.0314	0.19b	0.15b
	(2.24)	(1.90)	(1.91)	(2.00)	(1.08)	(2.50)	(2.22)
(SK/BS)	0.18	-0.02	-0.03	0.01	0.0489c	-0.00	0.01
	(1.00)	(0.22)	(0.49)	(0.42)	(1.86)	(0.12)	(0.29)
(NO/(SK+BS))	-0.06	-0.11	-0.09	-0.00	0.0406	0.06	0.07
	(0.29)	(1.20)	(1.09)	(0.07)	(1.44)	(1.33)	(1.09)
(K/L) * ($Tariffs_{t-5}$)	3.80a	1.48a	0.86a	-0.33a	-0.4344a	0.10	-0.24
	(3.31)	(3.15)	(2.70)	(3.31)	(4.07)	(0.36)	(0.94)
(AT/L) * ($Tariffs_{t-5}$)	-12.22a	-4.69a	-2.31a	0.05	0.3992	0.61	0.94
	(3.03)	(3.79)	(2.74)	(0.17)	(1.35)	(0.82)	(1.26)
(MF/L) * ($Tariffs_{t-5}$)	-0.58	-0.21	-0.17	0.05	-0.0082	0.01	0.05
	(1.07)	(0.93)	(1.04)	(0.74)	(0.13)	(0.07)	(0.40)
(SK/(BS)) * ($Tariffs_{t-5}$)	0.68	0.09	0.08	-0.00	0.1017	-0.55	-0.67c
	(0.56)	(0.14)	(0.18)	(0.02)	(0.61)	(1.54)	(1.91)
(NO/(SK+BS)) * ($Tariffs_{t-5}$)	2.00	0.94	0.59	0.13	0.1362	-0.70c	-0.55
	(1.42)	(1.60)	(1.18)	(1.05)	(0.93)	(1.92)	(1.37)
Inflation	-0.19b	-0.05	-0.02	0.00	0.0186	0.02	0.03c
	(2.38)	(1.52)	(0.71)	(0.47)	(0.92)	(0.94)	(1.88)
Income/expenditure	-0.20a	-0.09b	-0.08a	-0.00	0.0077	0.04	0.05b
	(2.80)	(2.56)	(2.63)	(0.20)	(0.62)	(1.60)	(2.15)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	146	146	146	146	146	146	146
# Countries	55	55	55	55	55	55	55

Besides plausible estimates with the FE estimator (Milanovic (2005, footnote 8 argues that because this panel is very short there is insufficient data variability to use such an estimator), the following patterns stand out. First, in spite of an insignificant correlation between GDP growth and sample mean income growth rates, the previous results hold over this sample period when using the Gini (or Theil) index as a measure of inequality. (Signs in column 7 of table 6 are the same as those in table 4 and, with the exception of K/L,significance holds for the interaction terms between tariffs and relative endowments.)

Turning to the decile estimates, by and large the same patterns continue to hold (remember the signs of the coefficients should be reversed in columns 1 to 3 (when compared with those in columns 7). We still find that a reduction in protection decreases the share of the lower deciles and that this effect is more pronounced for countries that have a high K/L ratio while the opposite holds for countries with a high arable land (AT/L) ratio. However, when it comes to breaking down skills, the results lose significance suggesting a lack of robustness when a finer breakdown of skills is attempted. While this should not be surprising since there is quite a high correlation across different endowment measures. Given the small time dimension, lack of controls and noise in the data, it is rather comforting that the signs are preserved and near significance for the measure of the non-educated.

These results were submitted to several robustness checks (see tables in the appendix; others available upon request). First, we ran the same regression without taking the logarithm of the variables, obtaining similar results. Regarding reverse causality, as previously, we ran the same regression using future trade rather than past values and the results become mostly insignificant, suggesting that reverse causality should

not be a problem here. As to control variables, in other specifications, we added government expenditure and/or an index of democracy, resulting in a large reduction in sample size. In general, the significant results in table 6 carry on to this smaller sample (see table A11).

Since the correlation between tariff reductions and inequality after controlling for endowments is still significant in this shorter time span, we used the coefficient estimates in table 6 to simulate the average impact of a 5 point decrease in tariffs (this corresponds to the average tariff reduction during that period) on the bottom and top three deciles for two aggregated developing 'regions': Latin America (15 countries) and East, South and South East Asia (11 countries excluding Japan & Singapore).[25] In each case, regional values are values averaged over countries in the region[26] and only statistically significant coefficients are used which means that the simulations mostly capture the estimated effect of differences in K/L and AT/L ratios. Results of this simulation exercise are reported in table 7.

[25] In a previous draft we also included SSA as a region. However, SSA only has 10 observations spread over 5 countries, implying a very unbalanced panel with only two observations per country.

[26] Because of the possibility of outliers and influential observations, we checked that the results in table 6 were not sensitive to the exclusion of outliers.

Table 7: Decile changes in income simulated from a 5 percentage points reduction in tariffs

- **Latin America [0.482, 0.483]****

Argentina (3), Bolivia (3), Brazil (3), Colombia (3), Costa Rica (3), Dominican Republic (3), Ecuador(3), Jamaica (3), Mexico (3), Nicaragua (2), Panama (3), Paraguay (2), Peru (3), Uruguay (3) and Venezuela (3)

		Decile 1	Decile 2	Decile 3	Decile 8	Decile 9	Decile 10
Latin America	A	1.3% - 1.0%	2.5% - 2.3%	3.6% - 3.4%	11.6% - 11.5%	16.6% - 17.1%	38.0% - 38.1%
	B	348 - 280	704 - 636	1007 - 947	3306 - 3293	4763 - 4929	10994 - 11040
	C	2.1%	1.0%	0.6%	0.0%	-0.3%	0.0%

- **East, South and South-East Asia [0.358, 0.357]****

Bangladesh (2), China (2), India (3), Indonesia (2), Korea (3), Malaysia (3), Pakistan (3), Philippines (3), Singapore (3), Sri Lanka (3) and Thailand (3)

Asia	A	3.0% - 2.2%	4.3% - 3.8%	5.2% - 4.9%	11.6% - 11.5%	15.1% - 15.3%	29.6% - 29.5%
	B	613 - 445	955 - 834	1184 - 1103	2704 - 2658	3486 - 3549	6692 - 6679
	C	3.1%	1.3%	0.7%	0.2%	-0.2%	0.0%

Row A corresponds to the relative shift of the share due to a 5 points decrease of tariffs.
Row B corresponds to the shift of the absolute income of the share due to a 5 points decrease of tariffs.
Row C shows the corresponding annual real growth (over the 10 years) that would be necessary to keep each decile's income at its initial value.

*Number of observations in parentheses.
** Gini coefficients before and after simulated tariff reduction in brackets.

Subject to the validity of imposing the same reaction to tariff liberalization across countries, trade liberalization reduces the income of the first three deciles (and mildly up to decile 7) with usually a small increase for the top three deciles. Regarding the interpretation of the growth that would be necessary to compensate for the adverse effect of trade liberalization on income inequality, Wacziarg and Welch (2003) report an increase in average yearly growth (over a 7-year period) of 0.5 percentage points following the trade liberalizations in their sample suggesting that the growth-induced effects of trade liberalization would not be sufficient to compensate for the adverse distributional implications for the poorest quintile.

Finally, the often-observed lack of sensitivity of aggregate measures of inequality to changes in the distribution of income is confirmed when inspecting the changes in the values of the Gini coefficients reported in table 7 (in spite of the large changes in mean decile incomes, Gini coefficient values only change at the third decimal). Because of the many biases likely to remain in these estimates in spite of the inclusion of many control variables, it is difficult to comment with confidence on the additional information provided by the detailed results on the decile data.

As an alternative presentation of these orders of magnitude, figure 2 reports country-level estimates of the simulated changes in the bottom and top quintiles of the distribution.[27] Gains and losses in the bottom quintile are mostly reflected in changes in the top quintile rather than the middle of the distribution.

[27] The simulations are based on average values over the period. Because of the inclusion of fixed effects in our estimations, actual values of mean quintile shares are extremely close to those reported in figure 2, obviating the need to comment on how the model fits the data.

Figure 2: Simulated changes in quintile mean incomes of a 5 percentage points reduction in tariffs

Figure 2a: bottom quintile*

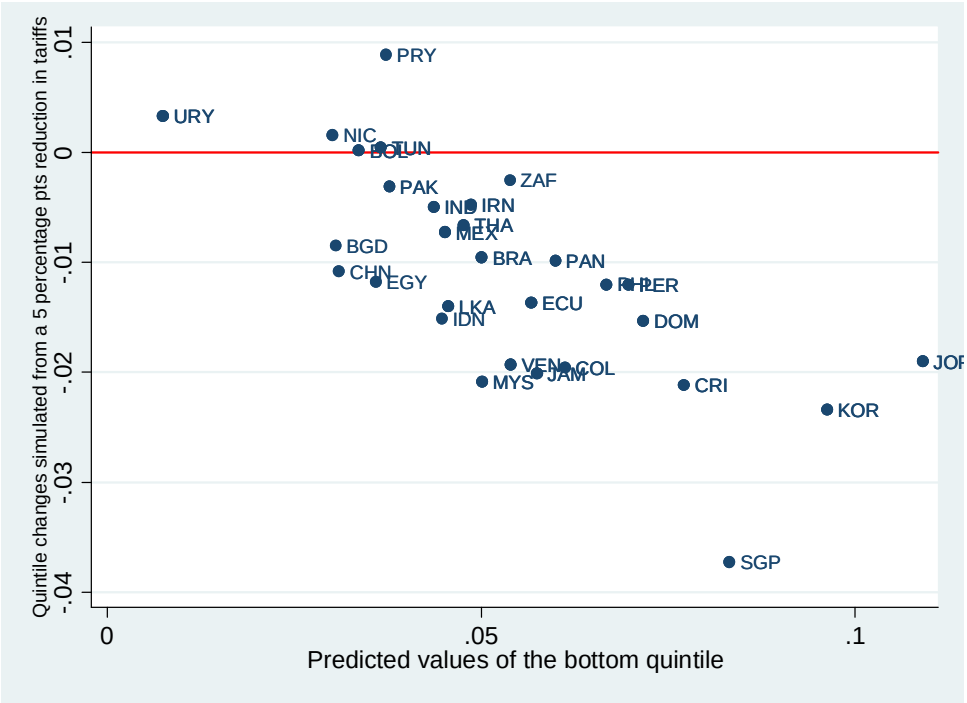
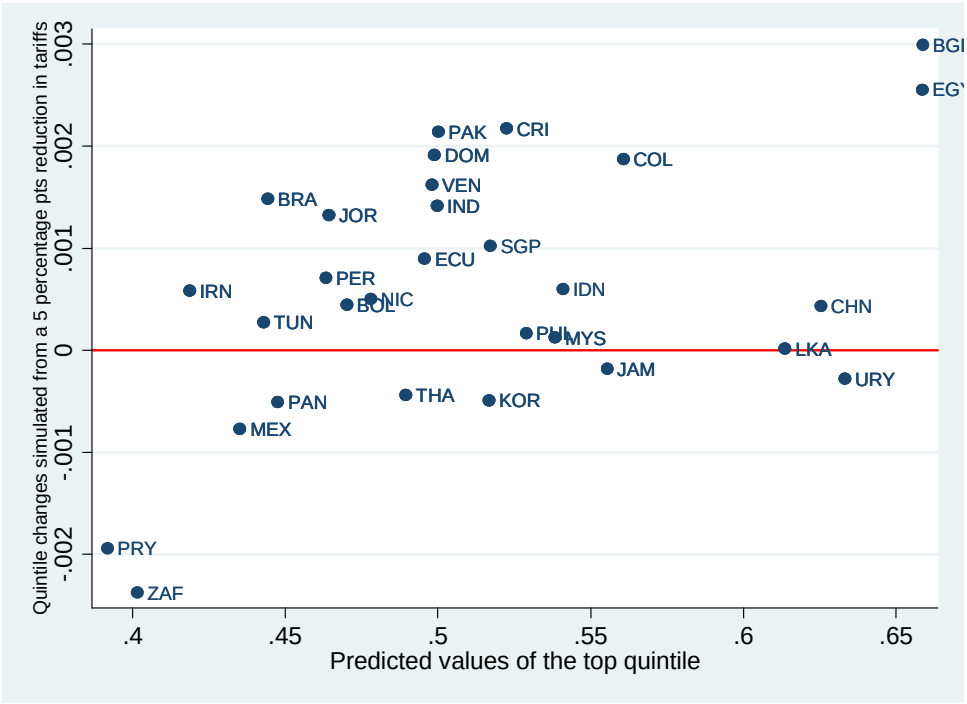


Figure 2b: top quintile*



* Simulated quintile share before tariff reduction on the horizontal axis, and changes in quintile share following the tariff reduction (here, a 5 percentage points) on the vertical axis. For example, the average income share of the poorest 20% of Indonesia (IDN) is reduced from 6% of total income to 4% after the tariff reduction

5. Conclusions

Much of previous research on the correlates of inequality has established that inequality is largely determined by factors that are quite different across countries and that change only slowly within countries. Notably, the effects of changes in trade policies, and of globalization more generally, have been difficult to detect. This paper has focused exclusively on within-country variations to trade policy changes while carefully disaggregating factor endowments. Overall, the results suggest that changes in inequality are correlated with changes in tariffs which are quite robust to inclusion of various controls and to changes in sample periods.

Several patterns emerge from these conditional correlations that support the usefulness of resorting to factor-proportions theories of international trade when studying the effects of changes in trade policy on income distribution.

First, along Stolper-Samuelson predictions, with income per capita serving as a proxy for factor endowments, trade liberalization is associated with an increase in inequality in high-income countries and a decrease in inequality in low-income countries, a result that has escaped most previous studies that have neglected to distinguish within-country from between-country effects.

Second, after accounting for several controls, when interacted with tariffs, factor endowments have the expected effects on inequality. Trade liberalization is associated with increases in inequality in capital-abundant and high-skill abundant countries. Increases in inequality are also positively correlated with trade liberalization in countries abundant in a non-educated labor force, though it decreases inequality in countries that are well-endowed with primary-

educated labor. These results give support to the critics of globalization who often point out that trade liberalization in poor countries leads to increases in inequality.

While spurious correlation cannot be excluded, this result on the pattern of signs is quite robust to the addition of several control variables which also carry expected signs. We find no evidence of reverse causality. Controlling for the sources of income distribution data is almost always significant along expected lines. A reduction in macroeconomic instability (proxied by a reduction in inflation) also reduces within-country inequality.

More tentative conclusions are reached when it comes to the extending the analysis of distributional shifts by studying the whole income distribution rather than using aggregate distribution measures like the Gini or Theil coefficients. Over a shorter ten-year time-span, we obtain similar results with decile data, but the estimates often lack precision when we attempt to break down factor endowments beyond capital and labor to include skill and education levels. Nonetheless, even though measurement errors are probably exacerbated by the short temporal dimension, we would maintain that the relative robustness of the endowment effects to changes in specification justifies looking beyond averages and quantifying effects on the poor.

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Annexes to:
Trade Liberalization, Inequality, and Poverty: Endowments Matter (Julien Gourdon, Nicolas Maystre, Jaime de Melo)

Annex 1: List of countries included in the sample 1980-2000(Gini from WIDER)

	Countries	Number of observations
Latin America	Argentina	3
	Barbados	1*
	Bolivia	2
	Brazil	3
	Chile	3
	Colombia	4
	Costa Rica	4
	Dom. Republic	4
	Ecuador	3
	Guatemala	1*
	Guyana	1*
	Honduras	1*
	Jamaica	3
	Mexico	4
	Nicaragua	2
	Panama	4
	Paraguay	2
	Peru	4
	Trinidad & Tobago	2
	Uruguay	3
	Venezuela	4
Total	**17 (21*)**	**54 (58*)**
Developed Countries	Australia	4
	Austria	3
	Canada	4
	Cyprus	2
	Denmark	2
	Finland	3
	France	4
	Greece	4
	Ireland	3
	Italy	4
	Japan	4
	Netherlands	2
	New Zealand	2
	Norway	4
	Portugal	4
	Spain	4
	Sweden	4
	Switzerland	2
	United Kingdom	3
	United States	4
Total	**20**	**66**

	Countries	Number of observations
Africa and Middle East	Botswana	1*
	Burundi	1*
	Cameroon	2
	Egypt	2
	Ghana	3
	Iran	4
	Israel	3
	Jordan	4
	Kenya	3
	Lesotho	2
	Malawi	4
	Mali	1*
	Mauritius	3
	Rwanda	1*
	Sierra Leone	1*
	South Africa	4
	Tanzania	1*
	Tunisia	4
	Uganda	2
	Zambia	1*
	Zimbabwe	2
Total	**14 (21*)**	**42 (49*)**
Asia	Bangladesh	3
	China	1*
	India	4
	Indonesia	3
	Korea Rep.	4
	Malaysia	3
	Nepal	1*
	Pakistan	4
	Philippines	3
	Singapore	4
	Sri Lanka	4
	Thailand	4
Total	**10 (12*)**	**36 (38*)**

* means that countries are excluded in our specifications with country fixed effects.

Annex 2: List of countries included in the sample 1988-1998 (deciles from WYD)

	Countries	Number of observations
Africa and Middle East	Egypt	2
	Ghana	2
	Iran	3
	Jordan	3
	Kenya	2
	Lesotho	2
	South Africa	2
	Tunisia	3
	Uganda	2
	Zimbabwe	2
Total	**10**	**23**
Latin America	Argentina	3
	Bolivia	3
	Brazil	3
	Colombia	3
	Costa Rica	3
	Dominican Rep	3
	Ecuador	3
	Jamaica	3
	Mexico	3
	Nicaragua	2
	Panama	3
	Paraguay	2
	Peru	3
	Uruguay	3
	Venezuela	3
Total	**15**	**43**
Asia	Bangladesh	2
	China	2
	India	3
	Indonesia	2
	Korea	3
	Malaysia	3
	Pakistan	3
	Philippines	3
	Singapore	2
	Sri Lanka	3
	Thailand	3
Total	**11**	**29**

	Countries	Number of observations
Developed Countries	Australia	2
	Austria	3
	Canada	3
	Cyprus	2
	Finland	2
	France	3
	Greece	3
	Ireland	3
	Israel	3
	Italy	3
	Japan	2
	Netherlands	3
	Norway	3
	Portugal	3
	Spain	2
	Sweden	3
	Switzerland	2
	United Kingdom	3
	United States	3
Total	**19**	**51**

Annex 3: List of variables

Label	Content	Sources
Gini	Gini coefficients	WIDER(2004)
ShareX (X = 1,…, 10)	Absolute income level of each decile normalized by the mean income. (X = 1 corresponds to the poorest 10% of the population and X = 10 to the richest 10%)	WYD (2002)
Mean	It corresponds to the mean income derived from household surveys (in current $PPP)	WYD (2002)
GDPpc	GDP per capita, PPP (constant 1995 international $)	Penn World Tables (2005)
Capital	Capital per Worker	Easterly and Levine (1999) & Kraay and al. (2000)
Land	Land per labor force Land arable per labor force Crop Land per Labor force /Cereal Land per Labor force/Forest Land per Labor Force	WDI (2004)
Mining & Fuel	Production of minerals, coal and oil	World Energy Council (2004)
Education	Average years of schooling in the population over 15 years old	Barro and Lee (2000)
No Educated	Proportion of the population over 15 years non educated (or primary not completed)	Barro and Lee (2000)
Primary (Based) Educated	Proportion of the population over 15 years primary educated (completed) (or secondary not completed)	Barro and Lee (2000)
High (Skilled) Educated	Proportion of the population over 15 years High educated	Barro and Lee (2000)
Inflation	Annual growth rate of the GDP implicit deflator. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.	WDI (2004)
FDI	Foreign Direct Investment as % of Gdp.	UNCTAD Handbook of Int. Trade and Development Statistics (1996, 1997, 2000)
M2/Gdp	Money and quasi money comprise as % of Gdp.	WDI (2004)
Gov Expenditure	Total expenditure includes both current and capital expenditures as % of Gdp	WDI (2004)
Mature	Share of the population between 40 and 59 years old	Higgins and Williamson (1999)
Civil Liberties	Measure the extent to which people are able to express their opinion openly without fears of reprisals and are protected in doing so by an independent judiciary.	Freedom House
Democracy	Democracy is defined as "general openness of political institutions". The variable ranges from 0 (absence of democracy) to 10 (best)	Monty G. Marshall and Keith Jaggers (2002). Polity IV Dataset.
Ethnicity	Herfindhal index which measure the probability for two individuals to be in a different group each other.	La Porta and al. (1999)
Infrastructure	Quantity (Stock); Principal component analysis on road per km², telephone lines per workers, power Gigawatt per worker Quality: waiting times for phone com., energy losses, paved road	Calderon and Serven (2004)
Tariffs	Import duties comprise all levies collected on goods at the point of entry into the country. In % of Imports	WDI (2004)
Index Dollar	Index of price distortion	Dollar (1992)
Index Pritchett	Adjusted Trade ratio: residual once we account for size and distance	Pritchett (1996)
Index Spilimbergo	Adjusted Trade ratio: residual once we account for size, distance and difference in factor endowment	Spilimbergo and al. (1999)
Index Leamer	Adjusted Net Trade ratio: residual once we account for size, distance and difference in factor endowment	Leamer (1987)
Index Hiscox & Kastner	Fixed country years effect in a gravity model once we account for size, distance and difference in factor endowment.	Hiscox & Kastner (2002)
Black market premium	Black market premium	WDI (2004)
Index Wacziarg & Welch	Index taking value 0 or 1 depending on liberalization	Wacziarg & Welch (2005)
Tax Barro & Lee	Tax on capital and input	Barro and Lee (2002)
(X+M)/Gdp	Output trade ratio	WDI (2004)

Annex 4: Construction of index of relative factor endowment

Let E_{ift} is per capita endowment of country *i* in factor *f* in year *t* and E^*_{ft} the world per capita effective endowment of country *i* in factor *f* in year *t* , computed by weighting every country's endowment by the population and by the degree of openness

$$E^*_{ft} = \frac{\sum_i \left(E_{ift} \times pop_i \times \left(\frac{X+M}{GDP} \right)_i \right)}{\sum_i \left(pop_i \times \left(\frac{X+M}{GDP} \right)_i \right)}$$

The indicators of relative advantage is $A_{ift} = \ln \frac{\left(E_{ift}\right)}{\left(E^*_{ft}\right)}$

Annex 5a: Relative Factor Endowments: percentile distribution

Obs.	Percentile	K/L	AT/L	MF/L	SK/BS-	NO/ (SK+BS)	NO /L	BS /L	SK /L
210	25	0,365	0,481	0,000	0,650	0,323	0,505	0,717	0,406
	50	0,943	0,934	0,171	0,927	0,874	0,937	1,008	1,129
	75	2,473	1,636	1,065	1,285	1,857	1,309	1,321	1,863

Note: Values above (below) unity indicates a country endowment above (below) the sample average.

Annex 5b: Tariff Reduction, inequality and factor endowments (full result table 5)

Variable	Percentile	5 percentage point tariff reduction*
(K/L)	0.25	0.4
	0.75	6.0
(AT/L)	0.25	5.2
	0.75	2.1
(MF/L)	0.25	2..3
	0.75	3.4
(SK/BS)	0.25	1.1
	0.75	4.7
(NO/(SK+BS))	0.25	-0.4
	0.75	5.4
(NO/L)	0.25	-3.2
	0.75	3.4
(BS/L)	0.25	1.3
	0.75	0.9
(SK/L)	0.25	-4.1
	0.75	1.5

* Percentage change in Gini coefficient

Annex 6: Adding macro and institutional variables as control

	(1)	(2)	(3)	(4)
	Gini	Gini	Gini	Gini
(AT/L)	-0.0800	-0.1191	-0.0883	0.0844
	(0.60)	(0.92)	(0.68)	(0.67)
(MF/L)	0.1066b	0.1148b	0.1290b	0.0292
	(1.99)	(2.19)	(2.48)	(0.65)
(K/L)	0.0016	-0.0038	0.0312	-0.0964c
	(0.04)	(0.09)	(0.52)	(1.92)
(SK/BS)	0.0629c	0.0684c	0.0573	0.0541c
	(1.76)	(1.88)	(1.59)	(1.71)
NO/(SK+BS)	0.1347a	0.1443a	0.1487a	0.0657b
	(3.62)	(3.75)	(3.93)	(2.04)
$Tariff_{t-5}$	-0.6834c	-0.6274	-0.2170	0.3274
	(1.66)	(1.48)	(0.48)	(0.79)
$(AT/L)*Tariff_{st-5}$	0.5006	0.5383	-0.0480	-0.7290c
	(1.07)	(1.12)	(0.10)	(1.73)
$(MF/L)*Tariffs_{t-5}$	-0.0482	-0.1293	-0.1534	-0.0022
	(0.33)	(0.90)	(1.20)	(0.02)
$(K/L)*Tariffs_{t-5}$	-0.5701a	-0.6124a	-0.3929c	-0.0139
	(2.87)	(2.93)	(1.79)	(0.07)
$(SK/BS)*Tariffs_{t-5}$	-0.6815a	-0.8937a	-0.7086a	-0.6884a
	(2.59)	(3.47)	(2.59)	(2.69)
$NO/(SK+BS)*Tariffs_{t-5}$	-1.0363a	-1.1379a	-1.3857a	-0.7409a
	(3.51)	(3.91)	(4.66)	(2.96)
Inflation	0.0166	0.0157	0.0158	0.0198
	(1.29)	(1.23)	(1.20)	(1.52)
Civil Liberties	0.0234	0.0195	0.0229	0.0051
	(0.56)	(0.48)	(0.53)	(0.12)
Gov. Expenditures (%Gdp)		-0.0579	-0.0589	-0.0378
		(1.33)	(1.45)	(1.09)
Infrastructure stock			-0.0133	0.0655
			(0.23)	(1.25)
Infrastructure quality			-0.0247b	-0.0242a
			(2.52)	(2.69)
Financial depth (M2/Gdp)				-0.0162
				(0.52)
gross/net income	-0.0172	-0.0076	-0.0039	-0.0365b
	(0.99)	(0.44)	(0.22)	(2.25)
income/expenditure	0.1055a	0.0957a	0.1113a	0.1343a
	(3.87)	(4.02)	(4.15)	(5.40)
Households/individual	0.0631a	0.0383b	0.0494a	0.0168
	(3.41)	(2.33)	(2.90)	(1.02)
Fixed Effects	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	202	194	178	141
# Countries	61	61	56	46

Annex 7: Inequality, different skill categories and openness in Quintile

	(1)	(2)	(3)	(4)	(5)	(6)
	Quint1	**Quint2**	**Quint3**	**Quint4**	**Quint5**	**Gini**
(AT/L)	-1.2789b	-0.7471a	-0.1009	0.1524	0.2634c	0.0047
	(2.35)	(2.65)	(0.53)	(1.55)	(1.65)	(0.03)
(MF/L)	0.1587	0.0641	0.0288	-0.0373	0.0052	0.0769
	(1.34)	(0.61)	(0.45)	(0.75)	(0.11)	(1.16)
(K/L)	-0.0313	0.0430	-0.0749	-0.0644	0.0471	0.0120
	(0.19)	(0.48)	(1.17)	(1.55)	(1.07)	(0.23)
(SK/BS)	-0.1403	-0.1224c	-0.1558a	0.0300	0.0259	0.0747c
	(1.33)	(1.84)	(2.85)	(0.62)	(0.86)	(1.96)
(NO/(SK+BS))	-0.2509b	-0.1219c	-0.0860c	-0.0416	0.0767b	0.1746a
	(2.15)	(1.87)	(1.92)	(1.20)	(2.32)	(3.81)
$Tariffs_{t-5}$	0.4429	-0.9382	-0.4793	-0.1430	0.4055	0.2700
	(0.27)	(1.05)	(0.77)	(0.37)	(0.79)	(0.47)
(AT/L) * ($Tariffs_{t-5}$)	2.2169	1.6313	0.5474	-0.0282	-0.7021	-0.3462
	(1.21)	(1.48)	(0.73)	(0.06)	(1.08)	(0.61)
(MF/L) * ($Tariffs_{t-5}$)	-1.8282	-0.5524	-0.1929	-0.2062	0.4176	-0.4216
	(1.53)	(0.69)	(0.27)	(0.62)	(0.98)	(0.82)
(K/L) * ($Tariffs_{t-5}$)	3.4739a	1.8325a	0.5288b	0.1616	-1.0226a	-0.3766b
	(6.51)	(5.59)	(2.19)	(0.86)	(6.73)	(2.15)
(SK/BS) * ($Tariffs_{t-5}$)	0.8075	0.3490	0.7972c	0.0536	0.0158	-0.8097a
	(1.13)	(0.75)	(1.68)	(0.15)	(0.06)	(2.91)
(NO/(SK+BS)) * ($Tariffs_{t-5}$)	2.9618a	2.2255a	0.7086c	0.2726	-0.9611a	-1.7310a
	(2.97)	(3.88)	(1.71)	(0.86)	(3.39)	(4.46)
Inflation	-0.0349	-0.0317	0.0531	0.0061	-0.0058	0.0457a
	(0.97)	(0.80)	(1.14)	(0.36)	(0.26)	(3.08)
Gross/Net Income	-0.0820	-0.0416	0.0553b	0.0695a	-0.0298	0.0516b
	(1.37)	(1.34)	(2.10)	(3.93)	(1.61)	(2.43)
Income/Expenditure	0.1118	-0.0626	-0.1498	-0.0259	-0.0009	0.1543a
	(0.44)	(0.53)	(1.64)	(0.60)	(0.01)	(5.53)
Households/Individual	-0.0747	0.0052	0.0329	-0.0358	0.0455	-0.0066
	(0.33)	(0.05)	(0.52)	(1.00)	(0.89)	(0.31)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135	135
Number of P	45	45	45	45	45	45

Notes:
Column (6) corresponds to the specification of table 5 (column 7) but with the smaller sample of countries
Figures in bold correspond to those obtained with the Gini measure.
Figures in italics are opposite to those obtained with the Gini measure

Annex 8: Excluding one region at a time

	(1)	(2)	(3)	(4)	(5)	(6)
	Without LAC	Without EAP	Without SA	Without SSA	Without MONA	Without WE & NA
(AT/L)	-0.0327	-0.1662	-0.1098	0.0222	-0.1153	0.0651
	(0.17)	(1.18)	(0.77)	(0.16)	(0.75)	(0.46)
(MF/L)	0.1365b	0.0931	0.1210b	0.1232b	0.1156b	0.1811a
	(2.05)	(1.43)	(2.29)	(2.39)	(2.26)	(2.86)
(K/L)	0.0188	0.0998c	-0.0145	-0.0213	0.0088	-0.0790c
	(0.36)	(1.67)	(0.30)	(0.45)	(0.19)	(1.72)
(SK/BS)	0.0262	0.0911b	0.0574	0.0049	0.0595	0.1220b
	(0.61)	(2.36)	(1.54)	(0.13)	(1.60)	(2.25)
(NO/(SK+BS))	0.1091b	0.1497a	0.1391a	0.1235a	0.1564a	0.0770c
	(2.39)	(3.49)	(3.40)	(3.15)	(3.81)	(1.75)
$Tariffs_{t-5}$	-0.8141	-1.0992a	-0.7373	-0.1951	-0.2463	-0.0891
	(1.51)	(2.59)	(1.60)	(0.46)	(0.51)	(0.19)
(AT/L) * ($Tariffs_{t-5}$)	1.1649c	1.0850b	0.5721	-0.2465	-0.1791	0.0233
	(1.92)	(2.21)	(1.12)	(0.53)	(0.29)	(0.05)
(MF/L) * ($Tariffs_{t-5}$)	-0.4412	-0.0629	-0.0497	0.0285	-0.0175	-0.0943
	(1.04)	(0.43)	(0.32)	(0.22)	(0.12)	(0.73)
(K/L) * ($Tariffs_{t-5}$)	-0.6864a	-0.5343b	-0.5842b	-0.2835	-0.8142a	-0.2140
	(2.72)	(2.51)	(2.45)	(1.17)	(3.62)	(0.96)
(SK/BS) * ($Tariffs_{t-5}$)	-0.5745b	-0.7110b	-0.7118b	-0.1805	-0.6865b	-1.0220a
	(1.96)	(2.51)	(2.35)	(0.57)	(2.44)	(3.09)
(NO/(SK+BS)) * ($Tariffs_{t-5}$)	-1.0310a	-0.9240a	-1.0162a	-0.9432a	-1.3939a	-0.8426a
	(2.93)	(2.87)	(2.74)	(2.96)	(4.25)	(2.83)
Inflation	-0.0642	0.0086	0.0153	0.0282b	0.0184	0.0241b
	(0.73)	(0.63)	(1.19)	(2.16)	(1.48)	(2.11)
Gross/Net Income	-0.0022	-0.0164	-0.0224	0.0066	-0.0139	-0.0417b
	(0.09)	(0.88)	(1.26)	(0.36)	(0.70)	(2.34)
Income/Expenditure	0.0967a	0.1066a	0.1094a	0.1168a	0.1092a	0.1148a
	(2.86)	(3.65)	(3.67)	(3.69)	(3.96)	(3.70)
Households/Individual	0.0645b	0.0637a	0.0622a	0.0600a	0.0668a	0.0515b
	(2.43)	(3.43)	(3.28)	(3.07)	(3.48)	(2.10)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	148	171	187	177	181	146
Number of P	44	52	57	52	55	45

Notes:
Column (6) corresponds to the specification of table 5 (column 7) but with the smaller sample of countries
Figures in bold correspond to those obtained with the Gini measure.
Figures in italics are opposite to those obtained with the Gini measure

Annex 9: Using different measures of Trade Openness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Tariffs	(XM/Gdp)	(M/Gdp)	(X/Gdp)	Hiscox & Kastner	Spilimbergo et al.	Prichett
	Gini	Gini	Gini	Gini	Gini	Gini	Gini
(AT/L)	-0.2053	0.4239	0.4791	0.4936	-0.0250	-0.0362	-0.1355
	(1.64)	(1.37)	(1.34)	(1.43)	(0.13)	(0.17)	(1.07)
(MF/L)	0.1209b	0.2767	0.3434c	0.1824	0.0687	0.1700b	0.0668
	(2.55)	(1.21)	(1.92)	(1.30)	(0.85)	(2.39)	(1.60)
(K/L)	-0.0224	-0.1650	-0.1031	-0.1200	-0.1508	-0.0493	0.0018
	(0.47)	(1.28)	(1.02)	(1.05)	(1.45)	(0.71)	(0.04)
(SK /BS)	0.0607c	-0.3877a	-0.3084b	-0.3080a	0.0153	-0.0391	0.0065
	(1.69)	(2.58)	(2.46)	(2.65)	(0.16)	(0.41)	(0.22)
(NO/(SK+BS))	0.1244a	-0.2279	-0.0534	-0.2621b	-0.2259a	0.1046	0.0262
	(3.42)	(1.60)	(0.54)	(2.14)	(3.06)	(1.49)	(0.99)
$Open_{t-5}$	-0.4403	0.1229b	0.2824a	0.2074b	0.0266	0.0284b	0.1007b
	(1.03)	(2.08)	(3.36)	(2.33)	(0.96)	(2.27)	(2.01)
$(AT/L)*Open_{t-5}$	0.3669	-0.0505	-0.1977b	-0.1846c	-0.0225	-0.0187	-0.0586
	(0.70)	(0.91)	(1.98)	(1.90)	(1.32)	(1.64)	(1.38)
$(MF/L)*Open_{t-5}$	-0.2353	-0.0605b	-0.0817	-0.0233	0.0138	-0.0147	-0.0576
	(1.64)	(2.10)	(1.48)	(0.61)	(0.89)	(1.01)	(0.94)
$(K/L)*Open_{t-5}$	-0.4049c	0.0315	0.0182	0.0242	0.0216	0.0030	-0.0338
	(1.71)	(1.08)	(0.69)	(0.83)	(1.03)	(0.37)	(1.00)
$(SK/BS)*Open_{t-5}$	-0.6691b	0.0973a	0.0948b	0.0918a	-0.0019	0.0089	0.1598b
	(2.32)	(2.68)	(2.57)	(2.77)	(0.09)	(0.57)	(2.47)
$(NO/(SK+BS))\ Open_{t-5}$	-1.0085a	0.0670c	0.0251	0.0928a	0.0596a	0.0116	-0.0200
	(3.31)	(1.89)	(0.81)	(2.59)	(3.77)	(1.07)	(0.37)
Inflation	0.0052	0.0216	0.0117	0.0175	0.0124	0.0020	0.0039
	(0.38)	(1.37)	(0.75)	(1.09)	(0.91)	(0.14)	(0.31)
gross/net income	-0.0321c	-0.0314c	-0.0425b	-0.0466b	-0.0317b	-0.0440a	-0.0407b
	(1.92)	(1.81)	(2.32)	(2.52)	(2.14)	(2.58)	(2.45)
income/expenditure	0.1002a	0.1080a	0.1057a	0.1087a	0.0989a	0.1065a	0.1107a
	(3.55)	(3.85)	(3.88)	(3.92)	(3.69)	(3.76)	(4.11)
household/individual	0.0650a	0.0714a	0.0642a	0.0716a	0.0691a	0.0689a	0.0651a
	(3.52)	(3.98)	(3.66)	(3.95)	(3.90)	(3.87)	(3.63)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	177	177	177	177	177	177	177
# Countries	56	56	56	56	56	56	56

Annex 10: Inequality, factor endowments and openness (full results of table 6)

	$\ln\theta_1$	$\ln\theta_2$	$\ln\theta_3$	$\ln\theta_4$	$\ln\theta_5$	$\ln\theta_6$	$\ln\theta_7$	$\ln\theta_8$	$\ln\theta_9$	$\ln\theta_{10}$	lngini	lntheil
$Tariffs_{t-5}$	14.6459a	6.0793a	3.2486a	2.0345b	1.6894b	1.0321c	0.3388	-0.3167	-0.7990a	-0.4306	-1.1449	-2.2244
	(3.88)	(4.12)	(3.23)	(2.44)	(2.49)	(1.88)	(0.76)	(0.93)	(2.66)	(0.49)	(1.47)	(1.29)
Mean income	-0.2042	-0.1332	-0.0805	-0.0408	-0.0598	-0.0695b	-0.0642a	-0.0505a	-0.0436b	0.1265a	0.0869b	0.2006b
	(1.48)	(1.62)	(1.23)	(0.70)	(1.56)	(2.55)	(2.97)	(2.76)	(2.51)	(2.99)	(2.06)	(2.20)
(K/L)	0.6270b	0.1905	0.1056	0.0722	0.0838	0.0887b	0.0516	0.0603c	0.0341	-0.1808a	-0.1229c	-0.2983c
	(2.27)	(1.35)	(0.97)	(0.78)	(1.40)	(2.25)	(1.53)	(1.92)	(0.89)	(2.61)	(1.65)	(1.88)
(AT/L)	0.7550	0.0328	0.0747	0.1589	0.2942c	0.4062a	0.4644a	0.4250a	0.2673b	-0.6948a	-0.2687	-0.7411c
	(0.83)	(0.08)	(0.27)	(0.66)	(1.76)	(3.22)	(4.25)	(4.57)	(2.08)	(3.01)	(1.30)	(1.65)
(MF/L)	-0.8847b	-0.3018c	-0.1896c	-0.1515c	-0.1612a	-0.1302a	-0.1290a	-0.0627b	-0.0314	0.1925b	0.1515b	0.3640b
	(2.24)	(1.90)	(1.91)	(1.95)	(2.58)	(2.73)	(3.22)	(2.00)	(1.08)	(2.50)	(2.22)	(2.41)
(SK/BS)	0.1766	-0.0158	-0.0267	-0.0235	-0.0249	-0.0098	-0.0087	0.0065	0.0489c	-0.0047	0.0130	0.0205
	(1.00)	(0.22)	(0.49)	(0.50)	(0.73)	(0.40)	(0.43)	(0.42)	(1.86)	(0.12)	(0.29)	(0.21)
(NO/(SK+BS))	-0.0621	-0.1145	-0.0896	-0.0762	-0.0747c	-0.0502b	-0.0406c	-0.0014	0.0406	0.0635	0.0666	0.1414
	(0.29)	(1.20)	(1.09)	(1.02)	(1.67)	(1.98)	(1.81)	(0.07)	(1.44)	(1.33)	(1.09)	(1.09)
(K/L) * ($Tariffs_{t-5}$)	3.7957a	1.4825a	0.8644a	0.5135b	0.3970c	0.1301	-0.0277	-0.3332a	-0.4344a	0.0992	-0.2417	-0.3059
	(3.31)	(3.15)	(2.70)	(2.01)	(1.88)	(0.79)	(0.21)	(3.31)	(4.07)	(0.36)	(0.94)	(0.54)
(AT/L) * ($Tariffs_{t-5}$)	-12.2183a	-4.6897a	-2.3084a	-1.3152c	-1.2517b	-0.9016b	-0.5356	0.0478	0.3992	0.6130	0.9350	1.9123
	(3.03)	(3.79)	(2.74)	(1.94)	(2.26)	(2.13)	(1.49)	(0.17)	(1.35)	(0.82)	(1.26)	(1.16)
(MF/L) * ($Tariffs_{t-5}$)	-0.5832	-0.2138	-0.1741	-0.1340	-0.0697	0.0152	0.0590	0.0473	-0.0082	0.0087	0.0517	0.1113
	(1.07)	(0.93)	(1.04)	(1.00)	(0.67)	(0.19)	(0.79)	(0.74)	(0.13)	(0.07)	(0.40)	(0.40)
(SK/BS) * ($Tariffs_{t-5}$)	0.6794	0.0873	0.0788	-0.0876	-0.0307	-0.0194	0.0693	-0.0026	0.1017	-0.5459	-0.6657c	-1.3784c
	(0.56)	(0.14)	(0.18)	(0.24)	(0.11)	(0.10)	(0.41)	(0.02)	(0.61)	(1.54)	(1.91)	(1.81)
(NO/(SK+BS))*($Tariffs_{t-5}$)	1.9963	0.9401	0.5866	0.3569	0.4028	0.2868	0.3500b	0.1342	0.1362	-0.6970c	-0.5549	-1.2857
	(1.42)	(1.60)	(1.18)	(0.81)	(1.34)	(1.53)	(2.09)	(1.05)	(0.93)	(1.92)	(1.37)	(1.46)
Inflation	-0.1946b	-0.0540	-0.0176	-0.0021	-0.0037	-0.0045	0.0026	0.0043	0.0186	0.0186	0.0314c	0.0658c
	(2.38)	(1.52)	(0.71)	(0.10)	(0.23)	(0.34)	(0.23)	(0.47)	(0.92)	(0.94)	(1.88)	(1.80)
Income/expenditure	-0.2013a	-0.0943b	-0.0782a	-0.0553c	-0.0343	-0.0205	-0.0117	-0.0023	0.0077	0.0416	0.0507b	0.1064b
	(2.80)	(2.56)	(2.63)	(1.96)	(1.42)	(0.99)	(0.69)	(0.20)	(0.62)	(1.60)	(2.15)	(2.05)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	146	146	146	146	146	146	146	146	146	146	146	146
# Countries	55	55	55	55	55	55	55	55	55	55	55	55

Absolute value of z statistics in parentheses
c significant at 10%; b significant at 5%; a significant at 1%

Annex 11: Inequality, factor endowments and openness (adding democracy and government expenditure)

	$\ln\theta_1$	$\ln\theta_2$	$\ln\theta_3$	$\ln\theta_4$	$\ln\theta_5$	$\ln\theta_6$	$\ln\theta_7$	$\ln\theta_8$	$\ln\theta_9$	$\ln\theta_{10}$	lngini	lntheil
$Tariffs_{t-5}$	15.5875a	5.8575a	2.4075c	0.9256	0.6286	0.0638	-0.3640	-0.4348	-0.3479	0.5754	-0.1396	-0.1225
	(4.01)	(3.29)	(1.75)	(0.78)	(0.76)	(0.11)	(0.76)	(1.01)	(0.81)	(0.52)	(0.15)	(0.06)
Mean income	-0.0377	-0.0365	-0.0244	-0.0080	-0.0577	-0.0955a	-0.0888a	-0.0834a	-0.0437	0.1297b	0.0651	0.1571
	(0.20)	(0.29)	(0.23)	(0.09)	(1.08)	(3.20)	(3.70)	(3.68)	(1.63)	(2.25)	(1.04)	(1.17)
(K/L)	1.1080a	0.3143b	0.1127	0.0418	0.0395	0.0408	0.0187	0.0541c	0.0460	-0.1365c	-0.0992	-0.2500
	(3.75)	(2.12)	(0.97)	(0.43)	(0.63)	(0.96)	(0.56)	(1.80)	(1.11)	(1.80)	(1.23)	(1.45)
(AT/L)	2.6981b	0.4909	0.2191	0.1685	0.2764	0.3572b	0.3693b	0.3036b	-0.0954	-0.4872	-0.3481	-0.7684
	(2.29)	(0.90)	(0.54)	(0.49)	(1.13)	(1.97)	(2.52)	(2.39)	(0.62)	(1.55)	(1.24)	(1.24)
(MF/L)	-0.7002b	-0.2137	-0.1297	-0.1060	-0.1129c	-0.0974b	-0.0937b	-0.0590c	-0.0413	0.1344c	0.0811	0.2121
	(2.30)	(1.60)	(1.35)	(1.30)	(1.86)	(2.02)	(2.38)	(1.73)	(1.08)	(1.76)	(1.27)	(1.51)
(SK/BS)	0.5310b	0.0841	0.0178	-0.0077	-0.0097	-0.0077	-0.0226	-0.0200	0.0198	0.0087	-0.0029	0.0005
	(2.40)	(0.96)	(0.26)	(0.13)	(0.26)	(0.32)	(1.11)	(1.13)	(0.58)	(0.19)	(0.05)	(0.00)
(NO/(SK+BS))	0.3755	0.0184	-0.0304	-0.0518	-0.0512	-0.0396	-0.0458b	-0.0241	-0.0062	0.0658	0.0305	0.0817
	(1.48)	(0.17)	(0.32)	(0.63)	(1.05)	(1.50)	(2.04)	(1.12)	(0.19)	(1.23)	(0.42)	(0.53)
(K/L) * ($Tariffs_{t-5}$)	2.7484b	1.1079b	0.5371	0.3119	0.1793	0.0008	-0.1267	-0.2348b	-0.2840b	0.2439	0.0035	0.2128
	(2.42)	(2.17)	(1.49)	(1.07)	(0.83)	(0.00)	(0.99)	(2.05)	(2.38)	(0.83)	(0.01)	(0.36)
(AT/L) * ($Tariffs_{t-5}$)	-12.1632a	-4.7621a	-2.0592c	-0.8906	-0.8345	-0.4805	-0.1936	0.1515	0.1669	0.1973	0.5870	1.1720
	(3.14)	(3.49)	(1.95)	(1.00)	(1.27)	(1.00)	(0.49)	(0.45)	(0.43)	(0.22)	(0.68)	(0.61)
(MF/L) * ($Tariffs_{t-5}$)	-0.6383	-0.0573	0.0113	0.0291	0.0636	0.0847	0.0987	-0.0124	-0.0842	-0.0850	-0.1134	-0.2222
	(1.28)	(0.33)	(0.08)	(0.22)	(0.63)	(1.04)	(1.38)	(0.24)	(1.19)	(0.72)	(0.83)	(0.74)
(SK/BS) * ($Tariffs_{t-5}$)	-2.4418	-0.3308	0.1797	0.4017	0.3879	0.3699	0.3412	0.2071	0.3233	-0.9294	-0.7880	-1.6544
	(1.16)	(0.32)	(0.25)	(0.75)	(0.96)	(1.21)	(1.38)	(0.97)	(1.10)	(1.63)	(1.46)	(1.40)
(NO/(SK+BS))*($Tariffs_{t-5}$)	-2.0573	0.0104	0.3946	0.5806	0.6098	0.6037b	0.5918a	0.3928b	0.3674	-1.0347b	-0.5974	-1.4476
	(1.17)	(0.01)	(0.60)	(1.02)	(1.62)	(2.44)	(2.92)	(2.29)	(1.45)	(2.17)	(1.17)	(1.30)
Democracy	0.0113	0.0036	0.0016	-0.0013	-0.0022	-0.0018	-0.0020	-0.0024	-0.0060b	0.0013	-0.0037	-0.0068
	(0.40)	(0.29)	(0.17)	(0.16)	(0.40)	(0.47)	(0.68)	(0.96)	(2.17)	(0.21)	(0.66)	(0.55)
Government expenditure	-0.6073a	-0.2088a	-0.0951c	-0.0265	-0.0181	-0.0070	0.0178	0.0218	0.0689c	0.0166	0.0711c	0.1220
	(3.93)	(2.97)	(1.72)	(0.51)	(0.45)	(0.20)	(0.62)	(0.90)	(1.72)	(0.33)	(1.79)	(1.38)
Inflation	-0.3638a	-0.0986b	-0.0221	0.0071	-0.0001	-0.0061	0.0037	-0.0010	0.0388	0.0148	0.0406c	0.0774
	(3.60)	(2.02)	(0.58)	(0.23)	(0.01)	(0.49)	(0.39)	(0.12)	(1.38)	(0.66)	(1.81)	(1.62)
Income/expenditure	0.0573	-0.0249	-0.0651	-0.0642	-0.0429	-0.0299	-0.0207	-0.0027	-0.0210	0.0599c	0.0455	0.1047
	(0.78)	(0.47)	(1.35)	(1.45)	(1.48)	(1.42)	(1.19)	(0.18)	(1.10)	(1.85)	(1.43)	(1.52)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114	114	114	114	114	114	114	114	114	114	114	114
# Countries	41	41	41	41	41	41	41	41	41	41	41	41

Absolute value of z statistics in parentheses
c significant at 10%; b significant at 5%; a significant at 1%

Annex 12: List of countries for the three regions and their average endowments used for calculation of the impact of a 5 points decrease in tariffs on inequality and poverty.

- **Latin America**

List of countries:
Argentina, Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela

Variables	# Obs.	Mean	Std. Dev
K/L	43	-0.23	0.46
AT/L	43	0.81	0.41
MF/L	43	0.79	1.37
SK/(BS)	43	0.02	0.34
(SK+BS)/NO	43	-0.12	0.56

- **East, South and South-East Asia** (except Japan and Singapore)

List of countries:
Bangladesh, China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka and Thailand

Variables	# Obs.	Mean	Std. Dev
K/L	27	-1.01	0.87
AT/L	27	0.44	0.21
MF/L	27	0.27	0.35
SK/(BS)	27	-0.09	0.58
(SK+BS)/NO	27	0.06	0.98