Why Isn't the Doha Development Agenda More Poverty Friendly?

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Thomas W. Hertel, Roman Keeney, Maros Ivanic, L. Alan Winters

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Abstract

Critics of the Doha Development Agenda rightly point to the lack of aggressive reform in wealthy countries for its role in dampening developing country gains. We find that the absence of tariff cuts on staple food products in developing countries also critically limits poverty reduction in developing countries. Based on our analysis of the impacts of multilateral trade policy reforms in a sample of fifteen developing countries, we find there is some evidence of poverty increases in agriculture when the poor working in agriculture lose protection for their agricultural earnings. However, these effects are minimized when agricultural tariffs are cut in *all* developing countries, and when the impact of lower food prices on low income consumers is taken into account in our fifteen country sample.

*Hertel & Keeney: 403 West State Street, W. Lafayette, IN 47907, hertel@purdue.edu, rkeeney@purdue.edu., Ivanic: The World Bank, Washington, D.C., Winters: University of Sussex, U.K., Tel: 44 1273 678332

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Address of Contact Author: Thomas W. Hertel, Center for Global Trade Analysis, Purdue University, 403 West State Street, W. Lafayette, IN 47907, Phone 765-494-4199, Fax 765-496-1224, hertel@purdue.edu

1. Introduction and Motivation

The troubled progress of the World Trade Organization's Doha Development Agenda has largely revolved around agricultural negotiations and the implications for developing country gains associated with these potential reforms. It is the connection between agricultural reforms and development that has arisen as the most contentious issue in the negotiations. For the current analysis, we adopt an operational definition of development – reduction in the extreme poverty headcount– and ask how different elements of trade liberalization contribute towards this goal. We find that a likely Doha package will be less poverty-friendly than it could have been when considering reforms already removed from the negotiating table. Previous analyses have identified the misplaced attention on industrial countries' agricultural subsidies as not particularly poverty-friendly (Anderson, Martin and Valenzuela, 2006; Hertel et al., 2007; Hoekman, Ng and Olarreaga, 2004). In the current analysis, we concur with this result and note additionally that the limited reform requirements placed on developing countries curtails the ability of the negotiations to reduce poverty in these same nations.

Based on the patterns of protection involved, our analysis suggests that developing country poverty reduction is enhanced both by liberalizing industrial countries' agricultural trade (and rising agricultural prices) and by liberalizing developing countries' trade (which reduces agricultural prices). We are able to resolve the paradoxical nature of these two results by decomposing poverty level income into changes into earnings, taxation, and cost of living effects to identify the sources of poverty reduction across a fifteen developed country sample.

We follow previous simulation analyses of the DDA such as Hertel and Winters (2006) and Hertel et al. (2007) by constructing plausible Doha round outcomes and translating them into

reductions in agricultural support. Using these reforms, we employ a general equilibrium model (GTAP) to estimate the impacts on factor and commodity prices and government revenue in 34 countries and regions. In fifteen of the developing countries we use detailed household data on factor earnings and consumption to calculate the effects on poverty across seven strata of households across countries. The fifteen developing countries span the continents of Africa, Asia and Latin America accounting for nearly 1 billion people, and more than 150 million poor (evaluated at the $1/day poverty line). The basic scenarios and modeling approach in this paper are the same as in Hertel et al. (2007). Whereas that article looked at rich-country income distribution as well as poor, and only at the net effects on developing country poverty, here we focus on the decomposition of the effects of different policies and the contrast between developed and developing country liberalization. We believe it is the first systematic attempt to look at the poverty impacts of omitted developing country liberalization in the Doha round. We turn now to our analytical framework, which features a novel approach to decomposing the poverty impacts of trade reform.

2. Analytical Framework

The Poverty Model

There are many alternative approaches to estimating the change in poverty headcount due to trade reforms (Hertel and Reimer, 2005; Winters et al., 2004). The approach here builds from Hertel et al. (2004), using a sequential modeling strategy with results from a global trade model passed to a series of micro-simulation models. Beginning with a consumer demand system, and the associated utility function, the *poverty level of utility* is defined. Evaluation of poverty

changes is thus simplified to calculating the percentage of the population below this poverty level of utility.

In this study, we use Rimmer and Powell's (1996) AIDADS demand system to represent consumer preferences. AIDADS is particularly useful for poverty analysis as it devotes two-thirds of its parameters to consumption behavior in the neighborhood of the poverty line (Cranfield et al., 2003). Estimation of this demand system is undertaken using the 80 country, per capita consumption data set offered by GTAP version 6.1 with the demand system estimates then calibrated to reproduce base year per capita demands in each country.

A key finding in the work of Hertel et al. (2004) is the importance of stratifying households by primary source of income. Farm households in developing countries often rely on the farm enterprise for virtually all of their income. And national poverty tends to be concentrated in agriculture-specialized households in the poorest countries in our sample. In these cases, the poor are more likely to benefit from producer price increases. In other countries, the national poverty headcount is dominated by wage earners who will be more susceptible to food price rises. To delineate the patterns of earnings specialization we follow Hertel et al. (2004) in identifying five household groups that rely almost exclusively (95% or more) on one source of income: agricultural self employment, non-agricultural self-employment, rural wage labor, urban wage labor, or transfer payments. The remaining households are grouped into rural and urban diversified strata, giving seven strata.[1]

Given our emphasis on the poverty headcount, we focus on households in the neighborhood of the poverty line using a *highly disaggregated* poverty elasticity.[2] Our analysis begins with the cumulative density function of per capita income in region r for the population

stratum s: $F_{rs}(y)$. Thus $F_{rs}(\bar{y}_r^p)$ computes the poverty headcount ratio when $\bar{y}_r^p$ is the level of income required to attain the poverty level of utility in region r at initial prices. Since preferences and consumer prices are assumed to be the same across all strata in the country, this poverty level of income is unique. We are interested in the elasticity of this poverty headcount with respect to a small change in the real income of households at the poverty line, in a given stratum *s*: dy_{rs}^p. Assuming unchanging commodity prices, and given the function $F_{rs}(\bar{y}_r^p)$, this may be computed as follows (where the elasticity is defined to be non-negative):

$$\varepsilon_{rs} = -\frac{dF_{rs}(\bar{y}_r^p)/dy_{rs}^p}{F_{rs}(\bar{y}_r^p)/y_{rs}^p}.$$

The top panel in Table 1 reports these (positive) stratum-specific poverty elasticities for the fifteen countries in our sample. They range from a low of 0.0006 in the self-employed agriculture stratum in Zambia, where nearly all of the population is well below the poverty line, to a high of 3.63 in the urban diversified stratum of Brazil, where the population density at the poverty line is quite high.

The proportional change in real income of households at the poverty line in stratum s of region r can be written as the income–share weighted sum of the households' real after-tax factor earnings:

$$\hat{y}_{rs}^p = \sum_j \alpha_{rsj}^p (\hat{W}_{rj} - \hat{C}_r^p) \qquad (1)$$

where α_{rsj}^p is the share of income obtained from factor j by households at the poverty line in stratum *s* of region r. These poverty earnings shares tend to be dominated by unskilled labor.[3]

The proportional change in after-tax earnings of factor *j* in region *r* is denoted $\hat{W}_{rj}$ and $\hat{C}_r^p$ is the proportional change in the cost of living at the poverty line in region *r*, obtained by evaluating the consumer utility function for the level of expenditure required to *remain at the poverty level of utility*.[4] We can now express the proportional change in the poverty headcount in stratum *s* of region *r* as follows:

$$\hat{F}_{rs}(\bar{y}_r^p) = \hat{H}_{rs} = -\varepsilon_{rs} \cdot \hat{y}_{rs}^p = -\varepsilon_{rs} \cdot \sum_j \cdot \alpha_{rsj}^p (\hat{W}_{rj} - \hat{C}_r^p) \qquad (2)$$

The national poverty headcount can now be expressed as a function of the stratum headcounts and stratum populations (POP_{rs}): $H_r = \left[\sum_s POP_{rs} * H_{rs}\right] / POP_r$, where $POP_r = \sum_s POP_{rs}$. So the proportional change in H_r is given by: $\hat{H}_r = \sum_s \beta_{rs} * \hat{H}_{rs}$, where the share of stratum *s* poverty in nationwide poverty in region *r* is computed as: $\beta_{rs} = \left[\left(POP_{rs} * H_{rs}\right) / POP_r\right] / H_r = \left(POP_{rs} * H_{rs}\right) / \sum_k \left(POP_{rk} * H_{rk}\right)$. These stratum poverty shares are reported in the bottom panel of Table 1 for our 15 focus countries. Agriculture specialized households and rural diversified households tend to dominate the poverty headcount, although exceptions are Colombia, Venezuela and Peru, where self-employed, non-agriculture households contain a large share of the poor. Substituting (2) into this expression, we get the following equation with which to evaluate the change in the national poverty headcount in response to changing factor and commodity prices:

$$\hat{H}_r = -\sum_s \beta_{rs} \cdot \varepsilon_{rs} \cdot \sum_j \alpha_{rsj}^p \left(\hat{W}_{rj} - C_r^p\right) \qquad (3)$$

For purposes of subsequent analysis and discussion, it will be useful to further separate the tax component associated with the replacement of lost tariff revenue by another tax instrument. Hertel and Winters (2006) find that the choice of a revenue replacing tax instrument can have a significant impact on the poverty results following trade reform. Here, we follow those authors in adopting the rather neutral approach of an endogenous, uniform factor income tax. Define the uniform *ad valorem* income tax on factor *j* in region *r* as follows: $TAX_{rj} = t_r W_{rj}^m \cdot L_{rj}$, where t_r is the tax replacement instrument applied to market earnings, W_{rj}^m. Letting $T_r = (1 + t_r)$ be the *power* of the replacement income tax in region *r*, then with fixed endowments, the proportional change in after tax income is given by: $\hat{W}_{rj} = \hat{W}_{rj}^m - \hat{T}_r$. Substituting into (3) we have the following decomposition of changes in the poverty headcount in region *r* into market earnings, replacement tax, and cost of living components:

$$\hat{H}_r = -\sum_s \beta_{rs} \cdot \varepsilon_{rs} \cdot \sum_j \alpha_{rsj}^p \left(\hat{W}_{rj}^m - \hat{T}_r - \hat{C}_r^p \right) \qquad (4)$$

Finally, since only relative prices matter in the general equilibrium model, and since we wish to separate the "earnings" and "spending" effects of trade reform on households, it is useful to normalize both market wages and the cost of living by a common variable. The choice of normalization factor is arbitrary, since we will first subtract it from wages, thereupon adding it back in with the cost of living. The normalization variable should be a national, nominal variable that does not vary by stratum or earnings type, and it should have some economic meaning when compared to a particular category of wages, or to the cost of living. For the present analysis, we choose net national income in the region: y_r. Subtracting and adding $\hat{y}_r$ to the term in brackets in (4), recognizing that the tax replacement and cost of living effects are independent of stratum

and earnings type, and making use of the fact that $\sum_j \alpha_{rsj} = 1$, we define the national poverty elasticity as the poverty share-weighted sum of the stratum elasticities: $\varepsilon_r \equiv \sum_s \beta_{rs} \varepsilon_{rs}$. This gives the final decomposition of the national poverty impacts of a trade reform in:

$$\hat{H}_r = -\sum_s \beta_{rs} \varepsilon_{rs} \sum_j \alpha_{rsj}^p \left(\hat{W}_{rj}^m - \hat{y}_r \right) + \varepsilon_r \hat{T}_r + \varepsilon_r \left(\hat{C}_r^p - \hat{y}_r \right) \qquad (5)$$

The first term in (5) will be termed the "earnings effect" and identifies the change in a particular wage, relative to net national income. The second term is the "tax effect". And the third term is the spending effect, which identifies the change in cost of living at the poverty line, relative to net national income.

For expository purposes, let us now consider what (5) has to say about three different trade policy-induced changes: a rise in the unskilled wage rate, a rise in the power of the tax, and a rise in the price of staple foods. Since unskilled wages often represent an important part of poverty income, (i.e. $\alpha_{rsj}^p > 0$), a rise in the wage rate relative to y_r will boost real income substantially moving some households across the poverty line. The proportional change in stratum headcount following the wage rise will depend on the density of the stratum population in the neighborhood of the poverty line as captured by ε_{rs}. If this density is high, and the stratum also contains a substantial share of the nation's poor, as captured by β_{rs}, then there will be a relatively large reduction in the poverty headcount *ceteris paribus.* Of course, other factors may change as well. If tariffs are cut, we expect that the income tax, t_r will rise so that $\hat{T}_r > 0$ inducing a *rise* in poverty. Finally, if trade liberalization results in a rise in staple food prices for

which the poor household's expenditure share is very large, then we expect a rise in the cost of living at the poverty line, relative to net national income, leading to a rise in poverty in region *r*.

In light of the fact that trade reforms considered here change all the relative prices as well as tax revenues, the decomposition offered by (5) is quite important for understanding the underlying drivers behind any change in the national poverty headcount. We now turn now to the general equilibrium framework that will determine how these factor prices, commodity prices and taxes change as a function of trade policies.

The Global General Equilibrium Model

Our starting point for the global general equilibrium analysis of the impacts of trade policy is the GTAP version 6.1 data base (Dimaranan, 2007). These data permit us to draw on the carefully constructed Doha reform scenarios developed and utilized in the recent books by Anderson and Martin (2006), and Hertel and Winters (2006). We conduct the necessary experiments to update key trade policies to 2005 to establish that year as the benchmark for trade liberalization, as well as modifying the standard GTAP CGE model to enhance our analysis of agricultural reforms and simulation of poverty impacts. While we retain the simplistic yet empirically robust assumptions of constant returns to scale and perfect competition typically featured in agricultural trade studies, we modify the model to shed new light on the distributional consequences of the Doha reforms – focusing particularly on unraveling the puzzle of why the Doha Development Agenda is not more poverty friendly. Specifically, we ensure consistency on the demand-side of the model by modifying the global model to incorporate the same AIDADS demand system used in the poverty module. Thus, aggregate preferences are consistent with the preferences used to

evaluate the impact of price changes on households at the poverty line – although expenditure patterns differ due to differing income levels.

The other modifications relate to the factor markets for discerning earnings effects. We follow recent studies of global agricultural trade liberalization (e.g., Keeney and Hertel, 2005) in modeling farm/non-farm mobility by specifying a constant elasticity of transformation function which "transforms" farm employed versions of labor and capital into non-farm uses and vice-versa. This transformation function permits wages to diverge between the farm and non-farm sectors, a key driver for our distributional analysis. With segmented factor markets, the impact of reduced subsidies to agriculture in the rich economies will not be shared equally between the farm and non-farm labor forces or between farm and non-farm capital owners, and similarly for the benefits from higher farm prices in developing countries following rich country reforms. In order to parameterize these CET factor mobility functions we draw on the OECD's (2001) survey of agricultural factor markets.

We assume a constant aggregate level of land, labor, and capital employment reflecting the belief that the aggregate supply of factors is unaffected by trade policy. In addition, we employ a macroeconomic closure which fixes the ratios of government spending, tax revenue, net national savings, and the trade balance, all relative to net national income. This (relatively standard) closure facilitates linking the aggregate and disaggregate welfare impacts of trade reform (see online Appendix for a discussion of our closure assumptions and their implications).

Implementation of (5) requires us to map factor earnings in the general equilibrium model to household income sources. Agricultural labor and capital receive the corresponding farm factor returns from the general equilibrium model, as do non-agricultural labor and capital.

Wage labor for diversified households reported in the surveys presents a problem because information is lacking to allocate it between agricultural vs. non-agricultural activities. We simply assign to it the composite wage for labor determined by the CET endowment function. Finally, transfer payments are indexed by the growth rate in net national income.

3. Policy Scenarios

Our attention in this paper is on the developing country poverty impacts of trade reforms undertaken in both rich and poor countries. We address these in two stages focusing initially on the poor country poverty impacts of liberalizing rich country agricultural policies in isolation. We then contrast this with agricultural trade reforms in the poor countries themselves. The latter have proven controversial – particularly with regard to their impact on poverty, with some policy makers emphasizing that lowering protection for agriculture in developing countries will hurt poor farmers. Others have argued that lower food prices will serve to reduce poverty. Our poverty decomposition from equation (5) allows us to identify both the earnings and spending sides of the problem, providing a natural framework for analyzing the combined impact on poverty in our sample of fifteen countries. Finally, we bring in non-agricultural reforms (in both rich and poor countries) to complete the global reform scenarios.

We consider both full liberalization – as a benchmark – as well as a carefully constructed Doha scenario which derives from the so-called July 2004 Framework Agreement (WTO, 2004). The Doha scenario follows the core liberalization assumptions in Hertel and Winters (2006) and is summarized alongside other policy scenarios considered in this paper in Appendix Table A2. Our treatment of Doha entails a combination of cuts to domestic support, export subsidies and tariffs. We assume that industrial countries with domestic support in excess of 20 percent of

production cut their bound commitments by 75 percent, while others cut by 60 percent. However, even with these ambitious reductions, the binding overhang means that effectively only five WTO members would be required to reduce actual support, based on 2001 notifications: Australia, EU, Iceland, Norway, and USA (Jensen and Zobbe, 2006). For developing countries domestic subsidy bindings are cut by 40 percent. In this case, Jensen and Zobbe (2006) estimate that only Thailand's subsidies would be affected. Export subsidies are assumed to be fully eliminated. Agricultural tariffs in the rich countries are reduced using a tiered formula , with a marginal reduction of 45 percent on the first 15 percentage points of the tariff, 70 percent reduction for between 15 and 90 percent, and 75 percent on the remainder of the tariff. The same approach is applied for developing countries with 20, 60 and 120 percent bound tariff levels in agriculture and marginal cuts of 35, 40, 50 and 60 percent, respectively.

Cross-sector trade-offs are at the heart of the WTO negotiations, so we also consider the impact of non-agricultural elements of a prospective Doha Development Agenda. We focus exclusively on market access in non-agricultural trade, since barriers to services and investment remain difficult to quantify and those WTO negotiations appear unlikely to yield significant changes in the near term. Non-agriculture tariffs are subjected to proportional reductions of 50 percent for developed and 33 percent for developing countries. Least developed countries are exempted from these reductions.

4. Results

Agriculture Liberalization by the Rich Economies

In our empirical analysis, we make use of the poverty decomposition outlined in equation (5), working through this expression from the inside out, beginning with the fundamental "drivers" of

poverty changes, namely factor prices, tax rate changes and the cost of living change, by region. We then translate the earnings changes into poverty changes by strata, using the earnings shares and poverty elasticities in (5). Finally, we aggregate across strata to examine the national poverty impacts in each region resulting from the effects of changes in earnings taxes and cost of living. This approach provides significant new insights into the contrasting effects of trade reforms in rich and poor countries, as well as Doha vs. Full Liberalization.

Table 2 reports the change in relative factor returns, cost of living and income tax rates, by country resulting from agricultural trade liberalization by the rich economies.[5] We first note that relative returns to factors employed in agriculture (land, labor and capital) increase throughout the sample, while returns to non-agriculture factors decline. Economy-wide returns to unskilled wage labor rise, while those associated with skilled wage labor fall. These results are to be expected, since rich country agricultural reforms tend to shift agricultural production from North to South, thereby boosting the demand for agricultural inputs and unskilled labor in general in developing countries. Observe that the impact on the "earnings" associated with transfer payments is zero, as these payments are indexed to net national income, which is also used to deflate all earnings types reported in Table 2.

The first row of the second block of entire in Table 2 averages the changes across our focus countries, while the second row reports the Average Absolute Value (AAV) of the price changes, which tells us how large the price changes are regardless of sign. Thus, we see that the impact on factor price is largest for land, followed by agricultural unskilled labor, and then skilled labor and agricultural capital. The absolute size of the impacts on non-agricultural factor returns and economy-wide wages are much smaller. So we expect the earnings-driven poverty

impacts from rich country agricultural liberalization to be greatest in strata where agricultural factors command large earnings shares.

The consistency of the results across sample countries is neatly summarized by the "sign consistency" statistic (Hertel and Ivanic, 2006) of a given variable (e.g., agricultural unskilled wages). This is the ratio of the average to the average absolute value of the price change, and it is reported in the third row of the second block of Table 2 entries. Since rich agricultural reforms boost unskilled wages in all countries, the sign consistency measure reaches its maximum value of 1.0 for these factors. On the other hand, when it lowers a relative price in all regions – as is the case with non-agriculture skilled wages, the sign consistency measure reaches its minimum value of -1.0. The most striking thing about the relative factor returns impacts under rich country agric. liberalization is the great consistency of effects across this diverse group of countries (either 1.0 or -1.0 in all cases).

The final two columns in Table 2 report the percentage changes in the power of the income tax and the cost of living at the poverty line. Since the rich agricultural reform scenarios involve no tariff reductions in developing countries, there is no need to raise income taxes to replace lost revenue. So the only tax changes are due to the interaction between trade, production and consumption volumes and the associated taxes. In this case, we see that, in most cases, income tax rates increase slightly, thereby increasing the power of the tax. From the next column, we see that the cost of living at the poverty line rises in all focus countries, save Malawi. Both the tax and living cost factors has an adverse impact on poverty, *ceteris paribus*

For purposes of comparison, we also report the summary statistics from the rich countries' partial reforms under Doha[6] at the bottom of Table 2. Note that the SC summary

measures share the same sign, but are somewhat muted – the results are mixed across the focus countries. Similarly, the AAV measures are considerably smaller. As a result, we expect the poverty impacts of the rich country agricultural liberalization to be similar in sign between Full and Doha reforms, but smaller in size under the Doha scenario.

As previously discussed, our analysis of poverty changes and the elasticity of poverty is developed from the earnings and stratum level (see Appendix Table A4 for these disaggregate results). In general, we find that poverty falls in the earnings specialized agricultural stratum and rises in the specialized non-agricultural stratum. In other strata earnings-driven poverty falls, driven by the rise in unskilled wages. Thus, apart from those households specialized in self-employment in non-agricultural activities, earnings impacts of rich country agricultural liberalization are favorable for poverty reduction. This general finding follows through in the Doha partial reform scenario as well – albeit with less sign consistency and a smaller AAV.

In order to determine the national poverty impacts, we must aggregate the earnings impacts across strata (weighting the stratum changes by the groups' share in national poverty), and combine this with the poverty impacts of changing taxes and consumer prices. Table 3 depicts these results of the national poverty impacts separately for earnings, taxes, and cost of living changes, in addition to their sum, which is the total impact on the national poverty headcount. Earnings changes from rich country agricultural liberalization contribute to national poverty reduction in all cases. The rise in agriculture-related returns as well as unskilled wages is sufficient to reduce poverty, even in those countries where the non-agriculture stratum contains a relatively large share of the poor (e.g., Colombia and Peru). The tax effect is negligible, while the cost of living effect tends to raise poverty in all regions save one (Malawi).

With the earnings and spending effects working in opposite directions, it is now a question of relative size in determining the combined impact on national poverty. From Table 3, we see that the earnings effect dominates in nine of the fifteen cases, and it is sufficiently large to boost the SC measure to -0.88 (recall that uniform poverty reduction across countries would yield a SC of -1.0). Thus we conclude that full agricultural liberalization in the rich countries is poverty reducing on average for this sample of countries. In contrast, the partial rich country reforms stemming from the Doha scenario yield summary measures (see bottom of Table 3) with a smaller SC measure and an AAV about one-quarter the magnitude of full liberalization. Thus we conclude that rich country reforms under Doha are less poverty-friendly than they would be under full liberalization, and about one-quarter as large size. This can be attributed to the heavy emphasis on elimination of export subsidies and the relatively modest cuts in tariffs and domestic subsidies (Hertel and Ivanic, 2006).

Agriculture Liberalization by the Developing Economies

Next we consider the impacts of poor country agricultural liberalization following the same scheme as the previous section for rich countries. Table 4 reports the impacts by underlying "driver" in each focus economy. Note that now it is nonagricultural labor and capital, as well as skilled labor, that realize the largest post-reform gains. This is as expected, because the tariff cuts are now implemented in the developing countries; they reduce the relative demand for unskilled labor and result in the loss of tariff revenue. The impact on deflated agricultural returns is mixed, with substantial declines in some cases, and modest rises in those cases where agricultural exports to other developing countries rise as a result of increased South-South trade. With the exception of agricultural land and transfers (the latter's impact is zero due to indexing), the SC

summary measure is positive for other factors. The tax and cost of living impacts are quite consistent across countries, with income tax rates rising (to replace lost tariff revenue) and the cost of living falling as consumers get access to food at world market prices (SC = -1.0).

As before, we aggregate the earnings effects across factors and translate them into poverty reductions, by stratum (see table A5). We now find that the set of households specialized in non-agricultural self-employment realize the most consistent poverty reduction. The other strata show aggregate poverty reductions, but less consistently so. Not surprisingly, the largest AAV is for the agriculture specialized and rural diversified households as these are the groups most directly affected (on the earnings side) by the agricultural tariff cuts. This pattern of poverty reduction presents a striking contrast with the stratum impacts of reforms in agriculture by wealthy countries. In the latter case, the non-agriculture stratum consistently experiences poverty increases. So combining agriculture reforms in the poor countries with those in the rich countries is quite appealing from an equity point of view since they benefit different segments of the poverty population.

Table 5 summarizes the national poverty impacts of poor country agricultural trade liberalization. The first column represents the poverty share-weighted sum of the percentage changes in stratum poverty headcounts due to earnings. Here, we see that the impacts on poverty, while mixed, are on balance poverty reducing. This is somewhat surprising in light of concerns about agricultural tariff cuts on the poor. However, the reader needs to bear in mind that these are the impacts prior to tax replacement. Once the income tax adjustment is introduced (next column), the earnings picture is less rosy. Indeed, in all countries excepting Brazil, income taxes

rise and this has an adverse impact on poverty. Furthermore, the AAV of the tax rise is nearly half as large as the earnings effect, and it dominates the former for several of the focus countries.

Of course the primary benefit of agricultural tariff cuts with respect to poverty alleviation is to allow the poor access to food at world prices. This effect is evident in the cost of living column, where the deflated cost of living falls in all regions except Brazil, where increased export demand in other developing countries boosts food prices. The sign consistency measure is -0.99 for the cost of living contribution to national poverty changes and the AAV measure of 0.82 is even larger than the earnings AAV. The results presented in this table demonstrate clearly the beneficial impact of developing country agricultural liberalization on poverty, through the lowering of food prices.

The final column in Table 5 reports the total impact arising from agricultural trade reform in the poor countries, taking into account the combined earnings, tax, and cost of living impacts. It is striking to note that poverty falls in all but one country. And the SC measure of -0.91 indicates that these reforms are even more consistently poverty friendly than the rich agricultural reforms in Table 3. On the other hand, the contribution of poor country agriculture tariff cuts under Doha (bottom panel of Table 5), while also poverty friendly, are negligible in magnitude, as indicated by AAV = 0.09.

Table 6 summarizes the poverty outcomes under rich, poor and combined (Subtotal Agric. Reforms column) agricultural reforms. Here we see total poverty changes repeated from agricultural reforms as reported in Tables 4 and 5, along with their combined effect. Given the total impact of agricultural liberalization we see that our findings suggest that only Mexico and Uganda would see an increase in the poverty headcount attributable to agricultural reforms (due

to rich country reforms for Uganda and reforms by both types of reforms for Mexico). Furthermore, the AAV summary measure of 1.91 indicating significant movement of persons across the poverty line due to agricultural reforms, suggests that the impact of combined rich and poor country reforms is significantly more important than either one taken alone. The sign consistency value of -0.93 is also higher than the either of the two sets of reforms alone and indicates that global agricultural trade reforms are heavily weighted in the direction of poverty alleviation. This outcome is a direct consequence of the fact that both developed and developing country reforms reduce poverty – but each tends to do so for a different segment of the population; their poverty benefits are complementary in nature.

The bottom panel in Table 6 summarizes the results from the combined agricultural reforms undertaken under Doha. We find (see Appendix Table A6) that only seven of the fifteen countries realize a reduction in the poverty headcount due to partial agricultural reforms under the postulated Doha scenario. The limited poverty reduction impact is reflected in the small (one-third of full reforms) value for the AAV of 0.31 for agricultural reforms shown in the bottom panel of Table 6, and the lack of uniform cross-country reductions of these partial reforms is reflected in the more moderate -0.76 sign consistency value, considerably smaller than that under full agriculture reforms (-0.93).

Beyond Agricultural Liberalization

The fourth column of Table 6 reports the focus country poverty impacts of non-agricultural reforms and the fifth and sixth columns show the combined effect with agricultural reforms (full liberalization and Doha, respectively). The full reform of non-agricultural tariffs contributes to a poverty increase in the majority of our focus countries. However, the AAV of 0.80 is less than

the values for full agricultural reforms in either the rich or poor countries, indicating a lesser absolute impact on poverty, and the sign consistency of 0.23 indicates a mixture of poverty increases and decrease (note the importance of the large reduction in Vietnam in this calculation). In the fourth column of the bottom panel of Table 6 these same impacts are reported for Doha reforms in non-agriculture and we see that the AAV is smaller, indicating less impact, but slightly more consistent (SC = 0.32), indicating that the impact of the Doha reforms across this sample countries is somewhat more consistently poverty raising than full reform.

The final two columns in Table 6 reports the combined impact of all merchandise trade reforms on poverty in our focus countries. The full reforms reduce poverty in 9 of the 15 countries, with a Sign Consistency of -0.81 and an average absolute value of 1.96. On the other hand, Doha reforms (last column in Table 6) reduce poverty in only 7 of the 15 countries, with lower Sign Consistency and an AAV only about one-fifth as large. Thus, we conclude that the Doha reforms only generate about one-fifth of the poverty change as Full reforms and are considerably less poverty friendly. This stems from the fact that both the agriculture and the non-agriculture Doha reforms are individually less poverty friendly than the full reforms.

5. Conclusion

This paper has examined the likely poverty impacts of trade reforms under the Doha Development Agenda, and contrasted them with the poverty consequences of full reform. We expect partial reforms to generate smaller poverty responses than full reforms, and indeed we find this to be the case, with lower Average Absolute Values (about one-fifth as large) for national poverty changes across our fifteen focus countries. However, the two types of reforms are also *qualitatively* different. This is captured in our Sign Consistency measure, which reports

how poverty friendly a given reform is, regardless of magnitude. By this measure, we judge that full reforms are nearly twice as poverty friendly as the Doha reforms.

There are two factors driving this result. The first is that rich country agricultural reforms under Doha emphasize those elements of policy reform – export subsidies and to a lesser degree domestic support -- that are less important to developing countries as a whole (Hertel and Keeney, 2006), and less favorable to poverty in particular (Ivanic, 2006). The latter is underscored by our comparison of the Sign Consistency of rich country agricultural reforms under Doha and Full Liberalization. Less well-understood is the second reason why the Doha scenario is not more poverty friendly – it largely omits tariff cuts in the developing countries themselves. Our analysis shows that this is the most poverty friendly aspect of global trade reform and serves to effectively complement the poverty impacts of rich country reforms. While the latter tend to raise food prices, the developing country reforms lower food prices for the poor, by reducing tariffs on these products. This generates rather widespread poverty reduction.

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Country	Strata							
	Agric.	Non-Agric.	Urban Labor	Rural Labor	Transfer	Urban Diverse	Rural Diverse	Total
*Elasticity of Poverty Headcount by stratum ($1/day) wrt total income**								
Bangladesh	1.64	2.02	1.58	0.63	0.56	1.74	1.09	1.24
Brazil	0.75	1.28	1.94	2.19	0.34	3.63	2.69	1.35
Chile	1.90	2.24	2.06	1.55	2.45	2.29	2.60	2.18
Colombia	0.79	0.60	1.73	1.72	0.93	1.14	1.00	0.82
Indonesia	2.35	2.14	2.38	2.89	1.17	2.58	2.87	2.47
Malawi	0.49	0.30	2.26	1.97	0.43	1.04	0.76	0.58
Mexico	1.73	1.90	3.33	2.08	2.28	1.63	1.80	2.02
Mozambique	0.28	0.94	0.97	0.76	0.48	1.58	0.99	0.64
Peru	1.50	1.32	2.37	1.73	0.44	1.09	1.05	1.07
Philippines	2.25	1.96	2.98	2.44	1.69	2.42	1.98	2.15
Thailand	2.30	2.42	2.98	2.45	2.78	2.42	2.59	2.57
Uganda	0.28	0.40	1.71	0.34	0.01	0.36	0.21	0.24
Venezuela	0.69	1.16	2.57	2.17	0.01	1.72	1.53	1.20
Vietnam	0.48	1.12	2.81	8.98	0.84	0.86	1.01	0.98
Zambia	0.00	0.64	2.28	0.91	0.45	1.29	0.37	0.61
*Stratum Contributions to the $1/day Poverty Population in each Country **								
Bangladesh	0.15	0.13	0.04	0.22	0.03	0.07	0.37	1.00
Brazil	0.14	0.09	0.24	0.15	0.32	0.04	0.03	1.00
Chile	0.26	0.01	0.09	0.09	0.28	0.15	0.12	1.00
Colombia	0.28	0.43	0.03	0.04	0.12	0.05	0.04	1.00
Indonesia	0.42	0.12	0.02	0.07	0.04	0.06	0.28	1.00
Malawi	0.54	0.11	0.00	0.03	0.07	0.01	0.25	1.00
Mexico	0.05	0.06	0.05	0.12	0.28	0.14	0.29	1.00
Mozambiqe	0.41	0.13	0.01	0.05	0.14	0.06	0.19	1.00
Peru	0.07	0.35	0.01	0.02	0.22	0.11	0.23	1.00
Philippines	0.12	0.06	0.03	0.05	0.03	0.23	0.49	1.00
Thailand	0.06	0.02	0.00	0.06	0.11	0.07	0.68	1.00
Uganda	0.10	0.04	0.00	0.03	0.02	0.07	0.75	1.00
Venezuela	0.08	0.24	0.17	0.10	0.28	0.08	0.05	1.00
Vietnam	0.04	0.11	0.00	0.00	0.05	0.10	0.70	1.00
Zambia	0.34	0.23	0.10	0.07	0.07	0.09	0.11	1.00

Notes:*Values in strata columns are elasticities of the poverty headcount with respect to changes in earnings. Total column gives the national elasticity which is the poverty share weighted aggregate elasticity for each country. Elasticities estimated by authors using country specific household survey data.
**Values are shares of the impoverished population that are specialized in a particular stratum of earnings. Shares are derived from country-specific household surveys. Total column reflects that entire poverty population is allocated among the seven strata.

Table 1. Key Data for Focus Country Poverty Analysis

Countries	Land	Ag. Unskilled Labor	Ag. Skilled Labor	Non-Ag. Unskilled Labor	Non-Ag Skilled Labor	Wage Labor Unskilled	Wage Labor Skilled	Agricultural Capital	Non-agricultural Capital	Transfers	Taxes	Cost of Living
Rich Agric. Full												
Bangladesh	2.1	1.1	0.9	-0.1	-0.2	0.3	-0.2	0.9	-0.3	0.0	0.0	0.3
Brazil	41.5	17.7	16.3	-0.6	-1.0	1.6	-0.8	16.2	-1.3	0.0	0.3	0.8
Chile	13.5	7.0	6.3	-0.2	-0.5	0.9	-0.5	6.3	-0.6	0.0	0.0	0.7
Colombia	11.5	5.8	5.1	-0.5	-0.7	0.7	-0.7	5.1	-1.0	0.0	0.1	1.2
Indonesia	3.2	1.9	1.5	-0.2	-0.4	0.5	-0.4	1.5	-0.4	0.0	0.0	0.6
Malawi	1.0	0.4	0.1	-0.4	-0.7	-0.1	-0.7	0.2	-0.7	0.0	0.1	-1.3
Mexico	11.2	5.0	4.5	0.0	-0.2	0.9	-0.2	4.5	-0.3	0.0	0.1	0.9
Mozambique	2.2	1.1	0.9	-0.2	-0.3	0.2	-0.3	0.9	-0.3	0.0	0.0	0.5
Peru	16.9	9.6	7.9	-0.8	-1.2	2.3	-0.9	7.7	-1.3	0.0	0.1	0.8
Philippines	3.1	1.9	1.5	-0.1	-0.2	0.8	-0.1	1.4	-0.4	0.0	0.2	0.6
Thailand	23.4	12.2	9.6	-0.2	-1.2	3.8	-1.0	9.3	-1.8	0.0	0.1	1.2
Uganda	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Venezuela	2.4	1.3	1.2	-0.1	-0.1	0.1	-0.1	1.2	-0.1	0.0	0.0	0.3
Vietnam	4.9	2.7	2.3	-0.3	-0.5	0.4	-0.5	2.3	-0.4	0.0	0.1	0.3
Zambia	1.8	1.0	0.8	-0.1	-0.1	0.2	-0.1	0.8	-0.3	0.0	0.0	0.2
Average	9.2	4.6	3.9	-0.2	-0.5	0.8	-0.4	3.9	-0.6	0.0	0.1	0.5
AAV	9.2	4.6	3.9	0.3	0.5	0.8	0.4	3.9	0.6	0.0	0.1	0.7
Sign Cons.	1.0	1.0	1.0	-1.0	-1.0	1.0	-1.0	1.0	-1.0	0.0	0.9	0.7
Rich Agric. Doha												
Average	2.2	1.1	1.0	0.0	-0.1	0.2	-0.1	1.0	-0.1	0.0	0.0	0.2
AAV	2.5	1.3	1.1	0.1	0.1	0.2	0.1	1.1	0.2	0.0	0.0	0.2
Sign Cons.	0.9	0.9	0.9	-0.3	-0.6	0.8	-0.5	0.9	-0.5	0.0	0.8	0.9

Source: Authors' simulations

AAA is the average absolute value of the data in the column; 'sign cons' is the "sign consistency" of the data - the ratio of the average to the average absolute value of the variable.

Table 2. Drivers of Poverty Change across Focus Regions: Rich Country Agricultural Reforms

Countries	Earnings	Taxes	Cost Of Living	Total
Rich Agric. Full				
Bangladesh	-0.46	-0.04	0.39	-0.11
Brazil	-3.16	0.39	0.97	-1.80
Chile	-5.42	0.01	1.51	-3.90
Colombia	-1.28	0.05	0.95	-0.28
Indonesia	-2.68	0.05	1.40	-1.23
Malawi	-0.05	0.05	-0.74	-0.74
Mexico	-1.74	0.12	1.93	0.31
Mozambique	-0.23	-0.01	0.31	0.07
Peru	-1.32	0.07	0.85	-0.40
Philippines	-2.35	0.32	1.27	-0.76
Thailand	-9.63	0.16	2.84	-6.63
Uganda	-0.01	0.00	0.05	0.04
Venezuela	-0.17	0.00	0.42	0.25
Vietnam	-0.13	0.05	0.31	0.23
Zambia	-0.01	0.02	0.13	0.14
Average	-1.91	0.08	0.84	-0.99
AAV	1.91	0.09	0.94	1.13
Sign Cons.	-1.00	0.93	0.89	-0.88
Rich Agric. Doha				
Average	-0.46	0.10	0.16	-0.19
AAV	0.52	0.11	0.31	0.42
Sign Cons.	-0.88	0.92	0.52	-0.46

Source: Authors' simulations

Note: The total results in this table differ from the RichAgrFull poverty results in Hertel et al. (2007) since the results in this paper are computed as part of a full liberalization experiment using the methodology of Harrison, Horridge and Pearson (1999). Thus the results in this table reflect interactions with agricultural policy reforms in the poor countries, as well as non-agriculture reforms.

Table 3. Earnings-Driven Percent Change in the Poverty Headcount ($1/day) across Developing Country Stratums, when Rich Countries Reform Agriculture

Countries	Land	Ag. Unskilled Labor	Ag. Skilled Labor	Non-Ag. Unskilled Labor	Non-Ag Skilled Labor	Wage Labor Unskilled	Wage Labor Skilled	Agricultural Capital	Non-agricultural Capital	Transfers	Taxes	Cost of Living
Poor Agric. Full												
Bangladesh	-1.9	-0.9	-0.7	0.7	0.7	0.3	0.7	-0.7	0.7	0.0	0.5	-0.5
Brazil	1.9	1.3	1.2	-0.1	-0.1	0.1	-0.1	1.1	-0.2	0.0	-0.1	0.0
Chile	3.0	1.6	1.5	0.1	0.0	0.4	0.0	1.5	0.0	0.0	0.2	-0.1
Colombia	-0.7	-0.3	-0.3	0.3	0.2	0.2	0.2	-0.3	0.3	0.0	0.2	-0.5
Indonesia	0.1	0.1	0.0	0.2	0.0	0.2	0.0	0.1	0.2	0.0	0.2	-0.4
Malawi	3.7	2.3	1.8	0.2	-0.1	1.1	-0.1	1.8	-0.4	0.0	0.6	-0.8
Mexico	-12.4	-5.3	-4.7	0.0	0.2	-0.9	0.2	-4.7	0.3	0.0	-0.1	-0.5
Mozambique	3.4	2.3	2.0	0.8	0.7	1.2	0.7	2.1	0.7	0.0	0.9	-1.2
Peru	-1.9	-1.0	-0.8	0.4	0.3	0.0	0.3	-0.7	0.7	0.0	0.4	-0.5
Philippines	-2.3	-1.4	-1.0	0.4	0.4	-0.3	0.4	-0.9	0.8	0.0	0.2	-1.1
Thailand	3.4	2.4	2.1	0.7	0.5	1.2	0.5	2.0	0.5	0.0	0.7	-1.2
Uganda	0.3	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.0	0.2	-0.3
Venezuela	-1.6	-0.7	-0.7	0.3	0.2	0.1	0.2	-0.7	0.3	0.0	0.2	-0.2
Vietnam	5.7	3.9	3.6	1.8	1.6	2.3	1.6	3.5	1.4	0.0	1.5	-1.4
Zambia	-0.7	-0.4	-0.2	0.4	0.4	0.2	0.4	-0.2	0.7	0.0	0.3	-0.4
Average	-0.0	0.3	0.3	0.4	0.3	0.4	0.3	0.3	0.4	0.0	0.4	-0.6
AAV	2.9	1.6	1.4	0.4	0.4	0.6	0.4	1.4	0.5	0.0	0.4	0.6
Sign Cons.	-0.0	0.2	0.2	1.0	0.9	0.7	0.9	0.2	0.9	0.0	0.9	-1.0
Poor Agric. Doha												
Average	-0.09	-0.04	-0.03	0.01	0.02	-0.01	0.02	-0.03	0.01	0.00	-0.01	-0.06
AAV	0.38	0.20	0.16	0.03	0.04	0.04	0.04	0.16	0.05	0.00	0.02	0.07
Sign Cons.	-0.24	-0.22	-0.18	0.50	0.53	-0.16	0.53	-0.20	0.26	0.00	-0.42	-0.90

Source: Authors' simulations

Table 4. Drivers of Poverty Change across Focus Regions under Poor Agricultural Reforms

Countries	Earnings	Taxes	Cost Of Living	Total
Poor Agric. Full				
Bangladesh	-0.10	0.56	-0.63	-0.17
Brazil	-0.15	-0.05	0.05	-0.15
Chile	-1.36	0.19	-0.24	-1.41
Colombia	-0.03	0.14	-0.39	-0.28
Indonesia	-0.30	0.39	-0.92	-0.83
Malawi	-0.85	0.32	-0.43	-0.96
Mexico	1.84	-0.15	-1.08	0.61
Mozambique	-0.78	0.48	-0.78	-1.08
Peru	-0.07	0.34	-0.50	-0.23
Philippines	1.36	0.40	-2.33	-0.57
Thailand	-2.61	1.02	-2.96	-4.55
Uganda	-0.04	0.04	-0.06	-0.06
Venezuela	-0.11	0.25	-0.29	-0.15
Vietnam	-1.42	1.13	-1.42	-1.71
Zambia	-0.19	0.17	-0.27	-0.29
Average	-0.32	0.35	-0.82	-0.79
AAV	0.75	0.38	0.82	0.87
Sign Cons.	-0.43	0.93	-0.99	-0.91
Poor Agric. Doha				
Average	0.01	0.01	-0.10	-0.07
AAV	0.07	0.03	0.11	0.09
Sign Cons.	0.07	0.56	-0.88	-0.83

Source: Authors' simulations

Note: The total results in this table differ from the RichAgrFull poverty results in Hertel et al. (2007) since the results in this paper are computed as part of a full liberalization experiment using the methodology of Harrison, Horridge and Pearson (1999). Thus the results in this table reflect interactions with agricultural policy reforms in the poor countries, as well as non-agriculture reforms

Table 5. Earnings-Driven Percent Change in the Poverty Headcount ($1/day) across Developing Country Stratums, when Poor Countries Reform Agriculture

	Full Liberalization					Doha
Countries	Rich Agric. Reforms	Poor Agric. Reforms	Subtotal Agric. Reforms	Subtotal Non-Agric. Reforms	Total Full Lib	Total Doha Lib
Bangladesh	-0.11	-0.18	-0.29	0.57	0.28	-0.04
Brazil	-1.79	-0.15	-1.94	0.53	-1.41	-0.80
Chile	-3.89	-1.41	-5.30	0.31	-4.99	-1.29
Colombia	-0.29	-0.28	-0.57	0.67	0.10	-0.10
Indonesia	-1.24	-0.82	-2.06	0.61	-1.45	-0.20
Malawi	-0.74	-0.96	-1.70	-0.14	-1.84	0.36
Mexico	0.31	0.61	0.92	0.43	1.35	0.13
Mozambique	0.07	-1.08	-1.01	0.32	-0.69	0.02
Peru	-0.40	-0.23	-0.63	-0.16	-0.79	0.06
Philippines	-0.76	-0.56	-1.32	0.57	-0.75	-0.25
Thailand	-6.63	-4.55	-11.18	2.31	-8.87	-1.97
Uganda	0.04	-0.06	-0.02	0.08	0.06	0.04
Venezuela	0.26	-0.15	0.11	0.75	0.86	0.21
Vietnam	0.22	-1.70	-1.48	-4.37	-5.85	0.89
Zambia	0.14	-0.29	-0.15	0.24	0.09	0.03
Average	-0.99	-0.79	-1.77	0.18	-1.59	-0.19
AAV	1.13	0.87	1.91	0.80	1.96	0.43
Sign Cons.	-0.88	-0.91	-0.93	0.23	-0.81	-0.46
Doha Reforms						
Average	-0.16	-0.08	-0.24	0.04	n.a.	-0.19
AAV	0.30	0.09	0.31	0.13		0.43
Sign Cons.	-0.55	-0.86	-0.76	0.32		-0.46

Source: Authors' simulations

Table 6. Percentage change in the $1/day Head Count under Agr and Nonagr Reform

[1] A clear limitation of this approach stems from the rigidity of a given households' classification by earnings specialization. Obviously households maybe induced to change their specialization or diversify in response to changing relative factor returns. We believe that the relatively broad definition of strata circumvents this problem for the majority of households in the face of modest earnings changes. However, this important qualification will be further considered below in the results section.

[2] We have chosen to focus on households in the neighborhood of the poverty line in order to permit generalization of impacts across countries. An alternative would be to explore the impacts on all households within a single country.

[3] A complete set of shares for all strata are available in the online appendix: https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2292

[4] In practice we expect that price changes for importables are likely to be attenuated and those for exportables magnified – Winters, McCulloch and McKay (2004). Because importables are differentiated from domestic goods in this model the pass-through of tariff changes will be below 100% so that the prices of domestic varieties of importables move in the same direction, but by much less than border prices.

[5] A complete analysis of the macroeconomic results of the trade scenarios is available in the online appendix:https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2292

[6] Complete results from Doha experiments are available in the online appendix: https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2292.