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International Inequality Impacts of Multilateral Liberalization*

by

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*The views expressed are the authors' alone and not necessarily those of Purdue University, the United States Department of Agriculture, or any institution with which the authors may be affiliated.

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Introduction

Negotiations of the World Trade Organization (WTO) under the Doha Development Agenda (DDA) began in Qatar in 2001 for the purpose of advancing the liberalization of global trading rules agreed to under the Uruguay Round. As evidenced in the naming of the negotiating round, an explicit objective of the DDA trade reform process is the achievement of liberalization that will have significant impact on development and growth in the lowest income countries in the world. Significant gains in global welfare are expected from implementation of increased trade liberalization, yet negotiators continue to struggle to meet an agreement. The Doha era of WTO negotiations has been most notable for its failure to reach a concluding agreement since talks began in Qatar. Certainly, a major contribution to the failure to advance the negotiations has been dissatisfaction with the 1995 Uruguay Round outcomes, which produced only limited movement in trade barriers, and according to many, the Doha disciplines have been insufficiently aggressive (Bouët, Mevel and Orden 2007, Francois, van Meijl and van Tongeren, and Hertel *et al.* 2009). The economics profession has been actively involved in investigating the potential implications of trade liberalization scenarios that generate economic benefits for parties in the negotiations (Anderson, Cockburn and Martin (eds.) 2010 and Anderson and Martin 2005). However, there remains a need for continued investigation of implications of trade reform that considers the political economic environment in which negotiations take place.

Studies which delve into the within country distributional consequences (Hertel *et al.* 2007, 2009) have necessarily been more cognizant of the political realities of selling a negotiation outcome that leaves influential domestic groups behind post-reform and are less sanguine about the obvious advantage of particular countries' participation in aggressive reform deals. While these distributional analyses provide a glimpse of how trade negotiators might be constrained politically at home, they are incomplete. WTO disciplines apply to trade and domestic support policies only, but do not directly address the variety of domestic initiatives geared toward income redistribution to make WTO reforms more palatable to member nations. Thus, a likely additional factor is the distribution of cross-national outcomes (relative winners and losers) serving as an impediment in the negotiations. The majority (60%) of global inequality (income inequality across the world's citizens) is accounted for by differences in income across countries (Bourgignon, Levin, and Rosenblatt 2008). Due to this, participants in the negotiations are likely to be concerned with how their country appears to have fared in the new agreement relative to other parties at the negotiating table.

In this study, we focus on the political realities of the WTO's negotiating framework to examine the cross-country distributional impacts of trade liberalization. Specifically, we examine the changes in per capita GDP resulting from various liberalization instruments relating to non-agricultural merchandise tariff reductions, as well as the three pillars of agricultural support and protection included in the DDA, which encompass the reduction of import tariffs, export subsidies and domestic support for agriculture. This analysis is performed using a CGE model and its accounting of the changes in post-reform national income. Remaining sections in the paper discuss cross-country inequality and studies of Doha outcomes, outline the modeling approach, present results and offer conclusions.

Background

Studies of possible Doha outcomes have been in high demand as negotiations continue. Analytical capacity is considerably larger than it was during the Uruguay Round era and has resulted in a proliferation of comparisons of alternative scenarios available to policy makers as they form positions in the negotiations. Efforts aimed at the analysis of Doha possibilities have contributed to the discussion with a general objective of identifying the effects of proposed reform. The literature on the economic implications of trade reform varies from cross-country regression analysis, partial equilibrium, general equilibrium modeling and frameworks using micro-macro simulations (Hertel and Reimer 2005). Anderson, Cockburn and Martin (2010) summarize the results from two recent economy-wide global modeling exercises (Anderson et. al 2010 and Hertel and Keeney 2010) and provide results from nine individual country models to describe the potential income inequality and poverty reductions that may prevail if global trade of agriculture and non-agricultural products is liberalized. While the magnitudes of model results vary, the overall conclusion from each supports the hypothesis that inequality and poverty will in fact be reduced given further liberalization of the global trading regime. In general, studies show a strong preference for broad participation across countries (developed to least developed) and establish the priority position of improved market access through tariff reduction as the key component of a DDA outcome (Anderson et al. 2002, Anderson and Valenzuela 2007 and Hoekman, Ng, and Olarreaga 2004). Furthermore, these studies show that the national level benefits on the whole are positive for all groups of countries generating positive welfare outcomes as distortions are removed. CGE models are consistently found to serve as the most appropriate methodology for comparing the effects of trade reform policies across

countries (Charlton and Stiglitz 2005). Accordingly, we employ the GTAP-AGR model to determine changes in per capita GDP attributable to each liberalization instrument in order to gain an understanding of the inequality reduction potential of each instrument relating to the three pillars of the DDA.

Modeling Approach

We employ the GTAP version 7 database and CGE model as our starting point for analysis. Fully disaggregated, the database and model specify 113 distinct regions of the world. Each region is modeled with a representative household who owns factors of production which it supplies to a complement of perfectly competitive firms. Using this database and model allows us to evaluate distributional outcomes in a modeling environment commonly used for assessing welfare outcomes of trade liberalization scenarios. In particular, model estimates of Doha round outcomes have relied heavily on this database for projecting the potential gains of alternative reform scenarios in agriculture and manufacturing trade (Bouët and Laborde 2010 and Anderson, Cockburn and Martin 2011). Because our primary interest is in examining the cross-country income distribution when liberalizing reforms are enacted, we leave the database fully disaggregated with respect to regions in the model such that all 113 countries and country groupings of the GTAP database are represented in the model. In terms of sectors, we aggregate GTAP's fifty-seven sectors to a group of ten, indicated in Table 1.

Table 1. Aggregate Tradable Commodities in the Model

Short Name	Description
GrainsCrops	Farm level grain and crop products
MeatLstk	Farm level meat and livestock products
Extraction	Other primary production/extraction
ProcFood	Processed food products
TextWapp	Textiles and wearing apparel
LightMnfc	Lightweight manufactured goods
HeavyMnfc	Heavy manufactured goods

Util_Cons	Utility and construction services
TransComm	Transportation and communication services
OthServices	Other services

The GTAP model used is comparative static which limits our analysis of cross-country distribution to the equilibrium market exchange effects that follow changes in protection. The dynamic effects of aggressive trade reform which affect industry growth and international investment patterns are not included in the model specifications and represent an important limitation of our analysis of distributional impacts.

The empirical modeling literature addressing the Doha negotiations has considered a number of partial reform scenarios. Rather than adopting one of these, we opt to consider full reform (i.e. elimination) of non-agricultural merchandise tariffs, as well as the three pillars of agricultural support and protection included in the DDA. Initial protection levels in the GTAP database are sourced from a variety of data outlets as documented in Narayanan and Walmsley (2008). We summarize the initial levels of border protection in Table 2, using the trade weighted average ad valorem tariff rate for agricultural and non-agricultural tariffs for three classes of countries¹ organized by their average per capita income.

The first section of Table 2 summarizes the current level of applied agricultural tariffs. Here we see that the highest tariffs imposed are by low income countries, and in particular are levied against agricultural imports from other low income countries. This tendency toward high south-south protection, where low income countries maintain relatively high tariffs against imports from other low income countries, has been analyzed elsewhere and shown to be a large potential source of welfare improvement for the poorest nations of the world (Hertel, Keeney, Ivanic, and Winters 2007). Of particular note regarding south-south protection is the fact that most negotiating frameworks call for only minimal tariff reform by the world's poorest countries to increase the welfare of developing nations. On the other hand, high income countries have the lowest average tariff rates, although the impact of this protection is influenced by the significantly large volume of goods these countries import.

¹ Countries were grouped into three categories; high, medium and low income, based on per capita GDP.

Table 2. Average Applied Tariff by Regional Income Groups and Commodity Type

Exporter	Importer		
	High Income	Middle Income	Low Income
<i>Agricultural Tariffs</i>			
High Income	6.76	11.22	13.58
Middle Income	13.39	10.62	15.57
Low Income	10.82	12.84	20.18
<i>Non-Agricultural Tariffs</i>			
High Income	1.06	5.69	8.06
Middle Income	0.93	3.73	6.22
Low Income	3.18	8.55	9.13
<i>All Tariffs Combined</i>			
High Income	1.51	6.08	8.34
Middle Income	2.27	4.70	7.68
Low Income	3.71	9.04	10.58
<i>Proportion of Non-zero Tariffs</i>			
	0.57	0.75	0.67

Source: Authors' calculations and Narayanan and Walmsley 2008.

The pattern of non-agricultural tariffs is very similar to that for agriculture, though the rates are much smaller tending towards less than half the rates for agriculture. There are a large number of tariff lines in non-agricultural merchandise. Presenting average tariff levels masks considerable protection that exists at the tariff line as protection is often tailored to quite specific products that show large tariff peaks. We get some idea of the wide variability in tariff based protection from the last row in Table 2 where we see that between twenty five and forty three percent of aggregate sector tariffs in the data are actually zero depending on the particular regional grouping. In addition to the elimination of tariffs and export subsidies for agriculture, we model the removal of domestic subsidies in OECD countries (where producer support estimates are used as source data for ad valorem subsidy equivalents). WTO trade reform in non-agriculture and the three agricultural pillars represents the only perturbations to the model we introduce.

We use per capita GDP for all countries as our measure of income, consistent with previous analyses of the cross-country dimension of international income distribution (Bourguignon, Levin and Rosenblatt 2008 and Milanovic 2006). The plot of gross domestic product per capita as measured in the GTAP database for all 113 countries is given in Figure 1. Dramatic differences exist in average income across countries with a number of moderately populated countries/regions with very high incomes and a large number of countries (and global population) at the bottom of the

scale with very low average income. Of course the large gap between the wealthiest and poorest nations means that changes in inequality arising from equilibrium adjustment to reduced tariffs will be small since the benefits are shared over a large number of trading nations. Thus, our particular interest will be on the relative inequality impacts of categories of reform such that we can provide some analytical guidance on which areas of the Doha negotiations have the largest impact on cross-country inequality. This insight will then be complementary to the studies reviewed in section one which discussed analysis of reform measures and their relative contributions to welfare changes.

3. Results

Our reporting of results is focused on changes in per capita GDP and how international income is distributed, on average, across countries. Table 3 reports a measure of the GDP change following full liberalization of all instruments. The changes in GDP results are decomposed into twenty component changes, related to the corresponding instrument type and labeled using the following nomenclature. The first letter indicates the type of protection intervention (T = tariff, X = export subsidy, S = producer subsidy). The second letter indicates the aggregate sector involved (A = agriculture, N = non-agriculture). The final two letters indicate the exporter (3rd letter) and importer (4th letter) with the following designations (H = high income country, M = middle income country, L = low income country, and * = all countries). Thus, the second row (TAMH) of the table indicates the average percentage change in GDP resulting from the elimination of tariffs applied to agriculture on trade from middle income countries to high income countries. The columns of the table indicate the category of country according to the three levels of income we use to summarize average effects.

Table 3. Sign Consistency of Percentage Change in Per Capita GDP by Income Class

Instrument	High Income	Middle Income	Low Income
TAHH	-0.02	-1.00	-1.00
TAMH	-0.06	1.00	-0.47
TALH	-0.99	-0.92	1.00
TNHH	-0.63	-1.00	-1.00
TNMH	-0.96	1.00	-0.63
TNLH	-0.99	-0.97	0.93
TAHM	0.99	-1.00	-1.00
TAMM	-0.99	0.20	-1.00

TALM	-1.00	-1.00	1.00
TNHM	0.56	-0.97	-1.00
TNMM	-0.92	1.00	-0.81
TNLM	-0.90	0.20	0.83
TAHL	1.00	-1.00	-1.00
TAML	-0.86	0.98	-0.98
TALL	-0.91	-1.00	0.52
TNHL	0.63	-1.00	-1.00
TNML	-0.85	1.00	-1.00
TNLL	-0.99	-0.88	0.68
XAH*	0.07	-0.25	-0.99
SAH*	1.00	1.00	1.00
Total	-0.69	0.54	0.00

Note: The first column refers to each liberalization instrument. The first letter indicates the type of protection intervention (T = tariff, X = export subsidy, S = producer subsidy). The second letter indicates the aggregate sector involved (A = agriculture, N = non-agriculture). The final two letters indicate the exporter (3rd letter) and importer (4th letter), where H = high income country, M = middle income country, L = low income country, and * = all countries.

Source: Authors' calculations

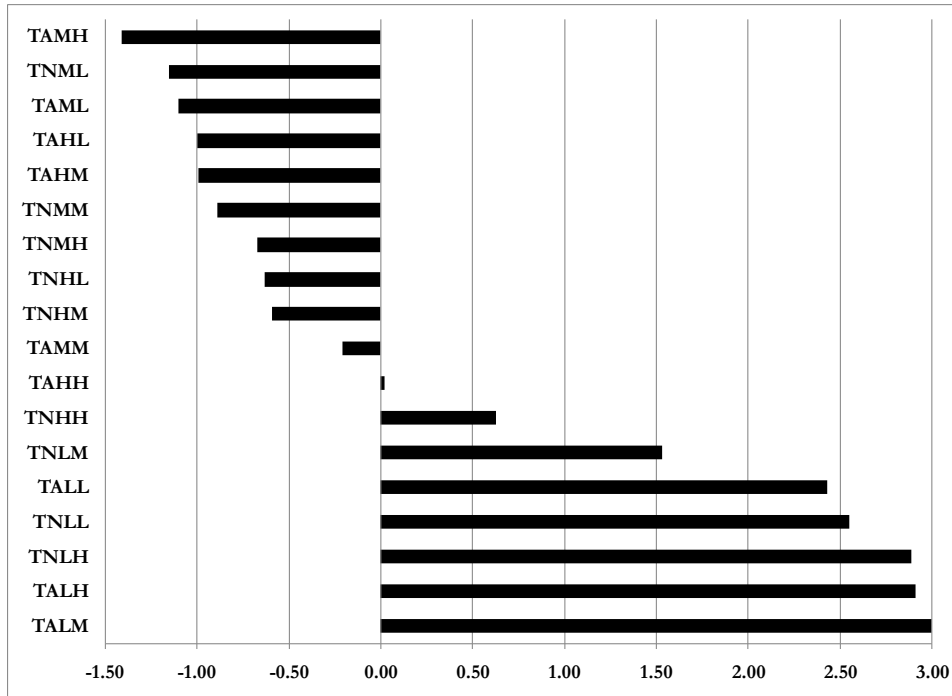
The values reported in Table 3 are not actual percentage changes; rather, they are a measure of sign and consistency of the effect across the broad group of countries within an income category. The values are the average percentage change divided by the average absolute value of the percentage change, both for the value of per capita GDP. This sign consistency (SC) measure clearly will range between value of negative and positive one, with a value of negative one meaning that a particular instrument uniformly reduces GDP for countries in the category while a positive one indicates all countries in the group realize a positive GDP effect of a particular liberalization instrument. In terms of analyzing and predicting the impact of a particular instrument on inequality, pay particular attention to the instruments which evidence values at or near the extremes of the sign consistency statistic, indicating a uniform effect for a particular group of countries and indicating that all countries in the same neighborhood of the income distribution move in a consistent direction following the shock.

The results in Table 3 can thus be used to provide a cursory indication of the impacts of different instruments' impact on inequality by evaluating policy reforms that increase GDP for the lowest income countries while reducing it for those with higher incomes. In particular, a value of 1.00 for the low income grouping and -1.00 for both the middle income and high income countries would strongly indicate a reduction in inequality across countries. This is exactly the case that we observe for the instrument TALM (tariffs on agriculture placed on low income countries' exports by

middle income importers). The SC statistic we report in Table 3 does not include information on magnitudes of effects, so we cannot assert directly that this measure is inequality reducing (all of the changes could be very small or the wealthiest countries in the low income grouping could disproportionately experience the GDP increases). That said, the measures give us a strong indication of the relative uniformity of benefits and costs of reforms in a manner that is consistent with how the negotiations are enacted (i.e. agriculture vs. non-agriculture or industrial vs. developing vs. least developed economies).

To further develop this analysis using the sign consistency statistic in accordance with comparing the potential distributional impacts, we can subtract the SC of both of the higher income groups from the SC of the low income countries to compare the uniformity of instruments' impact on the value of GDP. Thus, a value of 3 would be the maximum (+1 for low income, and -1 for the two higher income groups) and the descending order would give us a means of ranking instruments as to their inequality reduction potential. Figure 2 presents this ranking for instruments and we see that six of the values for this addition of SC's are over a value of 1.5. These are split evenly among importers with each of the country groupings having two measures greater than 1.5 and all six of these instruments related to low income country exports. Thus, our approach to evaluating inequality reducing impacts is able to identify market access concessions in agriculture and non-agriculture as the most important reforms in terms of reducing inequality. Moreover, we see that agricultural market access in middle and high income countries rank the highest in terms of having the broadest uniform impact in reducing inequality across low income countries.

Figure 2. Comparison of Instruments' Uniformity of Impact on Value of GDP



Note: The y-axis labels refer to each liberalization instrument. The first letter indicates the type of protection intervention (T = tariff, X = export subsidy, S = producer subsidy). The second letter indicates the aggregate sector involved (A = agriculture, N = non-agriculture). The final two letters indicate the exporter (3rd letter) and importer (4th letter), where H = high income country, M = middle income country, and L = low income country.

Source: Authors' calculations

The virtue of examining the uniformity of per capita GDP changes in neighborhoods of the initial distribution lies in the fact that we do not limit ourselves to a particular set of restrictions associated with an inequality measure. The literature on inequality measures contains considerable debates on appropriateness of measures and how they relate to social welfare or preferences, thus compounding the debate over reform instruments with additional complexity of inequality measurement. That said, our analysis would be incomplete without some accounting for the magnitudes involved, which are critical in determining reductions in inequality. In Table 4, we report two measures of inequality changes, the Gini and Theil indices. We again report these by liberalizing instrument and focus on the sign change of inequality.

We first note that the predicted changes in inequality are all in agreement between the Theil and Gini indices for each instrument. As previously discussed, the predicted changes are relatively small. In terms of instruments and their predicted impacts, we see that reform of 11 tariff types as

well as high income countries' domestic agriculture and export subsidies are inequality reducing. Notably, both forms of south-south (**LL) liberalization reduce inequality. Among the seven inequality increasing instruments using the Gini or Theil measure, we see that the elimination of agricultural tariffs imposed against high and middle income countries by low income countries will worsen inequality. Thus, when magnitudes of changes are considered, the gains from these reforms disproportionately benefit the high income country group for a variety of reasons related to adjustments in the bilateral trading patterns that exist under status quo and full reform protection.

Table 4. Changes in Inequality by Instrument

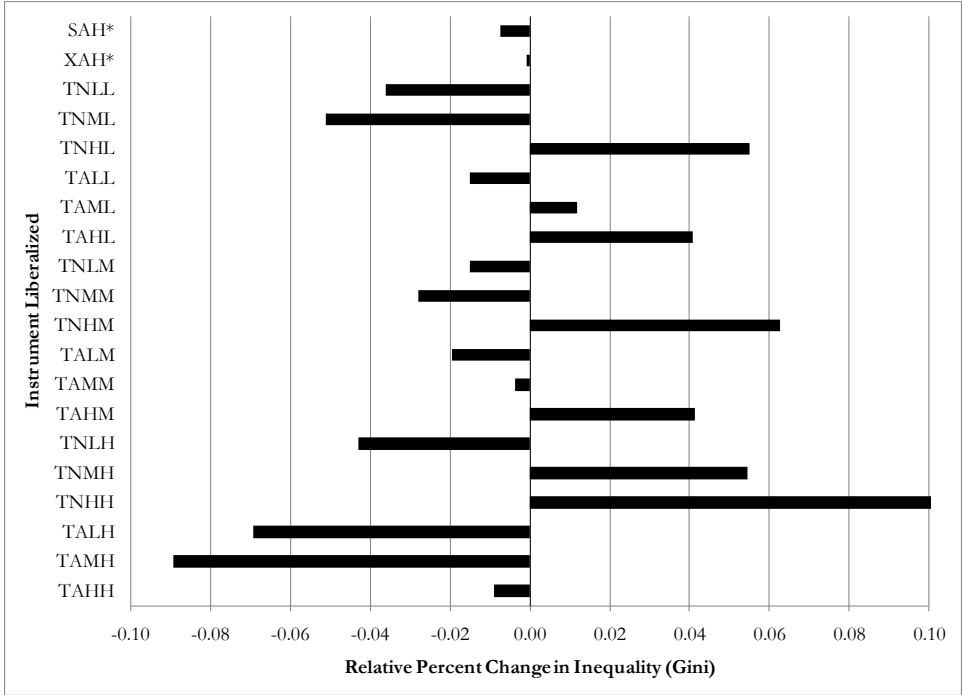
Instrument	Gini	Theil	Inequality Reducing?
TAHH	-0.000413	-0.000600	Yes
TAMH	-0.004105	-0.016766	Yes
TALH	-0.003185	-0.007420	Yes
TNHH	0.051500	0.040629	No
TNMH	0.002500	0.005287	No
TNLH	-0.001976	-0.004292	Yes
TAHM	0.001897	0.005977	No
TAMM	-0.000172	-0.001246	Yes
TALM	-0.000893	-0.001272	Yes
TNHM	0.002872	0.010225	No
TNMM	-0.001289	-0.005565	Yes
TNLM	-0.000687	-0.001147	Yes
TAHL	0.001870	0.004669	No
TAML	0.000543	0.000412	No
TALL	-0.000690	-0.001264	Yes
TNHL	0.002524	0.007545	No
TNML	-0.002343	-0.008854	Yes
TNLL	-0.001663	-0.003656	Yes
XAH*	-0.000039	-0.000116	Yes
SAH*	-0.000345	-0.000699	Yes

Note: The table shows the general inequality reduction potential shown as changes in the Gini and Theil indices attributable to each liberalization instrument. The first column refers to each liberalization instrument. The first letter indicates the type of protection intervention (T = tariff, X = export subsidy, S = producer subsidy). The second letter indicates the aggregate sector involved (A = agriculture, N = non-agriculture). The final two letters indicate the exporter (3rd letter) and importer (4th letter), where H = high income country, M = middle income country, L = low income country, and * = all countries.

Source: Authors' calculations

We place the Gini changes from Table 4 on a relative (to the total inequality change) basis and plot these in Figure 3. Focusing on the left-hand side (inequality reducing) of the graph, which illustrates instruments that reduce inequality, we see that agricultural tariff reform by high income countries on imports from middle and low income countries yield the strongest negative movement in measured Lorenzean inequality. Following these, tariff reform in low income countries on non-agricultural imports from middle and low income countries' exports have the strongest relative impacts. Notable in the inequality measure analysis is that the Gini, like other measures of inequality, does not favor movements at the low end of the income distribution such that if middle income countries increase their income relative to the highest income countries this can lead to a large measure of inequality reduction. Finally, we note that elimination of agricultural production and export subsidies reduce inequality, yet have only small impacts relative to tariff reduction.

Figure 3. Comparison of Relative Contributions to Inequality Reduction



Note: The figure illustrates the relative percentage change in inequality as measured by the percentage change in the Gini coefficient attributable to each liberalization instrument. The y-axis labels refer to each liberalization instrument. The first letter indicates the type of protection intervention (T = tariff, X = export subsidy, S = producer subsidy). The second letter indicates the aggregate sector involved (A = agriculture, N = non-agriculture). The final two letters indicate the exporter (3rd letter) and importer (4th letter), where H = high income country, M = middle income country, L = low income country, and * = all countries.

Source: Authors' calculations

In comparison to our measures of the summation of SC's which focused on inequality relative to the low income countries, we see that the four largest relative inequality impacts have different effects for the low income countries. While TAMH reform has the largest Lorenzean inequality reducing effect, Figure 2 indicates that it has a low likelihood of improving income equality for the lowest income countries. Thus, the two frameworks of analysis are complementary in identifying both a general (Gini) and local (SC) dimension of inequality reduction.

4. Concluding Remarks

This study reports the outcomes of a full reform experiment consistent with liberalizing global trade in a WTO/Doha type framework. Our approach to assessing the effects on international income inequality expands on traditional approaches which are confounded by the need to evaluate the entire cross-country distribution. In fact, we complement the measurement of overall changes in international inequality (measured by the Gini and Theil coefficients) by using a sign consistency statistic over income groupings, to locate potential for inequality improvement in a neighborhood of the distribution. Inequality reduction potential differs when considering local changes in GDP, as measured by the sign consistency statistic, versus changes in income across countries as illustrated by the Gini coefficient. While the magnitudes of the changes in per capita GDP are small across countries, it is the relative changes within the distribution of income that are critical to more fully understand the inequality effects of liberalization. In accordance with previous welfare focused studies, we conclude that market access is the most important of the three pillars of the DDA for generating benefits for least developed/low income countries. Further, we find that allowing free market access to low income country imports has the greatest potential benefit for reducing inequality located at the bottom of the cross-country income distribution.

Further work in this area extends naturally into the determinants of GDP, as calculated within the CGE model solution. Since GDP is a real value term, it can be decomposed into its real price and quantity components to explore additional cross-country determinants to the comparative static predictions of post-reform equilibrium, and provide further analytical insight into the potential income redistribution impacts of reducing trade barriers.

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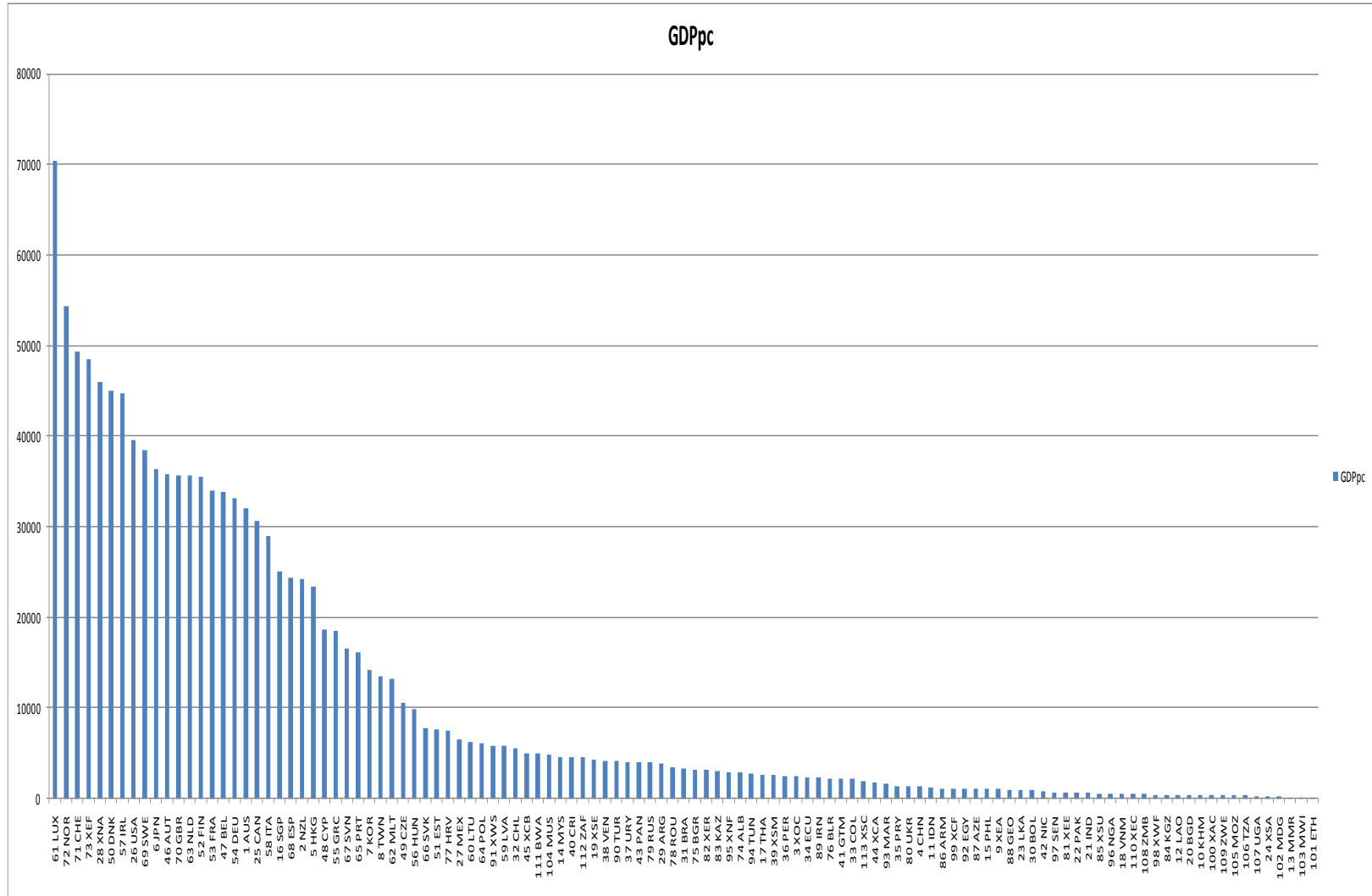
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Figure 1. Distribution of Per Capita Income across Regions



Source: GTAP 7 Database