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MULTILATERAL TRADE LIBERALIZATION AND POVERTY IN BRAZIL AND CHILE

Thomas W. Hertel, Paul V. Preckel, John A.L. Cranfield & Maros Ivanic[1]

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ABSTRACT. This paper combines results from a newly available international, cross-section consumption analysis, with earnings data from household surveys from Brazil and Chile, to analyze the implications of multilateral trade liberalization for impoverished households in these two countries. Emphasis throughout this paper is on the short run, during which capital and self-employed labor are sector-specific, with wage labor being the only mobile factor of production. We find aggregate poverty is reduced in both Brazil and Chile. However, while the agriculture-specialized populations in both countries experience a large reduction in poverty, the non-agriculture profits-specialized and wage-labor households experience increases in poverty.

JEL Classification: F02; F11; F13.
Keywords: Multilateral Trade Liberalization; Poverty; General Equilibrium Analysis.

RÉSUMÉ. Cet article analyse les répercussions de la libéralisation commerciale multilatérale sur les ménages pauvres pour le Brésil et le Chili, en combinant les résultats d'une étude originale de la consommation en coupe internationale avec des données de revenus disponibles issues d'enquêtes auprès des ménages. L'étude met l'accent sur le court terme, où le capital et le travail indépendant sont considérés comme immobiles entre secteurs, avec l'emploi salarié comme seul facteur de production mobile. Le résultat montre que la pauvreté recule au Brésil comme au Chili. Toutefois, alors que les populations spécialisées dans l'agriculture connaissent dans les deux pays une nette réduction de la pauvreté, les ménages de travailleurs indépendants non agricole et de salariés subissent un accroissement de la pauvreté.

Classification *JEL* : F02 ; F11 ; F13.
Mots-clefs : Libéralisation commerciale multilatérale ; pauvreté ; analyse en équilibre général.

1. Corresponding author: Thomas W. HERTEL, Professor, Purdue University and Director, Center for Global Trade Analysis (hertel@purdue.edu).
Paul V. PRECKEL, Professor, Purdue University; John A.L. CRANFIELD, Assistant Professor of Agricultural Economics at the University of Guelph; Maros IVANIC, Graduate Research Assistant in the Department of Agricultural Economics at Purdue University.

Poverty in Latin America remains stubbornly high. However, after increasing throughout the 1980's, poverty in the region fell through the 1990's. As a consequence, by 1997, the overall rate of poverty in Latin America had returned to roughly the level of 1980 (ECLAC, 1999). This contrasts sharply with Asia, where poverty was reduced substantially over this same period (World Bank, 2000). Some blame the economic reforms implemented in Latin America during this period, while others attribute the increase in poverty in the 1980's to macro-economic factors.

Morley (2001) offers a comprehensive survey, as well as some original analysis of the impacts of these different forces on the distribution of income, as well as on poverty, in Latin America. He concludes that trade reforms – the particular focus of this paper – had a regressive effect on income distribution, and a negligible effect on poverty. However, he admits that it is quite difficult to distinguish, based on his econometric approach, the poverty effects of trade reforms from those of other reforms and from general economic growth and macro-economic stability. In light of the continuing importance of poverty in Latin America, as well as the pending proposals for trade liberalization in the region, this paper seeks to provide a more definitive answer to the question: Does trade liberalization reduce poverty? In so doing, we focus not only on the impact of changing trade barriers within the region, but we also consider the impacts of global trade liberalization, on poverty in two Latin American countries: Brazil and Chile.

There is now a great deal of work being undertaken to analyze the links between trade and poverty. Some of this focuses on the consumption side of the problem (e.g., Levinsohn, Barry and Friedman, 1999; Case, 1998), while abstracting from the effects on earnings and hence on poverty. This is a natural outgrowth of the historical preference on the part of poverty researchers to focus their attention on the expenditure side of household surveys. Observations on expenditures are generally a more reliable measure of the current well-being of households. In contrast, earnings tend to be under-reported and they are much more volatile than consumption. While well-suited to the poverty measurement problem, this consumption-based approach is inadequate when it comes to counterfactual analysis of poverty impacts due to exogenous economic shocks. Here, it is impossible to proceed without proper treatment of the factor markets and earnings effects of trade liberalization, which are often the dominant household impacts flowing from changes in trade policy.

Others in the trade and poverty literature have used single-region computable general equilibrium (CGE) models to bring in the income side of the picture (Devarajan and van der Mensbrugghe, 2000; Harrison, Rutherford and Tarr, 2002; Löfgren, 1999; Decaluwé, Patry, Savard and Thorbecke, 1999). This can be traced back to the path-breaking work of Adelman and Robinson (1978) who incorporated income distribution considerations into their analysis of the Korean economy. The CGE approach has the advantage of forcing a full reconciliation of household survey and macro-economic data in the form of a Social Accounting Matrix. This modeling approach also captures the impact of any change in rela-

tive prices, not only on consumption, but also on earnings. Therefore, it is well-suited to analyzing the links between trade and poverty.[2]

However, if one wishes to look at the impact of bilateral or multilateral trade agreements on poverty, then a multi-region CGE model is required. There have been several studies that have used a combination of multi-region, CGE models and single region models or household surveys to analyze the link between multilateral trade liberalization and poverty (Evans, 2001; Friedman, 2001; Ianchovichina, Nicita and Solaga, 2000).[3] This paper extends the latter body of literature by rigorously reconciling the earnings data in the GTAP, multi-region CGE model with national household surveys for Brazil and Chile. On the spending side, we use an international demand system characterizing expenditure across the income spectrum in order to establish the poverty level of utility in these two countries, as well as the transfer required to lift impoverished households to this utility level. We are then in a position to assess how changes in multilateral trade policies affect the incidence of poverty in Brazil and Chile.

A FRAMEWORK FOR ANALYZING THE IMPACT OF TRADE LIBERALIZATION ON POVERTY

Our analysis of the impacts of trade liberalization on the poor begins with the specification of a utility function, and an associated consumer demand system, with which we can determine household consumption, as well as the maximum utility attainable by the household at a given set of prices and income. The utility of the marginal household, that is the household at the poverty line, is defined as the *poverty level of utility*. In the wake of trade liberalization, if some households' utility falls below this level, they are deemed to have "fallen into poverty". Conversely, if they are lifted above this level of utility, they are no longer in poverty. The poverty level of utility may also used to compute the so-called "poverty gap", representing the transfer required to lift those households currently in poverty to the poverty line – i.e. to permit them to achieve the poverty level of utility.

In this study, we adopt Rimmer and Powell's (1992a, 1992b, 1996), AIDADS[4] system to represent consumer preferences, due to its capability to capture expenditure patterns across the global income spectrum (see also Cranfield *et al.*, 2000). AIDADS has now been widely estimated on international cross section data, and it performs well out of sample, when compared to other demand systems (Cranfield *et al.*, 2002). This functional form may be viewed as a generalization of the popular, but restrictive, Linear Expenditure System (LES). Unlike the LES, AIDADS allows for non-linear Engel responses, while maintaining a parsimonious parameterization of consumer preferences.

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2. The extensive literature on trade and relative wages of skilled and unskilled workers is also relevant. This research points towards openness leading to greater wage inequality (Robbins, 1995, 1996; Edwards, 1997; Ocampo and Taylor, 1998).
3. Harrison, Rutherford and Tarr (2002) go one step further and embed a disaggregated household structure for one country into a multi-region trade model.
4. An Implicit, Directly Additive Demand System.

AIDADS stands for An Implicit, Directly Additive Demand System, and it originates with an implicitly additive utility function of the form $\sum_{i=1}^{n} U_i(x_{ik}, u_k) = 1$ for all k, where i = 1, …, n indexes the commodities, k=1,…,T indexes observations (groupings of households), U_i (x_{ik}, u_k) is a twice-differentiable, monotonic function, x_{ik} is consumption of the ith good in the kth observation and $u_k \in \Re$ is the level of utility attained from the consumption bundle, (x_{1k}, x_{2k}, …, x_{nk}). Furthermore, U_i (x_{ik}, u_k) is assumed to satisfy the requisite concavity requirements. Rimmer and Powell choose the following function for U_i (x_{ik}, u_k):

$$U_i(x_{ik}, u_k) = \varphi_{ik}(u_k) \ln\left(\frac{x_{ik} - \gamma_i}{A \exp(u_k)}\right) \quad \forall\, i,k \tag{1}$$

where $\varphi_{ik}(u_k) = \left[\alpha_i + \beta_i G(u_k)\right] / \left[1 + G(u_k)\right]$, α_i, β_i, γ_i and A are parameters, and $G(u_k)$ is a positive, monotonic, twice differentiable function. In addition, $0 \le \alpha_i, \beta_i < 1$ for all i, and $\sum_{i=1}^{n} \alpha_i = \sum_{i=1}^{n} \beta_i = 1$. The first order conditions for utility maximization, subject to a linear budget constraint, can be solved to obtain the AIDADS demands:

$$x_{ik} = \gamma_i + \frac{\varphi_{ik}(u_k)}{p_{ik}}\left(M_k - \mathrm{p}_k'\gamma\right) \quad \forall i,k \tag{2}$$

where M_k is per capita expenditure, p_{ik} is the price of the ith good in the kth observation, p_k is a vector of prices with components p_{ik}, and γ is a vector with components γ_i. In this context, γ_i can be thought of as the subsistence consumption level for the ith good. If $\alpha_i = \beta_i$ for all i then (2) becomes Stone's (1954) Linear Expenditure System (LES).

By replacing the exponents in the LES with more general terms that are functions of a value that varies with real expenditure level (in this case utility), Rimmer and Powell allow for marginal budget shares that vary across expenditure levels in a very general manner. The ensuing flexible Engel properties are a key feature of the AIDADS model, and this is why it is so successful at tracking consumption behavior across the income spectrum. Assuming $G(u_k) = \exp(u_k)$ Rimmer and Powell show that φ_{ik} (u_k) behaves logistically and is contained in the interval between α_i and β_i (Rimmer and Powell 1996, p1615). This yields the following demand system used in our study:

$$w_n = \frac{p_n \gamma_n}{M} + \frac{a_n + \beta_n \exp(u)}{1 + \exp(u)}\left(1 - \frac{p'\gamma}{M}\right) \quad \forall\, n \tag{3}$$

The associated marginal budget shares are:

$$\psi_i = \varphi_i(u) - (\beta_i - \alpha_i)\left[\sum_{j=1}^{n}(\beta_j - \alpha_j)\ln(x_j - \gamma_j) - \left(\frac{(1+\exp(u))^2}{\exp(u)}\right)\right]^{-1} \tag{4}$$

which in turn determine the Engel elasticities: $\eta_{ik} = \psi_{ik} / w_{ik}$, where w_{ik} is the budget share for the *i*th good in the *k*th observation.

The main focus of this paper is not on the consumption side of the story, but rather on the earnings effects of trade liberalization, so we turn now to a definition of income for household *i*, net of depreciation and inclusive of any transfers:

$$Y^i = \sum_f W_f \bar{E}_f^i - \sum_f \delta_f P_f \bar{E}_f^i + T^i Y \tag{5}$$

where W_f is the wage paid to (fixed) endowment E_f^i, δ_i is the geometric rate of depreciation for endowment E_f^i (zero for endowments other than capital), P_f is the cost of replacing depreciable endowment *j* (the capital goods price), and T^i is the transfer rate for household *i*, assumed to be a constant share of net national income, *Y*.

In our subsequent analysis, we will begin with survey-based observations on the endowments and transfer rate for a given household group. The depreciation rate for capital stock and is obtained from macro-economic data. Trade liberalization will alter the wages associated with each endowment, the price of capital goods and transfers, with the relative contribution of each of these components depending on the earnings shares. The resulting level of income for household *i* can be computed using equation (5). Once we know the new income level, it may be combined with the new vector of commodity prices to compute utility using (1). Based on the post-liberalization utility level, we are in a position to compute the change in poverty.

The remainder of the paper is organized as follows. We begin by describing the endowments and wages – or equivalently the earnings shares – of each household group in Brazil and Chile, and how they have been obtained from survey data. We then turn to the estimation of the parameters of the utility function in (1) using international cross-section data on price and expenditures, in conjunction with income distribution information. Finally we discuss the global trade model used to simulate the price and wage impacts of trade liberalization. This sets the stage for our analysis of trade liberalization and poverty in Brazil and Chile.

Factor earnings by income level and stratum

As noted above, we believe that factor markets represent a primary channel for trade policy transmission to poverty. Furthermore, while the link between trade and wages has received ample attention in the literature (Robbins, 1995, 1996; Spilimbergo, Londono and Szekely, 1997; Wood, 1994, 1997; Edwards, 1997; Ocampo and Taylor, 1998), the overall earnings picture has been a relatively neglected area in the poverty literature, with authors preferring to emphasize the more readily measurable consumption impacts. So we begin by focusing

on the elements of equation (5). For purposes of discussion it is useful to think about the differential form of this equation:

$$y^i = \sum_f \Omega_f^i w_f - \sum_f \Lambda_f^i p_f + \tau^i y \qquad (6)$$

where lower case variables represent percentage changes, Ω_f^i reports the share of income from factor *f* for household *i*, Λ_f^i is the share of depreciation associated with factor *f* in household *i*'s net income, and τ_i is the share of transfers in *i*'s net income. Clearly the relative importance of any given factor price change in total income hinges on the size of the associated earnings share. Therefore, we focus the ensuing discussion of the pattern of earnings shares derived from the household surveys for Brazil and Chile.[5]

In our analysis of poverty, we find it useful to stratify the population into five groups, depending on their primary source of income. Otherwise one is left with the impression that all households are diversified in their income sources, with the composition of their earnings reflecting the average for their income level. We believe that, in the short run, household incomes will be differentially affected depending on their reliance on sector-specific factors of production. For example, a household which earns all of its income from a family run farm will be heavily dependent on the prices of agricultural products. If prices rise, they will likely have a hard time gaining access to land and credit with which to expand production in the short run. If prices fall, they may eventually be able to find other employment, but this is likely to be difficult in the short run – particularly if they are not currently employed off-farm. This close link between farm household welfare and agricultural prices has also been observed by those working with annual household survey data (e.g., Chen and Wang, 2001).

Accordingly, our first stratum identifies self-employed households specializing in agricultural production (95% or more of income). Similarly, the second stratum comprises households specializing in non-agricultural enterprises, (i.e., income from profits for non-agricultural enterprises). The third and fourth strata are comprised of households that work for others – being specialized in wages/salaries (95% or more), and those relying almost exclusively (95% or more) on transfers (both public and private) for their income, respectively. The fifth stratum encompasses the remaining "diversified" households. Note that this final category comprises all those households that get less than 95% of their income from each of the four sources: transfers, agricultural profits, non-agricultural profits and labor – hence the label "diversified".

Given the likely differential impact of trade liberalization on the diverse household groups, it is important to examine the relative importance of each stratum in overall poverty. The last

5. The sources of these surveys are as follows: Pesquisa Nacional por Amostra de Domicilios (1998), Brazilian Institute of Geography and Statistics (IBGE). Encuesta de Caracterizatcion Socioeconomica Nacional, 1998, Ministerio de Plantificacion y Cooperacion, Santiago, Chile.

column of TABLE 1 reports the percentage of the total population on less than $1/day in Brazil (5.1%) and Chile (4.2%), as reported in the World Development Report: 2000/2001.[6] The remaining columns of TABLE 1 report the estimated composition of poverty, by stratum, as a percentage of the total population. In the case of Brazil, we see that the largest portion of the poor (1.58% of the 5.2% total) appears in the wage-labor specialized stratum. This is followed closely by the agriculture-specialized stratum (1.22%) and then the diverse stratum (1.04% of the total population are in this group and are poor). Of course the fact that only about a quarter of the poor are in the agriculture-specialized stratum understates the importance of agricultural activity to the poor in Brazil, since some of the poor wage-laborers work in agriculture, and also agricultural profits are also quite important for the poorest households in the diverse stratum. In Chile, the relative importance of these five strata in the overall poverty picture is rather different. Now the diverse stratum contains nearly 40% (100% * 1.62/4.2) of the poor. This is followed in importance by the transfer-, labor- and then agriculture-specialized household strata.

Table 1 - Estimated distribution of poverty in Brazil and Chile: Head count by stratum as a percentage of the total population

	Agriculture	Non Agriculture	Labor	Transfer	Diverse	Total
Brazil	1.22	0.75	1.58	0.51	1.04	5.10
Chile	0.61	0.15	0.82	1.00	1.62	4.20

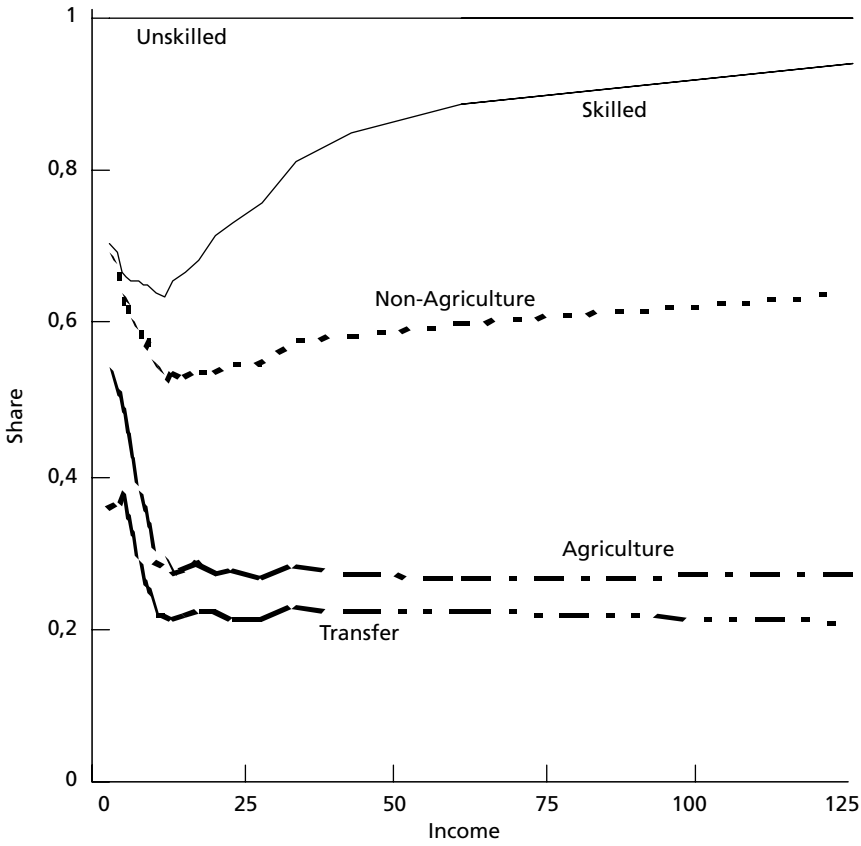
Sources: Pesquisa Nacional por Amostra de Domicilios, 1998. Brazilian Institute of Geography and Statistics (IBGE). Caracterizacion Socioeconomica Nacional, 1998. Ministerio de Plantificacion y Cooperacion, Santiago, Chile.

Given the importance of the diversified stratum in the overall poverty picture for both Brazil and Chile, it is interesting to explore the composition of earnings for these strata. FIGURES 1 and 2 report the composition of incomes (share of earnings from each source) for the diversified households in Brazil and Chile, respectively. Since the income range differs considerably across earnings strata, these figures are not as easily compared across strata or countries. However, it is clear that unskilled wages and transfers dominate at the lowest income levels in both countries. Unskilled wages are especially dominant in Chile, where they comprise about half of diversified household income in the poorest vingtile. In Brazil, this figure is about one-third. As incomes rise, non-agricultural profits and skilled labor income become much more important for diversified households in both countries. Also note the persistently large share of transfers in diversified households' income in the richest vingtile in Brazil. This attests to the importance of public pensions for the wealthy households in that country.

6. We have calibrated the poverty level of utility in each country to reproduce this total. An alternative would be to use the AIDADS model and the $1/day definition for 1996 ICP dollars to predict poverty in each country. However, this appears to result in an over-estimate of poverty – likely due to the presence of under-reporting of income in the household surveys. Therefore, we prefer to benchmark the model to independent estimates of the poverty level.

Figure 1 - Composition of income in the diversified households for Brazil.

Brazil diverse stratum



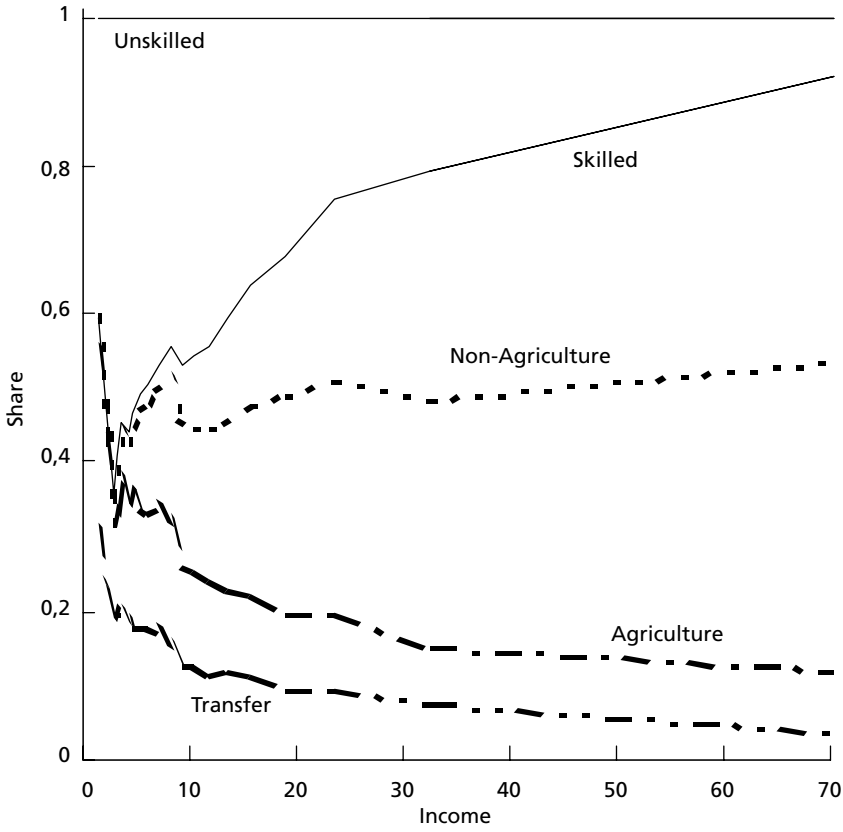
Source: Pesquisa Nacional por Amostra de Domicilios, 1998. Brazilian Institute of Geography and Statistics (IBGE).

It is also interesting to explore the composition of earnings in the households that rely almost exclusively on wages or salaries for their incomes. For purposes of this study, we define skilled labor based on the available occupational information in the household surveys. In particular, individuals working as managers and professionals were deemed skilled, with all others classified as unskilled.[7] The earnings splits for the labor-specialized households in Brazil and Chile are displayed in FIGURES 3 and 4. Not surprisingly, unskilled labor dominates at the lowest income levels and subsequently diminishes in importance as income increases.

7. Skilled professions are the following: technicians, scientists, artists and administrators/managers, unskilled: all others.

Figure 2 - Composition of income in the diversified households for Chile.

Chile diverse stratum



Source: Caracterizacion Socioeconomica Nacional, 1998. Ministerio de Plantificacion y Cooperacion, Santiago, Chile.

However, it also persists at the higher income levels within this labor-specialized stratum – especially in Chile. This likely reflects the limitations of our occupation-based skill-splits.

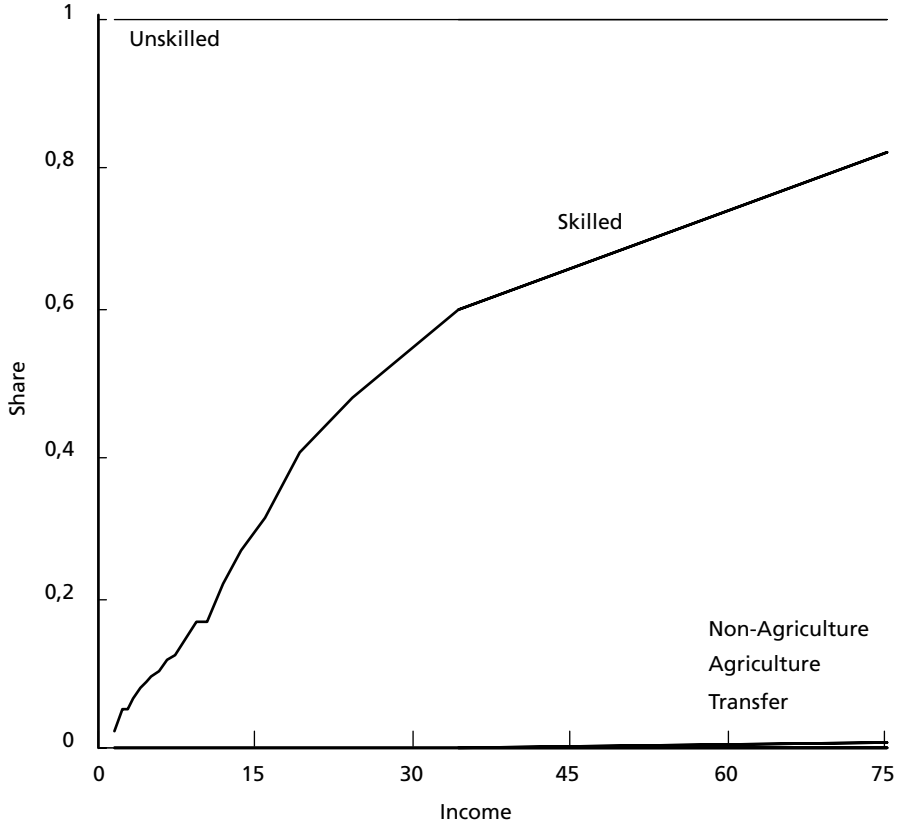
Estimating AIDADS

We estimate the AIDADS parameters in (3) using international, cross-section data from 1996.[8] The estimation strategy draws on recent work by Cranfield *et al.* (2004) who estimate the parameters of a complete demand system while simultaneously estimating the

8. Another alternative would be to estimate this demand system using household survey data from Brazil and Chile. Unfortunately, the Brazilian survey does not contain information on expenditures, and the alternative survey which has this information has a small sample size. The other problem of course is obtaining data on prices. The advantage of the international cross-section approach – augmented with information on income distribution – is that it can be used across a wide range of situations, and provides a consistent treatment on consumption behavior across countries.

Figure 3 - Composition of income in the labor-specialized households for Brazil.

Brazil diverse stratum



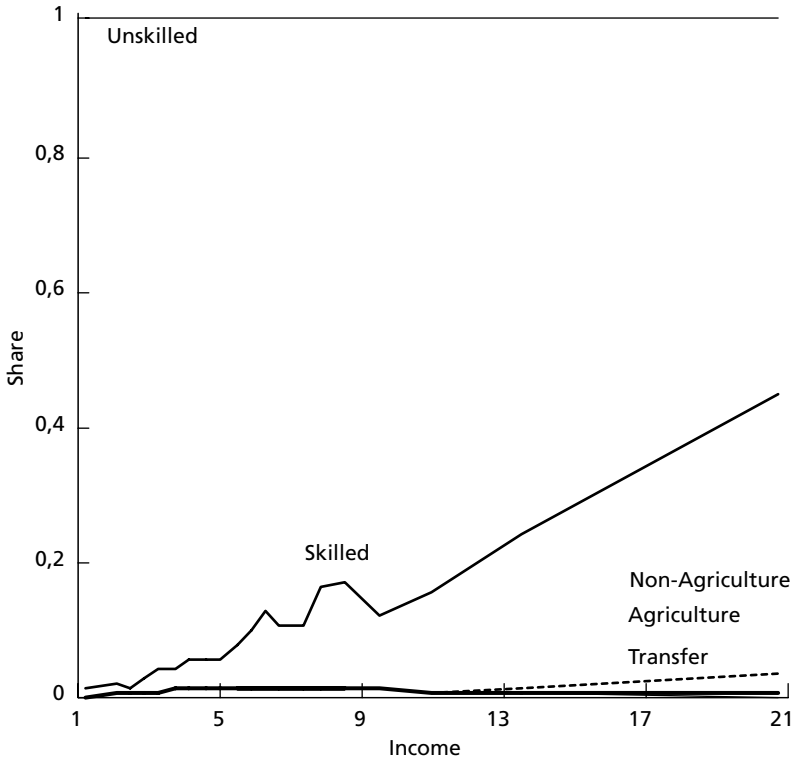
Source: Pesquisa Nacional por Amostra de Domicilios, 1998. Brazilian Institute of Geography and Statistics (IBGE).

unobserved distribution of household expenditure, by commodity, for each quintile. This approach requires data typically used in demand system estimation (*i.e.*, prices, *per capita* quantities and *per capita* expenditure from the International Comparisons Project), in addition to summary measures of the distribution of total expenditure (or income), such as variance, skewness, kurtosis, or quintiles and the relevant range of expenditure in each observation. The latter are obtained from the Deninger and Squire (1996) database and the World Bank's *World Development Reports*.

Rather than estimating a model that predicts a budget share for each good on a *per capita* basis for each country, the framework approximates the distribution of expenditure, estimates demand system parameters consistent with the demand and expenditure data (including the distribution information), and predicted budget shares for each good *across*

Figure 4 - Composition of income in the labor-specialized households for Chile.

Chile diverse stratum



Source: Caracterizacion Socioeconomica Nacional, 1998. Ministerio de Plantificacion y Cooperacion, Santiago, Chile.

expenditure levels within each national observation. The data set used for estimation purposes contains 113 countries from the 1996 ICP data set (Kravis, Heston and Summers). The ICP consumption and price data are aggregated up to six goods: staple grains, livestock products, other food products, other non-durable goods, durable goods, and services. The emphasis on food products (three of the six categories) is appropriate for this study, since we are focusing on poverty, and poor households spend a large share of their income on food products.

TABLE 2 reports estimates of the AIDADS parameters for this study. For livestock, grains, and other food, the estimate of α_i is greater than the estimate of β_i. Given the AIDADS structure, the estimates of α_i and β_i represent upper and lower limits for the marginal budget shares. For modest expenditure levels, livestock's average budget share is about 0.2. However, as

expenditure grows, livestock's average budget share approaches 0.03. Upper and lower asymptotes for grain's marginal budget share are 0.16, and 0, respectively, while those for other food's marginal budget share are 0.3 and 0.02, respectively.[9] The estimate of γ_n is zero for livestock and other food, but positive for grain. Thus, an individual with expenditure equal to subsistence consumption (*i.e.*, where $y = \sum_{n=1}^{6} p_n \gamma_n$) is predicted to consume grain, but not livestock or other food. As expenditure grows, the subsistence household will begin to consume livestock and other food products.

Table 2 - AIDADS parameter estimates

	Grains	Livestock	Other Food	Non-durables	Durables	Services
α	0.1592	0.1950	0.2999	0.1754	0.0521	0.1183
β	0.0000	0.0289	0.0219	0.2669	0.1146	0.5677
γ	17.7969	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Authors' estimates.

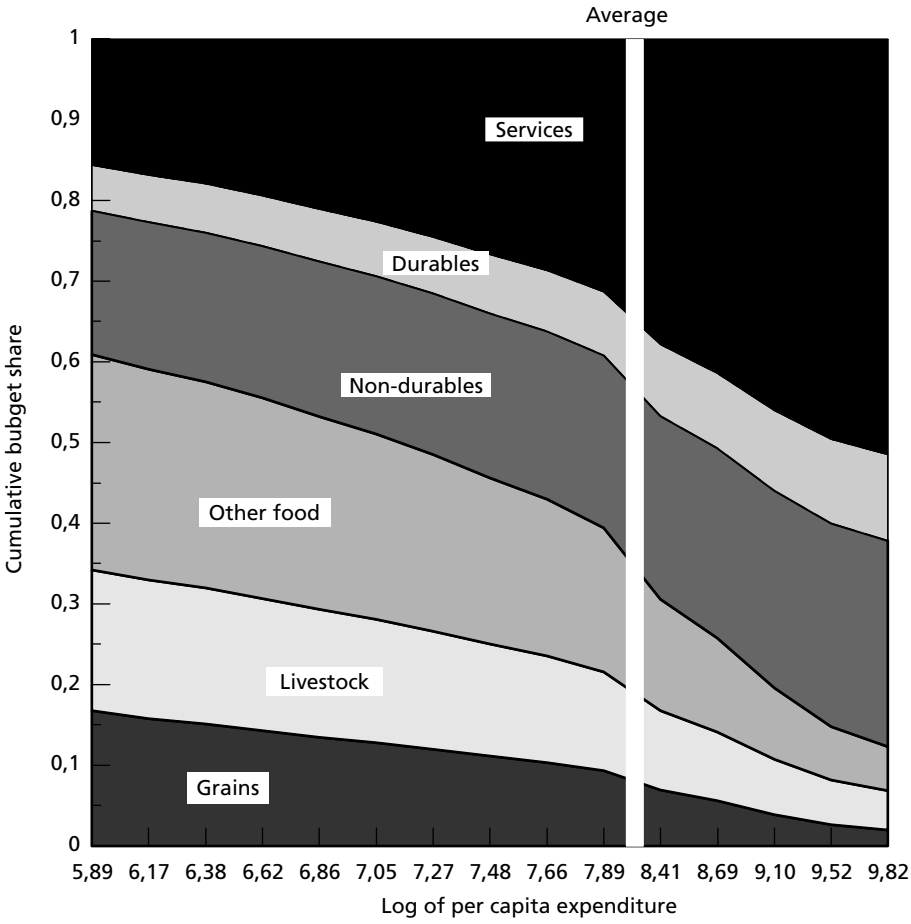
To illustrate the performance of this demand system in the case of Brazil, turn to FIGURE 5 which plots the predicted pattern of each good's share in total spending over a range of expenditure levels for Brazil. The grains budget share follows a monotonically declining pattern, while the budget shares for both livestock and other food increase, reach a peak and then decline. The average budget share associated with other (non-food) non-durable goods follows an increasing pattern, while those for services and durables also increase. So at the highest income levels, spending on food is only about 10% of total expenditure. If we compare the budget shares for the poorest household – with those for the average household, we see that food expenditure for the latter former is roughly one-half the value of twice the latter. On the other hand, food expenditures for the poorest households reach 60% of income. Therefore the poor will be much more severely affected by a rise in food prices, than will the average household in Brazil.

Modeling the price effects of multilateral trade liberalization

In the interests of tractability, we have taken a fairly simple approach to modeling trade liberalization. We draw on the GTAP modeling framework (Hertel, 1997), using the latest version (6.1) of that model in conjunction with the most recent, version 5.0, GTAP data base (Dimaranan and McDougall, 2001). However, before conducting an analysis of trade policy

9. The lower bound of zero for grain's marginal budget share may seem troubling as it implies that as expenditure grows without bound, expenditure on other food goes to zero. Recall, however, that this is an asymptotic result and the average budget share does not equal zero, even at the highest income levels.

Figure 5 - Predicted consumer budget shares for Brazil



Source: Authors' estimates.

and poverty, we must first reconcile the household income data obtained from the household surveys with the macroeconomic data on earnings reported in the GTAP model. The discrepancies in these figures are revealed by comparing the two rows of entries in TABLES 3a and 3b. The reported wage and salary share of gross factor income in the Brazilian survey (59%) is higher than the share of wage income in the GTAP data base (50%) for Brazil – and so the capital and land share is correspondingly lower in the survey.[10] A larger divergence is

10. This difference is more significant, when one considers the fact that the GTAP data base is intended to include self-employed labor in the wage payments. However, extracting self-employed labor is difficult and GTAP data base contributors have had mixed success in doing so for developing countries.

evident from comparing of the shares of skilled and unskilled labor incomes: we can see that the GTAP data base estimates a much smaller share of income accruing to skilled labor (16%) than the does the survey (29%). Because we believe that the survey information provides better information on the composition of factor incomes, we have chosen to adjust the GTAP data, in light of the survey information. The adjusted gross factor income shares are shown in the second row of TABLE 3a, and they correspond to the gross factor income shares obtained from the survey.

Similar adjustments were also made to the Chilean data base (TABLE 3b). Here, too, the survey suggested a higher overall share of wage income (50%) than the original GTAP data base (40%). As is the case with Brazil, the shares of skilled and unskilled labor returns reported in the Chilean survey (17% and 33%, respectively) show a greater share for skilled labor than does the GTAP data base (11% and 28%, respectively). Accordingly, the gross factor income shares in the GTAP data base are adjusted to match the survey data (second row in TABLE 3b).

The GTAP 5.0 data base incorporates the latest tariff information for merchandise trade and agricultural protection. Agricultural tariffs are derived from the AMAD data base and are for 1998. The non-agricultural tariff data are for 1997, or the most recent year, and come from the WITS system maintained by UNCTAD and the World Bank. The only non-tariff trade barriers in the data base relate to export measures. In the case of agriculture, export subsidies for 1998, reported to the WTO, are incorporated. Also, the quota rents associated with restrictions on textile and apparel exports to North America and Europe from many developing countries are reflected in the database. In our trade liberalization experiment, we remove the tariffs and quotas. We do not attempt to capture the impact of prospective liberalization of direct trade in services or barriers to international investment or the movement of people in the services sectors. Also, we leave domestic agricultural subsidies in place. Appropriate modeling of these subsidies requires considerable care – given the decoupled nature of many of these programs. We will tackle this in future work.

A summary of the average import tariffs used in this study of multilateral trade liberalization is provided in TABLE 4. For purposes of this table, services sectors are omitted. (The GTAP database does not incorporate protection on services trade.) Chile's almost uniform tariff structure is immediately obvious from the second column in TABLE 4. This efficient profile of protection means that own-liberalization will generate smaller efficiency gains than elsewhere. In the case of Brazil, protection levels are higher, on average, in processed food, textiles and manufactures and slightly lower in primary agricultural commodities. The other regions shown in TABLE 4 refer to Rest of Latin America (RLA) – excluding Mexico, the North American Free Trade Area (NAFTA) and Rest of World (ROW). They have protection rates roughly within the range of those in Brazil and Chile, with the exception of ROW, which shows significantly higher protection for food commodities.

Table 3a - Original and adjusted factor earnings data for Brazil

Percent of total earnings

	Total				Agriculture				Non-agriculture		
	Capital*	Skilled labor	Unskilled labor	Land	Skilled labor	Unskilled labor	Capital	Land	Skilled labor	Unskilled labor	Capital*
GTAP - original database	48.4	16.4	33.8	1.4	0.0	2.2	5.8	1.4	16.3	31.6	42.6
Short-run data	40.3	29.3	29.7	0.7	0.2	2.6	6.0	0.7	29.1	27.1	34.3

* Includes natural resources.

Source: Pesquisa Nacional por Amostra de Domicilios, 1998. Brazilian Institute of Geography and Statistics (IBGE). GTAP version 5.0 data base, Dimaranan and McDougall, 2001.

Table 3b - Original and adjusted factor earnings data for Chile

Percent of total earnings

	Total				Agriculture				Non-agriculture		
	Capital*	Skilled labor	Unskilled labor	Land	Skilled labor	Unskilled labor	Capital	Land	Skilled labor	Unskilled labor	Capital*
GTAP - original database	58.1	11.4	28.1	2.3	0.1	4.3	3.7	2.3	11.3	23.8	54.4
Short-run data	45.3	17.0	33.3	4.3	0.1	3.6	2.4	4.3	16.9	29.7	43.0

* Includes natural resources.

Source: Caracterizacion Socioeconomica Nacional, 1998. Ministerio de Plantificacion y Cooperacion, Santiago, Chile. GTAP version 5.0 data base, Dimaranan and McDougall, 2001.

Table 4 - Average rates of protection, by region and merchandise commodity

	Brazil	Chile	RLA	NAFTA	ROW
1 rice	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
2 wheat	6	11	8	31	44
3 feedgrains	7	11	10	20	45
4 othagr	9	11	12	12	13
5 oilseeds	6	11	7	6	32
6 rawsugar	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
7 meatlstk	5	12	9	4	11
8 rawmilk	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
9 forestry	5	12	7	0	1
10 fishing	9	10	11	0	4
Primary agriculture	**8**	**11**	**10**	**10**	**19**
11 procmeat	12	11	17	21	28
12 fatsoils	12	11	14	8	18
13 procdairy	19	11	21	59	32
14 procrice	15	11	29	4	44
15 procsgr	19	11	18	43	28
16 othprfood	16	11	16	12	22
17 bevtobac	23	11	18	11	21
Proc. food	**17**	**11**	**17**	**16**	**24**
18 textiles	16	11	16	8	10
19 wearapp	20	11	23	12	10
Textiles apparel	**17**	**11**	**19**	**10**	**10**
24 autos	39	11	21	1	6
25 electronics	14	11	9	1	3
26 othmnfcs	15	11	12	3	4
Other manuf.	**19**	**11**	**13**	**2**	**4**
20 woodpaper	10	11	11	1	3
21 mining	4	11	5	0	1
22 pchemineral	9	11	9	2	4
23 metals	12	11	11	2	4

* These raw products are essentially non-tradeable. They are protected by tariffs on processed rice, sugar and milk, respectively.

Source: GTAP version 5.0 data base, Dimaranan and McDougall, 2001.

It is also of interest to consider the height of the trade barriers faced by Brazil and Chile in third markets. This information is summarized in TABLE 5. Each pair of columns in the table reports the average tariff faced by Brazilian and Chilean exports in the Rest of Latin America (RLA), NAFTA and Rest of the World (ROW) markets, respectively. (Since the version 5 GTAP data base uses MFN applied tariff rates, the differences between Brazil and Chile are solely due to product and destination composition effects.) The final columns report the average world tariff on each countries' exports. While there is considerable variation across commo-

dities and markets, Brazilian exports tend to face higher tariffs, as can be seen by comparing the entries for these two countries in the total row. Chilean exports tend to face higher protection in Latin America, and for manufactures in NAFTA, whereas Brazilian exports face higher barriers for food exports to NAFTA, and higher average tariffs in ROW.

Table 5 - Barriers to trade faced by Brazil and Chile in other regions

	Rest of Latin America		NAFTA		Rest of the World		World	
	Brazil	Chile	Brazil	Chile	Brazil	Chile	Brazil	Chile
1 rice	n.a.*	n.a. *	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
2 wheat	n.a.*	5.4	n.a.*	36.1	5.1	91.0	5.1	69.7
3 feedgrains	9.2	11.4	3.0	0.9	19.9	38.4	16.0	9.2
4 othagr	9.4	12.9	17.1	6.8	10.3	28.4	11.7	16.9
5 oilseeds	7.9	5.9	13.5	16.6	25.7	36.7	24.8	16.3
6 rawsugar	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
7 meatlstk	8.6	9.2	1.7	5.3	17.2	8.4	13.3	8.4
8 rawmilk	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*	n.a.*
9 forestry	7.6	8.5	1.2	0.0	5.3	1.7	5.1	1.7
10 fishing	7.3	10.6	1.2	0.6	7.6	9.2	3.7	5.0
Primary ag.	**9.1**	**12.5**	**16.1**	**5.6**	**16.0**	**22.3**	**15.6**	**14.2**
11 procmeat	14.6	15.0	9.1	53.8	63.0	61.7	56.0	44.0
12 fatsoils	12.5	13.3	6.0	10.4	26.2	8.5	25.8	11.1
13 procdairy	18.9	19.7	66.3	53.6	106.2	88.0	56.4	26.4
14 procrice	23.0	19.8	5.1	6.3	60.0	128.1	43.3	59.1
15 procsgr	18.2	21.4	43.2	45.7	19.8	37.8	21.8	38.0
16 othprfood	15.1	16.7	12.3	12.2	32.4	30.6	24.2	25.1
17 bevtobac	17.8	18.0	4.3	15.9	30.7	16.3	18.2	16.5
Proc. food	16.2	17.0	17.9	13.8	33.4	29.7	30.3	24.2
18 textiles	15.5	16.8	7.4	16.3	10.2	7.3	12.5	15.3
19 wearapp	18.7	18.6	10.1	15.7	10.2	8.7	13.2	14.8
Textiles apparel	15.9	17.2	8.1	16.0	10.2	7.9	12.6	15.1
20 woodpaper	13.3	8.2	1.5	1.3	3.3	1.2	4.8	2.8
21 mining	2.5	4.0	1.7	4.4	0.7	0.3	0.9	1.0
22 pchemineral	10.6	10.8	5.8	2.9	6.5	6.8	8.2	7.7
23 metals	11.8	8.0	3.0	2.8	3.8	1.5	5.2	2.3
24 autos	20.0	22.9	3.7	10.9	11.3	6.0	14.6	20.9
25 electronics	9.7	9.7	3.2	2.5	3.7	3.9	5.7	6.8
26 othmnfcs	12.9	15.0	5.7	10.1	5.4	5.7	8.3	13.0
Other manuf.	**15.5**	**16.2**	**5.0**	**10.1**	**6.9**	**5.5**	**10.0**	**13.8**
Total	**13.5**	**11.1**	**5.6**	**5.3**	**11.5**	**6.6**	**10.7**	**7.1**

* These raw products are essentially non-tradeable. They are protected by tariffs on processed rice, sugar and milk, respectively.

Source: GTAP version 5.0 data base, Dimaranan and McDougall, 2001.

For purposes of this study, we have modified the model closure in a number of important respects. First or all, we have introduced an explicit revenue replacement assumption in all

regions. Specifically, we maintain a constant ratio of tax receipts, relative to net national income.[11] This is achieved by endogenizing the rate of consumption taxation. Secondly, we fix foreign savings, relative to net national income. When combined with the usual GTAP assumption that consumption, domestic saving (private and government combined) and government spending are also fixed relative to net national income[12], we can deduce that transfers will also be fixed relative to net national income. A careful treatment of transfers is important, since, as we have seen above, they represent a significant component of income for the poorest households in many countries.

The other major modification with respect to earlier studies of multilateral trade liberalization involves the use of a short run closure with respect to the factor markets. We believe that a short run focus is of considerable interest when examining poverty impacts, since these households rarely have the luxury of worrying about the medium to long run. Meeting basic needs in the current year is their top priority. Specifically, we assume that wage and salaried labor are mobile across sectors, but capital, land and self-employed labor (now explicitly subsumed in the capital returns – see TABLE 3) are immobile. As a consequence, supply response is considerably lower, and price changes larger, than in most such studies – as would be expected in the short run.[13]

Disaggregated commodity price changes for Brazil and Chile are reported in TABLES 6 and 7, while aggregated factor and commodity price changes are reported in TABLE 8. The aggregated commodity price changes are reported both for producer prices (excluding wholesale/retail/transport margins) and consumer prices (margin inclusive).[14] The latter are blunted in many cases by a more modest change in the price of margins services. Since the AIDADS demand system employed in the post-simulation analysis is estimated at consumer prices, it is the vector of consumer price changes that is pertinent for our evaluation of household welfare.

In developing the results for TABLES 6-9, we have taken advantage of a new technique for decomposing model results, developed by Harrison, Horridge and Pearson (1999). It employs numerical integration techniques to attribute changes in the endogenous variables (e.g., prices) to changes in sub-sets of the exogenous shocks (tariffs and export interventions). We

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11. GTAP users will recognize that the MFA quota rents are treated as export taxes in the model. However these rents rarely accrue in full to the government price, so we have omitted them from the tax replacement equations.
12. This fixed share assumption is not strictly true in version 6.1 of the GTAP model – due to non-homotheticity of private consumption which endogenizes the cost of private utility faced by the representative regional household. Therefore, we impose this constant share assumption exogenously on the model.
13. Of course a WTO agreement would typically be phased in over a number of years, so this short run closure is somewhat stylized. However, it highlights the most extreme outcome and this therefore a useful benchmark. Also, as noted in the text, this short run closure permits us to match price changes with the income sources from the household survey. In future work, we plan to explore the implications of alternative factor mobility assumptions.
14. The consumer price changes are computed assuming a simple, Cobb-Douglas wholesale/retail/trade sector which is introduced in the post-simulation analysis. This sector combines GTAP producer goods with GTAP trade and transport services to produce aggregated consumer price changes consistent with the general equilibrium results. Since we do not have data on the share of margins services embodied in consumer goods, we deduce these margins based on the difference in consumption shares at consumer prices (ICP) and producer prices (GTAP).

have grouped the trade policy shocks according to the sector/region doing the liberalizing. In the case of Brazil, this includes: Brazil's own trade policies, those of the rest of Latin America, NAFTA policies and trade policies in the rest of the world. Together, these four columns sum to the "Total" column, by virtue of the numerical integration method employed. The decomposition of results in TABLES 6-9 permits us to explain in greater detail the source of differences in outcomes for Chile and Brazil.

All reported price changes are relative to the numeraire in this model, which is the average price of primary factors, worldwide. A rise in the average primary factor price index in Chile, and – to a lesser extent Brazil – means that these two countries experience a real appreciation as a result of this liberalization experiment. That is, increased demand for Chilean exports bids up the prices of all factors, relative to the world average. In the case of Brazil, the situation is mixed, with agricultural profits rising, while wages and non-agricultural profits fall, relative to the numeraire.

In light of the extensive literature on trade liberalization and wages, it is also interesting to observe what happens to the relative returns to skilled and unskilled labor. In Brazil, short run wage inequality widens slightly following multilateral trade liberalization. This conforms to the received wisdom in the literature on Latin America, which has generally found greater openness leading to wage inequality (Robbins, 1995, 1996; Wood, 1994, 1997; Edwards, 1997; Ocampo and Taylor, 1998). However, the opposite is true in Chile, where multilateral trade liberalization reduces the skilled/unskilled wage gap in the short run, by boosting unskilled wages more than skilled wages. If we narrow in on the impact of own-liberalization only, then we find that, in Brazil, own-agricultural and non-agricultural liberalization result in very similar short run impacts on skilled and unskilled wages. In the case of Chile, non-agricultural liberalization has a stronger negative impact on skilled wages, thereby contributing to the overall result that global liberalization reduces wage inequality.

Turning to the impacts of global liberalization on commodity prices, we see that (at producer prices) food prices rise in both Brazil and Chile – driven by cuts in agricultural protection in North America, Europe and Japan. Durable prices fall in both countries, as a result of tariff cuts, as do non-durable and services prices in Brazil (TABLE 8). A detailed comparison of TABLES 6 and 7 reveals that the pattern of disaggregated changes in market prices for Brazil and Chile is different, especially for certain food commodities such as "other agriculture", processed meat and processed sugar. We can explain these differences by referring to differences in the initial patterns of trade and protection for Brazil and Chile. For example, because the exports of other agricultural production in Chile represent a much higher portion of the country's output (25%) than in Brazil (8%), an increase in Chile's exports has a more pronounced impact on the commodity price in Chile than in Brazil; a similar explanation applies to Chile's fisheries sector. Conversely, Brazil's more significant involvement in the exports of processed meat and sugar, mean that increased demand for exports of these commodities has a greater effect on domestic prices in Brazil than in Chile.

Table 6 - Disaggregate market price changes for Brazil

	Brazil's own trade liberalization		Trade liberalization by other Latin American countries		NAFTA's trade liberalization		Trade liberalization by the rest of the world		Total
	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	
Land	–3.3	1.6	0.1	–0.5	1.4	0.5	15.9	–0.3	**15.2**
Unskilled labor	–0.4	–3.9	0.1	0.8	0.1	0.6	1.7	0.1	**–0.7**
Skilled labor	–0.4	–3.8	0.1	0.8	0.2	0.6	1.9	0.1	**–0.5**
Capital	–0.6	–3.1	0.1	0.7	0.3	0.6	3.1	0.0	**1.0**
Natural resources	0.1	1.3	0.0	–0.9	–0.1	–0.3	–3.0	–2.1	**–5.2**
Rice	–5.0	–1.2	–0.3	–0.2	0.4	0.5	7.4	0.0	**1.6**
Wheat	–5.3	–0.1	–0.1	–0.3	0.6	0.4	14.4	–0.3	**9.2**
Feed grains	–3.5	–1.1	0.3	0.1	0.4	0.4	5.1	–0.2	**1.4**
Other agriculture	–1.4	–1.2	0.1	0.1	1.2	0.5	3.9	–0.2	**2.9**
Oil seeds	–0.7	0.4	0.2	–0.3	0.1	0.7	15.2	–0.2	**15.3**
Raw sugar	–0.1	–0.1	0.4	–0.1	1.5	0.6	9.0	–0.2	**11.0**
Meat, livestock	–0.8	–1.1	0.2	0.1	0.2	0.5	20.7	–0.1	**19.7**
Raw milk	–5.2	–3.2	–0.3	0.5	0.4	0.6	3.9	0.0	**–3.3**
Forestry	–0.8	–3.2	0.1	0.8	0.2	0.6	3.3	0.1	**1.3**
Fishing	–3.2	–1.6	0.2	0.3	0.5	0.6	4.0	–0.1	**0.7**
Processed meat	–0.8	–2.2	0.1	0.3	0.2	0.6	13.3	0.0	**11.5**
Fats, oils	–0.9	–1.5	0.1	0.1	0.1	0.6	9.1	–0.1	**7.5**
Processed dairy	–3.3	–3.4	–0.2	0.6	0.3	0.6	3.1	0.0	**–2.3**
Processed rice	–2.2	–2.5	–0.1	0.3	0.4	0.5	4.7	0.0	**1.1**
Processed sugar	–0.6	–2.0	0.2	0.3	0.8	0.6	5.3	–0.1	**4.4**
Other processed food	–1.7	–2.6	0.0	0.4	0.4	0.5	3.9	–0.1	**0.9**
Beverages, tobacco	–1.9	–2.8	0.1	0.4	0.3	0.5	3.4	–0.1	**–0.1**
Textiles	–0.3	–4.8	0.0	0.6	0.2	0.5	1.5	–0.1	**–2.3**
Apparel	–0.3	–5.2	0.1	0.7	0.1	0.6	1.4	–0.1	**–2.7**
Wood, paper	–0.4	–3.8	0.0	0.6	0.2	0.5	1.6	0.0	**–1.1**
Mining	0.0	–2.0	0.0	0.0	0.0	0.2	–0.6	–0.9	**–3.2**

Petrochemicals, minerals	–0.3	–4.1	0.0	0.5	0.2	0.5	1.3	–0.2	**–2.1**
Metals	–0.3	–4.1	0.0	0.6	0.1	0.5	1.2	–0.1	**–2.0**
Autos	–0.2	–10.0	0.0	–0.2	0.1	0.5	1.1	–0.1	**–8.9**
Electronics	–0.2	–6.6	0.0	0.4	0.1	0.4	1.0	–0.2	**–5.2**
Other manufactures	–0.2	–5.0	0.0	0.5	0.1	0.6	1.2	–0.1	**–2.9**
House utilities	–0.4	–3.9	0.1	0.7	0.1	0.6	1.7	0.0	**–0.9**
Trade, transportation	–0.4	–4.2	0.1	0.7	0.1	0.6	1.7	0.1	**–1.3**
Construction	–0.4	–4.0	0.1	0.7	0.1	0.6	1.6	0.0	**–1.3**
Business, finance	–0.3	–3.6	0.1	0.7	0.1	0.6	1.6	0.1	**–0.8**
Government service	–0.4	–3.9	0.1	0.8	0.2	0.6	1.9	0.1	**–0.7**
CAPITAL GOODS	–0.2	–4.9	0.0	0.4	0.1	0.5	1.2	–0.1	**–3.0**

Note: All price changes are relative to the numerare, which is the global average return to primary factors.

Source: Authors' simulation results.

Table 7 - Disaggregate market price changes for Chile

	Chile's own trade liberalization		Trade liberalization by other Latin American countries		NAFTA's trade liberalization		Trade liberalization by the rest of the world		Total
	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	
Land	–3.4	1.7	1.9	–0.5	0.9	0.3	26.0	0.0	**26.9**
Unskilled labor	–0.2	–1.3	0.3	0.6	0.5	0.6	3.4	–0.6	**3.3**
Skilled labor	–0.2	–1.9	0.3	0.6	0.5	0.6	3.0	–0.6	**2.2**
Capital	–0.2	–0.9	0.3	0.4	0.4	0.6	3.1	–0.6	**3.1**
Natural resources	0.7	4.1	0.8	–0.9	0.5	0.5	3.6	–0.5	**8.6**
Rice	–5.6	–1.4	–0.5	–0.2	1.3	0.6	10.8	0.9	**5.9**
Wheat	–2.8	0.1	1.1	0.0	1.9	0.2	14.6	–0.1	**14.8**
Feed grains	–3.7	–0.2	0.2	0.0	0.3	0.1	5.9	–0.4	**2.1**
Other agriculture	–0.7	–0.2	1.2	–0.2	0.1	0.4	13.8	–0.3	**14.1**
Oil seeds	–2.7	0.1	0.9	0.0	4.7	0.7	12.7	–0.2	**16.1**
Raw sugar	–7.8	–1.4	–0.4	–0.6	3.1	0.2	12.1	–0.4	**4.9**
Meat, livestock	–1.7	–1.8	0.6	0.2	0.7	0.5	10.8	–0.5	**8.8**
Raw milk	–2.5	–2.0	1.1	0.3	1.1	0.6	11.7	–0.5	**9.7**
Forestry	–0.3	0.4	0.0	0.0	0.0	0.2	0.7	–0.5	**0.6**
Fishing	0.4	0.3	1.0	–0.2	0.9	0.5	7.4	–0.2	**10.2**
Processed meat	–1.8	–1.7	0.4	0.2	0.6	0.5	8.7	–0.5	**6.5**
Fats, oils	–3.6	–0.9	0.3	0.2	0.6	0.6	5.3	–0.4	**2.0**
Processed dairy	–1.7	–2.0	0.6	0.3	0.6	0.5	6.2	–0.5	**3.9**
Processed rice	–4.8	–1.8	–0.5	–0.2	0.7	0.5	7.6	0.5	**2.0**
Processed sugar	–5.2	–1.4	–0.1	–0.3	2.1	0.3	9.0	–0.4	**4.0**
Other processed food	–1.0	–1.0	0.6	0.1	0.7	0.4	6.3	–0.4	**5.6**
Beverages, tobacco	–0.9	–1.7	0.4	0.2	0.9	0.4	6.4	–0.5	**5.2**
Textiles	–0.1	–4.7	0.1	0.4	0.3	0.5	1.7	–0.7	**–2.6**
Apparel	–0.2	–4.3	0.2	0.3	0.3	0.6	2.0	–0.7	**–1.8**
Wood, paper	–0.1	–2.1	0.1	0.2	0.2	0.3	1.6	–0.7	**–0.4**
Mining	0.0	–0.6	0.0	–0.2	0.0	0.4	–0.5	–0.8	**–1.7**

Petrochemicals, minerals	–0.2	–4.7	0.1	0.2	0.2	0.3	1.6	–0.5	**–3.0**
Metals	–0.1	–1.7	0.1	0.1	0.1	0.4	0.7	–1.3	**–1.6**
Autos	–0.1	–6.4	0.0	–0.5	0.1	0.3	0.8	–0.6	**–6.4**
Electronics	–0.1	–5.2	0.1	0.1	0.2	0.2	1.4	–0.7	**–3.8**
Other manufactures	–0.2	–4.5	0.1	0.4	0.2	0.4	1.5	–0.6	**–2.7**
House utilities	–0.2	–2.8	0.3	0.5	0.4	0.6	2.7	–0.7	**0.8**
Trade, transportation	–0.2	–1.9	0.2	0.4	0.4	0.5	2.6	–0.4	**1.6**
Construction	–0.2	–2.6	0.2	0.4	0.4	0.5	2.4	–0.6	**0.4**
Business, finance	–0.2	–1.9	0.3	0.5	0.4	0.5	2.8	–0.6	**1.9**
Government service	–0.3	–2.5	0.3	0.4	0.4	0.5	2.9	–0.6	**1.1**
CAPITAL GOODS	0.0	–2.1	0.2	0.1	0.3	0.3	2.4	–0.6	**0.5**

Note: All price changes are relative to the numerare, which is the global average return to primary factors.

Source: Authors' simulation results.

Table 8.a - Aggregated market price changes in Brazil

	Brazil's own trade liberalization		Trade liberalization by other Latin American countries		NAFTA's trade liberalization		Trade liberalization by the rest of the world		Total
	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	
Factors									
AgProf	–3.3	1.4	0.1	–0.4	1.3	0.5	15.3	–0.3	**14.6**
NonAgProf	–0.3	–3.6	0.1	0.8	0.1	0.6	1.4	0.0	**–0.9**
USkilled labor	–0.3	–3.9	0.1	0.8	0.1	0.6	1.7	0.1	**–0.7**
Skilled labor	–0.4	–3.8	0.1	0.8	0.2	0.6	1.9	0.1	**–0.5**
PubTrans	–0.5	–3.2	0.1	0.8	0.2	0.6	2.6	0.1	**0.7**
PrvTrans	–0.5	–3.2	0.1	0.8	0.2	0.6	2.6	0.1	**0.7**
Commodities									
				Producer prices					
Staple grains	–2.8	–1.2	–0.2	0.2	0.4	0.5	5.1	0.0	**1.8**
Livestock	–2.1	–1.5	0.0	0.4	0.2	0.6	9.7	0.0	**7.2**
Other food	–1.6	–1.0	0.1	0.2	0.6	0.5	4.4	–0.1	**3.0**
Nondurables	–0.4	–3.9	0.0	0.5	0.1	0.5	1.4	–0.1	**–1.8**
Durables	–0.1	–8.9	0.0	–0.1	0.1	0.3	0.8	–0.3	**–8.1**
Services	–0.3	–3.0	0.1	0.7	0.1	0.6	1.6	0.0	**–0.1**
Margin services	–0.2	–2.9	0.1	0.7	0.1	0.6	1.5	0.1	**–0.2**
Commodities									
				Consumer prices					
Staple grains	–1.8	–1.9	–0.1	0.4	0.3	0.5	3.6	0.0	**1.0**
Livestock	–1.4	–2.1	0.0	0.5	0.2	0.6	6.3	0.0	**4.2**
Other food	–1.1	–1.8	0.1	0.4	0.4	0.5	3.2	–0.1	**1.7**
Nondurables	–0.3	–3.6	0.1	0.5	0.1	0.5	1.4	–0.1	**–1.4**
Durables	–0.1	–6.8	0.0	0.2	0.1	0.4	1.0	–0.1	**–5.3**
Services	–0.3	–3.0	0.1	0.7	0.1	0.6	1.6	0.0	**–0.1**

Table 8.b - Aggregated market price changes in Chile

	Chile's own trade liberalization		Trade liberalization by other Latin American countries		NAFTA's trade liberalization		Trade liberalization by the rest of the world		Total
	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	in agricultural commodities	in non-agricultural commodities	
Factors									
AgProf	–2.3	2.1	1.7	–0.5	0.9	0.4	21.4	0.0	**23.7**
NonAgProf	–0.1	–1.0	0.2	0.5	0.4	0.6	2.1	–0.7	**2.0**
USkilled labor	–0.2	–1.3	0.3	0.6	0.5	0.6	3.4	–0.6	**3.3**
Skilled labor	–0.2	–1.9	0.3	0.6	0.4	0.6	3.0	–0.6	**2.2**
PubTrans	–0.4	–0.9	0.4	0.5	0.5	0.6	4.4	–0.6	**4.5**
PrvTrans	–0.4	–0.9	0.4	0.5	0.5	0.6	4.4	–0.6	**4.5**
Commodities									
				Producer prices					
Staple grains	–3.6	2.6	0.6	0.0	1.4	0.2	12.2	0.0	**13.3**
Livestock	–1.6	1.1	0.6	0.2	0.7	0.5	8.8	–0.5	**9.8**
Other food	–1.5	1.9	0.6	0.0	0.6	0.4	8.2	–0.4	**9.9**
Nondurables	–0.2	–2.6	0.2	0.1	0.3	0.4	2.5	–0.6	**0.1**
Durables	0.0	–7.8	0.0	–0.8	0.0	–0.1	0.3	–0.8	**–9.0**
Services	0.0	0.4	0.3	0.5	0.4	0.5	3.0	–0.6	**4.5**
Margin services	0.0	0.9	0.3	0.4	0.4	0.5	2.9	–0.4	**5.0**
Commodities									
				Consumer prices					
Staple grains	–3.1	2.3	0.6	0.0	1.2	0.3	10.7	–0.1	**12.0**
Livestock	–1.4	1.1	0.5	0.3	0.6	0.5	7.9	–0.5	**9.1**
Other food	–1.2	1.7	0.6	0.1	0.6	0.4	7.4	–0.4	**9.2**
Nondurables	–0.1	–1.0	0.2	0.3	0.4	0.4	2.7	–0.5	**2.3**
Durables	0.0	–4.7	0.1	–0.3	0.2	0.1	1.3	–0.7	**–4.1**
Services	0.0	0.4	0.3	0.5	0.4	0.5	3.0	–0.6	**4.5**

Note: All price changes are relative to the numerare, which is the global average return to primary factors.

Source: Authors' simulation results.

Implications for poverty

By combining the survey-based information on earnings profiles with the factor price changes in TABLES 6 and 7, we are able to infer changes in incomes for the 20 household groups in each of the five strata for Brazil and Chile. When combined with the AIDADS expenditure function and the consumer price changes we are able to compute the new level of utility for each of the 200 household groups, as well as the ensuing change in poverty headcount. The percentage changes in this measure of poverty for each stratum/country combination due to trade liberalization are reported in TABLES 9a and 9b.

Impacts on Brazilian poverty

Let us begin by looking at the combined impact of all liberalization measures (TABLE 9a, *total* row) on poverty across strata in Brazil. The percentage reduction in poverty is particularly striking in the case of agriculture-specialized households (–14.8%). Poverty also falls substantially for the transfer and diversified stratum in Brazil (–2.5%). On the other hand, there are very substantial increases in poverty among the wage labor and self-employed, non-agricultural households (+2.65% and +1.62%, respectively).

Combining the changes in poverty in individual strata, together with the relative importance of these strata in the overall poverty picture (recall TABLE 1), we are able to obtain an assessment of the impact on national poverty in Brazil. This is reported, again as a percentage change, in the lower right hand corner of TABLE 9a. Here we see that aggregate Brazilian poverty falls in the short run by 0.6% in Brazil, as a result of full, multilateral trade liberalization. This reduction is driven by the reduction in poverty among the self-employed farm households and the diversified households, which together comprise 43% of the poor according to our estimates.

TABLE 9a also permits us to decompose these total poverty changes, as well as the stratum changes, by source, i.e., by liberalizing policy. Consider the first two columns of the table – namely the impact on the two household groups that are self-employed, and therefore earning virtually all of their short run income from profits. In the case of the agriculture-specialized households, poverty rises by 5.0% following own-ag liberalization, as agricultural profits fall with the reduction in protection for that sector. On the other hand, poverty among non-agriculture households *falls* as a result of own-ag liberalization (–1.4 percent), as food prices fall and the non-agricultural sector becomes relatively more competitive.

In the case of non-agricultural liberalization in Brazil, precisely the opposite pattern emerges. Poverty falls among agricultural households (–5.2%) since manufacturing tariffs act as an indirect tax on agriculture. Reducing these tariffs serves to lower input costs for agriculture and leads to a real depreciation, making it easier to export agricultural products. Cheaper non-agricultural commodities also benefit the poor from the consumption side. Of course, the reduction in non-agricultural protection increases poverty by 1.4% amongst the house-

holds reliant on profits in this sector for their income. So the combined effect of unilateral Brazilian liberalization on poverty amongst both groups is essentially neutral. This is a good reason for undertaking such liberalization on an across-the-board, simultaneous basis.

When we turn to the impact on Brazilian self-employed households of liberalizing policies in other countries of the world, we see that the sign pattern is reversed – now agricultural liberalization elsewhere boosts agricultural prices, production and profits and lowers poverty among agriculture-specialized households. Conversely, with the exception of agricultural policies in RLA, agricultural trade policy liberalization in other regions raises food prices and hence poverty among the non-agriculture specialized households. When liberalization in other regions involves only the non-agricultural sectors, poverty falls for the non-agriculture specialized households and rises for the agriculture specialized group. Thus there is a strong symmetry in the pattern of gains and losses to the sectoral-specialized households in Brazil.

The short run impact of trade liberalization in Brazil, RLA, NAFTA and ROW on poverty among the Brazilian labor- and transfer-specialized households is quite similar to that of the non-agricultural, self-employed households. Own-agricultural liberalization and non-ag liberalization outside Brazil both serve to lower the incidence of poverty in these strata, while own-non-agricultural liberalization and agricultural liberalization outside the region raise poverty among Brazilian wage-labor-dependent households. In contrast, the diversified households in Brazil experience a reduction in poverty in all cases. This is due to their diversity of income sources. As a consequence, they benefit in line with the aggregate economy in the wake of trade liberalization.

Impacts on poverty in Chile

The pattern of poverty impact across the agricultural, non-agricultural and labor-specialized households in Chile (TABLE 9b) is quite similar to that in Brazil. Liberalization of agricultural trade policies in Chile worsens poverty among agriculture-specialized households as earnings fall, while nonagricultural and labor-specialized households benefit from lower food prices. Liberalization of Chile's own non-agricultural trade policies has the opposite effect on poverty, by lowering nonfood prices and reducing nonagricultural profits and wages. And the reverse is true for liberalization of agricultural and non-agricultural policies elsewhere in the Americas. ROW liberalization in either sector lowers poverty amongst self-employed farm households, while raising it among their non-agricultural counterparts.

The combined impact of global trade liberalization on poverty in Chile is quantitatively much more significant than for Brazil. The overall poverty reduction is about three times as great, and the individual stratum gains and losses – while identical in sign – are larger in absolute value in Chile, with the exception of the diversified households. This may be traced back to the stronger price effects in Chile, which in turn result from the greater dependence of Chile on world markets.

Table 9.a - Percentage changes in poverty head-count in Brazil (by stratum, liberalizing, sector/region)

Percentage change in poverty head-count, by stratum

		Agriculture specialized	Non-agriculture specialized	Labor specialized	Transfer specialized	Diversified	Total
Country's own liberalization	in agricultural commodities	5.0	–1.4	–0.6	–0.5	0.0	–0.2
	in non-agricultural commodities	–5.2	1.4	1.3	0.7	–0.1	0.5
Liberalization by the rest of Latin America	in agricultural commodities	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1
	in non-agricultural commodities	1.1	–0.8	–0.4	–0.3	–0.2	–0.3
Liberalization by NAFTA	in agricultural commodities	–1.3	0.3	0.1	0.0	–0.2	–0.1
	in non-agricultural commodities	0.0	–0.2	–0.1	–0.1	–0.1	–0.1
Liberalization by the rest of the world	in agricultural commodities	–12.8	3.6	1.5	0.6	–1.7	–0.2
	in non-agricultural commodities	0.3	–0.2	–0.1	–0.1	–0.1	–0.1
Total change in poverty		**–14.8**	**2.6**	**1.6**	**0.2**	**–2.5**	**–0.6**

Table 9.b - Percentage changes in poverty head-count in Chile (by stratum, liberalizing, sector/region)

Percentage change in poverty head-count, by stratum

		Agriculture specialized	Non-agriculture specialized	Labor specialized	Transfer specialized	Diversified	Total
Country's own liberalization	in agricultural commodities	3.1	–1.3	–1.1	–0.4	–0.5	–0.5
	in non-agricultural commodities	–4.2	1.6	2.1	0.8	1.1	1.1
Liberalization by the rest of Latin America	in agricultural commodities	–3.0	0.2	0.1	0.0	–0.3	–0.3
	in non-agricultural commodities	1.5	–0.4	–0.4	–0.1	–0.1	–0.1
Liberalization by NAFTA	in agricultural commodities	–0.8	0.3	0.2	0.1	0.0	0.0
	in non-agricultural commodities	0.0	–0.2	–0.2	–0.1	–0.2	–0.2
Liberalization by the rest of the world	in agricultural commodities	–28.3	4.6	3.1	0.9	–1.9	–1.8
	in non-agricultural commodities	–1.0	0.3	0.2	0.1	0.0	0.0
Total change in poverty		**–31.2**	**5.0**	**4.0**	**1.2**	**–1.9**	**–1.7**

Source: Authors' simulation results.

Conclusions and directions for future research

Poverty reduction is an increasingly important consideration in the deliberations over bilateral and multilateral trade liberalization. Nowhere is this of greater concern than in Latin America, where poverty in the 1980's increased – a phenomenon often attributed to policy liberalization. However, to date few studies have been able to address the poverty question in the context of multi-country trade liberalization due to the absence of distributional detail in global trade models. This paper combines results from a newly available international, cross-section consumption analysis, with earnings data from household surveys from Brazil and Chile, to analyze the implications of multilateral trade liberalization for impoverished households in these two countries.

The scenario that we examine is explicitly short run in nature, as we believe that this highlights the potential vulnerability of those poor households with earnings patterns that are highly specialized. Accordingly, we stratify households according to their earnings, separately identifying four different strata which obtain more than 95% of their income from self employment in agriculture, self-employment in non-agriculture, wage labor and transfers, respectively. All other households are placed in a "diversified" stratum. Households within each group are divided into 20 vingtiles, according to income level and a national poverty line is established using the World Bank's $1/day estimates.

The multilateral trade liberalization scenario involves complete elimination of merchandise tariff barriers as well as textile and apparel quotas in place in 1997. This ignores the potential impact of other non-tariff barriers as well as the significant barriers to trade and investment in services and trade distorting domestic farm policies. While this liberalization scenario is stylized, it does offer a useful benchmark for assessing the potential poverty impacts of multilateral measures. Of particular interest is our partitioning of the effects on poverty of countries' own policies versus those of other countries, as well as by sector (agriculture vs. non-agriculture).

We find that, in *the short run*, the aggregate measure of poverty is reduced in Brazil and Chile, following multilateral trade liberalization. The largest percentage reduction in poverty occurs among agriculture-specialized households in Chile and Brazil, as a consequence of higher agricultural profits. Diversified households also gain. In contrast, poverty increases among the self-employed non-agriculture- and the wage-specialized households in these countries. Here we find that the liberalization of non-agricultural policies at home and agricultural policies abroad tends to reduce poverty among the agriculture-specialized households. In contrast, the liberalization of agricultural trade policies at home and non-agricultural policies abroad both tend to reduce poverty among the self-employed non-agriculture, wage earning and transfer-specialized households. Poverty falls amongst diversified households across nearly all scenarios.

In closing, it is useful to compare our findings to other recent studies of trade liberalization and poverty in Latin America. While our finding of aggregate poverty reduction in Brazil due

to trade liberalization appears to be in agreement with the recent findings of Harrison, Rutherford and Tarr (2002), the mechanisms underlying this reduction are quite different. In their *long run* study, they treat self-employed labor and capital as being perfectly mobile. Thus the main determinant of poverty reduction is the change in the unskilled wage rate, relative to the basket of consumption goods for poor households. They find that multilateral trade liberalization boosts real unskilled wages, thereby reducing poverty. Yet in our study real unskilled wages fall in the case of Brazil. Poverty is instead reduced as a consequence of the increased agricultural profits that lift enough rural households out of poverty to offset the adverse impact on their urban counterparts.[15]

Our aggregate findings provide a weak challenge to Morley (2001) who concludes that the impact of trade reform on income distribution has been modestly regressive. However, as Morley points out, the most important impact of trade liberalization on the poor may well be through growth effects. Apart from the standard, static efficiency effects, this short run analysis has abstracted from the impact of trade liberalization on productivity, capital accumulation and economic growth. However, the most important contribution of this paper is not the findings with regard to aggregate poverty – which changes little as a result of trade liberalization – but rather the sharply differentiated short run incidence among low income, earnings-specialized households. Future analyses of the impact of trade reforms on poverty and income distribution need to pay closer attention to the stratification of households and the potential importance of earnings specialization[16.]

T.W.H., P.V.P., J.A.L.C. & M.I.

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15. In related correspondence and through a set of additional simulations, we have sought to understand the differences between these two studies which both begin with the same GTAP-5 data base. When we adopt the same long run closure as Harrison, Rutherford and Tarr (HRT, 2002), real wages do indeed rise. Furthermore, when we assume larger trade elasticities – another feature of the HRT study – real wages.rise even more. Two further sources of difference are data-driven. HRT impute a much higher wage to self-employed labor in agriculture (twice the minimum wage), making that sector appear much more labor intensive than in our study. Finally, HRT use a more recent input-output table for Brazil. This also appears to play a role in boosting real wages in the presence of trade liberalization. In short, with suitable adjustment to the closure, parameters and data, the two studies can be brought into agreement. However, they operate from two fundamentally different points of view about the factor markets – one long run and one short run. Future work should aim to reconcile these two within one common framework.

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