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Ole Boysen, Alan Matthews

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The Impact of Developed Country Agricultural Trade Liberalization on Poverty: A Survey

Ole Boyesen and Alan Matthews†

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Abstract

There has been growing criticism of agricultural policies in developed countries because of the way they are believed to undermine the ability of developing countries to reduce the numbers living in poverty. Developed countries have accepted to support developing countries to reach the Millennium Development Goal target of halving poverty by 2015. The desire for greater policy coherence with this stated development objective has been one of the factors behind efforts to reform developed country agricultural policies. This paper provides a survey of the limited empirical literature which tries to go beyond the estimation of national-level welfare effects on developing countries of developed country agricultural trade liberalization to estimate the effects on numbers in poverty. We find a relatively limited empirical contribution to this issue despite its policy relevance. The small number of studies from which inferences can be drawn tends to show a positive impact on poverty alleviation. However, the literature draws attention to the specificity of the country estimates and highlights a number of country characteristics which will influence the poverty impacts of external shocks arising from developed country agricultural trade liberalization.

†Ole Boyesen, e-mail: boyesen@tcd.ie, Alan Matthews, e-mail: Alan.Matthews@tcd.ie, Institute for International Integration Studies and Department of Economics, Trinity College Dublin, Ireland.

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1 Introduction

1.1 Developed Country Agricultural Trade Liberalization and Poverty Reduction

The impact of trade liberalization on poverty is a rapidly-growing area of research. This has been driven, in part, by the protracted WTO Doha Round of trade negotiations and the controversies over whether a successful outcome would help to alleviate, or would even exacerbate, poverty. Another factor has been the commitment of both developing and developed countries to the Millennium Development Goals (MDGs) adopted in 2000, which include the target of halving the proportion of people living in poverty by 2015. Poverty Reduction Strategy Papers (PRSPs) provide the link in low-income countries between national public policies, donor support and the development outcomes needed to meet the MDGs. However, the role that trade policy should play in the PRSPs or in national poverty reduction strategies more generally is often hotly disputed. Yet another motivation has been the call for the reform of certain developed country policies, in particular agricultural policy, on the grounds that it is inconsistent with the support by these governments for the MDG target of halving poverty. It is this latter claim which provides the starting point for this paper. We set out to examine the evidence whether developed country agricultural trade liberalization would have a significant impact on reducing poverty in developing countries or not.

Initial claims for the poverty-reducing impacts of trade liberalization were broad. A widely-quoted \cite{WorldBank2003} report estimated that the dynamic gains from a 'realistic' multilateral trade liberalization would be real income gains of $518 billion for the world as a whole and $394 billion for low- and middle-income countries in 2015 (in 1997 dollars). With such trade liberalization the number of people living in extreme poverty in these countries would fall by an extra 61 million (8 per cent of the projected 2015 level) by 2015, and the number of people living on less than $2/day would fall by an extra 144 million (7 per cent of the projected 2015 level) by 2015. \cite{Cline2004}, using a different model and including stronger dynamic effects and high elasticities of poverty reduction with respect to income gains, found that an extra 650 million people could be lifted out of $2/day poverty by 2015 through global free trade, or more than four times as many as the Bank estimate. A further \cite{IMF/WorldBank2002} survey on market access for developing countries in 2002 estimated that by 2015 the world-wide elimination of trade barriers could reduce the number of people living in poverty by 13%. But these expected impacts shrunk over time with improvements of models and data; see, for instance, \cite{Ackerman2005}.
Latest, more differentiated studies report rather small poverty impacts from trade liberalization.

Agricultural trade liberalization plays a crucial role in these estimates, for three reasons. First, agriculture is one of the most heavily protected economic sectors in the world. Average applied agricultural tariffs in the OECD countries are around 16%, and even higher in developing countries at 18%, compared to global average applied tariffs in manufacturing other than textiles and clothing of 3.5% (Anderson et al.; 2006).¹

Second, poverty in developing countries is concentrated in rural areas and associated with agricultural livelihoods, even if worldwide there is an increasing urbanization of poverty. Three out of every four poor people in developing countries live in rural areas - 2.1 billion living on less than $2 a day and 880 million on less than $1 a day - and most depend on agriculture for their livelihoods (World Bank; 2007). While estimates of the global distribution of the extremely poor depend on the methods used to make them, household survey-based estimates by the World Bank suggest that most of the world’s extremely poor live in rural areas particularly in India and China. However, looking ahead, if current trends continue, the majority of the extreme poor will be located in Africa.

Third, the special importance of the agricultural sector for poverty reduction is emphasized by the evidence that development of the agricultural sector, particularly when driven through productivity growth, is a prerequisite for, and accelerates, productivity growth in the industrial / modern sectors (Gollin et al.; 2002; World Bank; 2007). There is now accumulating evidence that agricultural growth can spur faster economic growth and poverty alleviation than growth in other sectors from case studies (Byerlee et al.; 2005); cross-country econometric analyses of the relationship between growth in different sectors, overall economic growth and poverty reduction (Christiaensen et al.; 2006); and simulation modeling to estimate the magnitude of growth linkages (Diao et al.; 2007).

In general, then, and despite adverse cost of living effects, we should expect large positive impacts of developed country agricultural trade liberalization on poverty because (a) OECD agricultural sectors are heavily protected, and thus depress world market prices for protected commodities, and (b) most poor people gain their livelihood in the agricultural sector, and thus would benefit from higher prices and expanded markets for agricultural outputs. However, not everyone is convinced by the pro-poor benefits of higher agricultural prices. Joachim von Braun, in IFPRI’s 2007 review of the world food situation, has commented: "In sum, in view of the

¹Average applied tariffs are calculated on a trade-weighted basis and take into account preferential trade regimes.
changed farm-production and market situation that the poor face today, there is
not much supporting evidence for the idea that higher farm prices would generally
cause poor households to gain more on the income side than they would lose on the
consumption-expenditure side. Adjustments in the farm and rural economy that
might indirectly create new income opportunities due to the changed incentives will
take time to reach the poor" (von Braun; 2007).\textsuperscript{2} In the last two years, prices for
certain commodities used as feedstocks for biofuels have been rising steeply due to
linkage with energy markets and public support in developed countries for the ex-

\begin{itemize}
\item[2] The IFPRI press release accompanying this report was titled "Rising food prices threaten
world’s poor people", \url{http://www.ifpri.org/pressrel/2007/20071204.asp} accessed 4 January
2008.
December 2007.
\end{itemize}

\textsuperscript{2}\textsuperscript{3}

\textsuperscript{2} BBC News 27 Oct 2007, \url{http://news.bbc.co.uk/2/hi/americas/7065061.stm} accessed 3
December 2007.

\textsuperscript{3} Jean Ziegler, the UN special rapporteur on the right to food, has branded the growing use of crops to produce biofuels as a crime against
humanity because it results in higher food prices and more hunger.\textsuperscript{3} Even the IMF
has expressed concern about the impact of rising food prices on the world’s poor
(IMF; 2007).

What we want to investigate is whether the empirical evidence supports the
maintained hypothesis that higher world food prices are good for the poor. The
initial impact on the poor will largely depend on their net sales position - are they
net purchasers or sellers of the agricultural commodities whose prices have risen?
However, by stimulating the demand for unskilled labor in rural areas, higher agri-
cultural prices also tend to result in higher rural wages, thus benefiting wage labor
households in addition to self-employed farmers (FAO; 2005). Increased trade, stim-
ulated by more open markets, can also bring access to new technologies which, in
turn, can result in higher productivity. The impact of higher food prices on poverty
in developing countries will thus be differentiated. However, we want to explore
whether it is possible to make any generalizations or draw any empirical regularities
from the studies which have been conducted to date.

\subsection*{1.2 Reviews of Previous Literature}

There have been a number of previous attempts to synthesize the literature both
on trade liberalization and poverty more generally and on agricultural trade liberal-
alization and poverty specifically. Winters et al. (2004) focus on the main economic
mechanisms linking trade policy and poverty, and review the empirical evidence
on each of these components. Other studies provide an overview of the tools and
methodologies available for evaluating the poverty impacts of trade policies, see
Bourguignon and da Silva (2003). Hertel and Reimer (2004) provide a survey categorized by the methodologies employed in the studies reviewed.

Syntheses of the impacts of agricultural trade liberalization on poverty include FAO (2005), Hertel (2006) and Hertel and Winters (2006a). Hertel (2006) reviews the available empirical evidence on the impacts of agricultural trade liberalization on poverty in developing countries up to 2004, including the impact of both own liberalization and international liberalization. His review focuses on the way households adjust to such external shocks, and highlights the importance of the extent of price transmission from border to local markets, the responsiveness of a given household to price changes, the functioning of labor markets, and the boost provided to economic growth in determining the poverty-reducing effects of agricultural trade liberalization. His paper provided the basis for the review of the poverty impacts of agricultural trade reforms in the FAO survey which appeared in The State of Food and Agriculture 2005. This review emphasized the key role of labor markets in determining the poverty impacts of trade liberalization. Net purchasers of agricultural commodities, who initially lose owing to higher prices, can ultimately gain if these prices translate into higher wages and more jobs. The impact of trade reforms on unskilled labor is central to the poverty story. Thus, for many developing countries, the positive food security impacts of trade arise because of its impact on non-agricultural incomes.

Hertel and Winters (2006b) contains a comprehensive analysis of the national poverty impacts of specific Doha Round policy reforms. In their opening chapter (Hertel and Winters, 2006a), they synthesize the findings of the twelve case studies included in their book, as well as a further cross-section study of 15 developing countries which estimated poverty impacts using a common methodology (Ivanic, 2006). They found that, in the short run, the largest poverty reductions, both in absolute and relative terms, would occur in countries with agricultural export potential to the markets that liberalize the most (i.e., East Asia and Europe). Poverty increases would tend to occur in countries that are net importers of agricultural products and that may benefit from preferential market access. In their sample of countries (which is not intended to be representative) they find that countries are roughly equally divided into those where poverty would fall and those where it would increase as a result of their Doha scenario, although because the poverty declines are concentrated in the more populous countries, there would be an overall decline in the absolute number of poor. The influence of the terms of trade shocks from international liberalization was the single biggest determinant of poverty outcomes. However, other factors which played a role included the degree of price transmission of world prices to rural households, the barriers to the mobility of workers between
sectors of the economy, and the incidence of national tax instruments used to replace lost tariff revenue.

The most sophisticated investigation of the impact of developed country agricultural trade liberalization on developing country poverty has been reported in a series of papers by Hertel et al. (2007a,b), not least because of the clarity of its experimental design. Although it is not a review paper as such, this work builds on the comparison of the 15 country case studies (Ivanic 2006) included in the Hertel and Winters (2006b) volume. They begin by examining the poor country poverty impacts of liberalizing agricultural policies in only the rich countries, and then contrast this with agricultural trade reforms in the poor countries. They then include the impact of liberalizing market access for non-agricultural goods, again distinguishing between developed and developing country reforms. This approach allows a clear decomposition of the relative contribution of different scenarios to overall poverty changes.

The poverty impacts are calculated according to a sequential macro-micro modeling strategy (see Section 4.2). In the macro model, seven household groups are distinguished according to their primary source of income. Their approach calculates the elasticity of the poverty headcount with respect to a small change in the real income of households at the poverty line within each of these stratified household groups. Depending on the density of households just around the poverty line, a small change in their real income can either have very little impact on the poverty headcount (where nearly all of the population is well below the poverty line) or may have quite a significant impact (where the population density at the poverty line is quite high). The changes in real income, in turn, are calculated by taking the factor income changes from the macro model, mapping these on to household earnings using the earning shares of households at the poverty line, adjusting for tax changes and deflating by the proportional change in the cost of living at the poverty line. To estimate national poverty impacts, the earnings impact across strata are combined with the poverty impacts of changing taxes and consumer prices.

In their simulation of full agricultural liberalization by developed countries, they find that poverty falls in all of the agricultural household strata, while rising in the non-agricultural strata. The earnings impact of rich country agricultural trade liberalization contributes to poverty reduction in all household groups, while the cost of living effect contributes to a rise in poverty in all countries, except one (in this scenario, the tax effect is negligible because developing countries are not asked to undertake trade reform). When the two effects are summed, they conclude that the earnings effect dominates in nine of the 15 countries in their sample, and that the gains in poverty reduction in these countries are more significant than the poverty
increases in those countries where the cost of living effect dominates. Thus they conclude, as do Hertel and Winters (2006b), that full agricultural trade liberalization in rich countries is poverty reducing on average for the range of countries included in their sample.

1.3 Outline of the Paper

In this paper, we provide an overview of the empirical methods used to obtain estimates of the impact of agricultural trade liberalization on poverty, as well as summarize the results of studies which have examined either exclusively or otherwise the impact of developed country agricultural trade liberalization on poverty in developing countries. The review of empirical methods is intended to highlight the strengths and weaknesses of the various approaches, to provide a better appreciation of the results obtained in the empirical studies. While significant advances have been made in developing methodologies to address this question, and there has been an explosion in the number of studies which provide empirical findings, there are actually relatively few studies which report the results of developed country agricultural trade liberalization on developing countries alone. The great majority of this literature focuses on the impact of own liberalization of agricultural policies by developing countries themselves. Other studies examine the impacts of global (multilateral) liberalization by both developed and developing countries and often do not distinguish in the discussion of their results the separate contributions of liberalization of the agricultural versus manufacturing sector, or by developed and developing countries (Anderson et al. (2006) and Hertel et al. (2007c) are exemplary in this respect). Although suggestive of the channels whereby external trade shocks might impact on the poor in these countries, these studies do not throw light directly on the poverty impact of developed country liberalization. Given the passion aroused by the issue, we were surprised at how relatively few studies have been published which attempt to directly address the concern of this paper.

Section 2 begins with a brief discussion of the linkages between trade and poverty alleviation. We then look at the methods used in empirical studies to assess the impacts of trade liberalization on poverty. These fall into two main categories: ex post evaluations using historical data discussed in Section 3 and ex ante model-based simulations discussed in Section 4. The estimates of poverty impacts from a recent sample of papers are reviewed in Section 5. Section 6 concludes and discusses the research and policy implications of our findings.
2 Definitions and Theory

2.1 Poverty Definition and Measures

In this paper, we are concerned about trade policy impacts on people currently suffering from poverty. We define poverty as absolute poverty. The focus of the discussion is on the absolute income levels of individuals in contrast to the income levels of individuals relative to some measure of quantile income of the population (as usually used in industrialized countries). Under the absolute poverty definition, individuals are regarded as poor when their income falls below the minimum income level necessary for physical survival. This minimum income level, the poverty line, is usually computed as the minimum expenditure required to provide sufficient caloric intake when composed of a typical regional poor households’ food basket while additionally allowing for some vital non-food expenditure like, for instance, for clothing and fuel.\(^4\)

The measure of individual “income” is generally computed on basis of a household survey either directly from stated household incomes or imputed from household consumption. Consumption is often seen as a better indicator of “usual” household income as households anticipate future incomes and risks and tend to smooth consumption over time whereas stated income can be biased significantly during the survey period, e.g., due to seasonality. Generally, stated income in household surveys is known to be systematically underreported while stated consumption appears to be a more reliable measure of welfare.\(^5,6\)

To reflect different physical requirements for nutrition and basic goods between adults and children and also that households enjoy scale economies / synergy effects, household income is sometimes scaled by equivalence scales. Each type of person, e.g. household head, children and spouse, is weighted by a different adult equivalent weight when individual income is calculated.\(^7\) Further adjustments to income are necessary to acknowledge price variations across regions and over the actual course of the household survey process.

The poverty measures \(P_{\alpha}\) introduced by Foster et al. (1984) are widely used in

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\(^4\)This is called the cost of basic needs method. A less frequently used method for calculating poverty lines is the food energy intake method, see, e.g., Ravallion and Bidani (1994).

\(^5\)Expenditure and income data in household surveys both are subject to imputations, recall bias, seasonality, and long questionnaires where these likely distort results even more strongly in income data. Furthermore, income is a more sensitive topic and also includes questions about assets and their returns, thus there can be strong incentives for underestimating income positions. For a detailed discussion see, e.g., Deaton (1997, pp. 26-32) or Deaton and Zaidi (2002, Section 2.4).

\(^6\)Note that in the following income stands for income per capita unless stated otherwise.

\(^7\)The OECD for instance computes the number of adult equivalents for all members of a household by weighting the household head with 1.0, each additional adult with 0.7, and each child with 0.5.
enumerating poverty due to their properties of additive decomposability and intuitive clarity. Additive decomposability means that the population can be decomposed into several subgroups, the poverty measure computed separately for each subgroup and in the end, all subgroup values add up to the value which would have been computed for the non-decomposed population. In the following, “poverty” implies the poverty headcount ratio measure $P_0$ unless stated otherwise. In the empirical studies reviewed in Section 5, studies sometimes also report the change in the depth of poverty which is measured by $P_1$ and in the poverty severity index $P_2$.

2.2 The Significance of Inequality and Structural Effects

If income gains were evenly spread throughout an economy and all households had similar characteristics, then there would be little interest in a specific investigation of the poverty impacts of a policy change. The poverty impacts could be read off directly from a knowledge of the overall welfare effect. It is precisely because incomes are unequally distributed, because economic sectors and factors are influenced differently by a policy change, and because households have different structural characteristics, that it becomes relevant to ask specifically about the poverty impacts of trade policy changes.

These poverty impacts are inseparably connected to their income distributional or inequality effects. Even if a country as a whole benefits from a trade policy change, these gains are not necessarily distributed evenly over all individuals. The redistributional effects of the trade policy change on current income can worsen inequality. On the contrary, a country not gaining in aggregate from trade policy reforms could still experience poverty alleviation because of the reforms’ redistributional effects on income. Kakwani (1993a, p. 122) partitions the overall poverty impact of a policy change into two effects. The growth effect is the mean income $\mu$ induced change in poverty when income distribution is held fixed. The inequality effect measures the effect of income redistribution holding mean income fixed.

How population groups fare due to trade liberalization will be affected by their socio-economic characteristics. While the urban poor are dependent on agriculture almost exclusively through their expenditures, the rural poor are also dependent on agriculture through their incomes. In addition, the share of poor people in the rural population is much higher than their share in the urban population and thus the effects on poverty are expected to differ in urban and rural areas. The extent to which individuals are affected through changes in agricultural trade policy

\[ P_\alpha = \frac{1}{N} \sum_{i=1}^{N} \left( \frac{z-y_i}{z} \right)^\alpha \cdot I_i \]

where $N$: population size, $z$: poverty line, $I_i = \begin{cases} 1 & \text{if } y_i < z \text{ and } \\ 0 & \text{otherwise} \end{cases}$, and $y_i$: income of individual $i$. 

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8 $P_\alpha = \frac{1}{N} \sum_{i=1}^{N} \left( \frac{z-y_i}{z} \right)^\alpha \cdot I_i$ where $N$: population size, $z$: poverty line, $I_i = \begin{cases} 1 & \text{if } y_i < z \text{ and } \\ 0 & \text{otherwise} \end{cases}$, and $y_i$: income of individual $i$. 

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also depends on the kind of agricultural production in which they are involved, i.e. the degree to which they are engaged in subsistence farming, production for domestic markets or export-oriented production or producing staples compared to high value crops etc. The higher the share of subsistence farming in the income of an individual, the lower is the impact of price and labor market changes. But even people living in complete self-subsistence and thus not participating in markets can be indirectly affected by rising market prices for their products or rising low-skill labor wages. These increase the opportunity cost of subsistence farming and could give an incentive to give up subsistence farming and begin selling their own produce or labor.

2.3 Theoretical Links between Trade and Poverty

International trade theory offers no single comprehensive framework to analyze the effects of trade liberalization on poverty. Various models focus on how changes in the economic environment / trade liberalization affect the pattern of international trade, product prices, and economic structure – and thus employment structure and factor rewards – through one single mechanism in isolation. The analysis is done on a highly aggregate level allowing inferences about the tendency of poverty impacts on different socio-economic groups as a whole only through application of various developing country stylized facts, such as that developing countries are unskilled labor abundant, agricultural production is highly intensive in unskilled labor, the majority of the poor works in the agricultural sector and spends a large part of its income on food commodities, etc.

In the case of rich large country agricultural trade liberalization, the initiating mechanism by which this trade policy reform is transmitted to poor countries is a terms of trade effect. The trade liberalization increases the level (though possibly reducing the variability) of world food prices. Countries which are net exporters of commodities whose prices are increased will gain; countries which are net importers of these commodities will lose. This simple story needs to be qualified in several respects. Some net exporters may enjoy preferential access and can lose from trade liberalization due to preference erosion. Countries experiencing a terms of trade gain may nonetheless suffer a welfare loss in the presence of domestic distortions, for instance, if the exporting sector receives a domestic subsidy or due to other distortions, e.g., surplus labor in a traditional sector. There is now an extensive literature measuring the expected effects on developing countries as a whole of developed country agricultural policy reform (see Matthews [2007] for a review).

However, alleviation of poverty requires an increase in poor peoples’ individual
real incomes and not only in poor countries’ average income. McCulloch et al. (2001) discuss three channels by which the real income of the poor can be affected directly through trade liberalization: the consumption channel, the enterprise channel, and the government channel.

The consumption channel. Real income increases if prices for consumption goods decrease. For the poor, the single most important consumption item is food, then fuels, housing, and clothing (Hoekman et al.; 2002, p. 30). Expenditure shares shift with increasing income from these essential goods towards services and luxury goods. These regularities are described, e.g., by Engel’s Law, which says that food’s share in total household expenditure shrinks with increasing total household expenditure.9

The enterprise channel. As producers, poor people’s profit depends on prices of inputs and outputs. As workers, price changes will affect enterprise profits and these in turn factor demand, which materializes in employment and wage changes. Typically, the main sources of income of the poor are low-skill labor wages and the value of consumption of their own produce (auto-consumption).

The government channel. Finally, the poor are affected by government policies through transfers, taxes and provision of public goods and social services. In particular, transfers are shown to be an important income source for the poor.

These are the channels through which policies immediately impact on poverty. Less directly and more dynamically the poor might be also affected via the following channels.10 Trade liberalization increases incentives for investment and innovation and thus economic growth. It also affects the vulnerability of an economy and households to negative external shocks, e.g., by encouraging specialization in a small number of goods. On the other hand, lesser volatility in some world markets can also decrease vulnerability by cushioning negative national price shocks.

But price changes at country borders are not directly transferred to households. Vertical price transmission along the marketing chain is dependent on the degree of competition at the various stages and the importance of fixed marketing costs. Spatial price transmission might be subject to strong frictions, in particular, from distribution, i.e., transportation and information costs, depending on the quality of the infrastructure. As Winters (2004) elaborates, transportation costs dampen border price changes for consumers but amplify them for producers. Border price changes might not reach locations at all which are poorly connected.

Furthermore, who reaps the gains or suffers the losses within a country is largely determined by the structural changes and thus changed employment opportunities, wages and consumption prices brought about as a consequence of the policy change.

9See, for example, Deaton (1997, p. 25).
This hinges on the functioning of the markets to transfer the price signals. But developing countries often exhibit duality of their labor markets which often manifests in low labor mobility and large wage differentials between formal and informal sectors as well as wages in modern and traditional sectors which are not set according to their marginal productivity. Or markets are monopolized as in the case of state marketing boards which do not pass on the price changes. Markets might even be missing or inaccessible. If many poor people work in non-traded sectors, they might lose from export expansion irrespective of the country’s terms of trade gains. Finally, the effect on households depends also on their ability and capacity to adjust, avoid threats, and seize opportunities. Even in cases where poor households are expected to benefit in the long run they might face severe adverse effects during the adjustment period.\textsuperscript{11}

\section{Ex-Post Analysis of Trade Impacts on Poverty}

The prevailing view among international institutions and most economists is that trade liberalization leads to higher growth rates which imply higher per capita incomes and hence reduced poverty. The literature decomposes the search for empirical ex-post evidence for these impacts into two steps. One strand of literature tries to establish the impact of trade, openness, globalization, or economic integration on income growth or development.\textsuperscript{12} This variety of terms used for the cause indicates that the literature deals with slightly differing and relatively imprecise concepts. The second strand tries to establish the impact of income growth or development on poverty. The most popular technique for such analyses is cross-country regression analysis since in theory it yields generalizable results.\textsuperscript{13} Usually, the variables of interest are averaged over a specific time period for each country and then these averages regressed across countries to separate out average effects of a multitude of factors. The discussion in this section does not specifically address the empirical evidence on the ex-post effects of agricultural trade liberalization on poverty. Rather, it summarizes the reasons why no firm link from general trade liberalization to poverty has been found. Separating out the effect of agricultural liberalization in particular is likely to be even more problematic. It also indicates that searching for

\textsuperscript{11}This paragraph is based on Winters (2004).
\textsuperscript{12}Although openness is a level and trade liberalization a change variable, the literature tends to make no difference between these.
\textsuperscript{13}Here, a typical cross-country regression equation would have an outcome variable on the left hand side, e.g. average growth rate, and a multitude of variables on the right hand side, i.e. the putative determinants of growth, as for instance openness, human capital investments, dummy variables to capture geographic factors and so on. The direction of effect is assumed to go from the right hand side variables to the left hand side variable.
a link from developed country liberalization to poverty might be similarly difficult. Moreover, much of the following discussion is also relevant to ex-ante attempts to establish such a link. For example, poverty elasticities estimated from ex-post data have sometimes been applied to the GDP or national welfare effects for developing countries of developed country agricultural trade liberalization to provide estimates of the poverty impacts of that policy change.

3.1 Openness and Growth

Theoretical trade models predict growth-enhancing effects from the static and dynamic efficiency gains of trade liberalization. The one-time static efficiency gains are the consequence of improved resource allocation within national economies as well as increased specialization across the world economy. The dynamic efficiency gains are attributed to increased X-efficiency, exploitation of economies of scale, increased diffusion of information and technology, and so on. Numerous articles study this relationship of openness and growth empirically, for example, Dollar (1992), Sachs et al. (1995), Edwards (1993), Frankel and Romer (1999), Rodriguez and Rodrik (1999), and Srinivasan and Bhagwati (1999). Note that the definition of “openness” varies over studies but generally includes, in addition to pure trade barriers, also other measures as for instance measures for barriers to capital movements, political systems, etc. The majority of studies find at least weak evidence for a positive relationship between openness and growth.

But there has been a heated controversy about the validity of these applications and over the interpretation of variables and outcomes in this context started by Rodriguez and Rodrik (1999) and followed up by Srinivasan and Bhagwati (1999). In brief, the literature highlights a number of weaknesses regarding the cross-country approach to analyzing the trade-growth relationship.\footnote{These criticisms have been compiled on basis of Jenkins (2004), Rodriguez and Rodrik (1999), Srinivasan and Bhagwati (1999), and Winters (2004) and are not exhaustive.} In essence, the critiques concern the measures used as variables, data availability and reliability, econometric issues, and missing theoretical foundation. For example, “openness” has no natural measure and must be constructed and proxied and might include, for example, both non-tariff barriers and tariffs. But even measuring tariffs is not trivial. For instance, a trade-weighted average tariff would neglect the existence of peak and prohibitive tariffs. Where the required data is missing for some countries, this reduces the sample and might introduce a bias to the selection of countries included in the analysis. The econometric problems raised include the assumptions made about the direction of causality between openness and growth, the endogeneity of some
independent variables, and omitted variables. Furthermore, the models generally assume a linear relationship between the independent and dependent variables which is probably not realistic in every case. Often, the regression models are not derived theoretically and thus their interpretation is difficult. Also, the estimated impact on growth over countries might not be the same as the impact of the same factors on growth for a single country over time. Lastly, there is a subtle difference in looking at the impact of trade on growth or at the impact of the removal of trade barriers on growth. Rodriguez (2007, p. 13) point out that even those openness measures which showed a consistent correlation with growth before 1990 did not continue to do so in the time span from 1990-2003.

Representative of many reviews of this literature, McCulloch et al. (2001, pp. 24-25) conclude in their review that cross-country case studies to date have not been able to prove the positive impact of trade openness for higher growth. They also point out, however, that there is even less evidence that trade openness has been a hindrance. Given these methodological problems, the literature points to the usefulness of detailed country case studies to gain insight into this link. Srinivasan and Bhagwati (1999) argue that such studies have made a strong case for the positive impact of openness on growth and that this evidence has not yet been refuted.

The bottom line appears to be that there is no general relationship between openness and growth. It seems likely that many factors play a role in making this link and that these vary from country to country. Looking only at openness and growth might simplify the relationship too much. This literature has a limited relevance for the purpose of this paper because it focuses on the implications of a country’s own trade policy stance for growth. Developed country agricultural trade liberalization affects growth in developing countries primarily through terms of trade effects plus any second-round effects set in motion by these external shocks. As noted, these effects can be positive or negative depending on the net trade status of any particular developing countries. Whether there is then a one-to-one correspondence with the direction of poverty reduction effects has also been the subject of empirical investigation.

3.2 Growth and Poverty

Even if it is known that the national economy grows, it is still unclear how this additional income is distributed over the population and thus impacts poverty. Another strand of literature is concerned with establishing regularities for the impact of income growth on poverty.

This impact is estimated by the income elasticity of poverty $\eta_p$ which translates a
percentage change in income $\mu$ into the corresponding change in the poverty measure $P_\alpha$. For the poverty headcount $P_0$, the income elasticity of poverty $\eta_\mu$ is the percentage of the poor who will be lifted over the poverty line if all incomes uniformly increase by one percent. As described in Section 2.2, the total effect on poverty depends not only on income growth but also on changes in inequality. By use of elasticities, the overall poverty effect is thus approximated by $\Delta P_\alpha = \eta_\mu \cdot \Delta \mu + \eta_I \cdot \Delta I$, where $\eta_\mu = \frac{\delta P_\alpha}{\delta \mu} \cdot \frac{\mu}{P_\alpha}$ and $\eta_I = \frac{\delta P_\alpha}{\delta I} \cdot \frac{I}{P_\alpha}$ are the income and inequality elasticities of poverty, respectively.

Although the results are controversial, the literature tends to find a general (positive) impact of growth on poverty. Fields (1989, pp. 174-175) looks at studies employing intertemporal single country data, complements it with new data of his own and finds that only in sporadic cases is income growth in a country accompanied by an increase in poverty and that in almost all cases poverty decreases.

In contrast, the attempts to link openness or growth with inequality have not yet established any general results. For example, Ram (2006, p. 604) cites a few sources which find no empirical evidence for a systematic relationship between income growth and changes in the level of inequality. Fields (1989, p. 172), evaluating existing studies and analyzing new data, finds that inequality increased in as many countries as it decreased with economic growth. He finds this same result independently of whether the study looks at cross-country data or periods and whether it uses Lorenz curves or Gini coefficients. There appears to exist no consistent relationship between income growth and inequality increase nor between the level of income and inequality. He suggests that the kind of growth rather than growth itself is the decisive factor for the direction of inequality change. In this regard, it seems practicable to present a selection of poverty elasticity-based results for a range of inequality coefficients leaving the particular choice to the policy maker, as for instance in Cline (2004).

There exist two fundamentally different approaches in the literature to estimate poverty elasticities.

The empirical approach (also called the accounting approach) consists of using periods of growth, inequality and poverty data, decomposing the total effect into a growth and inequality component and then estimating the income and inequality elasticities of poverty from these. It is often used in cross-country comparisons to find general ‘global’ estimates for the income growth elasticity of poverty thus depicting an average over developing countries. The derived inequality elasticity of poverty has to be interpreted with care since it is the outcome of the particular aggregate index measure of inequality (for example, the Gini index) and thus varies with the type of index measure used. Furthermore, as an aggregate measure, a given Gini
coefficient does not depict a unique Lorenz curve; different Lorenz curves can yield the same Gini coefficient. In general, using elasticities yields linear approximations valid for marginal effects. But data points available are often far apart in terms of time span and corresponding variations of mean income and inequality index, challenging the marginal effect presumption. Finally, the empirical approach does not explicitly consider the shape of the Lorenz curve / income distribution but relies on the approximation by using the inequality elasticity of poverty or assuming inequality to remain constant.

Ram (2006) recommends to interpret such income growth elasticities of poverty derived from cross-country studies with caution. On the one hand, compiling several such studies into one table, he finds elasticities between -1.65 and -7.87, centering around -2. On the other hand, summarizing aggregate GDP per capita and actual poverty reductions from some studies, a direct calculation of that elasticity yields values between 0 and -1.22 with a high frequency below but close to -1. He concludes that the commonly accepted estimates for the income elasticity of poverty headcount above -2 are misleading and attribute too much importance to income growth in poverty reduction.

The analytical approach (also called the parametric distribution function approach) uses a single household survey (thus static) to estimate a parametric income distribution function from which the two elasticities are analytically inferred. Once the statistical distribution of income is known then elasticities for different mean incomes and inequality levels can be directly estimated. The most common statistical distribution used to approximate income distributions is the log-normal distribution but there is no consensus on which distribution is the most appropriate. Lopez and Serven (2006) find strong support that the log-normal distribution approximates per capita income distribution rather well in a large cross-country study. In contrast, Bresson (2006) concludes in a study of distribution assumptions for the purpose of poverty elasticity estimation that none of the tested distributions for income systematically performed the best. In his view, the appropriate functional form that has the best fit must be chosen on a case-by-case basis. Also, he finds that the use of the log-normal distribution often results in an overestimation of the effects of income growth and inequality reduction in terms of poverty alleviation.

Both approaches described above initially assume that the shape of the distribution curve remains the same before and after some change. However, not only the change in inequality as measured, for example, by the Gini coefficient but rather the exact change of the shape of the Lorenz curve is decisive for the final effect on poverty. Heltberg (2002) finds two methods of dealing with this problem within

\[\text{Note, the transformation from the Lorenz curve to the Gini is not unique but one Gini}\]
the analytical approach in his literature review.

Kakwani (1993a) estimates a parametric function approximation of the Lorenz curve and assumes that the change in the Gini coefficient takes place proportionally along the entire Lorenz curve resulting in an up- or downward shift. In contrast, Bourguignon (2002b) assumes incomes to be distributed log-normally. With the mean income given, this allows computation of the missing shape parameter (the variance) from the after-change Gini coefficient. Then, the entire distribution is determined by a given income mean and Gini coefficient so that the poverty level can be read off according to the poverty line.

Cline (2004, appendix 1B, corrected version) uses Bourguignon’s approach to compute headcount poverty elasticities for several combinations of the Gini coefficient and the ratio of mean income to poverty line (called the “level of development”) and comes up with headcount elasticities in the interval -0.6 to -7.7. For a selection of 17 actual developing countries he reports headcount poverty elasticities between -1.0 and -3.5.

3.2.1 Openness and Inequality

Fields (1989) made the point that the particular kind of growth might be decisive for the direction of inequality change. This suggests it might be more promising to look directly at the relationship between openness and inequality instead of growth on inequality since the particular kind of change in openness determines the structural change of the economy and thus the change in individual incomes.

Goldberg and Pavcnik (2007) provide a comprehensive review of the current state of empirical research on the direct link between openness and inequality. Measured by the size of the wage difference between low- and high-skilled workers, the skill premium, they cite evidence from several middle-income Latin American countries that experienced an inequality increase during their trade liberalization periods in the 1980’s and 1990’s. On the other hand, they found decreasing inequality for several South East Asian countries during their trade liberalization periods in the 1960’s and 1970’s. They also emphasize that in their listing of country liberalization policies there is no single country which implements trade liberalization alone but always simultaneously with other policy changes. This impedes the disentanglement of the isolated effect of trade liberalization. Even though the relationship between openness and inequality is still unclear, they see little support for the general hypothesis of the Stolper-Samuelson theorem that low-skilled people in developing countries will gain relative to high-skilled from trade liberalization. One possible
explanation for the failure of the theoretical prediction is that there may be bar-
riers which prevent the reallocation of labor across sectors assumed in traditional 
trade theory. They conclude that the relationship between openness and inequality 
is country-, time-, and case-specific and that not only must it be examined together 
with other simultaneous policy reforms but also in light of the exact implementation 
circumstances.

Summarizing, the relationship between openness and inequality appears unset-
tled but it seems clear that it is conditional on other factors, as highlighted in the 
following two papers. Gourdon et al. (2006) using multi-country panel data find the 
openness-inequality relationship is conditional on factor endowments, supporting the 
factor-proportions theory. In particular, they find that openness in countries rela-
tively well-endowed (1) with both high-skill labor and very low-skill labor increases 
inequality, (2) relatively well-endowed with primary-educated labor decreases 
inequality, and (3) relatively well-endowed with mining and fuels production increases 
inequality. Milanovic and Squire (2005), also using multi-country panel data, report 
supporting evidence that tariff reduction increases wage inequality between skill-
levels and also between industries. Moreover, they find that average country income 
is an important factor for the trade liberalization impact on inequality.

In summary, the ex-post empirical evidence on trade liberalization impacts on 
poverty remain unclear. Problems with the quality and availability of data hamper 
the analysis of the issue. However, it appears that this relationship is conditional 
on a number of factors like factor endowments and average per capita income in each 
country. There are no studies regarding ex-post empirical evidence of agricultural 
trade liberalization impacts on poverty specifically. The methodological and data 
issues seem to prevent an analysis at this level of detail. Furthermore, if a more direct 
link with own liberalization does not emerge it should be even more difficult to prove 
such a link with foreign liberalization. Thus, structural model-based analysis seems 
to be more fruitful in disentangling such effects with the drawback that these models 
are only validated or able to be validated to a certain extent.

4 Ex-Ante Analysis of Trade Impacts on Poverty

The two dominant methods for analysis of trade liberalization policies are partial 
equilibrium and general equilibrium model analysis and yield – numerically solved 
– exact numbers for consequences. Technically, both model types consist of sets of 
non-linear equations solved with numerical methods for an exact solution vector of 

16See for instance Milanovic and Squire (2005, p. 52).
continuous variables. The equations implement market equilibrium conditions and optimality conditions for the agents' assumed behaviors.

Partial equilibrium models seek to equilibrate supply and demand in usually a single sector, or a subset of economic sectors, assuming the variables of other sectors as given. Thereby, they allow the detailed analysis of direct effects of policies in a transparent manner. Usually these are simple models which can contain high sectoral detail. But they neglect the indirect effects arising in other sectors linked in particular through employment, wages and prices. This is reasonable when the considered sector constitutes only a small share of the industry or economy but otherwise – as is the case with the agricultural sector in developing countries – the repercussions with other sectors need to be taken into account.

Computable general equilibrium (CGE) models implement the links between sectors thereby depicting entire national or world economies. As neoclassical models they model the economies' institutions as aggregate representative agents which all optimize – rationally and fully informed – for their individual benefits resulting in a market-cleared, no-profit equilibrium. Most CGE models used in trade policy analysis are structuralist models departing from the aforementioned by added structural macroeconomic conditions and market imperfections, such as tariffs, labor market segmentation and unemployment, in order to depict a more realistic economy. The base data for the economic structure are taken from social accounting matrices (SAMs) which contain mainly aggregate data from national accounts. CGE models are solved numerically and the outcomes of interest are detailed figures on the changes in sectoral output, employment, factor incomes, and consumer prices.

Summarizing, the analysis of the poverty impacts of trade liberalization requires information about the impacts on economic structure, in particular, regarding employment, prices, and remuneration of production factors for the entire economy. This makes CGE analysis the method of choice for ex-ante analysis. CGE models per se yield highly aggregate, accurately accounted values which are crude macroeconomic indicators. Standard CGE models implement a single representative household for each economy. Hence, the only basis for inference with regard to poverty impacts is the change of the income of the representative household. This allows only weak results, especially since one major characteristic of developing countries is that income is distributed very unequally across the population. Poor individuals do not necessarily participate in any gain in aggregate national income. Furthermore, the redistributional effects of structural change play a crucial role and need to be evaluated (see Section 2.2). In extreme cases, an aggregate income increase could be captured by only a few rich people and thus have no impact on poverty at all. In contrast, pure redistribution could increase or decrease poverty, leaving average
per capita income unchanged.

Translating these average income figures into impacts on poverty requires more detailed information about the distribution of income and its changes. The following sections summarize several approaches from the literature which extend CGE models to fit them better for poverty analysis.

4.1 Disaggregated Representative Household Groups

The least time- and data-intensive way of extracting some distributional information from a standard CGE model is to disaggregate the single representative household into several household groups according to some socio-economic characteristics which are expected to reflect the most important determinants of household income such as, for instance, location (rural or urban), sector of employment (industry or agriculture, formal or informal), skill level (skilled or unskilled), or main source of household income (subsistence farming, wages, self-employment, diversified, etc.). This yields information on the mean changes in incomes of those groups and thereby on between-group distributional change. An increase in the average income of a household group comprising predominantly poor people will likely decrease poverty within the group. This enables some qualitative results on poverty impacts, but by implicitly assuming a uniform income distribution within groups it does not allow a more accurate quantitative result. Agénor et al. (2004a) emphasize that within-group inequality often accounts for a greater part of overall inequality than between-group inequality.

To facilitate a more in-depth analysis of income distribution and poverty, the analysis has to draw in one way or another on actual household survey data. Appropriate approaches differ in their degree of how much homogeneity they assume on the side of household behavior. The one extreme, the non-behavioral approaches, assume no behavioral reactions from changes in the economic environment but only project the CGE results onto the household data and thereby simulate only first-order effects. The other extreme, the behavioral approaches, explicitly model individual or household behavior in reaction to the economic changes thereby taking also heterogeneity in household and individual characteristics into account.

In general, the income side is regarded as more important and thus in most models the consumption side of the households is only taken into account by deflating their incomes with individual price indices where the household consumption bundles have been reevaluated with the after-simulation price vector. Another approach defines a "poverty level of utility" and allows households to substitute amongst consumption items while optimizing its utility function, see, e.g., Hertel et al. (2007a,b).
The relative importance of the income side is supported theoretically by the Stolper-Samuelson theorem which states that an increase of the real price of one good will result in an even larger percentage increase in the real return of the factor which is used relatively intensively in this good’s production (the so called “magnification effect”). Thus, it predicts a larger relative impact on factor than on commodity prices. The assumption of the greater importance of the factor earnings side is supported empirically by general equilibrium studies which find that the dominant share of poverty impacts is due to changes in factor incomes rather than consumption expenditures.

4.2 Micro-Macro Models

4.2.1 Non-Behavioral Approaches

All the non-behavioral approaches link the household survey data to the CGE model sequentially, as a second layer. The variable changes from the CGE simulation results, in particular incomes and prices, are applied to the income data of a household survey. This updated income distribution is then utilized for further poverty analysis. Individual behavioral responses to income and price changes are neglected. Thus, only the factor returns change but not the labor supply.

The Elasticity of Poverty Another approach to infer poverty impacts from the simulation results of a representative household CGE model is to use the income elasticity of poverty which translates a percentage change in income $\mu$ to the corresponding change in the poverty measure $P_\alpha$ (see Section 3.2).

For a study using this approach with many representative household groups for 15 developing countries (Bangladesh, Brazil, Chile, Colombia, Indonesia, Malawi, Mexico, Mozambique, Peru, Philippines, Thailand, Uganda, Venezuela, Vietnam, and Zambia) see Hertel et al. (2004b, 2007a).

Statistical Distribution Approach This approach of dealing with income distribution is strongly related to the analytical approach of estimating income elasticities of poverty. Similarly, a parametric statistical distribution function is fitted to the household survey incomes. But, as described in Agénor et al. (2004a), here the aggregate income growth is assumed to uniformly increase all incomes within a socio-economic group by the same absolute amount thus shifting the unmodified distribution curve to the right. Thus, the poorer gain relatively more income compared to their initial income than the richer group members. This implies that inequality inevitably decreases within each group with income growth. As Agenor et al. (2005,
p. 18) elaborate, a major advantage of this approach is that computational effort
is minimal since the household survey is used only once for fitting the distribution
and further work with the parametric distribution is rather effortless.

A country application of this approach can be found in Naranpanawa (2005) for
Sri Lanka.

**Microaccounting** Microaccounting, or arithmetical microsimulation, is purely
based on scaling of earnings and consumption data of a household survey by price
and income growth rates generated from a CGE model. Ideally, the exact income
sources respectively factor endowments of the households are known and after-
simulation nominal household income is derived by multiplying these endowments
with their new prices thereby accounting for differences in income composition of
the households. But usually factor endowments and income sources are only incom-
pletely observed and have to be imputed. One way around this is to categorize the
households from the survey into the household groups of the CGE model and then to
apply the associated group’s income growth to the income of each survey household.
This requires the *a priori* association of a survey household with a CGE household
group and the assumption that the relative change in income is the same for all
households within a group and thus income growth changes only between-group ine-
quality while within-group inequality remains unchanged. However, to compute
real income, household incomes are usually deflated by household specific price in-
dices which weight prices with the household’s individual consumption bundle.

*Microaccounting with reweighting.* The microaccounting approach can be refined
by a reweighting procedure to impose changes in the employment structure from the
CGE model on to the household survey. The procedure adjusts the sample weights
of the different household groups according to the changes in employment structure
derived from the CGE model. To some extent, this simulates the movement of
people between sectors.

Country applications of the CGE-microaccounting approach in the context of
trade liberalization and poverty analysis can be found in Arndt (2005) for Mozam-
bique, Bibi and Chatti (2006) for Tunisia, Bussolo and Niimi (2006) for Nicaragua,
Cororaton et al. (2005) for Philippines, Diao et al. (2006) for Uganda and Zambia,
Hertel et al. (2003b) for Brazil and Chile, Hertel et al. (2003a) for Chile, Malawi,
and Vietnam, Iancovichina et al. (2001) for Mexico, Ivanic (2006) for 15 developing
countries, Lay et al. (2004) for Bolivia, Mabugu and Chitiga (2007b,a) for South
4.2.2 Behavioral Approaches

Behavioral models are simulation models in a stricter sense since they simulate agents' behaviors rather than only projecting the CGE outcomes onto the micro-database. This enables simulating the effects of policies on individuals in detail. The movements of individuals into and out of different occupations, sectors, and regions can be explicitly modeled.

Behavioral approaches explicitly model household and individual behavior in reaction to changes in earnings, commodity prices, and employment opportunities. Consequently, changes in the labor market structure will lead to adaptation not only in income through changed wages (first-round effect) but also in labor supply choices in reaction to those wage changes and changes in employment opportunities (second-round effect). This framework therefore enables capturing non-marginal changes and coping with longer time spans. In contrast to the non-behavioral approaches, here the modeled behavior directly yields a new income distribution according to the heterogeneous actions of the individuals. Assumptions about how the level of inequality and the distribution shape change are not necessary.

Two principally different microsimulation model types are distinguished, reduced-form and structural models.

*Reduced-form microsimulation models* in the sense used here are pure regression functions without an explicitly formulated underlying theoretic model. They are *ad hoc* model specifications not explicitly modeling agents' behavior but assuming that agents' behavior is implicitly captured in the regression model's coefficients. Extensive data are used to estimate the coefficients of that function. The coefficients also implicitly describe the underlying economic structure and hence structural change could invalidate the estimated model. Moreover, reduced-form models usually assume linear or other simplified dependencies between the variables and the quality of the approximation likely decreases when changes in variables become larger. Since there is usually only one household survey available to estimate the model parameters, it has to be assumed that the cross-sectional estimates also hold for the effects over time.

*Structural microsimulation models*, in contrast, are systems of equations depicting certain theoretical assumptions about the behavior of households or individuals. The parameters of this equation system are then estimated with household survey data. Structural models explicitly model behaviors and reactions to structural

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17 There seems to be no precise definition of the term microsimulation but it is rather used in many different meanings.

18 Strictly speaking, the term “reduced-form” describes a theoretical structural model that is solved so that there are only exogenous variables on the right-hand side of each equation fully determining the endogenous variables of the system.
change and thus deliver meaningful results also for non-marginal structural changes. But, these results rely on the set of theoretical assumptions underlying the structural model. The specification of structural microsimulations is very complex and restricted due to the econometric problems inherent in the estimation of systems of equations, such as identification problems. Consequently, an exhaustive disaggregation of goods and sectors becomes difficult.\footnote{See Robilliard and Robinson (2005, p. 36).}

This are various examples of behavioral equations found in developing country microsimulation models: individual income generation; occupational choice between formal and informal sectors, unemployment, and inactivity; labor supply; household income including subsistence farming and household enterprise profits; migration between rural and urban regions; educational choices. Often, the models contain different behavioral assumptions for household heads, spouses, and other members. Usually, consumption decisions are not modeled explicitly in the microsimulation part as they are seen to play an inferior role in determining poverty compared to labor market decisions (for a discussion of the latter point see Hertel and Reimer (2004, pp. 7-8)). But, for instance, Hertel et al. (2007a,b) model consumption behavior utilizing an AIDADS demand system. For more detailed overviews of microsimulation modeling for poverty analysis see for example Bourguignon and Spadaro (2006) or Cogneau et al. (2003).

4.2.3 Linking CGE and Microsimulation Models

Two different methods of linking CGE and microsimulation models have emerged in the literature. The first one uses a CGE and a microsimulation in sequence, while the second carries the disaggregation of the representative household of the CGE model to the extreme and models one household for each household in the household survey yielding a single large integrated model.

Sequential CGE-Microsimulation Models. \footnote{Often called "top-down" approach as it imposes the CGE model results onto the microsimulation model.} In the first step, a CGE simulation is carried out on the basis of the social accounting matrix from which changes in prices, factor returns, tax rates, and occupational structure are taken. In the second step, those values are imposed onto the microsimulation model to determine labor (factor) supply, incomes, and consumption. Herault (2006), for instance, uses a single-country CGE model for South Africa. Then, in the microsimulation model, the prices from the CGE model are used to reweigh household expenditure and to compute a household specific price index as an income deflator. Household income
is pieced together from incomes of the individual household members and other incomes like transfers, household enterprise and subsistence farming incomes. Individual incomes are an outcome of an occupational decision between participation in the informal or formal sectors, inactivity, and unemployment based on expected incomes and personal characteristics where the expected incomes again depend on personal characteristics. To establish consistency between the CGE outcomes and the microsimulation model, CGE price changes are directly applied to scale the prices in the microsimulation model, similarly for the formal wages according to the respective sector. Finally, changes in the number of workers with respect to skill level and sectoral employment have to match those changes from the CGE model (beyond the changes determined by the occupational choice model). This is accomplished by modifying the utility coefficients in the choice model subject to the constraint that the composition matches the one from the CGE model. For further applications, see, for instance, Robilliard and Robinson (2001). A problem of sequential approaches is that the household decisions on consumption in the microsimulation model do not necessarily correspond to those computed for the market equilibrium in the CGE model. Summing the household consumption quantities from the microsimulation model which have been re-optimized by the households in reaction to the new price vector yields values not consistent with those computed for the market equilibrium in the CGE model.

Recursive Sequential CGE-Microsimulation Models. Savard (2003) tackles this latter deficiency by repeating this sequential CGE to microsimulation link recursively in order to take additionally the feedback from household behavior to the economic structure into account. The CGE model computes prices and wages which are handed down as parameters to the microsimulation model. In turn, this computes a new household consumption vector which enters the CGE model as fixed parameters. This loop continues till the changes of the output vectors from one iteration to the other are very small and the system thus has converged. But convergence is not guaranteed and there seems to be a risk which is inherent to most sequential optimization algorithms – that the end result is path dependent.

Country applications of sequentially linked CGE models with behavioral microsimulation approaches can be found in Bussolo and Lay (2003), Bussolo et al. (2006) for Brazil, Devarajan and Go (2002) for Zambia, Diaz-Bonilla and Morley

\footnote{See Rutherford et al. (2005, p. 19).}

\footnote{On the other hand, most approaches impose the new labor market structure on the microsimulation model so that this part is consistent in the result.}

\footnote{While solving the CGE model, the solver has no information about the optimal solution of the microsimulation part and vice versa. This disconnectedness would require very well behaved functions in order to guarantee optimality.}

Country case studies using the recursive sequential link are, e.g., Mussard and Savard (2005a) for Philippines and de Souza Ferreira Filho and Horridge (2004, 2005) for Brazil.

**Fully Household-Disaggregated CGE Models** The second way of linking CGE and microsimulation models is to directly integrate an entire household survey into a CGE model by modeling each household of the survey as an individual agent. This *integrated CGE-microsimulation* model is a single, large system of equations and constraints which includes a full set of functions to describe the behavior of each household in the survey. Conceptually, this way of integrating CGE and microsimulation models is very appealing since it forms a single coherent model and feedback between the households and the CGE model is immediate and direct. The quantity decisions by households in response to the equilibrium price vector are fully consistent with the supply-demand balance on the macroeconomic level.\(^{24}\) This approach demands a single, fully consistent, set of data and thus the SAM and household survey must be reconciled.\(^{25}\)

But as the size of the model increases rapidly with the number of observations in the household survey, the computational effort to solve the model can become prohibitive. Then the number of households has to be traded-off against simplifications of the behavioral model or decreased detail of the CGE model in terms of number of sectors and factors of production.\(^{26}\) Because of the size of these models and the nature of the numerical non-linear solvers used for their solution, the types of functions in the microsimulation part are restricted compared to what is common in pure microsimulation.\(^{27}\) Moreover, using the microsimulation model inside

\(^{24}\) See Rutherford et al. (2005, p. 19).

\(^{25}\) See Section 4.3 for further details.

\(^{26}\) See Hérault (2006, p. 48). Moreover, Chen and Ravallion (2004) state that integrating their Chinese household survey of 85,000 households in this way is currently not possible. Rutherford et al. (2005) developed a new algorithm in order to be able to solve their CGE model integrating 55,098 households. Cugnoau and Robilliard (2000) only consider three sectors and four commodities. Tarp Jensen and Tarp (2005) aggregate their model with 5,999 households from 97 to 10 activity and commodity accounts in order to make their model feasible.

\(^{27}\) Discrete choice variables, for instance, which have to be modeled as binary or integer variables are highly problematic or even forbidden in the model, depending on the particular numerical solver
of a structural CGE model means that the microsimulation model itself has to be structural as well, imposing the aforementioned difficulties.


4.3 Discussion of the Micro-Macro Modeling Approaches

The necessity of increasing the detail of CGE models on the household side follows the realization of the importance of heterogeneity of individual possibilities, in particular of the poor, in terms of factor endowments including human capital, market access and consumption bundle composition. The consumption side is most often represented by reweighing household-specific consumption expenditures with the adjusted price vector serving as individual consumer price indices to deflate household incomes. As stated, for example by Reimer (2002, p.22), households are by far more specialized in their income sources than in their consumption bundles. Moreover, households can adjust their consumption fairly quickly to changes in the price pattern quite differently to the factors and commodities they supply. Hence, the size of the consumption price effect is seen as negligible compared to the size of the income effect. Indeed, only the works of Hertel et al. (e.g., Hertel et al.; 2007a) model consumption behavior explicitly by using an AIDADS demand system.

A generally important issue for all approaches is data consistency. The SAM contains factor, income, and consumption data taken from national accounts which might be very different from the data observed in the household survey. A decision must be taken whether the employment, consumption and factor endowment structures as reflected in the SAM or those in the household survey are more reliable. Rutherford et al. (2005, p. 3) find in their simulations that reconciliation of SAMs and household surveys causes substantially different impacts across income decile groups. Hertel and Reimer (2004, p. 32) note that using non-reconciled

\[27\]

\[28\]Aggregating income and expenditure over households in the survey usually yields levels that differ to a considerable extent and the micro-macro approach used might require balancing those thereby changing the structure of either income sources or expenditure over the survey.

\[29\]More specifically, they adjust the factor shares of the SAM to fit the household survey where the original SAM exhibited a much higher return on capital. Consequently, on expansion of capital intensive sectors they observe a much smaller capital to labor returns ratio using the reconciled

employed.
data can yield “wildly inconsistent” micro- and macro-predictions. Having chosen
the data source to use, the SAM or the household survey become unbalanced in the
remaining data columns so that a rebalancing procedure has to be applied.\(^{30}\) This
inevitably involves some additional “grinding” of the data removing some hetero-
genesis. From this discussion it seems unclear if data reconciliation is advantageous
or not. Furthermore, data reconciliation is not trivial and requires considerable
effort.

The approaches presented above differ in the degree in which they consider in-
dividual heterogeneity. Representative household group approaches capture only a
small part of observed heterogeneity, namely the part occurring between the house-
hold groups defined. This might give a weak indication of the direction of poverty effects\(^{31}\) but without analyzing the entire income distribution in full detail a state-
ment of the order of magnitude of the poverty effect is impossible. Moreover, without
considering changes in inequality, even this direction is ambiguous. Non-behavioral
micro-macro approaches take additionally the within-group heterogeneity into ac-
count by employing the income distribution of household surveys in full detail. The
elasticity of poverty and statistical distribution approaches make the strong as-
sumption that the change of aggregate group income is distributed in some uniform
/ homogeneous way within the household group. This assumption is relaxed in
varying degrees in microaccounting depending on the implementation. However,
non-behavioral approaches are seen as good first approximations for policy effects
on income and especially adequate when price impacts are expected to be marginal
or when the analysis is concerned with the very short-run. Not least, non-behavioral
models are quicker to implement. They are less costly in terms of modeling and data
preparation effort and less demanding in data quality than behavioral approaches.

Comparing microaccounting and sequential microsimulation approaches, Robilliard
et al. (2001, pp. 20-23) find experimentally that the microaccounting approach –
applying the income change corresponding to households’ classification into several
socio-economic household groups – systematically underestimates policy impacts on
inequality and hence also over- or underestimates impacts on poverty, depending on
the direction of the inequality effect. Intuitively, this follows from the equal, pro-
portional change of household income according to the assigned household group.

By not allowing households to adapt to the new economic circumstances, this pro-
duces worst-case impacts while households actually could improve the impacts in

\(^{30}\) For descriptions of data reconciliation procedures, see, for instance, Robilliard and Robinson

\(^{31}\) Here, poverty effects are inferred from aggregate income changes of socio-economic groups
which are primarily composed of poor people.
their favor through substitution of consumption and reconsideration of earnings options. Agenor et al. (2005) compare the microaccounting approaches without and with reweighting and the statistical distribution approach utilizing a Beta distribution function. The aggregated effects on distribution and poverty arising in all three simulation approaches were very similar when looked at on the economy-wide aggregate level. But when differentiating impacts between urban and rural, and formal and informal sectors, the microaccounting and Beta distribution approaches differed in the magnitude and even direction of the measured poverty results.

The computational power available nowadays devalues the computational cost advantage of the statistical distribution approach over microaccounting. Another potential advantage raised is that if the number of observations in a household group is small then a marginal shift in the income distribution could show large jumps in poverty using a microaccounting approach. In contrast, the statistical distribution approach would guarantee a smooth transition upon distribution shifts. However, parameters estimated over small household samples are not reliable.\textsuperscript{32}

The non-behavioral approaches take only the price effects from a policy shock on household income as given by the general equilibrium model into account so that household incomes are scaled. But they do not allow households to adapt their behaviors to the altered factor price and labor demand situation and thus their factor / labor and commodity supplies remain unchanged. If more substantial changes of the economic structure and therewith factor markets are expected in response to a policy change then it is likely that households also have to undergo major adjustments in particular with respect to their income sources. These indirect effects are simulated within behavioral models. Reduced-form microsimulation models assume that all relevant behavioral characteristics are captured in the coefficients of linear regression equations. But the coefficients capture also the economic structure and thus reduced-form models cannot cope with fundamental structural changes. Structural models explicitly model the economic structure and allow the analysis of major structural adjustments.

While sequential microsimulation models take in addition to prices also households’ choice of labor markets and participation into account and thus adapt the household survey data to the new economic structure, recursive-sequential and integrated microsimulation models in turn also let the economic-wide production side react to the household decisions -and vice versa in a mutual and recurrent way.\textsuperscript{32}

\textsuperscript{32}This paragraph is based on Agenor et al. (2005, p. 18).
in 3 versions which add linear expenditure system functions and labor market segmentation. Simulating a 50% import tariff cut, he finds that the difference between the two approaches in the observed macro results are marginal but increase a little when the CGE models are extended to represent more heterogeneity. He concludes that the recursive sequential approach has little added value if only macro results are of interest. But on the household level, differences in poverty headcount and inequality changes are substantial between the two approaches. In particular, often there are even qualitative differences in the direction of changes. Savard acknowledges that part of these differences might arise as a consequence of the overrepresentation of wealthier households in each group: The data for all households is summed up for each group and thus the income and expenditure structure of the poorer households might only contribute minor percentages to the overall picture of this representative household.

[Tarp Jensen and Tarp (2005)] look at Vietnamese data and compare two micro-accounting approaches based on a 16-household CGE model with a fully-household disaggregated CGE model integrating all 5999 households of the household survey. Considering poverty gap figures, they show that integrated modeling of the 5999 households makes a significant difference. The trade liberalization impacts may change in size but more importantly also in direction if all effects – income and expenditure as well as feedback effects – are accounted for. They also emphasize that the choice of government closure, whether lost tariff revenues are compensated by increased taxes or not, can have a quantitatively important effect and even change the direction of the poverty impact. It should be noted that governmental revenue loss can also lead to less provision of public goods and services and transfers / social spending which are not included in the household’s utility function of their model.

[Colombo (2007)] compares sequential, recursive-sequential, and fully integrated CGE-microsimulation variants of one model using the same data to simulate an export price shock. The macro- and poverty outcomes for the sequential and recursive-sequential models are virtually identical. The micro to macro feedback channel seems to have little effect in these settings. In contrast, the fully integrated approach yields very similar macro results but directionally different micro results with much stronger distributional and poverty effects. This might be due to the more complex

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33 Approach (1) projects the CGE consumption growth rates on the survey household consumptions and (2) additionally projects the CGE factor prices on survey household factor endowments and applies the new tax and savings rates.

34 Within the CGE model, if the government budget balance is not equilibrated by increases in tax rates then the poor people can still be directly affected since decreased government saving needs to be counterbalanced in the investment-savings balance which might be implemented by way of an increasing marginal propensity to save for households.

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behavioral reactions modeled in the behavioral equations of the sequential microsimulation approaches.

At first sight, the integrated CGE-microsimulation approach seems the most convincing since it is theoretically consistent in underlying data, and micro- and macro-results. A crucial difference with sequential CGE-microsimulation approaches is that labor supply and consumption behavior is specified only once, not twice in the micro- and macro-parts based on different assumptions, as in sequential CGE-microsimulation models. Ultimately, only solving a single, holistic model at once can guarantee finding the true global equilibrium.

On the other hand, Bourguignon and Ferreira (2005, p. 4) formulate three persuasive arguments in favor of the recursive-sequential over the integrated CGE-microsimulation approach: (1) There is neither the requirement to scale household data to national accounts nor to balance income and expenditure for each household in the survey and thus the exact income and expenditure structure from the household survey is retained. (2) Solving the CGE and microsimulation models separately imposes no limits on the level of disaggregation of the CGE model with regard to number of production sectors, factors and households. (3) The choice of functional forms in the microsimulation part is fully flexible.

The decision on which micro-macro modeling approach to use boils down to the trade-off between implementation time effort and the additional information gained by more sophisticated approaches. Moreover, the desire for theoretical consistency, personal opinion on data reconciliation and the different necessities regarding data, the restrictions in model size, behavioral detail and allowed functional forms might be considered. To date, it seems clear that different approaches can result in strongly misleading indications on poverty impacts especially if one is interested in which particular households are affected the most. Further research is needed to show under which circumstances the less demanding approaches yield misleading outcomes – in particular qualitative differences – and what are good indicators to flag those circumstances. Furthermore, the impact of data reconciliation deserves additional examination.

5 Selected Findings from Micro-Macro Approaches

In this section we distill some results from the literature on trade liberalization impacts on poverty. In the population of studies considered, we include all studies found via library, web, and citation searches up to October 2007 which look at
multilateral, uniform across the board tariff cuts, utilize detailed household income distribution data, report poverty headcount results, and are available in English. Due to the large number of degrees of freedom within the models and methods used, it proved unmanageable to describe each study in sufficient detail to expose the drivers of the results. Instead, we recapitulate selected points which seemed worth highlighting to the individual papers’ authors, like major insights, drivers, peculiarities, and limitations of these studies.

We mainly report on three scenarios as available: full elimination of domestic tariffs only, full elimination of foreign tariffs only, and full elimination of all (multilateral) tariffs. The selection of countries examined in these studies is shown in Table 1. The selection of countries is biased for data availability reasons: The studies need both household survey data as well as a global SAM database (usually the GTAP database) identifying the country separately. Details on the modeling approach used and additional results for each of the studies can be found in Tables 5 and 6 in the Appendix.

Anderson et al. (2005) use the global GTAP model and poverty elasticities to examine poverty impacts on an aggregate regional level. They find that despite the diminishing share of agricultural output in global output, agricultural protection will continue to play an important role in trade negotiations since 60% of the globally expected gains from trade liberalization can be attributed to agriculture. The industrialized countries will reap a larger share of the gains from global trade liberalization in goods but the income gains, as a percentage of baseline income, are much higher for developing countries. Poverty will be decreased to the extent that the removal of the existing pattern of trade protection which benefits skilled labor and capital relative to unskilled labor increases unskilled wages. The results show that a measure of the unskilled labor real wage, i.e. the nominal unskilled labour wage deflated by a food and clothing price index, increases by four times more than the average real income increase. They highlight that other aspects potentially positive for development, like, for instance, services and trade facilitation, are not considered.

Annabi et al. (2006) analyze the impacts of trade policy reforms on Bangladesh using a recursive-dynamic CGE-microaccounting model and find that domestic, foreign and multilateral full liberalization reforms all have negative poverty impacts.

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37 We made this choice since the descriptions of complex tariff cuts are often incomplete and also such results are difficult to compare across the sample of studies.

38 First attempts to create such a detailed listing revealed that studies often omit some details in the model and results descriptions making evaluation of their conclusions problematic. This problem is reinforced by the reports reviewed in this paper of individual modeling features changing even the direction poverty results.
in the short run (5 years) but the effects of domestic and multilateral liberalization scenarios turn positive in the long run (20 years). Rural area effects are larger than urban area ones.

Arndt (2005), using a CGE-microaccounting approach for Mozambique, finds a poverty headcount increase of 0.3 percentage points for sole domestic liberalization which is the largest of the three scenarios he examines. The change in welfare per capita is slightly negative for multilateral and domestic liberalization scenarios but slightly positive for foreign liberalization. Thus, the adjustment costs for the implementation of own free trade liberalization are relatively low. The model features a downward-sloping export demand function which increases consistency with the global CGE model but also turns out to determine the welfare results for domestic liberalization. If the model is changed to supply-constrained exports and constant world prices then the signs of the welfare results in the domestic liberalization case are switched. The author cautions that this export demand function is not realistic for all sectors. Many sectors are rather constrained by supply factors. For many sectors, in fact, low export volumes are regarded as the cause of low farm gate prices since they may lead to high marketing costs and diminished confidence of potential importers in the quality and reliability of supply of Mozambican products. These small impacts are explained by a 60% share of exports coming from predominantly foreign-owned sectors (aluminium smelting and electricity from one dam). Large parts of associated export revenues go abroad; the links of the export sectors to the domestic economy are weak. Furthermore, domestic industries do not compete with imports as there is little production in most import sectors (oil, vehicles, capital goods), so that only primary product processing is import competing.

Bussolo et al. (2006) analyze trade liberalization impacts on Brazil employing a recursive-dynamic sequential CGE-microsimulation model. Their microsimulation model in particular models migration from agricultural to non-farm occupations where poorer individuals are more likely to migrate and such migration is seen as poverty-reducing. By expanding the agricultural sector and raising wages there, multilateral liberalization decreases migration to non-farm occupations and thus diminishes the poverty alleviation potential. But this effect is outweighed by gains in agricultural incomes, ultimately resulting in a poverty decrease. In Brazil, 69.5% of the poor live in urban areas and thus small income gains for non-agricultural labor reduce poverty more than larger income gains in the agricultural sector. The overall gains are small since trade liberalization results in little growth and channels for potentially positive productivity impacts are not modelled.

Carneiro and Arbache (2006) also study Brazil using a sequential CGE-microsimulation model and find only very small poverty impacts of multilateral and domestic liberal-
eralization scenarios. They emphasize that trade liberalization alone is not sufficient to generate significant poverty reductions.

Chemingui and Thabet (2007), implementing an integrated CGE-microsimulation model for Tunisia, find comparatively large poverty headcount impacts of up to 2.7 percentage points nationally. In all scenarios, the GDP increases only by 0.2 to 0.3%, thereby giving a misleading impression of the poverty impacts which are far greater. The multilateral liberalization scenario has a more favorable poverty effect than domestic liberalization alone. This is due to the high level of protection of 89% on agricultural products on average which Tunisia maintains. Tunisia as a net agricultural importer is expected to experience decreasing terms of trade from developed country liberalization but this 5 to 20% price increase in agricultural products is outbalanced by the 89% tariff cut in that sector so that domestic agricultural prices fall. This suggests a loss to the agricultural sector but in effect poverty decreases with the strongest declines in rural areas. Efficiency gains seem to dominate. But positive outcomes depend at least partly on the ability of farmers to switch from the formerly protected activities to export producing ones (olives, dates, citrus). This highlights the importance of providing farmers with support to capture these opportunities.

Cororaton et al. (2005) employ a CGE-microaccounting model and find small mixed impacts on poverty of trade policy reforms in the Philippines. Domestic liberalization increases overall poverty and favors urban households due to higher initial average tariffs and thus price decreases in agriculture compared to manufacturing. In contrast, foreign liberalization decreases poverty. Here, rural households are favored because increased demand for agricultural commodities leads to income gains which outweigh world price increases. Multilateral full liberalization appears to decrease poverty and to favor urban households because the export sector expands which is mainly non-agricultural. But the effect of multilateral liberalization depends on the choice of the compensation mechanism for government revenue. An indirect tax results in decreasing poverty but this result is switched in case of an income tax. However, poverty depth and severity decrease in either case.

Emini et al. (2005) report mixed results for trade policy impacts on Cameroon from an integrated CGE-microsimulation model: they find a poverty decrease for foreign, an increase for multilateral, and also an increase for domestic liberalization. They note that the effect of domestic liberalization remains when the downward-sloping export demand curve is replaced by fixed export prices which abstracts from terms-of-trade effects. Furthermore, they find that the choice of the tariff revenue replacement tax instrument has a strong effect and can worsen poverty.

Hertel et al. (2003b) use a global CGE model together with a microaccounting
model to look at Brazil and Chile and examine the short-run impacts of multilateral trade liberalization since this highlights the potential vulnerability of poor households which are specialized in only one income source. The analysis classifies households according to their income source specialization. They find that both countries experience a small poverty decline upon multilateral liberalization and that the short-run poverty impacts are sharply differentiated depending on the income source specialization of the households. Agriculture-specialized households experience the strongest poverty decrease because of increasing agricultural profits but at the same time poverty increases for self-employed non-agriculture and wage-specialized households. The tendency is that (1) domestic non-agricultural and foreign agricultural liberalization decrease poverty among agriculture-specialized households and that (2) domestic agricultural and foreign non-agricultural liberalization decrease poverty among self-employed non-agricultural, wage earning and transfer specialized households. The analysis ignores non-tariff barriers, barriers to trade and investment in services, and trade-distorting domestic farm subsidies. Moreover, the model is static and therefore abstracts from trade liberalization impacts on productivity, capital accumulation and growth. The determinant for poverty reduction differs with the considered time horizon and the factor mobility assumptions, respectively. In the short-run, immobility of self-employed labor, land, and capital must raise agricultural profits enough to outweigh consumption price increases of the poor. In the long-run, factors are perfectly mobile and unskilled labor wages have to rise sufficiently.

Hertel et al. (2003a) employ the same methodology as above to compare the short- and long-run impacts of trade reforms for Chile, Malawi, and Vietnam. The short-run scenarios feature immobility of self-employed labor, land, and capital while in the long-run all factors are mobile. They find that the differences between short- and long-run poverty impacts of multilateral liberalization vary substantially by country. In Chile, the short-run simulation shows an overall poverty decrease where poverty decreases strongly among agriculture-specialized households but increases moderately for almost all other household categories. In the long-run, the direction of poverty change is basically the same for all households but now the poverty decrease for agricultural-specialized households is only a fifth of the short-run decrease so that the overall impact is a poverty increase. Factor mobility causes a redistribution of what were previously gains for the self-employed farmers to the rest of the economy, especially to land which is predominantly owned by richer agricultural households. Short- and long-run results for Malawi show declining poverty decreases in both cases but less so in the long-run due to higher land rental prices which tend to benefit richer land owners and due to overall smaller per capita income gains.
A quite different picture is found for Vietnam where poverty also decreases in the short- and long-run. Here, the long-run impact is actually twice as strong as the short-run impact despite smaller income per capita gains. Moreover, in the short-run poverty among agriculture-specialized households increases strongly with all other household categories experiencing poverty declines. This is attributed to the expansion of the apparel and light manufactures export sectors which raise the wages for unskilled labor and thus reduce agricultural profits. In the long-run, self-employed farmers can react to the reduced agricultural profits and switch to other sectors to enjoy the higher wages while the losses remain with the land owners.

Hertel et al. (2004b), again employing the same methodology, compare the short- and long-run impacts for Indonesia and observe that poverty is decreased in both cases but more strongly in the long-run. In the short-run, poverty decreases across all household categories but increases for agriculture-specialized households because rising unskilled wages reduce profits in agriculture and in addition food prices increase. In the long-run, poverty decreases uniformly across all household categories since self-employed farmers now can adapt and switch sectors.

Hertel et al. (2007a,b,c), building on Ivanic (2006), employing a similar methodology as in their previous studies but using many disaggregated household groups and corresponding poverty elasticities, examine the impacts of rich country agricultural and complete full multilateral liberalization scenarios across 15 developing countries, namely, Bangladesh, Brazil, Chile, Colombia, Indonesia, Malawi, Mexico, Mozambique, Peru, Philippines, Thailand, Uganda, Venezuela, Vietnam, and Zambia. Outcomes for complete multilateral liberalization are mixed in strength and direction: poverty decreases in nine countries and increases in six countries. A similar pattern is observed when only rich countries liberalize agricultural trade. In the majority of countries, rich country agricultural liberalization lifts more farm households out of poverty than other households are pushed into poverty by increased food prices. But developing countries experience the greatest poverty alleviation when the developing countries themselves also undertake full domestic liberalization of agricultural trade. Thus, Hertel et al. (2007c) underline that partial trade reforms, such as those expected from the Doha Round, generate smaller poverty responses than full reforms. They find full reforms to be nearly twice as poverty friendly as their Doha Round scenario, for two reasons. The first is that rich country agricultural trade liberalization in the Doha Round scenario emphasizes those elements of policy reform – export subsidies and, to a lesser extent, domestic support – that are less favorable to poverty reduction. The second is that developing countries are given special and differential treatment and thus are expected to conduct relatively limited tariff reductions. The evidence in this study shows that this actually is the
most poverty-friendly aspect of global trade reform.

For Bolivia, Jimenez (2006) applies a sequential CGE-microsimulation model and finds that multilateral liberalization causes contraction of the hydrocarbon sector which indirectly reduces demand for urban services. Overall, there is a small poverty decrease but the poverty depth increases. The industrial and urban informal sectors lose and thus hurt the non-agricultural poor. Sole domestic liberalization creates additional demand thereby increasing employment and wages. These gains dominate the poverty increasing effect of declining incomes of the poor in the agricultural sectors, so that overall poverty decreases while poverty depth increases.

Laens and Perera (2006) utilize a sequential CGE-microsimulation model to compare multilateral and domestic trade liberalization under short- and long-run closures for Uruguay. In the short-run, the exchange rate and real wages are fixed and capital is sector specific. In the long-run, the exchange rate and real wages are flexible and capital is fully mobile. When liberalizing domestically, there are small positive GDP impacts but the fixed exchange rate in the short-term scenario hampers an otherwise positive export effect so that the remaining GDP impact is negligible. Poverty decreases slightly under both closures. Also multilateral liberalization causes very small GDP increases despite strongly increasing exports. Still, the poverty headcount decreases by 1.2 to 2.0 percentage points depending on the closure. The authors caution that such a policy reinforces a structural change toward exports of primary commodities which are quite volatile.

Morley and Diaz-Bonilla (2006), employing a sequential CGE-microsimulation model, find the poverty effects in Mexico for both an unilateral 50% domestic liberalization scenario and a 100% multilateral liberalization are small, first and foremost because tariffs are rather low initially. Output increases in all cases mainly as a result of increasing unskilled labor supply rather than from reallocation of factors across sectors, attributable to their upward-sloping labor supply curve for unskilled labor. Cutting import tariffs by 50% unilaterally results in a small poverty decrease. However, the multilateral liberalization scenario leads to a decline in rural poverty but in urban areas and overall poverty rises.

In a multilateral liberalization CGE-microaccounting simulation by Nicita (2005) that takes, in particular, spatial price transmission from the USA border into Mexico’s regions into account, Mexico experiences an overall decrease in per capita income. The income decrease is even more strongly pronounced for the poor. This is due to preference erosion: Through membership in the NAFTA, Mexico has already liberalized widely with its most important trading partners, particularly the USA. The advantage of these low tariffs is diminished when the USA liberalizes with other countries as well. The spatial price transmission across Mexico determines the
variance of effects across households. The differences are more associated with geographic factors, in this case the distance from the US border, than with income sources and consumption bundles. Thus, improved spatial price transmission could provide for a more equal distribution of the trade liberalization gains and possibly lead to poverty reductions.

Porto (2003) utilizes the price effect results from other studies and econometrically estimated wage-price elasticities and finds that foreign liberalization has a stronger positive impact on poverty reduction in Argentina than own liberalization. Although the marginal effect of domestic liberalization is larger, the scope for additional liberalization is so much greater for foreign countries that this is ultimately dominating, causing strong poverty decreases when multilateral liberalization is implemented.

Robilliard and Robinson (2005, 2006) observe in their experiments with a sequential CGE-microsimulation model that all, domestic, foreign, as well as multilateral liberalization, will be poverty alleviating in Indonesia. These effects remain positive even under various wage flexibility and labor mobility assumptions. If foregone tariff revenues are replaced by the introduction of a direct tax, efficiency gains and positive poverty effects are higher than those in the case of a value-added tax.

Employing a sequential CGE-microsimulation model, Sanchez and Sauma (2006) notice a small poverty decline for Costa Rica when it liberalizes unilaterally. However, if liberalization is multilateral and despite a small increase in GDP, poverty increases slightly as a result of a dramatic decline in agricultural incomes. Inequality increases because agricultural incomes and employment drop while incomes in the formal sector increase.

de Souza Ferreira Filho and Horridge (2006) report from an analysis by means of a sequential CGE-microsimulation model that even considerable liberalization does not generate dramatic changes in poverty and inequality in Brazil. The effects are positive but very small. The scale of the Brazilian domestic market makes it less sensitive to trade and tariff shocks. Multilateral liberalization causes agricultural and food processing sectors to expand and manufacturing to shrink. Incomes rise most for the poorest households. Since large shares of the poorest people are still working in the agricultural sector it will continue to be important for poverty alleviation. Their model does not capture other potentially positive effects like endogenous technology improvement and other dynamic effects. They note that these other effects from trade liberalization are potentially more important.

Vasi and Carpio (2006) find that multilateral and domestic trade liberalization has a generally positive but small effect on poverty in Peru utilizing a sequential CGE-microsimulation model. Rural poverty decreases less than urban poverty.
Vos and Leon (2006) perform a sequential CGE-microsimulation for Ecuador and find that unilateral and multilateral liberalization result in increasing GDP for both fixed as well as flexible exchange rate regimes but still overall poverty increases. Aggregate employment and average labor income effects are positive but unequal, benefiting skilled workers in the formal, traded goods sectors while harming unskilled workers. Ultimately, inequality and poverty increase.

Tables 2, 3 and 4 crudely compile the poverty results from the sample of studies reviewed. Each country poverty result is counted as one observation and it is evaluated as decreasing (increasing) if the poverty headcount changed positively (negatively) for the particular liberalization scenario and region. All studies contain national poverty headcount impacts from multilateral liberalization but separate results for domestic and foreign liberalization are not always reported. The same applies to differentiated results for rural and urban areas. If several studies by the same author deal with the same countries, the results from the latest are taken. The dynamic CGE study of Bangladesh by Annabi et al. (2006) reports results for two different points in time and is included as two observations. More details on the studies’ setup and results can be found in Tables 5 and 6 in the Appendix.

The first question is whether poverty rates have moved in the same direction as national welfare as a result of the liberalization experiments. The results are presented in Table 2 distinguishing between own liberalization, foreign liberalization and multilateral liberalization. There are essentially four possibilities: national welfare increases and poverty rates increase or decrease; or national welfare decreases and poverty rates increase or decrease. By and large, the change in the poverty headcount varies in the expected direction with the change in national welfare. For example, in the case where multilateral liberalization increases national welfare, the poverty headcount decreases in 21 cases and increases in only 1 case, whereas in the case where national welfare falls, the poverty headcount index increases in 6 cases and falls in 3 cases. Multilateral liberalization includes own liberalization by developing countries, so it is of interest to examine the impact of foreign liberalization alone. Here, the number of observations is much more limited, and foreign liberalization is not necessarily confined to rich country agricultural liberalization. The limited number of observations does not allow conclusions to be drawn, but the

39A more differentiated appreciation of the numbers would be desirable in particular accounting for figures close to zero and the baseline of the poverty headcount. Unfortunately, several studies do not provide numbers for the baseline or point changes in the headcount. Furthermore, it is not always clear whether the reported percentages are point changes in or percent changes of the poverty headcount. 40Because some studies report zero percent changes in national welfare but nonetheless some small poverty impacts, we distinguish these studies separately in Table 2
outcomes tend to be more mixed than for multilateral liberalization.\textsuperscript{41}

Tables 3 and 4 present a more disaggregated picture of the results, broken down by region of study and source of liberalization. Most of the 34 country observations are concentrated on South- and Central America and Asia, while relatively few focus on African countries. Table 3 indicates that multilateral liberalization tends to decrease poverty both in terms of national and rural and urban headcount indices. However, all regions exhibit negative alongside positive cases. The six observations for Sub-Saharan Africa point toward a tendency for negative poverty impacts while the tendency is more on the positive side for Asia and South- and Central America. The 14 observations from those studies which also simulated a sole domestic liberalization show a picture similar to that of multilateral liberalization with similar consequences also showing a tendency toward poverty decreases in most regions but poverty increases in Sub-Saharan Africa. The 7 of the 34 studies which also simulated a separate sole foreign liberalization show a less clear picture with about equally many reporting an increase as a decrease in poverty.

Table 4 summarizes how often a poverty direction in rural areas occurs simultaneously with a poverty direction in urban areas, e.g., two studies on Asian countries reported a decrease in poverty in rural areas as well as in urban areas upon multilateral liberalization. Unfortunately, the small number of studies per region does not allow any firm conclusions. Across all regions, it seems that rural and urban poverty are more likely to decrease together rather than to move in opposing directions. If these tables emphasize anything, it is that there is little scope for generalization and that poverty impacts are highly different from country to country.

6 Conclusions

This survey has explored the literature which attempts to measure the impacts of rich country agricultural trade liberalization on poverty in developing countries, in the context of the ongoing Doha Round trade negotiations where there is high expectation that a successful outcome would make a significant contribution to assisting developing countries to achieve the MDG target of halving poverty by 2015. The Doha Round negotiations cover much more than agriculture, and a successful outcome will include agreements also to liberalize trade in manufactures and services as well as to new rules. Nonetheless, reform of agricultural trade policies has been shown to contribute a high proportion of the expected global welfare gains from

\textsuperscript{41}The observations in Table 2 do not include the findings of Hertel et al. (2007c) which also report mixed results of developed country agricultural trade liberalization on poverty headcount indicators.
goods trade liberalization (Anderson et al., 2006). Also, in many developed countries, development NGOs have launched a sharp critique of domestic agricultural policies on the grounds that they undermine the efforts of donor assistance programs to alleviate poverty. The studies reviewed in this paper throw light on this charge.

There is now a huge volume of empirical research on the consequences of further multilateral trade liberalization for developing countries. These studies generally show global gains as well as gains to developing countries in aggregate from developed country agricultural trade liberalization, although empirical estimates of the magnitude of these gains have been shrinking over time, see, e.g., Ackerman (2005). According to the most recent World Bank research, developed country agricultural policies cost developing countries about $17 billion per year—a cost equivalent to about five times the current levels of overseas development assistance to agriculture (World Bank, 2007). However, there is a high probability that not all developing countries would find themselves better off. Countries which either are net importers of the commodities protected in rich countries or else are exporters with preferential access to these highly protected markets could find themselves worse off.42 However, one lesson from the literature surveyed is that the impact of trade liberalization on poverty is not necessarily the same as its impact on a country’s overall national income; poverty may increase or decrease even as national welfare improves or disimproves. Trade reform affects the distribution of income as well as its level.

Beyond this, however, it is extraordinarily hard to generalize about the poverty effects of trade policy reforms. As Hertel and Winters (2006a, p. 5) comment, “...research into the poverty impacts of trade reform is new, and almost the only consensus it has reached is that countries differ.” The conclusion of this paper is that it is also difficult to provide quantitative estimates for the impact of developed agricultural trade liberalization on poverty, because relatively few studies address this specific issue and report consistent results. We hope that this survey, by highlighting the paucity of studies from which reliable inferences can be drawn, may encourage additional empirical work to address this issue.

The Heckscher-Ohlin-Samuelson model remains a useful starting point for predicting the effects of trade reform. Factors used intensively in sectors whose output price has risen (declined) will tend to experience real gains (losses). How these changes will affect the real incomes of individual households will depend on the precise composition of their income sources, factor endowments and consumption

42This statement refers solely to the effects of developed country agricultural trade liberalization. It does not imply that these countries would be worse off as a result of comprehensive multilateral trade liberalization, particularly where this included greater market access to developing country markets as well.
bundles. Pure subsistence farmers aside, where the poor are largely small-scale agricultural producers, they may be expected to benefit from higher agricultural prices. But where the very poor are largely reliant on transfers or on labor markets and thus do not participate in the gains on the production side, the impact of higher agricultural prices on poverty may be ambiguous.

Quantitative measurement of these effects will depend on the methodology used and the assumptions made. This paper reviewed both *ex post* and *ex ante* modeling approaches. There is a large literature on *ex post* approaches measuring the link between trade openness and poverty, and trade liberalization and poverty, at the economy-wide level but the methodology and conclusions of these studies have been widely criticized. The methodology does not seem to have been applied specifically to agricultural trade liberalization, possibly because it is neither feasible nor realistic to be able to identify the links between a specific policy reform and an economy-wide variable such as the level of poverty using historical data. For this purpose, an *ex ante* approach using simulation modeling, in which the model acts as a laboratory to allow controlled experiments, must be used. Among the *ex ante* approaches, the technique of choice is currently to use a computable general equilibrium model linked to a household survey, either by integrating all survey households directly into the CGE model, or by mapping the price and employment changes from the CGE trade reform simulation onto the distribution of household incomes and expenditures of the household survey where the mapping can involve a complex behavioral microsimulation. In principle, the microsimulation analysis could be used with any policy simulation framework capable of producing the required price and employment changes. But as both factor price as well as product price changes are required, this inevitably requires a general equilibrium model for policy simulation purposes. Macro-micro models differ in the extent to which they allow household behavior to respond to these price changes, and to the extent to which the effects of these household responses are fed back into the CGE model.

The use of CGE models is a powerful tool and ensures both a theoretically grounded understanding of the behavior of agents as well as ensuring that the model solution observes the relevant balance constraints. However, the precise results obtained from these models are dependent on the modeling structure and structural assumptions used. Poverty estimates are very sensitive to the way factor markets are modeled and whether they allow perfect, imperfect or no mobility of factors between sectors. Short- and long-run estimates of poverty impacts may differ because of short-run factor immobility (as well as possible inclusion of long-run capital accumulation and productivity effects). They are also influenced by the assumptions made with respect to other labor market features such as underemployment, dual
labor markets or the elasticity of labor supply. A number of studies have underlined the importance of the price transmission assumption in determining the results obtained. The way in which changes in tariff revenue are either replaced or used, and whether transfers to poor households are affected, will also influence the results. Other aspects of these closure rules, such as whether the trade balance is allowed to move out of equilibrium or not, will also have an important impact.

Apart from these fundamental decisions about how to model the way the economy works, generating poverty estimates requires more mundane decisions. The household datasets will usually not be consistent with the macroeconomic dataset behind the CGE model, and the way in which data reconciliation takes place may well influence the measured poverty outcome. Decisions must also be taken by the modeler on how to match categories between the two datasets, e.g., which individual occupations are defined as "unskilled" and to which the price change for unskilled labor has to be applied. Simulation results will also be dependent on the parameter values chosen, in particular elasticities, and in many instances econometrically derived elasticities will not be available. These generic issues in CGE modeling are well known to its practitioners, but help to explain why quantitative estimates of the poverty impacts of the same trade reform remain contentious.

In summary, *ex post* empirical work has not brought about strong enough evidence for any general relationships between trade liberalization and poverty alleviation, especially not detailed enough to separate out the effects of agricultural liberalization alone. For now, one has to rely on *ex ante* simulation approaches but such results need careful, critical appreciation of what exactly is modeled. Simulated adjustment pressures need to be contrasted with other impact factors outside the scope of the model.
Table 1: Countries occurrences in the survey

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of observations</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>1</td>
<td>Porto (2003)</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2</td>
<td>Annabi et al. (2006); Hertel et al. (2007a,b)</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1</td>
<td>Jimenez (2006)</td>
</tr>
<tr>
<td>Brazil</td>
<td>5</td>
<td>Bussolo et al. (2006); Carneiro and Arbachel (2006); Hertel et al. (2003b, 2007a,b); de Souza Ferreira Filho and Horridge (2005)</td>
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<td>Cameroon</td>
<td>1</td>
<td>Eminiet al. (2005)</td>
</tr>
<tr>
<td>Chile</td>
<td>3</td>
<td>Hertel et al. (2003a,b); Hertel et al. (2007a,b)</td>
</tr>
<tr>
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<td>1</td>
<td>Hertel et al. (2007a,b)</td>
</tr>
<tr>
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<td>1</td>
<td>Sanchez and Sauma (2006)</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1</td>
<td>Vos and Leon (2006)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3</td>
<td>Hertel et al. (2004a); Hertel et al. (2007a,b); Robilliard and Robinson (2006)</td>
</tr>
<tr>
<td>Malawi</td>
<td>2</td>
<td>Hertel et al. (2003a,b)</td>
</tr>
<tr>
<td>Mexico</td>
<td>3</td>
<td>Hertel et al. (2007a,b); Morley and Diaz-Bonilla (2006); Nicita (2005)</td>
</tr>
<tr>
<td>Mozambique</td>
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<td>Arndt (2005); Hertel et al. (2007a,b)</td>
</tr>
<tr>
<td>Peru</td>
<td>2</td>
<td>Hertel et al. (2007a,b); Vasi and Carpio (2006)</td>
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<td>2</td>
<td>Cororaton et al. (2005); Hertel et al. (2007a,b)</td>
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<td>Tunisia</td>
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<td>Chemingui and Thabet (2007)</td>
</tr>
<tr>
<td>Uganda</td>
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<td>Hertel et al. (2007a,b)</td>
</tr>
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<td>Laens and Perera (2006)</td>
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<td>Venezuela</td>
<td>1</td>
<td>Hertel et al. (2007a,b)</td>
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<td>Hertel et al. (2003a, 2007a,b)</td>
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<td>Zambia</td>
<td>1</td>
<td>Hertel et al. (2007a,b)</td>
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Source: Own presentation.
Table 2: Cross-tabulation of national welfare and poverty changes, by source of liberalization, in the surveyed studies

<table>
<thead>
<tr>
<th>Source of liberalization ⇒</th>
<th>Poverty headcount</th>
<th>Multilateral</th>
<th>Domestic</th>
<th>Foreign</th>
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<td></td>
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<td>Increase</td>
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<td>Decrease</td>
<td>1</td>
<td>6</td>
<td>4</td>
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Note: studies excluded: Nicita (2005): welfare effect derived from microsimulation not CGE; Anderson (2005): aggregates and also national poverty elasticity imply a direct relationship of welfare and poverty; Arndt (2005): only own liberalization usable since other poverty effects are reported imprecisely and may be positive or negative. Short- and long-run scenarios reported in the same study have been counted as separate observations. Source: Own presentation.

Table 3: Frequency of decreasing and increasing poverty headcount results by region, area, and liberalization scenario found in the studies surveyed

<table>
<thead>
<tr>
<th>Source of liberalization</th>
<th>Asia</th>
<th>North Africa</th>
<th>Poverty headcount</th>
<th>South and Central America</th>
<th>Sub-Saharan Africa</th>
<th>All</th>
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<tr>
<td></td>
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<td>Increase</td>
<td>Decrease</td>
<td>Increase</td>
<td>Decrease</td>
<td>Increase</td>
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<tr>
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<td>3</td>
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<td>0</td>
<td>12</td>
<td>6</td>
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<td>0</td>
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<td>1</td>
<td>3</td>
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Source: Own presentation.
Table 4: Simultaneous occurrence of decreasing or increasing rural and urban poverty impacts in the surveyed studies

<table>
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<tr>
<th>Source of liberalization</th>
<th>Asia</th>
<th>North Africa</th>
<th>South and Central America</th>
<th>Sub-Saharan Africa</th>
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<td>0</td>
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<td>Domestic</td>
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<td>1</td>
<td>3</td>
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<tr>
<td>Foreign</td>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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</table>

Source: Own presentation.
References


48


Ivanic, M. (2004). Reconciliation of the GTAP and household survey data, *GTAP Research Memoranda 1408*, Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.


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Saward, L. (2003). Poverty and income distribution in a CGE-household microsimulation model: Top-down/bottom up approach, Cahiers de recherche 0343, CIRPEE.


## Appendix

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Setup</th>
<th>Comp.</th>
<th>Export demand</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Anderson et al. (2005)</td>
<td>2001</td>
<td>GTAP6</td>
<td>Linkage + regional poverty elasticities</td>
<td>Generic</td>
<td>Linkage is a global recursive dynamic CGE model. Regional poverty elasticities (between .9 and 3.0 for $1/day poverty line) are applied to the change in mean wage of unskilled labor and deflated by food and clothing CPI.</td>
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<td>Annabi et al. (2006)</td>
<td>2000 SAM, 2000 HHS</td>
<td>GTAP + rec.dyn.</td>
<td>YTAAX</td>
<td>Curve</td>
<td>Microaccounting projects consumption growth onto HHS and prices on CPI.</td>
</tr>
<tr>
<td>Arndt (2005)</td>
<td>2003 HHS</td>
<td>GTAP + nat.CGE + micsim</td>
<td>DTAX</td>
<td>Curve</td>
<td>No detailed poverty effects given, largest effect is +0.3, in all other scenarios even smaller.</td>
</tr>
<tr>
<td>Carneiro and Arbache (2006)</td>
<td>1996 SAM, 1996 HHS</td>
<td>GTAP + CGE + seq.MS</td>
<td>None</td>
<td>Exogenous</td>
<td></td>
</tr>
<tr>
<td>Cororaton et al. (2005)</td>
<td>1994, recal. to 2001</td>
<td>GTAP + nat.CGE + micsim</td>
<td>ITAX</td>
<td>Curve</td>
<td></td>
</tr>
<tr>
<td>Emini et al. (2005)</td>
<td>2001</td>
<td>GTAP + nat.CGE + int.MS</td>
<td>PTAX</td>
<td>Curve</td>
<td></td>
</tr>
<tr>
<td>Hertel et al. (2003b)</td>
<td>1997 GTAP, 1998 HHS</td>
<td>GTAP + mic.acc.</td>
<td>CTAAX</td>
<td>Generic</td>
<td>Microaccounting projects income growth onto HHS. Utility based demand system (AIDADS) uses that income as a budget constraint.</td>
</tr>
<tr>
<td>Hertel et al. (2003a)</td>
<td>1997 GTAP</td>
<td>GTAP + mic.acc.</td>
<td>CTAAX</td>
<td>Generic</td>
<td>Microaccounting projects income growth onto HHS. Utility based demand system (AIDADS) uses that income as a budget constraint.</td>
</tr>
<tr>
<td>Hertel et al. (2004b)</td>
<td>1997 GTAP</td>
<td>GTAP + mic.acc.</td>
<td>CTAAX</td>
<td>Generic</td>
<td>Microaccounting projects income growth onto HHS. Utility based demand system (AIDADS) uses that income as a budget constraint.</td>
</tr>
<tr>
<td>Study</td>
<td>Year</td>
<td>Setup</td>
<td>Comp.</td>
<td>Export demand</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------</td>
<td>----------------</td>
<td>--------</td>
<td>---------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hertel et al.</td>
<td>2001 GTAP</td>
<td>GTAP + disagg. pov elasticities + AIDADS</td>
<td>CTA</td>
<td>Generic</td>
<td>Households categorized according income source specialization; poverty elasticity computed for each categories vignette around the poverty line; factor income changes deflated by poverty line utility demand which is obtained from an AIDADS demand system.</td>
</tr>
<tr>
<td>Jimenez (2006)</td>
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<td>GTAP + CGE + seq.MS</td>
<td>None</td>
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<td></td>
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<td>Morley and Diaz-Bonilla (2006)</td>
<td>1996 SAM, 2001 HHS</td>
<td>GTAP + nat.CGE + seq.MS</td>
<td>None</td>
<td>Curve</td>
<td>Supply of agricultural unskilled labor fixed but upward sloping labor supply curve for unskilled non-agricultural labor.</td>
</tr>
<tr>
<td>Sanchez and Sauma (2006)</td>
<td>1997 SAM</td>
<td>GTAP + CGE + seq.MS</td>
<td>None</td>
<td>Exogenous</td>
<td></td>
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<tr>
<td>de Souza</td>
<td>1996 SAM, 2001 HHS</td>
<td>GTAP + seq.MS + nat.CGE</td>
<td>STAX</td>
<td>Curve</td>
<td></td>
</tr>
<tr>
<td>Ferreira Filho and Horridge (2005)</td>
<td>1994 SAM, 1994 HHS</td>
<td>GTAP + nat.CGE + seq.MS</td>
<td>None</td>
<td>Exogenous</td>
<td></td>
</tr>
<tr>
<td>Vasi and Carpio (2006)</td>
<td>1993 SAM, 1995 HHS</td>
<td>GTAP + CGE + seq.MS</td>
<td>None</td>
<td>Exogenous</td>
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<tr>
<td>Voe and Leon (2006)</td>
<td>1993 SAM, 1995 HHS</td>
<td>GTAP + CGE + seq.MS</td>
<td>None</td>
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</tr>
</tbody>
</table>
Some details on the setup of the multilateral trade liberalization studies discussed above. Abbreviations in column Year: GTAP = trade analysis database described in Dimaranan (2006), HHS = household survey. Column Setup: GTAP = global CGE model described in Hertel (1997), dyn. = dynamic, rec. = recursive, mic.acc. = microaccounting, nat. = national, seq. = sequential, int. = integrated. Column Comp. describes the means used for compensating forgone governmental revenue: YTAX = income tax, VAT = value-added tax, ITAX = indirect tax, DTAX = direct tax, STAX = proportional tax on each households’ spending, PTAX = production tax levied equally on locally sold production and imports, CTAX = adapting consumption tax which keeps the ratio of tax receipts relative to net national income constant. Column Export Demand describes how export demand is modeled: Generic = export demand is generically endogenous in global CGE models, Curve = export demand is given by a downward-sloping demand curve, Exogenous = the country faces infinite demand at fixed prices (small country assumption), NA = not applicable. Source: Own presentation.
Table 6: Some details on the discussed multilateral trade liberalization studies.

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More detailed results taken from the multilateral trade liberalization studies discussed earlier. Mul., Dom., and For. abbreviate multilateral, domestic, and foreign liberalization scenarios, respectively. SR and LR mark short-run and long-run closures respectively. LB and UB mark simulations based on lower bound and upper bound macro-model outcomes respectively. The numbers in the Liberalization scenario columns are multipliers for the base tariff rate. * mark studies which found opposite GDP and poverty effects. Source: Own presentation.