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Agricultural Trade Reform and Poverty in the Asia-Pacific: A Survey and Some New Results

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UNITED NATIONS
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Economic and Social Commission for Asia and the Pacific

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Agricultural Trade Reform and Poverty in the Asia-Pacific: A Survey and Some New Results

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Abstract

We review the literature on the relationship between agricultural trade policy reform and poverty, and the results of recent detailed simulation studies applied to economies in the ESCAP region. We then use the GTAP model to evaluate the possible impacts of the most recently proposed modality for agricultural trade reform under Doha on the economies of the ESCAP region. We compare the results to a benchmark of comprehensive agricultural trade reform. We find that the current proposal does not result in significant cuts to applied tariffs, and has very modest overall effects on welfare. Poverty in the region would decrease overall, but the distribution across countries is uneven. By contrast, comprehensive agricultural trade reform, with developing economies fully engaged, tends to benefit most economies in the region in the aggregate, and to consistently lower poverty.

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1 Introduction

Agricultural trade liberalization and its effect on the developing economies have long been issues of contention in international trade negotiations, and the Doha round (formally the Doha Development Agenda or DDA) is proving no exception. Disputes over the treatment of agriculture, both between the major developed economies and between developed and developing economies, have threatened to derail the negotiations at several stages.

While there is broad consensus among economists that liberalization of international trade raises global and national level efficiency in the long run, developing economies as a group have generally taken a cautious view of multilateral agricultural trade reform. Key concerns for developing economies as a group include the potential for aggregate harm through preference erosion, that small, food-import dependent economies would be harmed by rising agricultural prices, and that changes in the world prices of food and agricultural products could have adverse effects on food security and poverty. The latter can come about both through rises in commodity prices, which have a direct negative effect on households which spend a high proportion of their income on food, and indirect effects on all households through changes in factor prices. They can also be driven by changes in government revenues streams.

This complex array of concerns is fundamentally empirical in nature in the sense that economic theory offers only limited guidance as to the direction of change, and little as to magnitude. There have been a number of studies addressing developing economy concerns at the aggregate level using various quantitative techniques, in particular computable general equilibrium, building on extensive analysis undertaken for the Uruguay Round using similar techniques. Perhaps the most comprehensive so far is the World Bank study led by Anderson and Martin (2005), which contains detailed analysis of the underlying issues, and computable general equilibrium simulations based on the proposals in place at that time. The studies in that volume are at the global level, and indicate that overall, most developing economies would gain from the Doha reform scenarios, in particular when they undertake trade reforms themselves and when the full agenda (i.e., both agricultural and non-agricultural market access, or NAMA, reforms are considered).[1] The results also indicate that agricultural trade reform is the primary source of global aggregate efficiency gains.

There has been less attention paid to the analysis of potential adverse effects of the trade reform scenarios on poverty until recently, in large part because to do so adequately requires a much richer set of underlying information at the household level, and more complex modeling techniques.[2] The linkages between trade reform and poverty, and developing ways to quantitatively assess those linkages, have, however, been the subject of intense recent research (see Winters, 2002, on the linkages, Winters et al., 2004, on ex-post analysis, and Hertel and Reimer, 2005, on the use of simulation techniques).

The most comprehensive studies in this area so far are Hertel and Winters (2006) and OECD (2006), both of which use a global model to assess aggregate effects of

[1] Also worth mentioning is the de Cordoba and Laird (2005) study through UNCTAD, which takes a distinctly developing economy view, but focuses on industrial trade reform, and also uses simulations only at the global level.

[2] The volume by Anderson and Martin (2005) does attempt to address poverty issues quantitatively using a method for estimating changes in the headcount ratio from the changes in the aggregate data. The same approach is used in Anderson et al. (2006), and we adopt the methodology here also, and compare the results to country studies.

trade reform (agricultural reform specifically in the case of the OECD study), and then a series of case studies with models of various specifications built at the national level to explore income distribution issues.[3] The cases covered in the OECD study are all outside of the region of primary ESCAP interest, however, (the study considers Brazil, Malawi, Italy, Mexico and the United States). The Hertel and Winters (2006) volume includes studies of China, the Philippines, Indonesia and Bangladesh. Gilbert (2007) uses similar techniques to analyze the case of India.

The purpose of this paper is also to assess the potential economic implications of agricultural trade reform under the Doha Development Agenda, with a special focus on the developing economies of the Asia-Pacific region. To do so we survey the latest results from detailed country studies in the region. We then present new results from an evaluation of the latest proposed modalities at the aggregate level for a larger number of economies.

The structure of the paper is as follows. First we briefly discuss the most recent proposals for agricultural trade liberalization under the Doha agreement, and set out the key features of the most recently proposed modality. We then review the general literature on the links between agricultural trade reform and poverty. In section 4, we briefly review key concepts relating to computable general equilibrium (CGE) modeling, before turning to a more detailed review of the models that have been applied to countries in the ESCAP region, and their key results. In section 6 we discuss our simulation methods using GTAP, and the results of our new aggregate analysis. Concluding comments follow.

2 Agricultural Trade Reforms under Doha

Agricultural trade reform is a politically charged issue that has threatened to derail the entire series of Doha Development Agenda negotiations. As a result there is still considerable debate over what the eventual outcome of the Doha negotiations on agriculture will look like. Proposed modalities in agriculture are contained in the special session of July 17, 2007, of the Committee on Agriculture. This is the latest of a series of proposals, several earlier versions of which have been analyzed in Jean et al. (2005a). The document contains a detailed proposal for liberalization. As with the Uruguay Round Agreement on Agriculture (URAA), the proposal is broken down into the areas of domestic support, market access and export competition, in addition to extensive discussion on safeguard and related issues. It is important to note again that this may not represent the outcome of final negotiations. The main features of the latest market access proposal are:

- Members shall reduce their bound duties in accordance with the tiered formula presented in Table 1. Commitments for developing economies have both higher bands and lower required reductions (two-thirds of developed economy levels). The least developed members and very recently acceded members (including Vietnam) are not required to undertake any reductions beyond those already committed. `Small and vulnerable' economies, defined as those with an average share of world trade of less than 0.16 percent, an average share of NAMA trade of less than 0.10 percent and a share of world agricultural trade of less than 0.40 percent, are entitled to moderate the required cuts by a further 10 percentage points.

[3] See also Azzoni et al. (forthcoming).

- Developing country members may lower their commitments proportionately across bands if their average reductions under the formula exceed 36-40 percent. Small and vulnerable members may do the same if their average reductions under the formula exceed 24 percent.

- Developed economies may designate 4-6 percent of dutiable lines as sensitive, with developing economies entitled to 5-8 percent. These require reductions at two-thirds of the rate required under the tiered-formula.

- Developed country members commit to duty and quota-free market access for all products originating in the least-developed countries by 2008 or the start of the implementation period.

The current proposal for reform of domestic support is:

- Reduction of total AMS in accordance with the tiered formula presented in Table 2. Developed countries with a level of total AMS of at least 40 percent of the total value of agricultural production shall reduce by a further 10 percent if their total AMS is in the second tier and by 5 percent if they are in the third tier.

- Reduction in the base level of overall trade-distorting domestic support or OTDS (defined as total plus 10 percent of the value of production in the base period, 1995-2000, plus the higher of the existing average blue box payments or 5 percent of the average total value of production in the base period) in accordance with the tiered formula presented in Table 2. Developed country members in the second tier with OTDS of at least 40 percent of the total value of agricultural production shall reduce by a further 4-6 percent.

- Developing economy member reductions are two-thirds of those of developed economies, while small, low-income recently acceded members are not required to undertake a reduction in total AMS.

- *De minimis* levels reduced by 50 percent from those set out under the URAA (i.e., 5 percent for developed economies and 10 percent for developed economies).

The commitment on export competition is simple and ambitious: elimination of export subsidies by 2013 for developed economies, and an as yet unspecified reduction by developing economies.

While the proposal appears ambitious in many respects, there remain several areas of concern. First is the problem of tariff overhang, where the bindings on tariffs (and AMS) are significantly higher than the actual applied rates, as a consequence in part of `dirty tariffication' and ceiling bindings allowed under the previous agreement. Similarly, many developing economies (e.g., Bangladesh) have limited binding coverage. That is, only a proportion of their tariffs are actually bound. Since commitments to cuts are made on bound tariffs, it is possible that even with significant cuts on paper; actual distortions could remain at high levels. A summary of current applied tariff rates is presented in Table 3, while Table 4 present bound rates.

The exceptions provided for sensitive products have been demanded by developed and developing countries alike, although perhaps for different reasons. While sensitivity in the developed world probably reflects political sensitivity in regard to the incomes of favored groups, Jean et al. (2005b) argue that a number of developing

countries have sought latitude to subject a set of products to reduced disciplines on the grounds that certain products are particularly important for livelihoods or for food self-sufficiency. In any case, it is certainly possible that exemptions for sensitive products could lead to many of the most highly protected markets remaining untouched by reform, potentially greatly eroding the economic gains (see Jean et al., 2005b, for further analysis).

Two issues of special concern to developing economies that are reflected in the draft's construction are principles of special and differential treatment, and the erosion of tariff preferences. Special and differential treatment reflects the principle that developing countries have special needs and should not be subject to the same commitments as developed economies. Hence the requirements for reform are lower, limiting the scope for efficiency within those economies.

Preference erosion refers to the effect that lowering barriers to other countries has on those who already have preferential access to developed country markets through a variety of schemes, including the Generalized System of Preferences (GSP), and a series of provisions within the European Union and the United States. Despite recent evidence suggesting that the utilization rate of such preferences is actually quite low (UNCTAD, 1999), this remains a major issue for some economies. As Anderson and Martin (2005) state, these schemes may reduce demands from preference-receiving countries for agricultural reform in developed economies, but at the same time worsen the positions of other countries excluded from such programs.

3 Poverty Links of Trade Reform

What are the likely effects of the reform proposals outlined on poverty? Unfortunately, there is no simple answer. As Anderson (2004) notes, the theoretical implications of trade reform on poverty are not always clear, and assessing the implications of trade liberalization is a difficult empirical task. Winters (2002) identifies seven linkages between trade reform and poverty: Changes in 1) consumer prices and availability of goods; 2) factor prices and quantities employed; 3) taxes and transfers influenced by shifts in tariff revenue; 4) the terms of trade and other external shocks; 5) investment and innovation that affect the long-run growth path; 6) remittances; and 7) short-run risk and adjustment costs.

At the most fundamental level, changes in international trade policy affect the relative prices. Changes in relative prices in turn drive changes in the returns paid to factors of production, which are owned by households in varying proportions. Factors may also have to absorb adjustment costs in the short- run. International trade therefore alters both the pattern of household income and the prices faced by those households. Changes in revenue may affect incomes directly or indirectly as other sources of revenue are adjusted to make up the difference.

Elementary trade theory does provide strong predictions on the aggregate consequences of agricultural trade reform, and also some clues as to the directions that household changes may take. As a consequence of agricultural trade reform there is likely to be a rise in average export prices of food and agricultural products. The Stolper-Samuelson (1941) theorem (and its short-run analogues) would tend to predict an increase in the return to factors used intensively in agriculture, e.g., land and agricultural labor. Since in many cases these factors are `owned' by the rural poor, we might expect to see an improvement in the incomes of those groups. On the other hand, the increase in price may negatively affect those who do not own

agricultural factors but who spend a significant fraction of their income on food product (e.g., the urban poor).

In developing economies in the region that are net exporters of food and agricultural products (e.g., Indonesia, Malaysia, Thailand and to a lesser extent India, see Table 5), we might expect the aggregate effect of an increase in agricultural prices to be positive, *ceteris paribus*, but nonetheless cannot rule out negative consequences at the household level. On the other hand, in developing economies in the region that are net importers of food and agricultural products (e.g., the Philippines and Bangladesh), we might expect the aggregate effect to be negative, *ceteris paribus*.

The picture may be clouded further when we consider not only the effect that agricultural trade reform in the developed countries may have on developing countries through changes in world prices, but also the direct effect of tariff reform within the developing countries themselves. As noted in the previous section, this is likely to be a requirement of the Doha agreement to at least some degree. In many developing economies in the region the average tariff on agricultural products remains very high (see Table 4). As Winters (2002) notes, this provides an avenue for importing economies to combat the effect of price rises. While we would generally expect the aggregate effects of such reform to be positive, especially for relatively small economies, again the price changes may affect household groups differentially. If tariff reductions are significant, it becomes possible that domestic agricultural prices in some countries may fall even as the world price rises, tending to hurt the owners of agricultural factors (and benefit those who spend a high fraction of their income on food products).

Distortions within the economic system may also alter the predictions of the classical theory. Hence, for example, if there are restrictions on the degree of labor mobility, owners of labor may be prevented from moving to the activities in which their primary resource is most valued, increasing the potential for negative impacts on those groups. On the other hand, if there is unemployment or underemployment in the economic system, it is possible for trade reform to have employment expanding effects which may have a positive impact on, for example, the urban poor.[4] Anderson (2004) discusses other possibilities.

Beyond these broad ideas, applying theory to real world examples of trade reform is a complex task. As we move beyond simple models with limited dimensions, the predictions generated by theory with regard to factor price movements are weak, and depend critically on the exact structure of production. Moreover, real-world economic systems vary considerably, and are riddled with a multiplicity of distortions. Hence, to accurately assess the implications of reform requires the application of quantitative techniques to the exact case under analysis. In other words, as Winters et al. (2004) simply put it: “Outcomes depend on the specific trade reform measures being undertaken, and the economic environment in which they take place."

Quantitative analysis of the poverty impacts of trade can be broadly divided into two literatures. *Ex post* analysis looks at cases of reform in the past and tries to ascertain the effect that the reform had, usually using econometric techniques. *Ex ante* analysis on the other hand tries to analyze what the effect of a proposed reform will be before the reform has in fact occurred. This type of analysis usually uses some kind of simulation model, very often of the computable general equilibrium (CGE) variety.

[4] See Gilbert and Wahl (2003) for an application of these ideas to the case of China's WTO accession.

Winters et al. (2004) have recently surveyed *ex post* analyses of the impacts of unilateral trade reform on poverty, concluding that the empirical evidence broadly supports the view that trade liberalization will reduce poverty in the long-run and on average, although there can be no simple and general conclusion about the relationship between trade liberalization and poverty.

Hertel and Reimer (2005) review *ex ante* studies and provide a method of classification by simulation type: Partial equilibrium models, general equilibrium models, and micro/macro simulation models that combine (not always with feedback) macro-level simulation with micro-level household models. They conclude that computable general equilibrium (CGE) techniques and micro/macro methods have the best potential for fully evaluating the complex web of determinants of changes in poverty *ex ante*.

Within the CGE literature there is a range of ways of addressing poverty impacts of global trade reform. Studies of the effect of Doha such as those contained in the recent UNCTAD volume on the NAMA aspects (de Cordoba and Laird, 2005) and the study by Anderson (2004) are limited to aggregate results at the regional level combined with sensible, but ultimately speculative, observations on potential effects on poverty. Other studies take results from a global trade model, and pass them through a sub-model to determine the poverty impact. In cross-country studies the sub-model is quite small, producing rough assessments of poverty impacts in the form of indices calculated from aggregate results, as in Anderson and Martin (2006). This is the approach taken in the new results in this paper.

Other studies at the country level go further, by either building more sophisticated sub-models of household behavior, or by attempting to incorporate income distribution at the household level within a regional CGE model. Several studies of this type have been conducted recently in Hertel and Winters (2006) and OECD (2006) for selected economies.[5] Gilbert (2007), in a companion piece to this paper, takes a similar approach for India. While drawing broad conclusions from these studies is difficult for the same reasons identified in Winters et al. (2004), both groups of studies note that changes in sources of income seem to be of greater consequence than changes in consumption patterns, and that it is inherently difficult to achieve aggregate efficiency gains without making at least some households worse off. Hence, non-trade reform is also required if poverty is a concern, and empirical results can usefully provide information on the degree to which it is necessary. We review in detail the results of the studies that apply to economies in the ESCAP region. But because the studies all utilize computable general equilibrium methods, it will be useful to first briefly review key concepts on this technique.[6]

4 Overview of CGE Modeling

The two most commonly utilized simulation techniques for numerically evaluating trade liberalization proposals such as those described in the section above are partial equilibrium (PE) and general equilibrium (GE) modeling. PE refers to an incomplete system where various *ceteris paribus* assumptions are in place, generally an analysis of a single sector. PE models cannot account for the interaction between the sector or sectors under consideration and the rest of the economy. Balanced against this limitation is simplicity, and the fact that reduced-form specification sometimes makes econometric estimation feasible. PE models are well-suited to shocks to a single

[5] See also the recent overview article on the same topic by Hertel and Winters (2005).
[6] The following section draws on the overview provided in Gilbert and Wahl (2002).

sector that is sufficiently small for any interaction with the rest of the economy to be ignored.

Computable general equilibrium (CGE) models are numerical models based on general equilibrium theory. Their objective is to turn abstract models of theory into a practical tool for policy analysis. A number of features distinguish CGE models. They are multisectoral, and in many cases multi-regional, and the behavior of economic agents is modeled explicitly through utility and profit maximizing assumptions. In addition, economy-wide constraints are rigorously enforced. Distortions in an economic system will often have repercussions beyond the sector in which they occur. By linking markets, CGE techniques are effective at capturing the relevant feedback and flow-through effects.

The typical applied model adds complexity, but retains the basic structure of textbook GE models. A single economy model will specify prices exogenously, or base them on partial ROW demand functions, while a multiregion model will specify demand and supply conditions in all global markets. Other typical modifications include the introduction of intermediate inputs in production, and final demands distinguished between households, government, trade, and capital creation. Most models also incorporate imperfect substitution between foreign and domestic goods, and between alternative sources of imports (if multi-regional). Based on Armington (1969), this specification serves the dual purposes of dampening the trade and output responses to changes in relative prices, and allowing intra-industry trade to be easily accommodated. Some models introduce a similar idea on the export side, differentiating between production for domestic and export markets. Because they are designed for policy analysis by counterfactual simulation, most models also incorporate a variety of distortions, most commonly in the form of taxes on economic activities, and rigidities in various markets. A wide variety of distortions can be accommodated in principle, even when those distortions would not be amenable to a clean analytical solution.

Aside from complexity of structure, CGE models may differ from the models of neoclassical trade theory in two other fundamental ways. First there is the question of closure or the selection of which variables in the model are to be exogenous. There are both micro and macroeconomic elements to the choice. Microeconomic elements relate to the function of markets: factor specificity, price fixing, rationing, unemployment, etc. Macroeconomic closure relates to the balances identity, and the choice of which of the components of this identity are exogenous, or determined by some functional rule. Closures rule issues have been discussed at length in Dewatripont and Michel (1987). The key point is that selecting different closures reflects different economic realities, and can therefore have a significant impact on the model results.

The second difference is that some models do not maintain the assumption of perfect competition in all markets. A variety of specifications have been adopted to introduce imperfect competition into CGE models (see Harris, 1984). Again, this can have a significant effect on model results.

Because CGE models attempt to capture the features of real world economies, they incorporate data on the structure of production and trade in the economy under consideration. The starting point is a national input-output table or social accounting matrix (SAM), and (for multi-regional models) a set of trade matrices. This data represents the state of the economy at the base year. Functional forms are chosen to define the substitution relationships. Once decided upon, `free' parameters are obtained by either econometric estimation or literature searches. Maximizing

conditions are assumed to hold in the base year, allowing remaining parameters to be determined by calibration.

Simulation in most CGE models involves comparative statics. That is, most models consider the role that changes in exogenous parameters (`shocks') have on the allocation of goods amongst consumers and of resources amongst productive activities, and the consequences for economic efficiency. These models have no explicit time dimension, instead representing different time frames by altering microeconomic elements of the closure. The results of static simulations are often interpreted as representing how the economic system in question would have looked, had the new policy been in place in the base year, after relevant equilibrium adjustments had taken place. In general, net welfare effects will be presented in terms of a money-metric utility function (most commonly the equivalent variation).[7]

Some CGE models run static simulations from a projected future equilibrium. A time element can also be introduced by solving the model sequentially, updating the capital stock to simulate investment and depreciation, the labor stock to simulate population growth, and productivity parameters to simulate advances in technology. Such models are known as recursive dynamic. They generate a base growth path to which the experimental growth path can be compared. In these models, however, the inter-temporal allocation of goods and resources will not be optimal in general. Dynamic models attempt to overcome this deficiency by explicitly modeling inter-temporal behavior.

One of the more popular current CGE models is the GTAP model created and maintained by the Center for Global Trade Analysis at Purdue University. This model is an example of a multiregional, competitive, Armington trade model. The code for the model is publicly available, as is the database on which the model is built. This allows simulation results to be replicated, and the model is in very widespread use. It can be considered the current benchmark model in the CGE literature.

For further discussion of CGE models and recent surveys of their application (including numerous examples using GTAP) see Scollay and Gilbert (2000), Gilbert and Wahl (2002), Robinson and Thierfelder (2002), Lloyd and MacLaren (2004) and Hertel and Winters (2005).

5 Survey of Recent Analyses

In this section we review the recent country studies of Doha trade reform on economies in the ESCAP region. Hertel and Winters (2005), which this survey is not intended to replace, provide a more general overview of the studies contained in Hertel and Winters (2006), including those outside the region. With the exception of Gilbert (2007) all of the existing studies consider a comprehensive Doha agreement, not only agriculture.[8] But, given the significance of agriculture within the proposed modalities, the results are still relevant. We consider the results from the six groups of country studies that are available (China, Indonesia, the Philippines, Bangladesh and India).

[7] Equivalent variation (EV) is the monetary value of the increment in income that would have to be given to (or taken away from) a household at today's prices to make them as well off today as they would be under the proposed policy change. The changes are sometimes called a `one off' gain/loss, but this is somewhat misleading since the changes are permanent.

[8] The aggregate study by Anderson et al. (2006) also includes a simulation where only the agricultural component of Doha is considered.

5.1 China

There has been significant interest in modeling trade reform in China using CGE methods (see Gilbert and Wahl, 2002), so much so that Ianchovichina and Martin (2004) have playfully termed the research literature a `cottage industry' while Kuiper and van Tongeren (2006) have noted that the growth in the literature has rivaled that of China itself. The latter study considers the poverty/income distribution aspects of Doha, as does Zhai and Hertel (2006). Both of these models take different and quite innovative approaches.

Kuiper and van Tongeren (2006) take a village modeling approach. Rather than considering a complete set of households within the national economy, they rather use a general equilibrium model of a single farming village. The model differs from standard CGE approaches in that the production and consumption decisions are not separable, they are made jointly by the individual farm households. They distinguish four groups of households using ownership of draught power and access to outside employment as grouping criteria. The resulting groups represent households with differential capacity for earning a living from agriculture and from migration to urban areas. The model is integrated with the results from the GTAP model, which generate global price shocks and changes in wages outside the village. Both Doha reform (agriculture and NAMA) and a comprehensive trade reform benchmark are considered.

Under the Doha scenario, the model projects average income gains within the farm village in the region of five percent, with ownership of capital in the form of draught power a defining factor in determining the distribution of the gains from price changes, and engagement in non-farm activities the defining factor in gains from employment. The results also suggest widening income inequality; in particular between those with access to outside employment opportunities and those without, as the latter group have fewer opportunities for adjustment.

Zhai and Hertel (2006) use a model distinguishing 53 productive sectors and 100 households (40 rural and 60 urban). The model would be classified as a competitive Armington-type model. It is used in conjunction with the GTAP model for global impacts. Interesting features of the model include imperfect labor mobility and rural-urban migration, both of which are important characteristics of the rural-urban divide in China (see also Gilbert and Wahl, 2003). The model identifies several labor category (unskilled, semi-skilled and skilled), with rural and urban workers distinguished and imperfectly substitutable in production (an indirect means of building geographic dispersion into the model). The model is benchmarked to a 1997 base year, and is updated via recursive dynamic simulation to 2005 prior to the trade reform simulations. The trade reform scenarios (Doha and several other benchmarks) are run as comparative statics with a steady-state closure.[9] In this approach the rental rate on capital is held constant and the stock of capital allowed to adjust in an attempt to approximate capital accumulation effects.

In terms of poverty impacts, Zhai and Hertel (2006) report that urban-rural income ratio declines in all three global trade liberalization scenarios, although the magnitude of this change is small. There is a small improvement in urban-rural inequality, but no change in inequality within the urban and rural areas. Poverty headcount ratios decline for all household groups. The results of Zhai and Hertel (2006) also suggest that the largest increases in welfare following global trade liberalization and Doha

[9] Zhai and Hertel (2006) also explore the role of investments in rural education.

would accrue to rural households, which benefit from the fact that returns to agricultural land increase relative to other factor prices.

5.2 Indonesia

The Robilliard and Robinson (2006) studies of Indonesia is unique in actually using a set of three models to estimate poverty effects. At the top level the study uses the GTAP model to estimate the overall effect of trade reform under the Doha proposals (agriculture and NAMA) at the world level. The world market effects are then used as input into a single economy CGE model for Indonesia. At the third level, a detailed micro-simulation model is used to estimate household results. In addition to the Doha scenario, the authors also consider comprehensive global reform and unilateral reform within the Indonesia as benchmarks.

The Indonesia CGE model is of the competitive Armington variety. It has an initial base year of 1995, but is adjusted prior to simulation to match 2002 economic activity and protection levels. It identifies 21 productive sectors and 15 productive factors (land, plus eight types of labor and six types of capital). The CGE model does not identify different households. The model attempts to characterize the dual nature of the Indonesian economy by distinguishing between formal and informal activities in each sector. The two sub-sectors differ in the type of factors they use and consumers purchase a composite formal and informal products of the same commodity (i.e., an Armington-type specification). Also of note is the characterization of rural and urban labor as separate factors of production, which implies that rural workers cannot shift out of rural production activities. The simulations are comparative static, with a medium/long-run time frame represented by mobility of capital across economic activities.

Prices, wages, and aggregate employment variables from the CGE model are used as input in a micro-simulation model that generates changes in individual wages, self-employment incomes and employment status. The micro-simulation model is based on household and individual level data from the survey data for the year 1996 and simulates income generation mechanisms for 9,800 households. For details see Robilliard and Robinson (2006).

The Doha scenario results indicate very small impacts for Indonesia, at just a 0.1 percent impact on per capita consumption and less than a one percent rise in aggregate imports and exports. There is a negligible impact on inequality, but rising incomes boost a small number of people out of poverty (about 50,000). By contrast, the results of the unilateral liberalization scenario indicate an increase in the average per capita household income of 0.6 percent and a decrease headcount ratio from 18.3 to 18.1 percent, with the greatest impact on urban households. Full global reform generates still larger results, pulling an estimated 1.7 million out of poverty, although this scenario must be regarded as a benchmarking exercise more than a realistic outcome of current negotiations.

5.3 Philippines

The impact of the Doha proposals (agriculture and non-agriculture) on the Philippines is analyzed in Cororaton et al. (2006). The study uses the GTAP model to estimate the overall effect of trade reform under the Doha proposals at the world level, and then inputs the world market effects into a single economy CGE model for the Philippines. The latter model is then used to generate household level results. In

addition to the Doha scenarios, the authors also consider comprehensive global reform and unilateral reform within the Philippines as benchmarks. Tax replacement is considered using indirect taxes and income taxes.

The Philippines model is a competitive CGE model of the Armington type. It has a base year of 1994, although protection levels are adjusted to 2001 levels (consistent with GTAP6) prior to simulation. The model identifies 35 productive sectors and six productive factors, with agricultural labor distinguished from non-agricultural labor and mobile only across agricultural sectors. Twelve household categories are distinguished, six each of rural and urban, with Cobb-Douglas preferences. The simulations are run as comparative statics, with a short-run adjustment time horizons represented by specificity of capital across productive sectors. Parametric sensitivity is not addressed.

Cororaton et al. (2006) estimate increases in income for all household groups under the Doha scenario, with roughly equal gains on average to rural and urban households. However, they do not present a household welfare measure, so it is unclear whether households are better off in real terms. Poverty calculations by the authors suggest that perhaps they are not - as poverty increases slightly under the Doha scenario. The authors argue that the deterioration is due to the fact that consumption prices rise more on average than household nominal incomes, primarily due to deterioration in the terms of trade. In general, rural households are somewhat more affected than urban households.

5.4 Bangladesh

Results for Bangladesh are available from Annabi et al. (2006). This study uses the GTAP model to estimate the overall effect of trade reform under the Doha proposals (both agriculture and non-agriculture) at the world level, and then inputs the world market effects into a single economy CGE model for Bangladesh. The single country model is used to generate detailed results at the household level. In addition to the Doha agenda, the study also considers the potential impact of more comprehensive global reform, and of unilateral reform by Bangladesh.

The Bangladesh model is a standard, competitive CGE model of the Armington type. It identifies 15 productive sectors, four factors of production, and nine households (five rural and four urban with Stone-Geary preferences), with a base year of 2000. The simulation procedure is recursive dynamic, with growth of the labor stock and productivity at fixed levels, and the capital stock growth path endogenized by a simple investment rule that is sector specific. Tax replacement is (implicitly) through lump sum transfers from the households. The simulations extend for a twenty year period, with comparisons are made relative to a baseline growth path. Parametric sensitivity is not addressed.

The results indicate aggregate welfare losses for Bangladesh under the Doha scenarios, along with small increases in the headcount ratio (diminishing somewhat but remaining negative in the long-run). The negative aggregate welfare effect is driven by adverse terms of trade movements. These remain even in a scenario with complete liberalization in the rest of the world. The poverty effect is driven by increased prices, even as nominal unskilled wages rise slightly. When broken down to the household level, Annabi et al. (2006) find poverty increases for all household categories except large farmers.

5.5 India

In a companion study to this paper, Gilbert (2007) considers the impact of the current proposed modalities for reform in agriculture only under Doha at the household level for India, in addition to more comprehensive agricultural reform. The study uses the GTAP model to estimate the world market effects, after first modifying the underlying GTAP6 data to reflect the latest available applied protection levels (using the TRAINS database). The global results are then input into a single economy CGE model of India, with household disaggregation.

The India model is a competitive CGE of the Armington variety. It identifies 43 productive sectors and five factors of production, along with nine households (four rural and five urban with Stone-Geary preferences). Household data is obtained from Pradhan and Amarendra (2006) and matched to the GTAP data on aggregate consumption, production and trade using RAS methods. The base year is 2001, although protection data is more recent, as noted above. The simulations are run as comparative statics, with two different adjustment time horizons (short- and long-run) represented by mobility/immobility of capital across productive sectors. Tax replacement is (implicitly) through lump sum transfers from the households. Parametric sensitivity is addressed with unconditional analysis of the trade elasticities, implemented using Monte Carlo (stochastic simulation) techniques, with the distributions on underlying parameters based on Hertel et al. (2007).

Under the Doha scenarios, the welfare of the poorest households (agricultural labor and other rural labor) falls, while the welfare of the richest group (urban self-employed) rises, in both the short- and long-run. The income of rural self employed (land owners) also rises under the Doha scenarios, suggesting that ownership of land and capital helps to insulate this group from the terms of trade shifts. The result is similar to that of Annabi et al. (2006) for Bangladesh, but the change is not statistically robust.

Under comprehensive reform the results are quite different. The aggregate welfare gains are several orders of magnitude larger, and all households except the rural self-employed rise. The results are statistically significant, and suggest that India's land owning class is able to benefit from rising world prices under Doha reform when India does not engage in significant reforms of its own, but faces considerable falls in income if domestic prices are allowed to fall (in the long-run the fall in the mean fall in the return to agricultural land is estimated at 10 percent).

Because of the household level data, an approximate Gini coefficient can also be calculated, and changes in the value evaluated. The results indicate that income inequality improves in all scenarios except for comprehensive reform of agriculture in the long-run. In all cases these results are statistically robust, but of small magnitude. Overall then, the results suggest that India would gain overall from agricultural reform, but that an increase in poverty is likely under the Doha agreement as it stands. On the other hand, comprehensive reform is likely to increase the incomes of the poorest groups, but at the expense of a slight increase in income inequality, and a substantial reduction in the incomes of land-owners.

6 New Results

In this section we present new estimates of the poverty impacts of the current modalities for agriculture. We start with a discussion of our experimental design, and

then turn to the results of our simulation analysis. Aggregate welfare measures are analyzed before turning to implications for poverty, and finally adjustment.

6.1 Methodology

We take an approach similar to that used in Anderson et al. (2006), using the GTAP model. This is a competitive, Armington type model, the structure of which has been exhaustively described elsewhere (the main reference being Hertel, 1997), so we do not go into any detail here. Numerous applications are reviewed in the surveys listed above. The GTAP model uses the GTAP6 database (Dimaranan, 2006), which is the most recent and comprehensive data of its kind available. It has a base year of 2001. While GTAP6 contains of 87 regions and 57 sectors, as a practical matter it is necessary to aggregate. Because the database does not have comprehensive measures of services protection, we have chosen to aggregate the services sectors, while maintaining the greatest possible degree of sectoral detail in agriculture and manufactures. The regions are aggregated to 22, with a focus on the economies of the ESCAP region. The sectoral and regional aggregation is presented in Table 6.

Before undertaking our analysis of the Doha scenario, we first update the agricultural protection data in the GTAP6 data to the latest available applied levels, using information in the WITS database and the ALTERTAX procedure. This is undertaken to give a more realistic picture of the actual level of agricultural protection in the region. We draw the latest bilateral applied tariffs in agricultural/food products for each country from the TRAINS database (see Table 3 for summary information).[10]

After updating the tariff data, we consider the effect of the agricultural trade reform as described in Section 2, within the GTAP model. The required tariff cuts are calculated on the basis of the latest bound rates in TRAINS (See Table 4), adjusted for binding coverage, and are assumed not to take effect if post-cut rates are above current applied levels. Export subsidies in agriculture are eliminated and domestic support measures cut by 60 percent for developed economies and 40 percent for developing countries. Vietnam and Russia, as newly acceded members, are assumed not to make any further commitments. Bangladesh, as an LDC, is exempt from cuts and the recipient of zero agricultural tariff preferences from developed economies. In light of the fact that Korea declares itself as a developing economy under the WTO, its commitments are those of a developing economy.

In order to gain some sense of the significance of our results, it is useful to have a benchmark simulation with which they can be compared. Earlier work (e.g., Anderson et al. 2006) has used global liberalization of merchandise trade as a benchmark. Given our focus on agricultural trade reforms, we run an alternative benchmark that involves comprehensive agricultural liberalization. In this scenario all tariffs, export subsidies and domestic support in agricultural and food products is eliminated. Running this scenario is of course not to suggest that this is a likely outcome of current global negotiations.

Both of these scenarios (Doha and comprehensive) are run as comparative statistics. The results should be interpreted as representing the change in the economic system that would occur given the proposed shock, given sufficient time to adjust to the new equilibrium. The model does not identify the path taken to the new equilibrium. We

[10] GTAP6 data is drawn from MacMaps, and while older (based on 2001) does have some advantages over the raw data. Where GTAP6 indicates that the applied tariff is lower than recorded in TRAINS, we leave it in place.

adopt several factor market closure rules to represent different adjustment time frames. In the first, we allow labor to adjust to the shock by reallocating across sectors (short-run), and then we allow capital to adjust also (long-run).

6.2 Aggregate Welfare

Table 7 presents the aggregate welfare results from the Doha scenario, using the equivalent variation (EV) measure. The first result to note is that the magnitude of the estimated welfare gains is quite modest, at around $4.6 billion globally in the short-run. Of this approximately $3.1 billion accrues to economies within the ESCAP of which $365 million is to developing economies.[11] The estimated gains are slightly larger in the long-run (by approximately $640 million in aggregate, over one-third of which accrues to developing economies in the ESCAP region). This is to be expected, as we allow a greater degree of economic response in the long-run. It should be reiterated that we are considering only agricultural trade reform here, and not the full Doha trade reform agenda. Nonetheless, agriculture is among the most protected sector of economies in the region, and is a major part of the agreement. The small aggregate gains reflect the relatively small degree of actual reform that is anticipated if the proposal on agriculture remains in its current form. That is, given the degree of binding overhang (compare Tables 3 and 4), the current proposal in most cases results in only very small reductions in the actual applied tariffs of the economies in the model. If sensitive products are excluded as discussed in Jean et al. (2005) the potential for economically significant gains to arise from agricultural reform could be eroded even further.[12]

To gain perspective on the potential efficiency gains left on the table by the currently proposed modalities, consider the welfare estimates from comprehensive agricultural trade reform. The results of this simulation are presented in Table 8. In this case estimated the global welfare gains exceed $23 billion in the short-run and $37 billion in the long-run. These figures are five and seven times larger than the corresponding estimates for the Doha scenario, respectively. This clearly indicates just how much reform is left undone by the current modalities. For developing economies in the ESCAP region the contrast is particularly sharp, these countries would gain (in aggregate) over ten times more (slightly less in the long-run) from comprehensive reform than from the current Doha proposals.

It is important to note, however, that not all countries are expected to gain from agricultural trade reform, in either scenario, and in fact the gains from the Doha scenario in particular are quite uneven across regions. In order to understand the distribution of the welfare gains/losses across different regions it is useful to go back to basic economic theory. The welfare effect of reform can be broken down into two components, the allocative efficiency (AE) effect and the terms of trade (TOT) effect. The former is the impact of reallocating resources across economic activities. As an economy removes its own barriers, this effect is generally positive.[13] The terms of trade effect is the result of changes in the world price. For a country engaging in its own liberalization, this effect is negative, *ceteris paribus*, and is increasing in the economic size of the country (i.e., the degree of market power). The overall impact of own reform will be determined by the balance of these two factors, with AE

[11] We include Republic of Korea in this group.
[12] It is also worth noting that GTAP data does suffer from aggregation bias. The weighted average tariffs in the database may not adequately reflect the potential for gains from elimination of peaks at the tariff line level.
[13] It is possible for allocative efficiency effects to be negative when there are other distortions in the economic system (such as taxes in other activities).

dominating when the degree of reform is large, and TOT dominating when the economy is large and/or the degree of reform small. The liberalization of other countries is also reflected in the terms of trade, when country A lowers its barriers to country B, the terms of trade of country B improve.

With these ideas in mind, reconsider Table 7, which presents a breakdown of EV into its allocative efficiency and terms of trade components. Some countries in the region are likely to be large gainers from positive external shifts in the terms of trade that they face. These are countries that have a strong comparative advantage in agricultural products (reflected in their position as net exporters in Table 5). Such economies include New Zealand and Australia, who are the largest beneficiaries in proportional terms. Other net importing economies benefit substantially from their own reform as the benefits of increased efficiency outweigh the negative effects of terms of trade shifts. The two primary examples of this type are Japan and Korea. Thailand benefits from both increased efficiency as a result of lowering its substantial tariffs, and from positive terms of trade shifts from improved market access, as does India (although the effects are proportionally much smaller).

Most of the other developing economies in the region are estimated to bear negative overall welfare effects of reform under Doha, although the magnitudes are small.[14] In all cases this is a consequence of adverse terms of trade movements, suggesting that rising agricultural prices would be harmful to most developing economies in the ESCAP region (excepting Korea, Thailand and India), although by small margins.

The case of Bangladesh is interesting because as an LDC it is not required under the current proposal to make any commitments to trade reform. Moreover, as an LDC it is the recipient of preferential access in agriculture to all developing economies. We might normally expect the latter to be rejected in a positive welfare effect through shifts in the terms of trade, but our results do not bear this expectation out. The aggregate effect on Bangladesh, while small, is negative, and appears to be driven by terms of trade shift. This suggests that tariffs faced by Bangladesh in the developed world are already low, and there is little to be gained in aggregate from preferential access. Rather Bangladesh is hurt as world prices rise (it is a net importer of both agricultural and food products as shown in Table 5), and/or through preference erosion as barriers to other countries are lowered. How could Bangladesh and similar economies counteract this effect? It is possible that allocative efficiency improvements could counter terms of trade movements if they were to liberalize their own relatively high (see Table 4) tariffs in agriculture and food products. This would require significant commitments in the case of Bangladesh; however, since binding overhang is probably more severe in Bangladesh than in any other country in the region (compare Tables 4 and 5). A similar case can be made for Vietnam and Russia, which as newly acceded members do not make any further commitments under this scenario. Substantial reductions in developing country tariffs also create new potential pathways to positive terms of trade shifts (i.e., through expansion of South-South trade in agricultural products).

To explore this possibility further, consider the regional allocation of gains from reform under the comprehensive agricultural reform scenario (Table 8). Under comprehensive reform all developing economies in the region experience positive welfare gains except the Philippines and Bangladesh, where the results remain negative (but small). The results for several countries stand out. Notably, Malaysia, Sri Lanka, Thailand and Korea benefit substantially in proportional terms under this scenario. India also gains substantially in dollar terms, and is a classic case of large

[14] To put the measures in perspective, we have provided EV as a proportion of the initial GDP levels.

allocative efficiency gains being able to outweigh terms of trade losses, much like Korea and Japan. In Bangladesh and the Philippines the efficiency gains are positive, but not enough to outweigh terms of trade loss. Finally, consider Malaysia, a net loser under Doha, but a substantial gainer under comprehensive reform (indeed the largest gainer in proportional terms). Interestingly, much of the gain is from term of trade effects. This unanticipated result suggests that there is scope for market access gains with agricultural reform for Malaysia also, but that the current modalities are not addressing the areas that would benefit Malaysia (suggesting that reform does not go far enough in some niche products in which Malaysia has a strong comparative advantage, and that the opening of Southern as well as Northern markets is particularly crucial for Malaysia).

Overall, the results lead us to two major conclusions. First, the current reform scenario in agriculture is unlikely to generate significant positive (or negative) impacts on most economies in the ESCAP region; the current proposed modalities simply do not go very far in terms of cutting into binding overhang. To the extent that reform does occur, the concerns of developing economies and LDCs over adverse terms of trade movements (both preference erosion and increased food import prices fall into this category) do appear to be justified for most developing economies in the region, although the effects are not large. Moreover, expansion of preferential access for LDCs does not appear to have the potential to ameliorate this effect. The second is the impact of expanded reform and special and differential treatment. Tariffs in many developing economies are quite high, suggesting substantial gains from increased efficiency are possible, gains that could outweigh the small negative effects of reform in some countries. A more comprehensive reform agenda, embracing reform in both developed and developing economies, would result in much larger aggregate gains and a much larger pool of winners.

6.3 Poverty

We now turn away from the aggregate welfare effects and consider the possible effect of the Doha and comprehensive reform scenarios on poverty. Table 9 reviews the poverty statistics in the region. These have been drawn from World Bank (2007), and we have selected the data year that is closest to our base year for each economy. Note that these statistics are only available for developing economies, and Korea does not fit that classification under the World Bank guidelines. The mean income figures are in US dollars, adjusted for purchasing power, and are per month. Several measures are provided. The most basic measure of poverty is the headcount ratio, the proportion of the population that fall below a defined poverty line. Commonly used criterion are the international $1/day standard and the $2/day standard, with the higher standard more widely applied to countries with higher average incomes. The headcount is the actual number of people in that category (in millions).[15] The total number in extreme poverty in the selected economies circa 2001 was approximately 600 million by the $1/day criterion and 1.7 billion by the $2/day criterion, with significant variation across economies and in some case across regions within economies (the headcount ratios are split by rural and urban for two major economies, China and India, with substantially higher levels of poverty in the rural regions in both cases.)[16] Poverty is most severe in Bangladesh, Rural China and India and Indonesia.

[15] See Chen and Ravallion (2004) for more in depth discussion of poverty measures and trends in global poverty.

[16] The 1.7 billion figure is of course likely to be a significant underestimate of poverty in the region because our data only tracks a subset of the economies.

Two other measures are provided in Table 9, both of which attempt to address the issue of poverty depth. The poverty gap measure is the mean distance below the poverty line as a proportion of the poverty line. The squared poverty gap weights individual poverty gaps by the gaps themselves, and provides a measure of inequality among the poor. The areas with the greatest poverty depth are Bangladesh and rural India. Finally, the Gini coefficient is a common measure of overall income inequality, with the greatest levels of inequality in Malaysia, the Philippines, Thailand and Sri Lanka.

How might these patterns change with agricultural reform? As noted above, a single representative household model like GTAP does not generate any direct measures of poverty (hence the use of sub-models in the country studies reviewed above). However, it is possible to gain some insights into the effects that trade reform may have on the poor through aggregate indices. We take an approach similar to that used in Anderson et al. (2006), calculating changes in an index that is likely to be especially relevant to the poorest members of society.

Anderson et al. (2006) argue that the incomes of the poor are dominated by returns to the factor of production that they own in the greatest abundance, their own (unskilled) labor. The most relevant consumption categories for poorer households are primary food products, and textiles. Hence, we can construct an index that measures the proportional change in the wages of unskilled workers, defeated by changes in the price index for those critical commodities. We might term this simple index the `real wage' of the poor. The calculated changes in the index are presented in Table 10. These are percentage changes, taking values between - ∞ and + ∞, with zero indicating no change, and negative values indicating a worsened outlook for groups that rely heavily on the sale of unskilled labor and on the purchase of basic foods/textiles.

The results are mixed under the Doha scenario. In several of the developed economies of the region (Australia, New Zealand), poverty levels decline marginally. In these economies the result is driven by higher wages for unskilled workers in the agricultural sectors. In Japan and Korea, by contrast, the more substantial increase in the index is driven mostly by decreases in primary food prices. Small improvements are also estimated in the South East Asian economies, in particular Thailand. However, in the other economies of South Asia, the index indicates an increase in poverty, although by relatively small magnitudes. Again, this could be countered from the consumer side in some economies by more aggressive liberalization (which would lower food prices and in the long-run have only a moderate effect on unskilled wages). We can see this from the comprehensive reform scenarios, where the simple index indicates an increase in poverty levels only for Sri Lanka in the long-run.

For developing economies in the region, it is possible to convert the index numbers into standard poverty measures using consumption to poverty elasticities.[17] Measures of the latter were obtained from World Bank (2007) estimates, for the headcount ratio and the poverty gap, evaluated using both a $1/day criterion and a $2/day criterion. The use of this approach implies several assumptions, including distribution neutrality of the proposed income change within the target group. Also, as Anderson et al. (2006) note, it is implicitly assumed that the change in unskilled

[17] It is also possible to base the calculations on average changes in real incomes, assuming complete distribution neutrality. Anderson et al. (2006) argue that linking key model variables to the possible change in the average per capita consumption of the poor, as this index attempts to do, better captures from model results some of the distributional aspects of the changes in real income and not simply the average gain.

wages is fully passed through to households and that tariff revenues are replaced only by skilled workers and high-income households. Anderson et al. (2006) argue that this is a realistic assumption in many developing countries. While the calculations are clearly only rough estimates, they do give us some quantitative indication on the likely patterns of poverty change.

The results are presented in Tables 11 (for Doha) and 12 (for comprehensive). Under the $1/day criterion, we estimate a reduction in poverty in the region by 5 million in the short-run and 7 million in the long-run under the Doha reform scenario, rising to 14 and 17 million by the $2/day criterion. The depth of poverty also declines, in some cases markedly (see Thailand). Overall then, we estimate that agricultural trade reform under Doha would have a beneficial if generally mild effect on poverty in the region. Once again, the distribution is not even, however. The majority of the positive impact is in rural China, while rural India experiences a rise in the number of people below the poverty line.[18] Here we note two points of interest. First, an aggregate welfare gain does not necessarily correspond to a reduction in poverty (China is estimated to lose overall under Doha, although by a negligible magnitude, while India is estimated to gain). This is because the poverty index we are using here, following Anderson et al. (2006), uses the real unskilled wage as the base, and this can move in the opposite direction to overall welfare. Second, in some countries poverty rises while aggregate income rises (e.g., India). Since aggregate welfare levels are higher under the reform scenario (see Table 7), it must be feasible to arrange a transfer under which poverty levels in fact decline, if the political will to do so exists. In other words, these calculations are based on an implicit assumption of business as usual in income distribution policy, but ultimately that is a domestic policy choice.

The results for the comprehensive reform scenario indicate a much greater impact on poverty, as we might expect. Under the $1/day criterion, we estimate a reduction in poverty in the region by 48 million in the short-run and 51 million in the long-run under the Doha reform scenario, rising to 60 and 65 million by the $2/day criterion. The long-run results are several orders of magnitude larger than under the Doha scenario. Again, the distribution is uneven, with the majority of poverty reduction in rural China, but the results indicate that in the long-run poverty would fall to some degree under comprehensive agricultural reform in all of the economies for which we are able to undertake the analysis except Sri Lanka. Again, we might note that since Sri Lanka gains overall in this scenario (see Table 8); it should be possible for poverty to be reduced there also, if the political will exists.

It is worth considering whether these aggregate results match with the results generated by the more detailed models, as an indicator of consistency and the extent to which these kinds of estimates are useful. Because the detailed results for India (Gilbert, 2007) were generated using a consistent dataset and experimental design, they provide the most direct comparison. The results of the detailed model indicated positive aggregate welfare gains in all scenarios, with the largest gains in the long-run with comprehensive reform. This is consistent with the GTAP results. At the household level, the results suggested that under Doha there would be a decline in the incomes of the poorest groups, which were a subset of rural households. This is consistent with the marked increase in rural poverty that the aggregate method predicts (Table 11). Moreover, in the long-run with comprehensive reform, the detailed model predicted an increase in the incomes of the poorest groups, and the GTAP model indicates a decline in poverty levels under the same scenario.

[18] Of business as usual in income distribution policy, but ultimately that is a domestic policy choice.

All of the other available studies consider the broad Doha agenda, but nonetheless the results are generally consistent. The results of Annabi et al. (2006) for Bangladesh match the somewhat bleak scenario that our analysis paints for that economy (i.e., falls in aggregate welfare and rises in poverty under all scenarios). The results for the Philippines by Cororaton et al. (2006) also match. The results for Indonesia are consistent in terms of sign but not magnitude with Robilliard and Robinson (2006), with our results indicating much larger poverty impacts. This is likely because of a difference in definition. Robilliard and Robinson (2006) use an official Indonesian poverty line, which is significantly lower than the $2/day criterion, resulting in less scope for poverty reduction. Similarly, the results of Zhai and Hertel (2006) for China also indicate poverty reduction, with the majority occurring in the rural areas. This is consistent with our results, but the magnitude we estimate is larger, in part rejecting lower initial poverty estimates in the Zhai and Hertel (2006) base. Overall, there is a broad consistency between the results, suggesting that the aggregate approach adopted in Anderson et al. (2006) and here at the least provides a useful guideline.

6.4 Adjustment

As noted in the discussion on computable general equilibrium, a comparative static type model does not generate information on the adjustment path to the new equilibrium. Nonetheless, adjustment costs associated with trade reform may be an important, if temporary, poverty component, especially if they tend to be borne by groups known to be at or close to the poverty line. Understanding the likely magnitude of adjustments required may therefore be useful in designing policies to alleviate those costs.

Existing studies have not attempted to address the adjustment cost issue. One way to gain some indirect insights is by considering indices of the magnitude of economic changes within the system. Given our interest in how agricultural trade reforms impact the poor, we consider adjustment of unskilled labor in detail (for reasons similar to those outlined in the preceding section, we may be interested in magnitude of adjustments required by the poorest members of society, which in most cases is the owners of unskilled labor). It is important to note that the indices we consider do not measure of the magnitude of the adjustment costs themselves, but rather tell us indicator which economies are likely to face highly relative adjustment costs, and by whom those costs are likely to be borne.

We calculate two types of index. In the first, labeled `shift' we take the employment share weighted average of the absolute values of the proportional changes in sectoral level employment of unskilled labor. This provides an overall measure of the extent to which unskilled labor is forced to change the sector in which it is employed as a consequence of the trade reform. The index is greater than zero, with numbers close to zero indicating less adjustment, and larger numbers indicating greater adjustment. We calculate the index both for the economies overall and for the agricultural subset.

The second index we have labeled `impact.' This is the production share weighted average of only the negative employment shifts. The rationale for this index is as follows. Suppose that an economy is rocked by some price shock, as a result of trade reform or any other change. The consequence will ultimately be a reallocation of resources, including unskilled labor, as some industries contract and others expand. The worst case adjustment scenario is that industries adversely affected by the shock immediately reduce their employment (an instantaneous impact), while

those positively affected increase their employment only slowly at some point in the future. Therefore, the impact measure can be interpreted as the upper bound (worst case) estimate of the fall in the rate of employment of unskilled labor, prior to any uptake in new sectors. Again, we calculate this statistic for the economy overall, and for unskilled labor in agricultural sectors only.

The results of our analysis are presented in Tables 13 and 14. Under the Doha scenario (Table 13), the results are quite moderate overall, as we might expect given the small changes in the aggregate economic variables, with the largest adjustments and largest potential negative impacts on unskilled labor employment levels in the Philippines and Thailand. The worst case changes are all less than one percent, however, even in the long run.[19]

When we consider just agricultural labor, the results are more significant. This result suggests that the burden of adjustment falls unevenly with unskilled labor employed in agriculture and the food processing industries generally having to shift activities at rates greater than the average shift, and having a greater probability of being temporarily unemployed in the adjustment phase. Hence, for example, unskilled agricultural labor in Malaysia must adjust at nearly 20 times the rate of unskilled labor overall, and is ten times more likely to face temporary unemployment (at worst).

The comprehensive agricultural reform scenario would, not surprisingly, entail much greater adjustment. Our results indicate that the most adversely affected economies would be Republic of Korea, Malaysia, the Philippines, Thailand and Vietnam, where temporary falls in employment of unskilled labor in the region of 1-2 percent are possible, with a disproportionate burden borne by agricultural workers (especially in Malaysia). The effect on agricultural labor in the long-run is marked.[20]

In summary, adjustment costs are temporary, and are part of the price of increased efficiency in the long term. Computable general equilibrium modeling does not address this issue directly. Nonetheless, our simulation results indirectly indicate that moderate sectoral adjustment is likely in agriculture throughout the region under Doha, and that the cost of adjustment are likely to be borne in large part by unskilled agricultural labor. This effect may contribute adversely to poverty during the adjustment phase if other policies are not put in place to address transition problems.

7 Concluding Comments

In this paper we have considered the potential implications of agricultural trade reform under Doha on overall welfare and poverty for economies in the Asia-Pacific region. The approach has been to survey the results of the limited number of detailed country studies, and construct new results based on simulations using the GTAP model. The latter differ from existing work by concentrating on the agricultural reform in the ESCAP region, drawing on the latest proposed modalities and tariff data,

[19] Moderate changes are also observed in New Zealand and Australia, largely rejecting pulling of resources into agriculture. On the other hand in the Republic of Korea and Singapore there are large adjustments rejecting pushing resources out of agriculture. The percentage change for Singapore is large also, but its economic significance must be interpreted in the light of the overall significance of agricultural production for Singapore, which is less than one percent of GDP. Similarly, agricultural output as a proportion of GDP is low in Japan and Korea. In any case, we would suspect that developed economies are better equipped to deal with transitional problems.

[20] This is perhaps a little misleading, since the adjustment period in the long-run is, by definition, longer. That is, we expect that the process of moving capital also takes time, so the `instantaneous' impact on unskilled labor is overstated.

making use of the latest poverty elasticity estimates, and addressing the issue of adjustment costs.

The results suggest that the level of agricultural reform currently being considered under Doha does not make sufficient cuts into the binding overhang to generate large welfare benefits. The very moderate cuts currently being proposed will likely have only a limited impact on developed economies. We do find some evidence to suggest that preference erosion may lower welfare in some economies, as may rising world prices, but again at very low levels given the limited degree of actual liberalization proposed. In aggregate welfare terms, many developed economies would do better by engaging more fully in the liberalization process, since own reform gains are under developing country control and likely to be more substantial than any conceivable benefit from tariff preferences. Most developing countries in the region would be winners in aggregate welfare terms from comprehensive agricultural trade reforms.

In terms of poverty, our aggregate results suggest that agricultural trade reform currently proposed under Doha may indeed hit the poor disproportionately in some countries in the region, by lowering unskilled wages and/or raising the prices of basic foodstuffs. However, the aggregate poverty levels decline by moderate amounts. This result is consistent with the results of the detailed studies available. The effect of comprehensive reform is a much more robust and broad-based decline in poverty levels in the region. The temporary burden of adjustment, however, does tend to be borne inequitably by the owners of unskilled labor, in particular those employed in agricultural activities.

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Table 1: Proposed Agricultural Tariff Cuts Under Doha

Developed Economies		Developing Economies		SVEs	
Tariff Band	Cut	Tariff Band	Cut	Tariff Band	Cut
0-20	48-52%	0-30	32-35%	0-30	22-25%
20-50	55-60%	30-80	37-40%	30-80	27-30%
50-75	62-65%	80-130	41-43%	80-130	31-33%
75-	66-73%	130-	44-49%	130-	34-39%

Source: Committee on Agriculture (2007)

Table 2: Proposed Agricultural Domestic Support Cuts Under Doha

Total Bound AMS		OTDS	
Support Band	Required Cut	Support Band	Required Cut
0-$US15b	70%	0-$US10b	75-85%
15-$US40b	60%	10-$US60b	66-73%
$US40-	45%	$US60b-	50-60%

Source: Committee on Agriculture (2007)

Table 3: Applied Tariff Rates in Agriculture/Food Products (%)

Country/Region	Year	Simple Average	Weighted Average	Standard Deviation	Minimum	Maximum
Agriculture						
Australia	2006	0.3	0.2	1.1	0.0	5.0
Bangladesh	2006	13.3	3.4	10.4	0.0	25.0
Canada	2006	1.0	0.2	6.3	0.0	94.5
Sri Lanka	2006	22.5	17.4	12.8	0.0	75.0
China	2005	10.5	10.4	8.7	0.0	65.0
Hong Kong, China	2006	0.0	0.0	0.0	0.0	0.0
India	2005	27.2	31.0	26.9	0.0	105.0
Indonesia	2006	2.7	1.4	3.0	0.0	20.0
Japan	2006	2.5	2.3	5.8	0.0	40.0
Korea, Rep.	2004	48.3	200.1	123.2	0.0	887.4
Malaysia	2005	1.7	0.5	5.6	0.0	40.0
Mexico	2005	7.4	2.6	11.8	0.0	125.1
New Zealand	2006	0.5	0.0	1.6	0.0	7.0
Philippines	2005	7.0	7.2	9.6	0.0	50.0
Russian Federation	2005	8.2	6.6	4.5	0.0	15.0
Singapore	2005	0.0	0.0	0.0	0.0	0.0
Vietnam	2005	15.5	10.8	15.2	0.0	50.0
Thailand	2005	19.5	11.0	17.5	0.0	60.0
United States	2006	2.2	2.2	43.8	0.0	350.0
European Union	2006	1.7	1.7	3.9	0.0	20.0
All Countries	2006	8.7	10.4	25.4	0.0	887.4
Food Products						
Australia	2006	1.5	1.1	2.2	0.0	5.0
Bangladesh	2006	21.1	11.7	7.4	0.0	25.0
Canada	2006	3.1	1.0	3.9	0.0	26.5
Sri Lanka	2006	23.0	20.6	13.6	0.0	100.0
China	2005	15.4	11.6	9.8	0.0	65.0
Hong Kong, China	2006	0.0	0.0	0.0	0.0	0.0
India	2005	45.6	66.1	50.8	0.0	182.0
Indonesia	2006	11.1	9.2	44.6	0.0	170.0
Japan	2006	9.7	7.8	9.6	0.0	50.0
Korea, Rep.	2004	32.2	29.3	101.5	0.0	800.3
Malaysia	2005	3.9	4.1	6.8	0.0	40.0
Mexico	2005	12.7	4.6	19.4	0.0	254.0
New Zealand	2006	2.5	1.1	2.9	0.0	7.0
Philippines	2005	9.7	7.1	12.2	0.0	65.0
Russian Federation	2005	11.4	11.0	4.6	0.0	20.0
Singapore	2005	0.0	0.0	0.0	0.0	0.0
Vietnam	2005	31.4	27.2	25.6	0.0	100.0
Thailand	2005	20.6	10.1	16.9	0.0	65.0
United States	2006	3.7	1.6	13.6	0.0	350.0
European Union	2006	4.9	4.0	7.4	0.0	74.9
All Countries	2006	14.1	8.1	40.1	0.0	3000.0

Source: WITS

Table 4: Bound Tariff Rates in Agriculture/Food Products (%)

Country/Region	Year	Simple Average	Weighted Average	Standard Deviation	Minimum	Maximum	Binding Coverage
Agriculture							
Australia	2006	1.6	2.5	4.3	0.0	25.0	100.0
Bangladesh	2006	179.5	157.9	56.2	7.5	200.0	94.1
Canada	2006	1.6	1.0	6.9	0.0	94.7	100.0
Sri Lanka	2006	49.4	49.3	4.0	5.0	60.0	95.7
China	2005	12.4	16.0	9.4	0.0	65.0	100.0
Hong Kong, China	2006	0.0	0.0	0.0	0.0	0.0	98.4
India	2005	94.3	87.3	36.6	10.0	150.0	99.6
Indonesia	2006	43.7	33.9	8.9	27.0	160.0	100.0
Japan	2006	3.0	2.5	6.7	0.0	32.0	100.0
Korea, Rep.	2004	52.1	167.3	129.8	0.0	887.4	99.2
Malaysia	2005	7.1	7.7	13.2	0.0	90.0	99.6
Mexico	2005	31.9	33.6	11.1	0.0	45.0	100.0
New Zealand	2006	1.8	0.6	4.4	0.0	26.0	100.0
Philippines	2005	34.6	33.7	14.3	3.0	60.0	97.3
Russian Federation	2005	-	-	-	-	-	0.0
Singapore	2005	9.9	9.6	1.1	0.0	10.0	99.6
Vietnam	2005	-	-	-	-	-	0.0
Thailand	2005	32.9	35.9	24.7	0.0	218.0	98.4
United States	2006	4.8	4.7	49.3	0.0	350.0	100.0
European Union	2006	3.6	4.3	4.9	0.0	20.0	100.0
All Countries	2006	50.5	23.5	47.3	0.0	887.4	77.0
Food Products							
Australia	2006	3.9	5.0	5.4	0.0	29.0	100.0
Bangladesh	2006	188.8	193.0	43.0	20.0	200.0	81.1
Canada	2006	4.7	5.1	16.2	0.0	238.3	100.0
Sri Lanka	2006	49.9	47.8	3.6	5.0	60.0	94.2
China	2005	16.8	12.2	10.5	0.0	65.0	100.0
Hong Kong, China	2006	0.0	0.0	0.0	0.0	0.0	100.0
India	2005	122.7	185.5	59.8	15.0	300.0	86.6
Indonesia	2006	48.7	72.8	28.1	9.0	210.0	100.0
Japan	2006	10.4	10.1	10.0	0.0	61.9	98.7
Korea, Rep.	2004	49.9	37.9	106.9	0.0	800.3	94.2
Malaysia	2005	15.6	13.6	20.7	0.0	168.0	92.7
Mexico	2005	38.4	36.7	7.9	0.0	72.0	100.0
New Zealand	2006	8.1	10.1	8.6	0.0	35.2	100.0
Philippines	2005	37.3	30.9	9.2	5.0	80.0	84.2
Russian Federation	2005	-	-	-	-	-	0.0
Singapore	2005	9.4	8.4	2.4	0.0	10.0	100.0
Vietnam	2005	-	-	-	-	-	0.0
Thailand	2005	31.5	35.6	28.7	0.0	216.0	98.7
United States	2006	7.8	3.8	22.9	0.0	350.0	100.0
European Union	2006	9.9	9.3	8.5	0.0	74.9	100.0
All Countries	2006	56.3	24.4	65.0	0.0	3000.0	73.1

Source: WITS

Table 5: Base Pattern of Trade/Production in Agricultural/Food Products

Country/Region	Imports	Exports	Production	Net Exports	Self Sufficiency
	(US$ millions)				(%)
Agriculture					
Australia	624.0	8340.3	24071.3	7716.3	132.1
New Zealand	279.2	1720.0	7142.8	1440.8	120.2
China	12006.2	7264.8	279963.3	-4741.3	98.3
Hong Kong	2431.0	16.8	2159.2	-2414.3	-11.8
Japan	16194.0	1275.1	71767.8	-14919.0	79.2
Republic of Korea	4958.2	580.0	27153.1	-4378.3	83.9
Indonesia	2310.3	2445.2	21934.9	134.9	100.6
Malaysia	2274.5	1172.9	3544.7	-1101.5	68.9
Philippines	1099.9	783.3	17162.0	-316.6	98.2
Singapore	1536.9	547.8	688.6	-989.2	-43.6
Thailand	1592.7	2921.5	14449.8	1328.7	109.2
Vietnam	333.0	1195.4	6050.4	862.4	114.3
Bangladesh	1019.6	131.1	12534.1	-888.5	92.9
India	2373.5	3209.2	138119.9	835.7	100.6
Sri Lanka	393.9	924.2	4503.3	530.3	111.8
Canada	4855.7	9587.8	25204.9	4732.1	118.8
USA	19235.1	33661.9	206040.3	14426.8	107.0
Mexico	5660.6	4057.2	34785.9	-1603.4	95.4
Russian Federation	3011.4	887.5	29329.7	-2123.9	92.8
South & Central America	8707.7	27588.4	137101.5	18880.7	113.8
European Union	72192.4	44177.8	260956.1	-28014.7	89.3
Rest of World	29914.8	24366.3	417595.9	-5548.5	98.7
Food Products					
Australia	2606.3	10443.5	35301.2	7837.1	122.2
New Zealand	960.1	6595.8	11044.5	5635.7	151.0
China	5971.4	9634.3	170842.9	3662.9	102.1
Hong Kong	4942.6	360.6	4910.5	-4582.0	6.7
Japan	34841.5	2317.5	310018.2	-32524.0	89.5
Republic of Korea	5432.1	2043.5	43101.8	-3388.6	92.1
Indonesia	1828.9	4585.3	33997.3	2756.5	108.1
Malaysia	2869.6	5501.1	9741.8	2631.5	127.0
Philippines	2438.7	1571.5	21119.8	-867.2	95.9
Singapore	3149.7	2333.3	4340.4	-816.4	81.2
Thailand	2925.5	9984.4	23819.8	7058.9	129.6
Vietnam	1227.2	1857.6	5483.4	630.3	111.5
Bangladesh	926.7	322.0	10530.2	-604.7	94.3
India	2297.0	3822.2	50463.1	1525.2	103.0
Sri Lanka	389.1	130.6	1501.2	-258.5	82.8
Canada	9175.7	11264.4	56526.8	2088.7	103.7
USA	35521.7	32550.6	754507.0	-2971.1	99.6
Mexico	5777.7	4202.0	105080.1	-1575.7	98.5
Russian Federation	7899.4	3101.1	31408.7	-4798.3	84.7
South & Central America	13993.5	32680.2	221491.3	18686.6	108.4
European Union	137036.7	137280.4	812591.2	243.7	100.0
Rest of World	44214.1	25797.4	359719.1	-18416.6	94.9

Source: Dimaranan (2006)

Table 6: Sectors and Regions in the GTAP6 Aggregation

Sectors		Regions
Paddy rice	Processed rice	Australia
Wheat	Sugar	New Zealand
Other cereal grains	Other food products	China
Vegetables, fruit, nuts	Beverages & tobacco	Hong Kong
Oil seeds	Textiles	Japan
Sugar cane, beet	Wearing apparel	Republic of Korea
Plant-based fibers	Leather products	Indonesia
Other crops	Wood products	Malaysia
Cattle, sheep & goats, horses	Paper products, publishing	Philippines
Other animal products	Petroleum, coal products	Singapore
Raw milk	Chemical, rubber, plastics	Thailand
Wool, silk-worm cocoons	Other mineral products	Vietnam
Forestry	Ferrous metals	Bangladesh
Fishing	Other metals	India
Coal	Metal products	Sri Lanka
Oil	Motor vehicles & parts	Canada
Gas	Other transport equipment	USA
Other minerals	Electronic equipment	Mexico
Cattle, sheep and goat meat	Other machinery & equipment	Russian Federation
Other meat products	Other manufactures	South & Central America
Vegetable oils and fats	Services	European Union
Dairy products		Rest of World

Table 7: Estimated Aggregate Welfare Effect of Agricultural Reform Under Doha

Region	Short Run				Long Run			
	EV	AE	TOT	%GDP	EV	AE	TOT	%GDP
	(US$ millions)				(US$ millions)			
Australia	856.9	55.1	801.7	0.24	755.2	10.5	744.7	0.21
New Zealand	390.4	-0.1	390.6	0.77	324.6	-12.6	337.1	0.64
China	-477.4	-66.0	-411.4	-0.04	-441.0	-115.3	-325.7	-0.04
Hong Kong	-15.8	-2.4	-13.4	-0.01	-3.7	-0.9	-2.8	0.00
Japan	1514.7	2380.1	-865.5	0.04	2117.2	2907.5	-790.3	0.05
Republic of Korea	818.3	974.1	-155.8	0.19	955.0	1176.2	-221.1	0.22
Indonesia	-64.3	-12.7	-51.5	-0.04	-53.8	-15.4	-38.4	-0.04
Malaysia	-30.0	24.2	-54.2	-0.03	-22.6	18.4	-41.0	-0.03
Philippines	-31.5	4.6	-36.1	-0.04	-38.4	-30.2	-8.2	-0.05
Singapore	-15.7	-2.7	-13.1	-0.02	22.5	3.9	18.7	0.03
Thailand	130.7	53.9	76.8	0.11	156.0	76.1	79.9	0.14
Vietnam	-6.3	-5.0	-1.3	-0.02	-13.3	-9.0	-4.3	-0.04
Bangladesh	-39.9	-6.5	-33.4	-0.09	-27.7	-3.1	-24.6	-0.06
India	66.2	18.0	48.2	0.01	94.6	40.5	54.1	0.02
Sri Lanka	-0.4	4.2	-4.5	0.00	3.9	4.1	-0.2	0.02
Canada	90.0	-127.9	217.9	0.01	70.8	-154.7	225.5	0.01
USA	1213.9	59.0	1154.9	0.01	1483.2	404.7	1078.5	0.01
Mexico	-188.7	179.1	-367.8	-0.03	-143.9	270.3	-414.2	-0.02
Russian Federation	-344.4	-164.1	-180.4	-0.11	-273.5	-178.6	-94.9	-0.09
South & Central America	607.4	29.4	578.0	0.04	465.6	38.9	426.7	0.03
European Union	1716.2	1982.5	-266.3	0.02	1196.6	1662.4	-465.8	0.01
Rest of World	-1617.5	-793.8	-823.7	-0.07	-1415.7	-872.0	-543.6	-0.06

Notes:
EV = Equivalent variation
AE = Allocative efficiency component of EV
TOT = Terms of trade component of EV
%GDP = EV as a percentage of base GDP

Source: GTAP simulations

Table 8: Estimated Aggregate Welfare Effect of Comprehensive Agricultural Reform

Region	Short Run				Long Run			
	EV	AE	TOT	%GDP	EV	AE	TOT	%GDP
	(US$ millions)				(US$ millions)			
Australia	1242.5	114.4	1128.2	0.35	2145.6	84.4	2061.2	0.60
New Zealand	529.8	-4.7	534.5	1.05	506.1	-19.3	525.4	1.00
China	-976.5	-50.1	-926.4	-0.08	-918.6	-188.6	-730.0	-0.08
Hong Kong	164.2	2.3	161.9	0.10	201.3	5.8	195.5	0.12
Japan	8067.9	10887.8	-2819.9	0.19	17614.1	19781.0	-2167.0	0.42
Republic of Korea	1741.1	2512.1	-771.0	0.41	2113.1	3159.5	-1046.4	0.49
Indonesia	101.8	-68.7	170.5	0.07	-25.8	-126.9	101.1	-0.02
Malaysia	1346.4	128.4	1217.9	1.53	830.6	76.4	754.3	0.94
Philippines	-27.9	76.0	-104.0	-0.04	-73.1	50.3	-123.3	-0.10
Singapore	6.1	2.6	3.4	0.01	16.6	8.5	8.1	0.02
Thailand	508.4	236.2	272.1	0.44	415.9	268.4	147.5	0.36
Vietnam	46.9	33.9	13.1	0.14	43.5	39.1	4.3	0.13
Bangladesh	-46.1	32.3	-78.4	-0.10	-19.0	57.7	-76.7	-0.04
India	351.3	1032.5	-681.1	0.07	844.2	1392.2	-548.1	0.18
Sri Lanka	105.5	-3.1	108.6	0.66	116.0	6.6	109.4	0.73
Canada	314.0	489.9	-175.9	0.04	442.3	507.4	-65.1	0.06
USA	2179.0	361.3	1817.7	0.02	2691.6	923.3	1768.3	0.03
Mexico	-177.6	535.3	-712.9	-0.03	-125.6	721.1	-846.7	-0.02
Russian Federation	3.2	298.6	-295.3	0.00	108.7	321.8	-213.1	0.04
South & Central America	578.4	396.8	181.5	0.04	263.2	388.8	-125.6	0.02
European Union	5405.9	3489.1	1916.9	0.07	7587.6	6810.6	777.1	0.09
Rest of World	1886.6	2898.4	-1011.9	0.08	2340.0	2911.3	-571.4	0.09

Notes:
EV = Equivalent variation
AE = Allocative efficiency component of EV
TOT = Terms of trade component of EV
%GDP = EV as a percentage of base GDP

Source: GTAP simulations

Table 9: Indicators of Poverty/Income Inequality for Developing Economies in the ESCAP Region

Region	Data Year	Mean Income ($)	Gini (%)	$1/day Poverty Line				$2/day Poverty Line			
				Headcount Ratio (%)	Headcount (millions)	Poverty Gap (%)	Poverty Gap^2 (%)	Headcount Ratio (%)	Headcount (millions)	Poverty Gap (%)	Poverty Gap^2 (%)
Bangladesh	2000	46.9	33.4	41.3	54.1	10.4	3.5	84.2	110.4	39.1	21.3
China (Rural)	2002	68.7	38.0	22.4	175.0	5.0	1.5	65.1	507.5	25.3	12.5
China (Urban)	2002	219.3	33.5	0.3	1.6	0.1	0.1	3.4	16.8	0.7	0.3
India (Rural)	2000	42.3	28.1	41.8	302.7	10.2	3.4	88.4	640.5	40.8	21.9
India (Urban)	2000	70.5	35.0	19.3	52.9	3.9	1.1	60.5	166.2	22.5	10.6
Indonesia	2002	81.3	34.3	7.8	16.5	1.0	0.2	52.9	112.0	15.9	6.2
Malaysia	1997	321.7	49.2	0.1	0.0	0.0	0.0	8.8	1.9	1.9	0.6
Mexico	2002	204.7	49.7	4.3	4.3	0.9	0.3	21.2	21.2	6.7	2.9
Philippines	2000	110.9	46.1	13.5	10.4	2.4	0.6	44.9	34.4	16.3	7.6
Russian Federation	2001	170.8	39.6	1.8	2.6	0.4	0.1	16.8	24.3	4.4	1.7
Sri Lanka	2002	105.4	40.2	5.8	1.1	0.7	0.1	41.5	7.9	12.1	4.6
Thailand	2002	145.2	42.0	0.9	0.6	0.0	0.0	25.8	16.2	6.2	2.0
Vietnam	2002	114.8	37.6	1.8	1.4	0.1	0.0	33.2	26.7	8.3	2.7

Source: Povcal, World Bank (2007)

Table 10: Estimated Change in Unskilled Wage Deflated by Primary Good Prices (%)

Region	Doha		Comprehensive	
	Short Run	Long Run	Short Run	Long Run
Australia	0.0	0.4	0.4	0.1
New Zealand	0.0	0.4	0.5	1.2
China	2.6	2.9	6.1	6.8
Hong Kong	0.0	0.1	0.5	0.7
Japan	6.8	7.8	13.7	17.0
Republic of Korea	6.7	7.5	21.8	22.6
Indonesia	1.0	1.3	3.6	4.2
Malaysia	0.0	0.2	-0.4	1.8
Philippines	2.2	2.9	7.4	8.5
Singapore	0.4	1.0	1.5	2.3
Thailand	4.7	6.1	11.9	14.2
Vietnam	0.9	1.0	8.7	9.0
Bangladesh	-0.4	-0.3	2.5	2.4
India	-0.9	-0.9	1.6	1.6
Sri Lanka	-0.3	-0.2	-1.7	-1.4
Canada	-0.6	-0.2	2.1	1.5
USA	-0.1	-0.2	0.1	0.0
Mexico	0.8	0.8	2.9	2.3
Russian Federation	-0.4	-0.1	4.7	4.9
South & Central America	0.2	0.5	2.6	2.8
European Union	1.2	1.1	2.6	2.6
Rest of World	0.0	0.2	4.4	4.6

Source: GTAP simulations

Table 11: Change in Indicators of Poverty Under Doha Agricultural Reform

Country	Short Run			Long Run		
	Headcount Ratio (%Δ)	Headcount (Δ millions)	Poverty Gap (%Δ)	Headcount Ratio (%Δ)	Headcount (Δ millions)	Poverty Gap (%Δ)
$1/day Poverty Line						
Bangladesh	0.7	0.4	1.1	0.6	0.3	0.9
China (Rural)	-5.9	-10.3	-9.0	-6.6	-11.5	-10.1
China (Urban)	-6.3	-0.1	-3.5	-7.1	-0.1	-3.9
India (Rural)	1.9	5.9	2.9	2.0	5.9	2.9
India (Urban)	2.4	1.3	3.7	2.4	1.3	3.7
Indonesia	-5.7	-0.9	-7.5	-7.3	-1.2	-9.6
Malaysia	-0.5	0.0	-0.5	-1.8	0.0	-1.7
Mexico	-2.5	-0.1	-3.0	-2.8	-0.1	-3.4
Philippines	-6.2	-0.6	-10.5	-8.1	-0.8	-13.7
Russian Federation	1.9	0.0	1.8	0.3	0.0	0.3
Sri Lanka	1.7	0.0	2.4	1.2	0.0	1.7
Thailand	-73.4	-0.4	-88.9	-95.0	-0.5	-100.0
Vietnam	-11.3	-0.2	-14.8	-12.3	-0.2	-16.1
$2/day Poverty Line						
Bangladesh	0.2	0.2	0.4	0.1	0.1	0.4
China (Rural)	-2.3	-11.8	-4.0	-2.6	-13.2	-4.5
China (Urban)	-10.2	-1.7	-9.1	-11.4	-1.9	-10.1
India (Rural)	0.3	2.2	1.1	0.3	2.2	1.1
India (Urban)	0.9	1.6	1.6	1.0	1.6	1.6
Indonesia	-1.4	-1.6	-2.4	-1.9	-2.1	-3.1
Malaysia	-0.1	0.0	-0.2	-0.4	0.0	-0.6
Mexico	-1.2	-0.3	-1.6	-1.4	-0.3	-1.8
Philippines	-2.5	-0.9	-3.9	-3.3	-1.1	-5.1
Russian Federation	0.9	0.2	1.2	0.1	0.0	0.2
Sri Lanka	0.5	0.0	0.7	0.3	0.0	0.5
Thailand	-9.3	-1.5	-14.8	-12.0	-1.9	-19.1
Vietnam	-1.7	-0.5	-2.8	-1.9	-0.5	-3.0

Source: GTAP simulations and calculations from Povcal, World Bank (2007)

Table 12: Change in Indicators of Poverty Under Comprehensive Agricultural Reform

Country	Short Run				Long Run		
	Headcount Ratio (%Δ)	Headcount (Δ millions)	Poverty Gap (%Δ)		Headcount Ratio (%Δ)	Headcount (Δ millions)	Poverty Gap (%Δ)
$1/day Poverty Line							
Bangladesh	-4.5	-2.5	-7.3	-4.5	-2.4	-7.3	
China (Rural)	-14.1	-24.7	-21.7	-15.6	-27.3	-23.9	
China (Urban)	-15.3	-0.2	-8.5	-16.9	-0.3	-9.3	
India (Rural)	-3.4	-10.2	-5.1	-3.3	-10.0	-4.9	
India (Urban)	-4.1	-2.2	-6.4	-4.0	-2.1	-6.3	
Indonesia	-19.4	-3.2	-25.6	-22.8	-3.8	-30.0	
Malaysia	4.3	0.0	4.1	-20.0	0.0	-19.2	
Mexico	-9.6	-0.4	-11.4	-7.6	-0.3	-9.0	
Philippines	-20.5	-2.1	-34.9	-23.4	-2.4	-39.9	
Russian Federation	-20.5	-0.5	-19.2	-21.0	-0.5	-19.7	
Sri Lanka	9.6	0.1	13.1	7.7	0.1	10.6	
Thailand	-100.0	-0.6	-100.0	-100.0	-0.6	-100.0	
Vietnam	-100.0	-1.4	-100.0	-100.0	-1.4	-100.0	
$2/day Poverty Line							
Bangladesh	-1.1	-1.2	-2.8	-1.1	-1.2	-2.8	
China (Rural)	-5.6	-28.4	-9.6	-6.2	-31.3	-10.6	
China (Urban)	-24.5	-4.1	-21.8	-27.1	-4.5	-24.0	
India (Rural)	-0.6	-3.8	-1.9	-0.6	-3.7	-1.8	
India (Urban)	-1.7	-2.7	-2.8	-1.6	-2.7	-2.7	
Indonesia	-4.9	-5.5	-8.2	-5.8	-6.5	-9.7	
Malaysia	1.0	0.0	1.5	-4.6	-0.1	-6.8	
Mexico	-4.6	-1.0	-6.2	-3.7	-0.8	-4.9	
Philippines	-8.3	-2.9	-13.0	-9.5	-3.3	-14.9	
Russian Federation	-10.2	-2.5	-13.3	-10.5	-2.6	-13.6	
Sri Lanka	2.5	0.2	4.1	2.0	0.2	3.3	
Thailand	-23.4	-3.8	-37.4	-27.9	-4.5	-44.5	
Vietnam	-16.3	-4.3	-26.3	-16.9	-4.5	-27.2	

Source: GTAP simulations and calculations from Povcal, World Bank (2007)

Table 13: Estimated Employment Adjustment Indices with Doha Agricultural Reform

Region	Short Run				Long Run			
	Overall		Agriculture		Overall		Agriculture	
	Shift	Impact	Shift	Impact	Shift	Impact	Shift	Impact
Australia	0.9	-0.4	5.3	-0.7	1.2	-0.6	7.7	-1.5
New Zealand	2.0	-1.0	5.6	-0.6	3.0	-1.5	9.1	-1.6
China	0.6	-0.3	1.3	-0.0	0.6	-0.3	1.2	-0.0
Hong Kong	0.1	-0.1	1.8	-0.5	0.1	-0.0	1.2	-0.3
Japan	0.3	-0.2	3.8	-0.3	0.2	-0.1	2.5	-0.4
Republic of Korea	0.7	-0.4	6.7	-1.3	0.5	-0.3	4.8	-1.2
Indonesia	0.5	-0.3	1.0	-0.0	0.5	-0.2	0.8	-0.0
Malaysia	0.1	-0.1	1.9	-1.0	0.1	-0.1	1.7	-0.9
Philippines	1.4	-0.7	1.5	-0.0	1.4	-0.7	1.5	-0.0
Singapore	0.2	-0.1	7.1	-2.7	0.2	-0.1	6.9	-2.3
Thailand	1.1	-0.5	2.6	-0.2	1.0	-0.5	2.7	-0.6
Vietnam	0.4	-0.2	1.2	-0.0	0.4	-0.2	1.2	-0.1
Bangladesh	0.2	-0.1	0.5	-0.1	0.1	-0.1	0.4	-0.0
India	0.2	-0.1	0.4	-0.3	0.2	-0.1	0.4	-0.3
Sri Lanka	0.1	-0.0	0.2	-0.0	0.1	-0.0	0.3	-0.1
Canada	0.2	-0.1	1.9	-0.3	0.2	-0.1	2.3	-0.7
USA	0.0	-0.0	0.8	-0.6	0.1	-0.0	1.1	-0.9
Mexico	0.4	-0.2	1.9	-0.7	0.3	-0.2	1.6	-0.7
Russian Federation	0.4	-0.2	1.9	-0.1	0.4	-0.2	1.7	-0.1
South & Central America	0.3	-0.2	1.2	-0.1	0.4	-0.2	1.8	-0.3
European Union	0.3	-0.1	2.2	-1.9	0.2	-0.1	2.0	-1.7
Rest of World	0.3	-0.2	0.9	-0.1	0.3	-0.2	0.9	-0.0

Notes:

Shift = Weighted average percentage change in employment by sector

Impact = Instantaneous fall in employment rate

Source: GTAP simulations

Table 14: Estimated Employment Adjustment Indices with Comprehensive Agricultural Reform

Region	Short Run				Long Run			
	Overall		Agriculture		Overall		Agriculture	
	Shift	Impact	Shift	Impact	Shift	Impact	Shift	Impact
Australia	1.2	-0.6	8.7	-2.5	3.4	-1.7	26.8	-8.9
New Zealand	3.0	-1.5	8.6	-1.0	4.4	-2.2	13.5	-2.3
China	1.2	-0.6	2.5	-0.0	1.2	-0.6	2.5	-0.0
Hong Kong	0.1	-0.0	2.2	-0.9	0.1	-0.0	1.9	-0.8
Japan	0.6	-0.3	11.4	-5.8	1.0	-0.5	16.5	-13.2
Republic of Korea	1.9	-1.0	21.9	-8.3	1.8	-0.9	16.8	-7.9
Indonesia	1.9	-0.9	4.1	-0.6	2.1	-1.0	4.5	-0.7
Malaysia	2.9	-1.5	37.0	-10.2	4.1	-2.0	52.1	-13.9
Philippines	3.2	-1.6	4.9	-1.4	3.1	-1.6	4.8	-1.4
Singapore	0.3	-0.1	8.6	-3.1	0.3	-0.2	8.7	-2.9
Thailand	4.5	-2.2	13.7	-3.9	4.5	-2.2	15.3	-5.5
Vietnam	2.3	-1.1	9.7	-4.1	2.4	-1.2	10.0	-4.1
Bangladesh	1.0	-0.5	3.4	-1.9	1.2	-0.6	3.6	-1.9
India	1.4	-0.7	2.6	-2.2	1.5	-0.7	2.6	-2.3
Sri Lanka	1.4	-0.7	3.2	-0.4	1.9	-1.0	4.0	-0.3
Canada	0.2	-0.1	2.8	-2.4	0.3	-0.2	4.6	-3.4
USA	0.1	-0.1	1.4	-1.4	0.1	-0.1	1.8	-1.8
Mexico	1.0	-0.5	5.2	-2.7	0.8	-0.4	4.2	-2.2
Russian Federation	0.6	-0.3	4.3	-2.5	0.6	-0.3	3.9	-2.5
South & Central America	0.4	-0.2	2.2	-0.5	0.6	-0.3	2.7	-0.5
European Union	0.4	-0.2	4.4	-2.5	0.4	-0.2	4.1	-2.7
Rest of World	0.7	-0.4	2.7	-0.8	0.7	-0.4	2.4	-0.5

Notes:

Shift = Weighted average percentage change in employment by sector

Impact = Instantaneous fall in employment rate

Source: GTAP simulations

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