Global Integration of Agricultural Markets: Implications for Asia-Pacific Countries

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Abstract

Farm incomes in Australia and many developing countries have been depressed by an anti-agricultural bias in own-country policies as well as by governments of other countries favouring their farmers with import barriers and subsidies. Both sets of price-distorting policies reduce national and global economic growth. They also add to inequality and poverty in developing countries, since most of the world's billion poorest people depend directly or indirectly on farming for their livelihood. Over the past two decades, governments in Australia, New Zealand and numerous developing countries reduced their sectoral and trade policy distortions, while some high-income countries also have begun reforming their agricultural protectionist policies. Drawing on results from a large multi-country research project, this paper summarizes new empirical estimates of the extent of those policy changes and of the trade, welfare, inequality and poverty consequences of remaining distortions to world markets for countries of the Asia-Pacific region. It concludes by discussing prospects for further reforms.

Keywords: Distorted incentives, agricultural and trade policy reforms, Asia-Pacific region

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Agricultural protection and subsidies in high-income (and some middle-income) countries have been depressing international prices of farm products for many decades. This has been lowering the earnings of farmers and associated rural businesses in developing countries and food-exporting countries such as Australia and New Zealand, and may have added to global inequality and poverty because three-quarters of the world's poorest people depend directly or indirectly on agriculture for their main income (World Bank 2007). In addition to that external policy influence on rural poverty, however, the governments of many developing countries have directly taxed their farmers over the past half-century (Johnson 1973). At the same time, many developing countries chose also to pursue an import-substituting industrialization strategy, predominantly by restricting imports of manufactures (as was also the case in Australia and New Zealand up to the 1980s), and to overvalue their currency. Together those measures indirectly taxed producers of other tradable products in developing economies, by far the most numerous of them being farmers (Krueger, Schiff and Valdés 1988, 1991). As a result there has been over-production of farm products in high-income countries and under-production in more-needy developing countries. It also means there has been less international trade in farm products than would be the case under free trade, thereby thinning markets for these weather-dependent products and thus making them more volatile. Using a stochastic model of world food markets, Tyers and Anderson (1992, Table 6.14) found that instability of international food prices in the early 1980s was three times greater than it would have been under free trade in those products.

Numerous countries have begun to reform their agricultural price and trade policies during the past quarter century, however. To get a sense of how much that has reduced the distortions to global markets for farm products, a recent World Bank research project examined policies affecting agricultural price incentives since 1955 in 75 countries that

together account for 92 percent of the world's population and agricultural GDP and close to 98 percent for the Asia-Pacific region. This paper summarizes some results from that project. They include estimates of the nominal rates of assistance (NRAs) for more than 70 different farm products (an average of almost a dozen per country so as to cover more than two-thirds of the gross value of national farm production). Having such a comprehensive coverage of countries, products and years offers the prospect of obtaining a reliable picture of long-term trends in price-distorting policies as well as annual fluctuations around those trends for all the key regions of the world.

The paper begins with a summary of the methodology used to generate annual indicators of the extent of government interventions in markets, details of which are provided in Anderson et al. (2008). The NRA and related indicators are then summarized across regions and over the half-decades since the mid-1950s. Results from a global economy-wide model provide quantification of the impacts on global agricultural trade and economic welfare of the reforms since the early 1980s and of the policies still in place as of 2004. New estimates of the impacts of 2004 policies on income inequality and poverty for Asian and other developing countries are summarized as well. The paper concludes by discussing prospects for further reform.

The extent of price distortions: methodology

Government-imposed distortions can create a gap between domestic prices and what they would be under free markets. The Nominal Rate of Assistance (NRA) for each farm product is computed as the percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention (or lowered them, if NRA<0). A weighted average NRA for all covered products is derived using the value of production at undistorted prices as weights (unlike the producer and consumer support estimates (PSEs and CSEs) computed by OECD (2008), which are expressed as a percentage of the distorted price). To that NRA for covered products is added a 'guesstimate' of the NRA for non-covered products (on average around 30 percent of the total value of farm production) and an estimate of the NRA from non-product-specific forms of assistance or taxation. Since the 1980s governments of some high-income countries have also provided so-called 'decoupled' assistance to farmers but, because that support in principle does not distort

resource allocation, its NRA has been computed separately and is not included for direct comparison with the NRAs for other sectors or for developing countries. Each farm industry is classified either as import-competing, or a producer of exportables, or as producing a nontradable (with its status sometimes changing over the years), so as to generate for each year the weighted average NRAs for the two different groups of covered tradable farm products.

Also computed is a production-weighted average NRA for nonagricultural tradables, for comparison with that for agricultural tradables via the calculation of a percentage Relative Rate of Assistance (RRA), defined as:

$$RRA = 100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$$

where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of the agricultural (including non-covered) and non-agricultural sectors, respectively.[1] Since the NRA cannot be less than -100 percent if producers are to earn anything, neither can the RRA (since the weighted average $NRAnonag^t$ is non-negative in all our country case studies). And if both of those sectors are equally assisted, the RRA is zero. This measure is useful in that if it is below (above) zero, it provides an internationally comparable indication of the extent to which a country's sectoral policy regime has an anti- (pro-)agricultural bias.

The extent to which consumers are taxed or subsidized is also considered. To do so, a Consumer Tax Equivalent (CTE) is calculated by comparing the price that consumers pay for their food and the international price of each food product at the border. Differences between the NRA and the CTE arise from distortions in the domestic economy that are caused by transfer policies and taxes/subsidies that cause the prices paid by consumers (adjusted to the farmgate level) to differ from those received by producers. In the absence of any other information, the CTE for each tradable farm product is assumed to be the same as the NRA from border distortions.

The cost of government policy distortions to incentives in terms of resource misallocation tend to be greater the greater the degree of substitution in production. In the case of agriculture which involves the use of farm land that is sector-specific but transferable among farm activities, the greater the variation of NRAs across industries within the sector then the higher will be the welfare cost of those market interventions. A simple indicator of

[1] Farmers are affected not just by prices of their own products but also by the incentives nonagricultural producers face. That is, it is *relative* prices and hence *relative* rates of government assistance that affect producer incentives. More than seventy years ago Lerner (1936) provided his Symmetry Theorem that proved that in a two-sector economy, an import tax has the same effect as an export tax. This carries over to a model that also includes a third sector producing only nontradables.

dispersion is the standard deviation of the covered industries' NRAs. However, it is helpful to have a single indicator of the overall welfare effect of each country's regime of agricultural price distortions in place at any time, and to trace its path over time and make cross-country comparisons. To that end, the family of indexes first developed by Anderson and Neary (2005), under the catch-all name of trade restrictiveness indexes, are drawn upon.

To generate indicators of distortions imposed by each country's border and domestic agricultural policies on its economic welfare and its agricultural trade volume, Lloyd, Croser and Anderson (2009) define a Welfare Reduction Index (WRI) and a Trade Reduction Index (TRI) and estimate them for the same focus countries, taking into account that for some covered products the NRA and CTE differ (because there are domestic measures in place in addition to or instead of trade measures). As their names suggest, these two new indexes respectively each capture in a single indicator the direct welfare- or trade-reducing effects of distortions to consumer and producer prices of covered farm products from all agricultural and food price and trade policy measures in place (while ignoring non-covered farm products and indirect effects of sectoral and trade policy measures directed at non-agricultural sectors). Specifically, the TRI (or WRI) is that ad valorem trade tax rate which, if applied uniformly to all farm commodities in a country that year would generate the same reduction in trade (or economic welfare) as the actual cross-commodity structure of agricultural NRAs and CTEs for that country, other things equal.

The WRI measure reflects the partial equilibrium welfare cost of agricultural price-distorting policies better than the NRA because it recognizes that the welfare cost of a government-imposed price distortion is related to the square of the price wedge. It thus captures the disproportionately higher welfare costs of peak levels of assistance or taxation, and is larger than the mean NRA/CTE and is positive regardless of whether the government's agricultural policy is favoring or hurting farmers. In this way the WRI and TRI go somewhat closer to what a computable general equilibrium (CGE) can provide in the way of estimates of the trade and welfare (and other) effects of the price distortions captured by the product NRA and CTE estimates: while not capturing the indirect distortions from other sectors as the RRA does, these indexes have the advantage over a CGE model of providing an annual time series and not requiring a formal model.

Estimates of the changing extent of agricultural price distortions

This section first presents aggregate results for the world as a whole, and then provides more details of the results for the Asia-Pacific region in particular, where the evolution of price distortions have been more dramatic than in any other region.

The global picture

The global summary of the new results from the World Bank project is provided in Figure 1. It reveals that the nominal rate of assistance to farmers in high-income countries rose steadily from the mid-1950s until the end of the 1980s, apart from a small dip when international food prices spiked around 1973-74. After peaking at more than 50 per cent in the mid-1980s, that average NRA for high-income countries has fallen a little, depending on the extent to which one believes that some new farm programs are 'decoupled' in the sense of no longer influencing production decisions (see dashed line in Figure 1). For developing countries, too, the average NRA for agriculture has been rising, but from a level of around −25 per cent during the period from the mid-1950s to the early 1980s to nearly 10 per cent in the first half of the present decade.

The average NRA for developing countries conceals the fact that the exporting and import-competing subsectors of agriculture have very different NRAs. Figure 2 reveals that while the average NRA for exporters has been negative throughout (going from −20 per cent to −30 per cent before coming back up to almost zero in 2000-04), the NRA for import-competing farmers in developing countries has fluctuated between 20 and 30 per cent (and even reached 40 per cent in the years of low prices in the mid-1980s). Having increased in the 1960s and 1970s, the anti-trade bias within agriculture (the taxing of both exports and imports of farm products) for developing countries has diminished since the mid-1980s, but the NRA gap between the import-competing and export subsectors still averages around 20 percentage points.

Figure 2 also reveals that the NRA for import-competing farmers in developing countries has increased at virtually the same pace as that in high-income countries. This suggests that growth in agricultural protection from import competition is something that begins at low levels of per capita income rather than being a phenomenon exclusive to high-income countries.

The improvement in farmers' incentives in developing countries is understated by the above NRA estimates, because those countries have also reduced their assistance to

producers of non-agricultural tradable goods, most notably manufactures. The decline in the weighted average NRA for the latter, depicted in Figure 3, was clearly much greater than the increase in the average NRA for tradable agricultural sectors for the period to the mid-1980s, consistent with the finding two decades ago of Krueger, Schiff and Valdés (1988, 1991). For the period since the mid-1980s, changes in the NRAs of both sectors have contributed almost equally to the improvement in incentives to farmers. The RRA, defined in the previous section, provides a useful indicator of relative price change: the RRA for developing countries as a group went from −46 per cent in the second half of the 1970s to 1 per cent in the first half of the present decade. This increase (from a coefficient of 0.54 to 1.01) is equivalent to an almost doubling in the relative price of farm products, which is a huge change in the fortunes of developing country farmers in just a generation. This is mostly because of the changes in Asia, but even for Latin America this relative price hike is one-half, while for Africa this indicator improves by only one-eighth. As for high-income countries, assistance to manufacturing was on average much less than assistance to farmers, even in the 1950s, and its decline since then has had only a minor impact on that group's average RRA (Figure 3).[2]

Turning to the single indicators of the impact of agricultural distortions on national economic welfare and trade volume, Lloyd, Croser and Anderson (2009) estimate their TRI and WRI for the 75 countries in the above-mentioned World Bank study. The TRI estimates indicate that the trade-reducing impact of agricultural policies for developing countries as a group was roughly constant until the early 1990s and thereafter it declined, while for high-income countries the decline in TRI began a few years later (Figure 4(a)). The TRI for developing countries is driven by the exportables subsector which was being taxed until recently and the import-competing subsector which was, and is increasingly, being protected (albeit less than in high-income countries – see Figure 2 above). For high-income countries, policies have supported both exporting and import-competing agricultural products and, even though they strongly favour the latter, the assistance to exporters has offset somewhat the anti-trade bias from the protection of import-competing producers.

The WRI estimates, shown in Figure 4(b), indicate a steady rise from the 1960s to the 1980s for agricultural policies, but some decline in the 1990s. This reflects the fact that NRAs for high-income and developing countries diverged (in opposite directions) away from

[2] Australia and New Zealand were clear exceptions, where manufacturing protection had been very high and its decline occurred several decades later than in other high-income countries (Anderson, Lloyd and MacLaren 2007).

zero in the first half of the period under study and then converged toward zero in the most recent quarter-century. That meant that their weighted average NRA traces out a fairly flat trend whereas the WRI traces out a hill-shaped path and thus provides a less misleading indicator of the trend in resource misallocation in world agricultural markets.

The Asia-Pacific region[3]

From the mid-1950s to the early 1980s, agricultural price and trade policies reduced earnings of farmers in developing Asia on average by more than 20 percent; but that implicit taxation declined from the early 1980s and, from the mid-1990s, the NRA switched sign and became increasingly positive. That average hides considerable diversity within the Asia-Pacific region, however. Nominal assistance to farmers in Korea and Taiwan was positive from the early 1960s (although very small initially when compared with the 40+ percent in Japan), Indonesia had some years in the 1970s and 1980s when its NRA was a little above zero (as did Pakistan prior to Bangladesh becoming an independent country in 1971), and India's and the Philippines' average NRAs became positive from the 1980s. In Australia (and to a lesser extent New Zealand) the NRA for agriculture has been positive but the NRA for non-farm tradables has almost always been greater than the agricultural NRA so that the RRA has been mostly negative – but policy reforms of the past quarter century have brought the RRA to almost zero (Table 1).[4]

The rising trend is present for the vast majority of the individual commodity NRAs for Asia too, with meat and milk the only products to have seen their assistance rates cut over that period. As is true for other regions of the world, assistance is among the highest for the 'rice pudding' products of sugar, milk and rice (Table 2). But even for those three products there is a great diversity across countries in their NRAs, with 5-year averages ranging from almost zero to as much as 400 percent for rice and 140 percent for milk in Korea, and to 230 percent for sugar in Bangladesh. There is a great deal of NRA diversity also across commodities within each Asian economy's farm sector, and the extent (as measured by the standard deviation) has grown rather that diminished over the past five decades, from a regional average of less than 40 percent in the early years under study to more than 55 percent in recent years. This suggests there is still much that could be gained from improved

[3] This section draws on and is further elaborated in Anderson (2009).

[4] Note that it has been assumed that NRA estimates for China pre-1981 and India pre-1965 are the same as the average NRA estimates for those economies for 1981-84 and 1965-69, respectively, and that the gross value of production in those missing years is that which gives the same average share of value of production in total world production in 1981-84 and 1965-69, respectively. This NRA assumption is conservative in the sense that for both countries the average NRA was probably even lower (more negative) in earlier years.

resource reallocation both between Asian economies and within the agricultural sector of individual Asian economies, were differences in rates of assistance to be reduced.

That possibility of trade and welfare gains from further reform is underscored by the estimates of WRIs and TRIs for Asia-Pacific countries, which are reported in Tables 3 and 4. For Japan and Korea, their TRIs are very similar to their high NRAs (c.f. Table 1), since all major farm products are importable and most are highly protected. Taiwan's TRI until recently was negative, reflecting the fact that its rice producers were assisted even when the island was a significant exporter. China's TRI was always positive and quite high in the 1980s and 1990s, because of the strong implicit taxes on both exports and imports of farm products. India's TRI was even higher, peaking in the latter 1980s and still high compared with China's and those for other South Asian countries. The TRIs for Southeast Asia are generally smaller, but vary considerably across countries and over time. The TRIs for Australia and New Zealand also are small, and, as for Taiwan, are often negative because some export industries are among those assisted.

The WRIs are necessarily positive and generally much higher than the NRAs. For China and India they have become considerably smaller over the past two decades, but they have declined little in such countries as Indonesia, the Philippines and Sri Lanka (Table 4), reflecting the fact that a wide range of NRAs still prevail in those countries. The WRI is now lowest for the food-exporting countries of Australia, New Zealand and Thailand, together with China.

Compared with their peaks in the 1980s, the TRI and WRI have fallen by four-fifths and two-thirds, respectively, for Asian developing countries, as compared with falls of a little less that two-thirds for all developing countries.

The anti-agricultural policy biases of the past were due not just to agricultural policies. Also important to changes in incentives affecting inter-sectorally mobile resources have been the significant reductions in border protection to the manufacturing sector (which has been the dominant intervention in the tradables part of non-agricultural sectors). That reduction in assistance to producers of non-farm tradables has been even more responsible for the improvement in farmer incentives than the reduction in direct taxation of agricultural industries. For Asia as a whole, the average NRA estimates for non-farm tradables declined steadily throughout the past four or five decades as policy reforms spread. This contributed to a decline in the estimated negative relative rate of assistance for farmers: the weighted average RRA was worse than -50 percent up to the early 1970s, but it improved to an average of -32 percent in the 1980s, -9 percent in the 1990s and is now positive, averaging 7 percent

in 2000-04. For Australia and New Zealand in recent years the RRA has hovered between + and -1 percent (Table 1).

Of the striking changes in RRAs shown for individual economies over the past two decades, it is the move from negative to positive RRAs for China and India that matter most for the region – and indeed for the world. The extent of the decline in the non-agricultural NRA since the early 1980s is very similar for those two key countries, but the agricultural NRA has differed: in China the 5-year averages have risen steadily from -45 percent to 6 percent, whereas in India it has been close to zero except for a spike upward when international food prices collapsed in the mid-1980s, and for a rise in the present decade. This dramatic rise in the RRA for the world's two most populous countries is of great significance to the current analyses of the causes of the international food price rises of the present decade. One of the contributors is said to be the growing appetite for food imports by these two countries as they industrialize and their per capita incomes rise. Yet both countries have remained very close to self sufficient in agricultural products over the past four decades. Undoubtedly the steady rise in their RRAs has contributed to that outcome (Anderson and Martin 2009, Tables 1.9 and 1.10). It may also have helped ensure that the trend in China's ratio of urban to rural mean incomes (adjusted for cost of living differences) has been flat since 1980 (Ravallion and Chen 2007, Figure 3), and that the Gini coefficient for India has hardly changed between 1984 and 2004 (World Bank 2008). A major question, to which we return at the end of the paper, is: will their RRAs remain at their current neutral level of close to zero, or will they continue to rise in the same way as observed in Korea and Taiwan and, before them, in Japan and Western Europe?

To summarize, one of the most salient features of price and trade policies in the Asia-Pacific region region since the 1960s is the spate of major economic reforms, including significant trade liberalization. Overall levels of non-agricultural protection have declined considerably, which has improved the competitiveness of the agricultural sector in many Asian economies but especially in China and India. Two other salient features have been the gradual policy movement away from taxing agricultural exportables, but at the same time – and in contrast to non-agriculture – a rise in agricultural import protection. The latter means there is still scope for reducing distortions in resource use within agriculture even in countries with an average NRA for agriculture, and an RRA, close to zero. In particular, an anti-trade bias in assistance rates within the farm sector remains in place. This may be understandable from a political economy viewpoint (see, e.g., Krueger 1990), but it nonetheless means that resources continue to be allocated inefficiently within the farm sector and, since openness

tends to promote economic growth, that total factor productivity growth in agriculture is slower than it would be if remaining interventions were removed.

Effects of past reforms and of remaining policies: results from economy-wide modelling

It is clear from the above that there has been considerable reform over the past quarter of a century of policy distortions to agricultural incentives throughout the world: the anti-agricultural and anti-trade biases of the policies of many developing countries have been reduced, and the export subsidies of high-income countries have been cut. As well, there has been some re-instrumentation toward less inefficient and less trade-distorting forms of support, particularly in Western Europe (see the dashed line in Figure 1). However, protection from agricultural import competition has continued to show an upward trend in both rich and poor countries (Figure 2), notwithstanding the Uruguay Round Agreement on Agriculture that aimed to bind and reduce farm tariffs.

What have been the net economic effects of agricultural price and trade policy changes around the world since the early 1980s? And how do those effects on global markets, farm incomes and economic welfare compare with the effects of policy distortions that were still in place as of 2004? Valenzuela, van der Mensbrugghe and Anderson (2009) use a global economy-wide model known as Linkage (van der Mensbrugghe 2005) to provide a combined retrospective and prospective analysis that sought to assess how far the world had come, and how far it still has to go, in rectifying the disarray in world agriculture. It quantifies the impacts both of past reforms and current policies by comparing the effects of the recent World Bank project's distortion estimates for the period 1980-84 with those of 2004.[5]

Several key findings from that economy-wide modelling study are worth emphasizing. First, the policy reforms from the early 1980s to the mid-2000s improved global economic welfare by US$233 billion per year, and removing the distortions that remained in 2004 would add another US$168 billion per year (in 2004 US dollars). This suggests that in terms of global welfare the world moved three-fifths of the way towards global free trade in goods over that quarter century. A similar result applies to Asian developing countries: a gain of $72 billion from reforms since the early 1980s, compared with a prospective gain of $29.7 billion from freeing the policies in place as of 2004.

[5] While international food prices in mid-2008 were well above those of 2004, the slump in these prices over the second half of 2008 suggests that prices in 2009 may not be so different from those of 2004, and in any case the Doha round negotiations have been using such a historical period against which to draw up reform proposals.

Second, developing economies benefited proportionately more than high-income economies (1.0 per cent compared with 0.7 per cent of national income) from those past policy reforms, and would gain nearly twice as much as high-income countries if all countries were to complete that reform process (an average increase of 0.9 per cent, compared with 0.5 per cent for high-income countries). Of those prospective welfare gains from global liberalization, 60 per cent would come from agriculture and food policy reform. This is a striking result given that the shares of agriculture and food in global GDP and global trade are only 3 and 6 per cent, respectively. The contribution of farm and food policy reform to the prospective welfare gain for developing countries alone is even greater, at 83 per cent.

Third, the share of global farm production exported (excluding intra-European Union (EU) trade) in 2004 has been slightly smaller as a result of those reforms since 1980-84, because of less farm export subsidies. The 8 per cent share for agriculture in 2004 contrasts with the 31 per cent share for other primary products and the 25 per cent for all other goods – a 'thinness' that is an important contributor to the volatility of international prices for weather-dependent farm products. If the policies distorting goods trade in 2004 were removed, the share of global production of farm products that is exported would rise from 8 to 13 per cent, thereby reducing instability of prices and reducing the quantities of those products traded.

Fourth, the developing countries' share of the world's primary agricultural exports rose from 43 to 55 per cent, and its share of global farm output from 58 to 62 per cent, because of the reforms since the early 1980s, with rises in output of nearly all agricultural industries except rice and sugar. Removing the remaining goods market distortions would boost their export and output shares even further, to 64 and 65 per cent, respectively.

Fifth, the average real price for agricultural and food products in international markets would have been 13 per cent lower had policies not changed over the past quarter century. Evidently the impact of the fall in RRA in high-income countries (including the cuts in farm export subsidies) in raising international food prices more than offset the opposite impact of the RRA rise (including the cuts in agricultural export taxes) in developing countries over that period. By contrast, removing the remaining distortions as of 2004 is projected to raise the international price of agricultural and food products by less than 1 per cent on average. This is in contrast to earlier modelling results based on the Global Trade Analysis Project (GTAP) protection database. (For example, Anderson, Martin and van der Mensbrugghe (2006) estimated that they would rise by 3.1 per cent or, for primary agriculture alone, by 5.5 per cent). The smaller impact seen in these new results is because export taxes in developing

countries, based on the above NRA estimates for 2004, are included in the new database (most notably for Argentina) and their removal would heavily offset the international price-raising effect of eliminating import protection and farm subsidies elsewhere.

Sixth, for developing countries as a group, net farm income (value added in agriculture) is estimated to be 4.9 per cent higher than it would have been without the reforms of the past quarter century, which is more than ten times the proportional gain in non-agricultural value added. The net farm income gain just for Asia's developing countries would be even higher, at 6.4 percent. If the price and trade policies remaining in 2004 were removed, net farm incomes in developing countries would rise a further 5.6 per cent, compared with just 1.9 per cent for non-agricultural value added. In addition, unskilled workers in developing countries – the majority of whom work on farms – would see their returns rise more than returns on other productive factors from that liberalisation.

Together, these findings suggest that international inequality and global poverty could be alleviated by further reform, given that three-quarters of the world's poor are farmers in developing countries. But to examine that issue more carefully, the World Bank research project undertook some economy-wide studies using global and national models with detailed household information (Anderson, Cockburn and Martin 2010), results from which are summarized in the next section.

Estimates of inequality and poverty effects of further reforms

At the outset it should be made clear that agricultural and trade policies are far from the first-best policy instruments for achieving national poverty or income distribution objectives: that is the prerogative of domestic social welfare and income tax policy measures. However, if empirical studies reveal that national trade-related policies are worsening particular countries' poverty or inequality, they provide yet another reason – on top of the usual national gains-from-trade reason – for those countries to reform their policies unilaterally. Should the inequality and poverty alleviating effects of national trade-related policy reforms be contingent on the rest of the world also reforming, that provides a further reason for that country to participate actively in promoting multilateral trade negotiations under the World Trade Organization (WTO). And should global modeling studies reveal that multilateral trade reform would alleviate global inequality and poverty, it underlines the importance of bringing the WTO's Doha Development Agenda (DDA) expeditiously to a successful conclusion with ambitious agricultural reform commitments.

In order to adequately capture poverty and inequality effects of price-distorting policies, careful consideration must be given to its impacts on household income and expenditure. The fact that the poorest households in the poorest countries are concentrated in agriculture means those households are likely to benefit from farm producer price increases engendered by trade policy reform, other things equal. However, the outcome is not certain because poor households also spend the majority of their income on staple foods (Cranfield *et al.* 2003), so if food prices rise as a consequence of reform then this adverse effect on household expenditure may more than offset the beneficial effect of higher earnings. The urban poor also would be adversely affected by a rise in consumer prices of staple food. However, it is possible that a trade reform that induced a rise in food prices may also raise the demand for unskilled labor (according to the relative factor intensities of production in the economy's expanding sectors), which – depending on how intersectorally mobile labor is – could raise the income of poor households more than it raises the price of their consumption bundle.

The approach adopted in the Anderson, Cockburn and Martin (2010) study to operationalize the above theory is a variant on the path-breaking approach pioneered by Hertel and Winters (2005, 2006) in their study of the poverty consequences of a prospective Doha round agreement under the WTO. The new country case studies examine unilateral reforms that individual developing countries might implement, not just multilateral trade reform. The effects of unilateral actions are compared with what full liberalization abroad would generate, so as to be able to assess the relative importance domestically for each nation of own-country policies as distinct from those of other countries (over which the country has influence only indirectly via trade negotiations).

The national CGE models are able on their own to estimate the effects of unilateral reform of agricultural or all merchandise trade-distorting policies. For the national modeler to estimate the effects of other countries' policies, however, requires input from a global model. The World Bank's Linkage model was chosen for that purpose, amended as discussed in the previous section to incorporate new estimates of agricultural distortions.

There are various ways of transmitting the results derived from a global CGE model such as Linkage to a single-country CGE model. Like Hertel and Winters (2006), the new study adopts the approach developed by Horridge and Zhai (2006). For imports, Horridge and Zhai propose the use of border price changes from the global model's simulation of rest-of-world liberalization (that is, without the focus developing country). For the focus developing

country's exports, the shift in its export demand curve following liberalization in the rest of the world is given in percentage changes by $x=(1/\sigma).q$ where x is the percentage vertical shift in the export demand curve, σ is the elasticity of substitution between the exports of country i and those from other countries, and q is the percentage change in the quantity of exports under the scenario with liberalization in the rest of the world excluding the focus country.

Typically the modeling experiments are performed in two stages. The first stage involves the imposition on the national CGE model of the policy shock (either unilateral liberalization, or an exogenous shock to border prices and export demand provided by the Linkage model). This generates changes in domestic product and factor markets. The consequent changes in consumer and factor prices are then transmitted to the microsimulation model to see how they alter the earnings of various household types (according to the shares of their income from the various factors) and their cost of living (according to the shares of their expenditure on the various consumer products). That in turn provides information on changes in the distribution of real household incomes and hence in inequality, and in the number of people below any chosen poverty line such as US$1 a day.

All country case studies ran a common set of simulations so as to make it possible to compare the inequality and poverty effects in each country of own-country versus rest-of-world policies affecting markets for agricultural (including lightly processed food) goods versus other merchandise. In most cases additional simulations were also run, often to illustrate the sensitivity of the results to key assumptions pertinent to that particular case study. Even though the models surveyed here are all standard perfectly competitive, constant-returns-to-scale, comparative static, economy wide CGE models, they nonetheless differ somewhat in order to capture important realities (such as labor market characteristics or data limitations) in their particular setting. However, to ensure their comparability, they all aimed to conform to a common set of factor market assumptions and closure rules in addition to using 2004 as their base and undertaking a common set of simulations using the same global distortions dataset.

Global modeling results

Anderson, Valenzuela and van der Mensbrugghe (2010) use the World Bank's global Linkage model (van der Mensbrugghe 2005) to assess the market effects of the world's agricultural and trade policies as of 2004 on individual countries and country groups, so as to be able to say something about international inequality and poverty. The Linkage model

results suggest that developing countries would gain nearly twice as much as high-income countries in welfare terms if 2004 agricultural and trade policies were removed globally. Thus in this broad sense of a world of just two large country groups, completing the global reform process would reduce international inequality. The results vary widely across developing countries, however, ranging from slight losses in the case of some South Asian and Sub-Saharan African countries that would suffer exceptionally large adverse terms of trade changes, to an 8 percent increase in the case of Ecuador (whose main export item, bananas, is currently heavily discriminated against in the EU market). This study also reports that unskilled workers in developing countries – the majority of whom work on farms – would benefit most from reform (followed by skilled workers and then capital owners), with the average change in the real unskilled wage over all developing countries rising 3.5 percent. However, the most relevant consumer prices for the poor, including those many poor farm and other rural households who earn most of their income from their labor and are net buyers of food, relate just to food and clothing. Hence deflating by a food and clothing price index rather than the aggregate CPI provides a better indication of the welfare change for those workers. As shown near the bottom of the final column of Table 5, for all developing countries the real unskilled wage over all developing countries would rise by 5.9 percent with that deflator. That is, inequality between unskilled wage-earners and the much wealthier owners of capital (human or physical) within developing countries would reduce with full trade reform.

The above results for real factor rewards and net farm income suggest that poverty, as well as international and intra-developing country inequality, could be alleviated globally by agricultural and trade policy liberalization. The authors of that study go a step further to explicitly assess reform impacts on poverty even though the Linkage model has only one single representative household per country. They do so using the elasticities approach, which involves taking the estimated impact on real household income and applying an estimated income to poverty elasticity to estimate the impacts on the poverty headcount index for each country. They focus on the change in the average wage of unskilled workers deflated by the food and clothing CPI, and assume those workers are exempt from the direct income tax imposed to replace the lost customs revenue following trade reform (a realistic assumption for many developing countries). Under the full merchandise trade reform scenario, Table 6 reports that extreme poverty (the number of people surviving on less than US$1 a day) in developing countries would drop by 26 million relative to the baseline level of just under one billion, a reduction of 2.7 percent. The proportional reduction is much higher in China and in

Sub-Saharan Africa, each falling around 4 percent. It is even higher in Latin America (7 percent) and South Asia other than India (10 percent). By contrast, the number of extreme poor in India (though not in the rest of South Asia) is estimated to rise, by 4 percent.[6] Under the more moderate definition of poverty—those living on no more than US$2 per day—the number of poor in developing countries would fall by nearly 90 million compared to an aggregate baseline level of just under 2.5 billion in 2004, or by 3.4 percent (notwithstanding the number in India below $2 a day still increasing, but by just 1.7 percent).

A second study, by Hertel and Keeney (2010), draws on the widely used global economy-wide model of the Global Trade Analysis Project (GTAP). Their study adopts the same price distortions as the Linkage model, and runs the same scenarios, but generates its own world price changes from the GTAP model for the multilateral trade reform scenarios. Those price changes alter border prices for the various countries in the GTAP model, a subset of which have attached to them detailed household survey data. This permits the authors to say something about poverty impacts across a range of diverse economies. This multi-country study focuses on 15 developing countries: five Asian (Bangladesh, Indonesia, Philippines, Thailand, and Vietnam), four African (Malawi, Mozambique, Uganda, and Zambia), and six Latin American countries (Brazil, Chile, Colombia, Mexico, Peru, and Venezuela). Overall, it concludes that removing current farm and trade policies globally would tend to reduce poverty, and primarily via agricultural reforms (Table 7). The unweighted average for all 15 developing countries is a headcount decline in extreme poverty (<$1 a day) of 1.7 percent. The average fall for the Asian sub-sample is twice that, however – and it is in Asia where nearly two-thirds of the world's extremely poor people live (although their sample did not include China and India). Turning to their results for specific countries, it is the agricultural-exporting developing countries in the sample, namely Chile, Thailand and Vietnam, where the most poverty alleviation would occur (column 3 of Table 7). The majority of the 15 countries studied experience small poverty increases from non-agricultural reforms, although the unweighted average across the fifteen countries suggests a slight decrease, primarily due to a strong decline in Vietnam (column 2 of Table 7).

Hertel and Keeney (2010) explore the relative poverty-friendliness of agricultural trade reforms in detail, examining the differential impacts on real after-tax factor returns of agricultural versus non-agricultural reforms. Their analysis is extended to the distribution of

[6] The rise in India is partly because of the removal of the large subsidies and import tariffs that assist Indian farmers, and partly due to the greater imports of farm products raising the border price of those imports.

households by looking at stratum-specific poverty changes. They find that the more favorable impacts of agricultural reforms are driven by increased returns to peasant farm households' labor as well as higher returns for unskilled work off-farm. They also find that liberalization of food grain markets represents the largest contribution to poverty reduction, and that removing import tariffs in those commodity markets dominates the poverty-increasing impacts of subsidy removal by high-income countries.

The final column of Table 7 reports the percentage change in the national poverty headcount when the poor are not subject to the income tax rise required to replace trade tax revenue following trade reform. This assumption represents a significant implicit income transfer from non-poor to poor households and thus generates a marked difference in the predicted poverty alleviation. Trade reforms go from being marginally poverty reducing in most of the 15 cases to being poverty reducing in all cases and by a considerable magnitude. It reduces the poverty rate by roughly one-quarter in Thailand and Vietnam, for example. Overall, the regional and total average extent of poverty alleviation is around four times larger in this scenario than when the poor are also assumed to be levied with income taxes to replace lost trade tax revenue. The unweighted average poverty headcount reduction for the three regions shown in the final column of Table 7 are remarkably similar to the population-weighted averages from the Linkage model reported in Table 6 above with a similar tax-replacement assumption: the latter's 17 percent for Asia excluding China and India and 6.4 percent for Latin America are just slightly above the GTAP model's 14 percent and 5.7 percent, while their 3.7 percent for Sub-Saharan Africa is just below the 4.5 percent obtained for the Hertel and Keeney sample.

National poverty modeling results

It is useful to compare results from five more-detailed individual Asian country case studies with the above results from global models.[7] Like the three global models, they focus on price-distorting policies as of 2004, even though the database for their CGE models and their household survey data typically date back a little earlier in the decade. They all include more sectoral and product disaggregation than the global models, and have multiple types of households and types of labor. All of the national studies include micro-simulations drawing on model results, as in the GTAP global model simulations just discussed.

[7] The five national studies are for China (Zhai and Hertel 2010), Indonesia (Warr 2010a), Pakistan (Cororaton and Orden 2010), Philippines (Cororaton, Corong and Cockburn 2010), and Thailand (Warr 2010b).

The national results for real GDP and household consumption suggest that GDP would increase from full global trade reform, but only by 1 or 2 percent, in all five countries. Given falling consumer prices, real household consumption would increase by considerably more in most cases. Generally these numbers are a little larger than those generated by the global Linkage model, but they are still generally much lower than would be the case had the authors used dynamic models. They therefore share the feature of the global models of underestimating the poverty-alleviating benefits of trade reform, given the broad consensus in the literature that trade liberalization boosts economic growth, which is in turn a major contributor to poverty alleviation.

Table 8 summarizes the national results for the incidence of extreme poverty resulting from own-country, rest-of-world or global full liberalization of agricultural or all goods trade. Some authors ran only six of the nine simulations shown in this table, but those that ran all nine found their results to sum up almost exactly, to one decimal place. We therefore have inferred the three missing results in the other country studies by assuming that the agriculture-only and nonagriculture-only results sum to the all-goods reform results. The inferred numbers are shown in italics in Table 8. In each case the total effects on poverty are subdivided into rural and urban.[8]

Poverty is reduced in all five countries by both global agricultural and, with the exception of the Philippines, non-agricultural liberalization (Table 8(c)). When all merchandise trade is liberalized, the extent of reduction ranges from close to zero to 6 percentage points.[9] On average nearly two-thirds of the alleviation is due to non-farm trade reform. The contribution of own-country reforms to the fall in poverty is much more important than rest-of-world reform for Pakistan and Thailand, but much less important for China and Indonesia.

The poverty alleviation is sub-divided in parts (a) and (b) of Table 8 into rural and urban sources. A glance at the final column of that part of the table reveals that rural poverty is cut much more than urban poverty in every case. That is true for both farm and non-farm trade reform in most cases. Since the rural poor are much poorer on average than the urban poor, this would lead one to expect trade reform to reduce inequality also.

Several of the national studies investigate impacts of reforms that could complement trade reforms, most notably different approaches to deal with the elimination of trade tax

[8] Using national or $1 a day poverty lines, except for China for which results are available only for $2 a day.

[9] The Pakistan results were generated assuming replacement of trade taxation with a rise in direct income taxes. Only urban, non-poor households pay direct taxes in Pakistan, so the removal of tariffs decreases the after-tax incomes of the urban non-poor and means the benefits of trade reform go mainly to the poor.

revenues. If these revenues can be recouped through taxes that do not bear on the poor, then the impacts of reform for poverty reduction are more favorable. The China study (Zhai and Hertel 2010) focuses on the vitally important issue of reducing the barriers to migration out of agriculture, by improving the operation of land markets and reducing the barriers to mobility created by the hukou system. These measures, and international trade liberalization that increases China's market access, are found to reduce poverty such that a combination of these measures would benefit all major household groups.

Prospects for further agricultural reform

The expectation is that, provided they remain open and continue to free up domestic markets and practice good macroeconomic governance, developing economies will keep growing rapidly in the foreseeable future once the current global recession passes The growth in Asia will be more rapid in manufacturing and service activities than in agriculture, and in the more densely populated economies of the region that growth will be accompanied by rapid increases in per capita incomes of low-skilled workers where labor-intensive exports boom. Agricultural comparative advantage is thus likely to decline in such economies. Whether these economies become more dependent on imports of farm products depends, however, on what happens to the RRA. The first wave of Asian industrializers (Japan, and then Korea and Taiwan) chose to slow the growth of food import dependence by raising their NRA for agriculture even as they were bringing down their NRA for non-farm tradables, such that their RRA became increasingly above the neutral zero level. A key question, foreshadowed above, is: will later industrializers follow suit, given the past close association of RRAs with rising per capita income and falling agricultural comparative advantage?

When the RRAs for Japan, Korea and Taiwan are mapped against real per capita income, it is possible to superimpose on that same graph the RRAs for lower-income economies to see how they are tracking relative to the first industrializers. Figure 5 does that for China and India, and shows that their RRA trends of the past three decades are on the same trajectory as the richer Northeast Asians. That provides reason to expect the governments of later industrializing economies to follow suit if other things were equal.

However, might one expect different government behavior now, given that the earlier industrializers were not bound under GATT to keep down their agricultural protection? Had there been strict discipline on farm trade measures at the time Japan and Korea joined GATT in 1955 and 1967, respectively, their NRAs may have been halted at less than 20 percent

(Figure 6). At the time of China's accession to WTO in December 2001, its NRA was less than 5 percent according to this present study, or 7.3 percent for just import-competing agriculture. Its average bound import tariff commitment was about twice that (16 percent in 2005), but what matters most is China's out-of-quota bindings on the items whose imports are restricted by tariff rate quotas. The latter tariff bindings as of 2005 were 65 percent for grains, 50 percent for sugar and 40 percent for cotton (WTO, ITC and UNCTAD 2007, p. 60). China also has bindings on farm product-specific domestic supports of 8.5 percent, and can provide another 8.5 percent as non-product specific assistance if it so wishes – a total 17 percent NRA from domestic support measures alone, in addition to what is available through out-of-quota tariff protection. Clearly the legal commitments China made on acceding to WTO are a long way from current levels of domestic and border support for its farmers, and so are unlikely to constrain the government very much in the next decade or so (Anderson, Martin and Valenzuela 2009).

The legal constraints on Asia's developing countries that joined the WTO earlier (except for Korea) are even less constraining. For India, Pakistan and Bangladesh, for example, their estimated NRAs for agricultural importables in 2000-04 are 34, 4 and 6 percent, respectively, whereas the average bound tariffs on their agricultural imports are 114, 96 and 189 percent, respectively (WTO, ITC and UNCTAD 2007). Also, like other developing countries, they have high bindings on product-specific domestic supports of 10 percent and another 10 percent for non-product specific assistance, a total of 20 more percentage points of NRA that legally could come from domestic support measures – compared with currently 10 percent in India and less than 3 percent in the rest of South Asia.

One can only hope that the China and South and Southeast Asia will not make use of the legal wiggle room they have allowed themselves in their WTO bindings and thereby follow Japan, Korea and Taiwan into high agricultural protection. A much more efficient and equitable strategy would be to instead treat agriculture in the same way they have been treating non-farm tradable sectors. That would involve opening the sector to international competition, and relying on more-efficient domestic policy measures for raising government revenue (e.g., income and consumption or value-added taxes) rather than trade taxes.

It might be argued that such a laissez faire strategy could increase rural-urban inequality and poverty and thereby generate social unrest. On the other hand, policies that lead to high prices for staple foods, in particular, involve potentially serious risks for the urban and rural poor who are net buyers of food in developing countries, as has been

demonstrated by concerns about the recent increases in prices of these goods (Ivanic and Martin 2008). Available evidence suggests that problems of rural-urban poverty gaps have been alleviated in parts of Asia and elsewhere by some of the more-mobile members of farm households finding full- or part-time work off the farm and repatriating part of their higher earnings back to those remaining in farm households (Otsuka and Yamano 2006, Otsuka, Estudillo and Sawada 2009). Concerted government intervention through social policy measures can be important both in reducing the gaps between rural and urban incomes, identified by Hayami (2007) as a concern, and in raising national incomes overall. Efficient ways of assisting any left-behind groups of poor (nonfarm as well as farm) households include reducing any underinvestment in rural public goods that have high social payoffs such as basic education and health and rural infrastructure, as well as agricultural research.[10]

The reasons why some countries have reformed their price-distorting agricultural and trade policies more than others in recent decades are varied. Some have reformed unilaterally, apparently having become convinced that it is in their own national interest to do so. China is the most dramatic and significant example of the past three decades among developing countries, and Australia and New Zealand among the high-income countries (Huang et al. 2009; Anderson, Lloyd and MacLaren 2007). Other developing countries may have done so partly to secure bigger and better loans from international financial institutions and then, having taken that first step, they continued the process, even if somewhat intermittently. India is one example, but there are numerous other examples in Africa and Latin America. Few have gone backwards in terms of increasing their anti-agricultural bias, but Zimbabwe and perhaps Argentina qualify during the present decade – and numerous others joined them in 2008, at least temporarily, in response to the sudden upward spike in international food prices. Also, some have reduced their agricultural subsidies and import barriers at least partly in response to the GATT's multilateral Uruguay Round Agreement on Agriculture, the European Union (EU) being the most important example (helped by its desire for otherwise costly preferential trade agreements, including its expansions eastwards in 2004 and 2007).

[10] Data in Pardey et al. (2006) suggest that public R&D expenditure in Asia since the late 1970s has averaged less than 0.5 percent of the gross value of production at undistorted prices, which is trivial compared with the NRA via price-distorting measures for Asia. Even if just one-twentieth of the current NRA provided to Asian farmers via farm price-support policies was replaced by agricultural R&D expenditure, that would more than double current public spending on such R&D – and the latter would increase regional economic welfare whereas price-distortionary policies reduce it. Such a boost to Asian R&D could well be able to generate another green revolution of the order of magnitude of the first one that began in the 1960s, especially if it took full advantage of the new developments in biotechnology (as shown for rice, for example, in Anderson, Jackson and Nielsen 2005).

The EU reforms suggest that growth in agricultural protection can be slowed and even reversed if accompanied by re-instrumentation away from price supports to decoupled measures or more direct forms of farm income support (Josling 2009). The starker examples of Australia and New Zealand show that one-off buyouts can bring faster and even complete reform (Anderson, Lloyd and MacLaren 2007). But in the developing countries where levels of agricultural protection are generally below those in high-income countries, there are fewer signs of a slowdown of the upward trend in agricultural protection from import competition over the past half-century.

Indeed, there are numerous signs that the governments of developing countries want to keep open their options to raise agricultural NRAs in the future, particularly via import restrictions. One indicator is the high tariff bindings to which developing countries committed themselves following the Uruguay Round: as of 2001, actual applied tariffs on agricultural products averaged less than half the corresponding bound tariffs for developing countries of 48 per cent, and less than one-sixth in the case of least-developed countries (Anderson and Martin 2006, Table 1.2). Another indicator of reluctance about agricultural trade reform is the demand by many developing countries to be allowed to maintain their rates of agricultural protection for reasons of food security, livelihood security and rural development. This view has succeeded in bringing 'special products' and a 'special safeguard mechanism' into the multilateral trading system's agricultural negotiations, even though such policies, which would raise domestic food prices in developing countries, may worsen poverty and reduce the food security of the poor, and would exacerbate instability in international markets for farm products. Given these developments, it is especially unfortunate that the WTO's Doha Development Agenda is struggling to deliver a new liberalizing agreement, and makes it more likely that developing countries will follow the same agricultural protection path this century as that taken last century by high-income countries.

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Table 1: Nominal rates of assistance to agricultural and non-agricultural tradables and relative rate of assistance,[a] Asia-Pacific countries, 1960 to 2004

(percent)

	1960-64	1970-74	1980-84	1985-89	1990-94	1995-99	2000-04
Japan							
NRA Ag.	44.5	47.3	67.0	127.7	129.7	133.4	133.6
NRA Non-Ag.	3.9	2.8	1.1	1.3	1.1	0.8	0.7
RRA	39.1	43.3	65.2	124.8	127.1	131.4	132.1
Korea							
NRA Ag.	4.9	46.1	118.6	159.8	197.6	164.8	171.9
NRA Non-Ag.	37.1	11.4	6.8	5.7	3.3	2.3	1.7
RRA	-21.4	30.5	104.8	145.9	188.2	158.8	167.3
Taiwan							
NRA Ag.	4.7	12.0	18.7	33.8	46.3	54.9	70.9
NRA Non-Ag.	9.3	7.5	5.2	4.5	2.6	1.8	1.0
RRA	-4.2	4.2	12.9	28.0	42.5	52.2	69.0
China [b]							
NRA Ag.	-45.2	-45.2	-45.2	-35.5	-14.3	6.6	5.9
NRA Non-Ag.	41.6	41.6	41.6	28.3	24.9	9.9	5.0
RRA	-60.5	-60.5	-60.5	-49.9	-31.1	-3.0	0.9
Indonesia							
NRA Ag.	na	-3.8	10.5	-1.9	-7.5	-9.7	13.9
NRA Non-Ag.	na	27.7	27.7	26.5	17.6	10.6	8.1
RRA	na	-24.7	-13.5	-22.5	-21.3	-18.3	5.4
Malaysia							
NRA Ag.	-7.6	-9.4	-4.9	1.4	2.6	-0.2	1.5
NRA Non-Ag.	7.4	7.1	5.2	3.9	2.8	2.0	0.9
RRA	-14.0	-15.5	-9.6	-2.4	-0.3	-2.2	0.6
Philippines							
NRA Ag.	-1.7	-6.0	-4.0	15.8	16.7	35.7	23.5
NRA Non-Ag.	19.0	16.3	12.9	11.0	9.9	8.6	6.4
RRA	-17.4	-19.8	-14.9	4.3	6.1	24.9	15.9
Thailand							
NRA Ag.	na	-23.1	-2.3	-6.9	-6.4	1.8	-0.2
NRA Non-Ag.	na	16.1	14.2	11.1	10.0	8.9	7.8
RRA	na	-33.7	-14.4	-16.3	-14.9	-6.5	-7.4
Vietnam							
NRA Ag.	na	na	na	-15.9	-26.4	0.0	20.7
NRA Non-Ag.	na	na	na	4.3	-11.2	1.5	20.8
RRA	na	na	na	-19.2	-17.4	-1.3	0.0
Bangladesh							
NRA Ag.	na	na	-3.9	17.5	-2.4	-8.0	4.0
NRA Non-Ag.	na	na	22.4	28.5	33.3	29.0	23.4
RRA	na	na	-21.5	-8.6	-26.7	-28.6	-15.8
India [b]							
NRA Ag.	5.2	12.6	4.1	67.5	2.0	-2.3	15.4
NRA Non-Ag.	113.0	83.1	59.3	48.6	15.9	12.6	5.2
RRA	-56.3	-38.3	-33.5	11.7	-12.1	-12.9	12.5
Pakistan							
NRA Ag.	-1.0	9.3	-9.3	-5.9	-10.2	-2.6	1.5
NRA Non-Ag.	169.7	146.7	48.3	45.1	39.3	27.0	14.6
RRA	-63.8	-55.9	-38.6	-35.1	-35.2	-23.0	-11.5
Sri Lanka							
NRA Ag.	-25.7	-18.5	-15.4	-11.2	-1.3	14.0	10.8
NRA Non-Ag.	124.6	70.7	57.1	59.0	47.1	36.4	22.9
RRA	-66.6	-51.6	-46.2	-44.3	-32.9	-16.3	-9.8
Asian dev. economies[c]							
NRA Ag.	-27.7	-24.3	-18.8	-11.2	-2.6	7.5	11.7
NRA Non-Ag.	67.1	50.3	38.3	15.4	14.9	9.6	4.3
RRA	-56.4	-47.9	-40.8	-22.8	-15.2	-1.9	7.1
Australia							
NRA Ag.	8.4	8.9	5.2	5.1	4.5	3.0	0.5

NRA Non-Ag.	20.7	16.8	11.1	8.2	5.3	2.6	2.0
RRA	-10.2	-6.8	-5.3	-2.9	-0.7	0.4	-1.5
New Zealand							
NRA Ag.	1.8	5.0	28.9	20.9	3.4	2.6	2.4
NRA Non-Ag.	24.0	30.0	20.3	16.6	10.8	6.5	3.8
RRA	-17.8	-19.0	7.1	3.5	-6.7	-3.6	-1.3

[a] The RRA is defined as $100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$, where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

[b] Estimates for China pre-1981 and India pre-1965 are based on the assumption that the nominal rates of assistance to agriculture in those years was the same as the average NRA estimates for those economies for 1981-84 and 1965-69, respectively, and that the gross value of production in those missing years is that which gives the same average share of value of production in total world production in 1981-84 and 1965-69, respectively. This NRA assumption is conservative in the sense that for both countries the average NRA was probably even lower in earlier years, according to the authors of those country case studies.

[c] Weighted averages of the above national averages for Asian economies other than Japan's, using weights based on gross value of national agricultural production at undistorted prices.

Source: Calculated from Anderson and Valenzuela (2008), which draws on national estimates reported in Anderson and Martin (2009) and Anderson (2009).

Table 2: NRAs for Asian developing country farmers, by product, 1960 to 2004

(percent, at primary product level)

	1960-64	1970-74	1980-84	1985-89	1990-94	1995-99	2000-04
Barley	84	120	166	357	524	543	563
Beef	25	44	101	94	145	106	85
Cassava	na	-23	-9	-17	-11	-14	-10
Chickpea	50	1	8	12	9	15	19
Cocoa	na	-3	-2	-1	-2	-2	0
Coconut	-29	-8	-11	-19	-34	-22	-8
Coffee	na	-7	-9	-5	-5	-1	-2
Cotton	-19	63	-12	-2	-3	0	5
Egg	-21	0	10	22	27	23	51
Fruits & veg	0	0	-8	-3	-11	-6	-4
Jute	na	-30	-29	-35	-38	-6	-39
Maize	-10	19	-20	-6	-15	8	13
Milk	na	122	108	124	40	23	32
Oilseeds	24	11	22	35	21	22	22
Palmoil	-11	-15	-1	-2	2	-9	-3
Pigmeat	16	51	-41	-39	-3	7	4
Poultry	0	18	48	-2	20	17	12
Rice	-6	-17	-27	-6	-9	2	18
Rubber	-16	-8	-19	-14	-16	5	4
Sorghum	82	55	7	36	7	21	16
Sugar	96	13	37	39	13	20	43
Tea	-39	-28	-18	-19	-10	-8	-7
Wheat	-12	15	-3	12	4	18	11
Weighted average:[a]	**-2.7**	**0.3**	**-21.6**	**-15.2**	**-4.8**	**6.0**	**10.2**

[a] Weights are production valued at undistorted prices across all Asian developing economies including Korea and Taiwan.

Source: Calculated from Anderson and Valenzuela (2008), which draws on national estimates reported in Anderson and Martin (2009).

Table 3: Trade Reduction Indexes, Asia-Pacific countries and other regions,[a] all covered tradable farm products, 1960 to 2004

(percent)

	1960-64	1970-74	1980-84	1985-89	1990-94	1995-99	2000-04
Banglasdesh	na	-13	-1	24	1	-8	6
China	na	na	44	44	19	4	1
India	na	42	38	70	26	18	22
Indonesia	na	1	14	5	2	-1	19
Korea	5	44	119	158	189	164	184
Malaysia	12	8	18	21	14	5	5
Pakistan	7	19	4	12	-3	-2	4
Philippines	-4	1	3	16	18	39	27
Sri Lanka	26	20	13	5	23	17	4
Taiwan	-6	-16	-19	-25	37	67	96
Thailand	na	25	13	11	9	6	1
Vietnam	na	na	na	12	28	6	-11
Asian DCs total	**15**	**23**	**34**	**28**	**18**	**8**	**6**
Africa	**32**	**33**	**18**	**54**	**17**	**16**	**22**
Latin America	**22**	**19**	**19**	**13**	**23**	**7**	**8**
All developing countries	**26**	**27**	**28**	**29**	**21**	**9**	**10**
Japan	64	73	105	144	134	132	127
Australia	-7	-6	-4	-7	-7	-3	-1
New Zealand	2	2	-11	-1	2	2	1
All high-income countries	**19**	**16**	**27**	**28**	**28**	**18**	**18**

[a] Regional aggregates are weighted using as weights the average of the value of production and the value of consumption at undistorted prices.

Source: Lloyd, Croser and Anderson (2009), based on product NRAs and CTEs in Anderson and Valenzuela (2008).

Table 4: Welfare Reduction Indexes, Asia-Pacific countries and other regions,[a] all covered tradable farm products, 1960 to 2004

(percent)

	1960-64	1970-74	1980-84	1985-89	1990-94	1995-99	2000-04
Bangladesh	na	30	29	49	29	25	31
China	na	na	55	48	25	12	8
India	na	49	54	87	31	22	27
Indonesia	na	18	31	21	24	28	27
Korea	45	69	130	176	211	194	228
Malaysia	14	10	57	95	71	31	34
Pakistan	44	75	39	46	31	24	29
Philippines	18	30	33	46	32	51	42
Sri Lanka	32	29	26	29	39	35	30
Taiwan	30	52	43	85	124	155	190
Thailand	na	30	22	18	16	19	12
Vietnam	na	na	na	22	30	24	37
Asian DCs total	**27**	**39**	**48**	**46**	**28**	**19**	**16**
Africa	**52**	**52**	**51**	**81**	**52**	**37**	**36**
Latin America	**42**	**38**	**44**	**39**	**42**	**20**	**23**
All developing countries	**44**	**42**	**48**	**48**	**32**	**19**	**18**
Japan	74	106	150	248	240	210	213
Australia	20	28	13	21	21	9	4
New Zealand	11	14	24	28	13	10	9
All high-income countries	**49**	**46**	**69**	**71**	**52**	**38**	**38**

[a] Regional aggregates are weighted using as weights the average of the value of production and the value of consumption at undistorted prices.

Source: Lloyd, Croser and Anderson (2009), based on product NRAs and CTEs in Anderson and Valenzuela (2008).

Table 5: Effects of full global merchandise trade liberalization on real factor prices, by country and region, using the Linkage model

(relative to the benchmark data, percent)

	Nominal change deflated by aggregate CPI			Real change in unskilled wages deflated by:		
	Skilled wages	**Capital[a] user cost**	**Land[a] user cost**	**Aggregate CPI**	**Food CPI**	**Food and clothing CPI**
East and South Asia	3.4	3.0	-1.8	3.2	4.6	4.8
Africa	4.7	4.3	0.1	4.4	5.8	6.9
Latin America	1.4	1.9	21.1	4.5	2.4	4.1
All developing countries	**3.0**	**2.9**	**1.6**	**3.5**	**5.5**	**5.9**
Eastern Europe & Central Asia	3.2	2.6	-4.5	1.7	4.2	4.5
High-income countries	1.0	0.5	-17.9	0.2	3.3	3.3
World total	**1.3**	**1.2**	**-3.1**	**0.9**	**3.6**	**3.8**

[a] The user cost of capital and land represents the subsidy-inclusive rental cost.

Source: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

Table 6: Effects of full global merchandise trade liberalization on the incidence of extreme poverty using the Linkage model

	Average unskilled wage change, real[a] *(%)*	Baseline headcount		New levels, $1/day		New levels, $2/day		Change in number of poor from baseline levels		Change in number of poor from baseline levels	
		$1/day (%)	$2/day (%)	Headcount (%)	Number of poor, million	Headcount (%)	Number of poor, million	$1/day, million	$2/day, million	$1/day, %	$2/day, %
East Asia	*4.4*	9	37	8	151	34	632	-17	-52	-10.3	-7.6
China	*2.1*	10	35	9	123	34	440	-5	-12	-4.0	-2.7
Other East Asia	*8.1*	9	50	6	29	42	192	-12	-40	-30.1	-17.1
South Asia	*-1.9*	31	77	32	454	78	1124	8	8	1.8	0.7
India	*-3.8*	34	80	36	386	82	883	15	15	4.2	1.7
Other South Asia	*4.0*	29	94	26	68	92	241	-8	-7	-9.9	-2.7
Sub Saharan Africa	*5.3*	41	72	39	287	70	508	-11	-14	-3.8	-2.7
Latin America	*4.1*	9	22	8	44	21	115	-3	-6	-6.8	-4.7
Middle East & North Africa	*14.3*	1	20	1	3	13	40	-2	-19	-36.4	-32.7
Developing country total	***5.9***	**18**	**48**	**18**	**944**	**46**	**2462**	**-26**	**-87**	**-2.7**	**-3.4**
Developing excl. China	*6.5*	21	52	20	820	50	2022	-21	-74	-2.5	-4.7
East Europe & Central Asia	*4.5*	1	10	1	4	9	43	-0	-4	-6.8	-8.0

[a] Nominal unskilled wage deflated by the food and clothing CPI

Source: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

Table 7: Effects of full global liberalization of agricultural and all merchandise trade on the incidence of extreme poverty using the GTAP model

(percentage point change using $1 a day poverty line)

	Default tax replacement			Alternative tax replacement (poor are exempt)
	Agriculture-only reform	Nonagriculture-only reform	All merchandise reform	All merchandise reform
Asia				
Bangladesh	-0.3	0.5	0.3	-5.3
Indonesia	-1.1	0.5	-0.6	-5.2
Philippines	-1.4	0.4	-1.0	-6.4
Thailand	-11.2	0.9	-10.3	-28.1
Vietnam	-0.5	-5.3	-5.7	-23.6
Africa				
Malawi	-1.6	-0.3	-1.9	-5.6
Mozambique	-1.2	0.2	-1.0	-4.3
Uganda	-0.0	0.1	0.1	-6.0
Zambia	-0.0	0.1	0.1	-2.0
Latin America				
Brazil	-2.5	0.4	-2.2	-10.0
Chile	-4.8	0.1	-4.6	-12.3
Columbia	-0.7	0.6	-0.1	-4.1
Mexico	0.8	0.4	1.1	-0.5
Peru	-0.6	-0.2	-0.8	-5.2
Venezuela	0.2	0.7	0.9	-2.1
Unweighted averages:				
-Asia	**-2.9**	**-0.6**	**-3.5**	**-13.7**
-Africa	**-0.7**	**0.1**	**-0.7**	**-4.5**
-Latin Amer	**-1.3**	**0.3**	**-1.0**	**-5.7**
-All 15 DCs	**-1.7**	**-0.1**	**-1.7**	**-8.0**

Source: Hertel and Keeney (2010, table 5).

Table 8: Impact of reform on the incidence of poverty according to national models
(percentage point change using national or $1 a day poverty line)

(a) rural poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	58	0.3	-1.4	*-1.1*	*0.2*	*-0.5*	*-0.3*	0.5	-1.9	*-1.4*
Indonesia	29	0.1	-1.1	-1.1	*-0.2*	*-3.2*	*-3.3*	-0.1	-4.3	-4.4
Pakistan	38	-1.4	-0.1	-1.5	*-6.2*	*-1.1*	*-7.1*	-7.6	-1.2	-8.6
Philippines	49	0.0	-0.6	-0.3	*0.6*	*-0.3*	*0.2*	0.6	-0.9	-0.1
Thailand	30	0.3	-1.6	-1.3	*-3.8*	*0.7*	*-3.1*	-3.5	-0.9	-4.4

(b) urban poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	3	0.0	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	0.0	-0.1	*-0.1*
Indonesia	12	-0.1	-0.3	-0.4	*-0.1*	*-1.7*	*-1.8*	-0.2	-2.0	-2.2
Pakistan	20	-2.4	-0.1	-2.7	*4.7*	*-1.4*	*3.1*	2.3	-1.5	0.4
Philippines	19	0.8	-0.9	-0.2	*1.2*	*-0.7*	*0.3*	2.0	-1.6	0.1
Thailand	6	0.0	-0.8	-0.7	*-3.3*	*0.2*	*-3.2*	-3.3	-0.6	-3.9

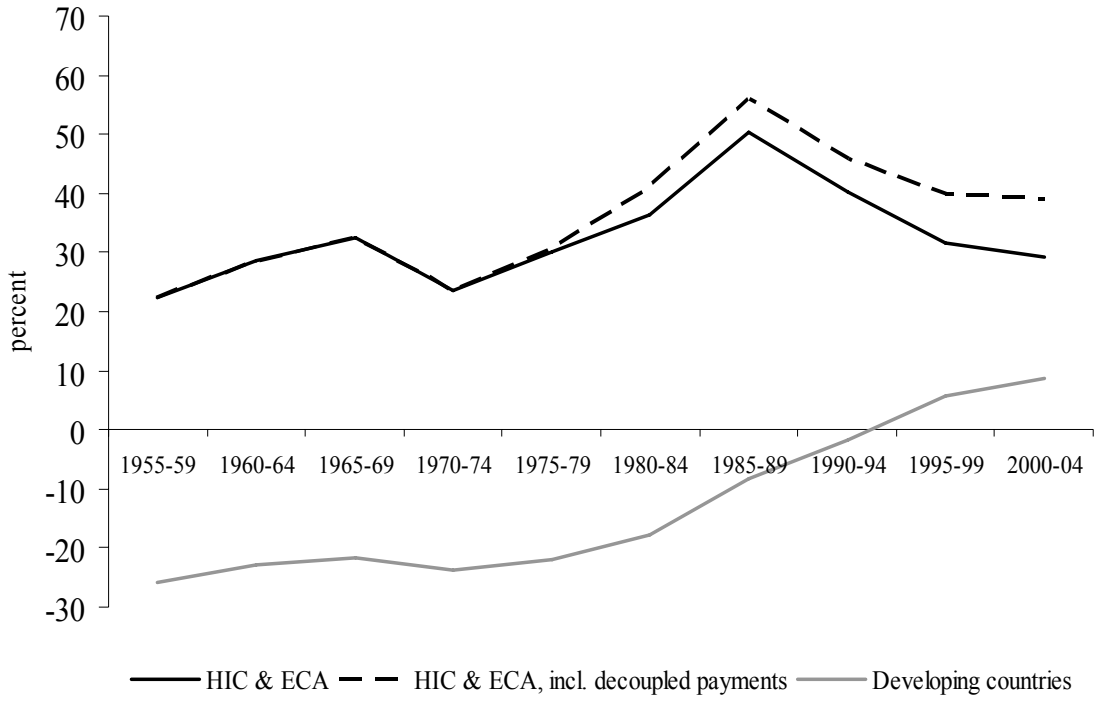
(c)total poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	36	0.2	-0.8	*-0.6*	*0.1*	*-0.4*	*-0.3*	0.3	-1.2	*-0.9*
Indonesia	23	-0.0	-0.8	-0.8	*-0.1*	*-2.7*	*-2.8*	-0.1	-3.5	-3.6
Pakistan	31	-1.6	-0.1	-1.8	*-3.6*	*-1.2*	*-4.6*	-5.2	-1.3	-6.4
Philippines	34	0.4	-0.6	-0.1	*0.7*	*-0.3*	*0.2*	1.1	-0.9	0.1
Thailand	14	0.1	-1.1	-0.8	*-3.5*	*0.4*	*-3.3*	-3.4	-0.7	-4.1

[a] Numbers in italics for individual countries are implied assuming linearity holds; numbers do not always add because of either rounding or interaction effects

Source: Country case studies in Parts II to IV of Anderson, Cockburn and Martin (2010).

Figure 1: Nominal rates of assistance to agriculture in high-income countries (HIC) and European transition economies[a] and in developing countries, 1955 to 2004
(per cent, weighted averages, with 'decoupled' payments included in the dashed HIC line)



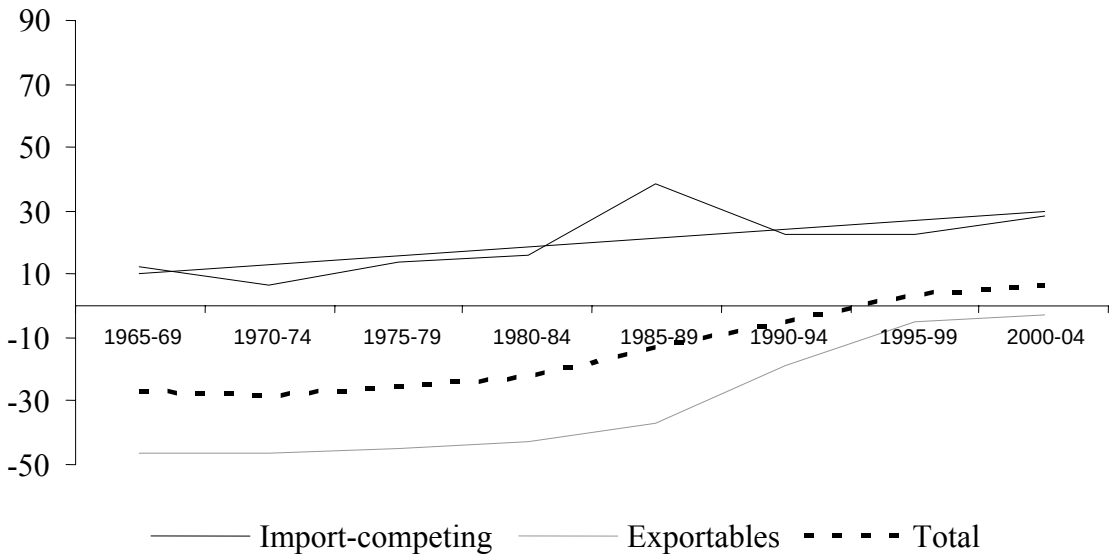
[a] Denoted by the World Bank as ECA, for (Central and Eastern) Europe and Central Asia.

Source: Anderson (2009, Ch. 1), based on estimates in Anderson and Valenzuela (2008).

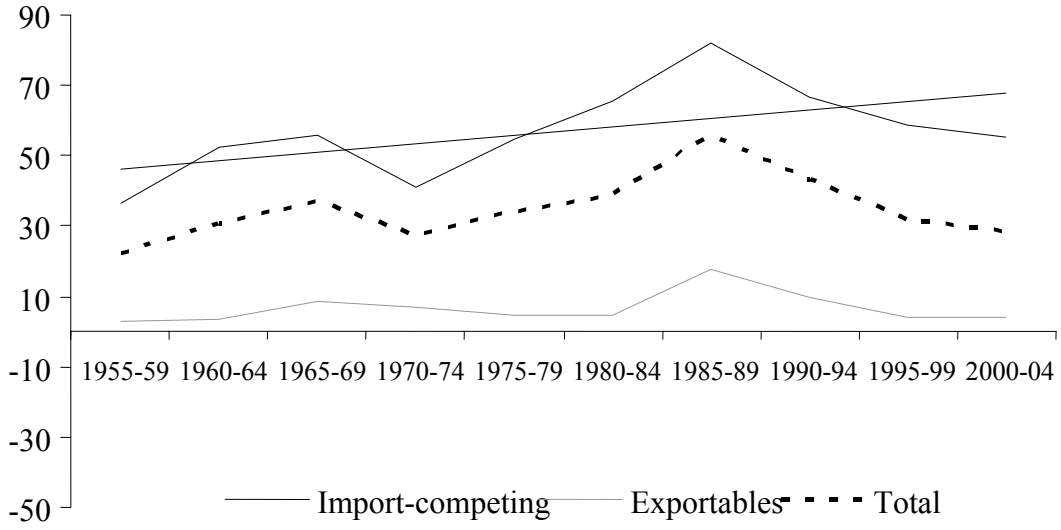
Figure 2: Nominal rates of assistance to exportable, import-competing and all covered agricultural products,[a] high-income and developing countries, 1955 to 2004

(per cent)

(a) Developing countries



(b) High-income countries plus Europe's transition economies

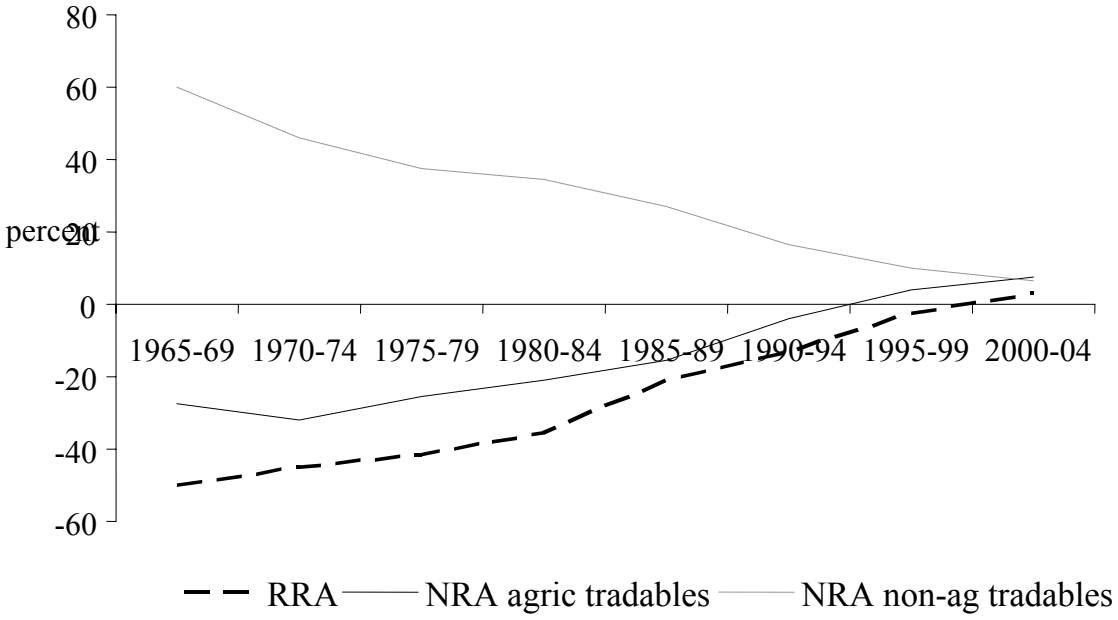


[a]Covered products only. The total also includes nontradables.

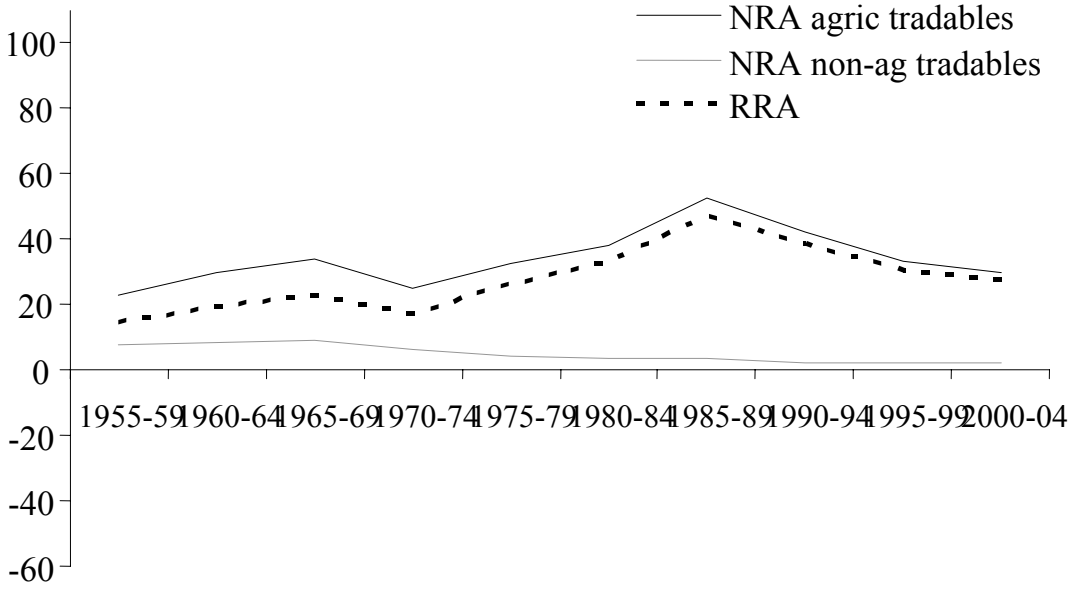
Source: Anderson (2009, Ch. 1), based on estimates in Anderson and Valenzuela (2008).

Figure 3: Nominal rates of assistance to agricultural and non-agricultural tradable sectors and relative rate of assistance,[a] developing and high-income countries, 1955 to 2004
(per cent, production-weighted averages across countries)

(a) Developing countries



(b) High-income countries



[a] The RRA is defined as $100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$, where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

Source: Anderson (2009, Ch. 1), based on estimates in Anderson and Valenzuela (2008).

Figure 4: Trade reduction and welfare reduction indexes for tradable farm products, by region, 1960 to 2007

(percent)

(a) Trade reduction index

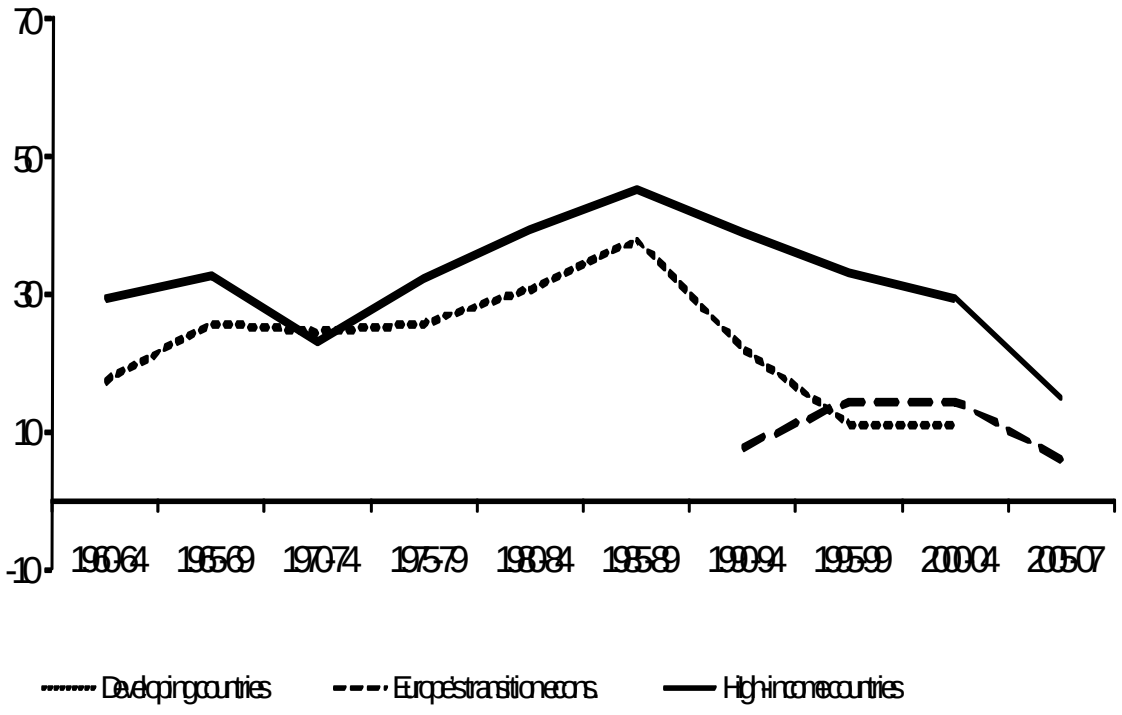


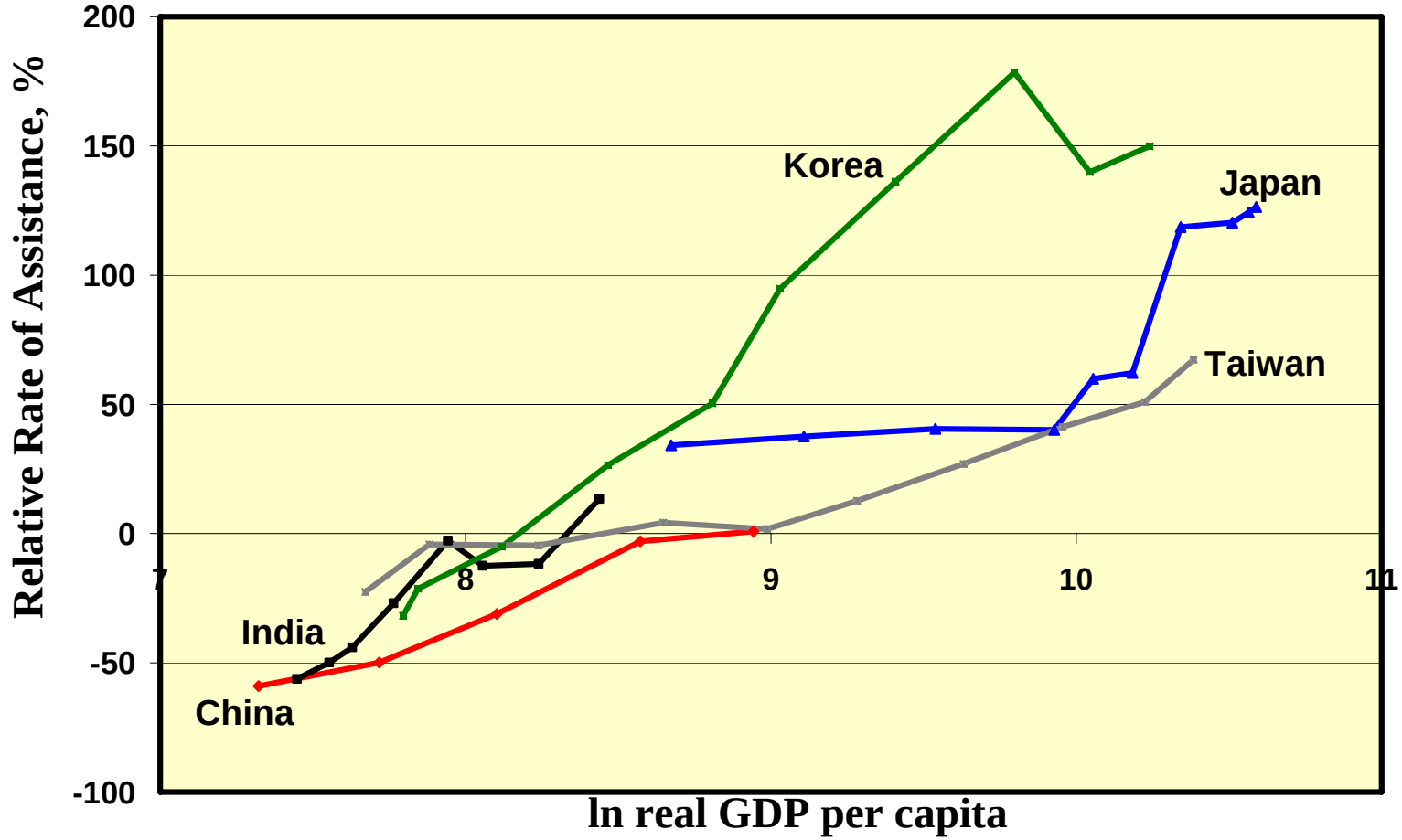
Figure 4 (continued): Trade reduction and welfare reduction indexes for tradable farm products, by region, 1960 to 2007

(percent)

(b) Welfare Reduction Index

Source: Lloyd, Croser and Anderson (2009), based on NRAs and CTEs in Anderson and Valenzuela (2008).

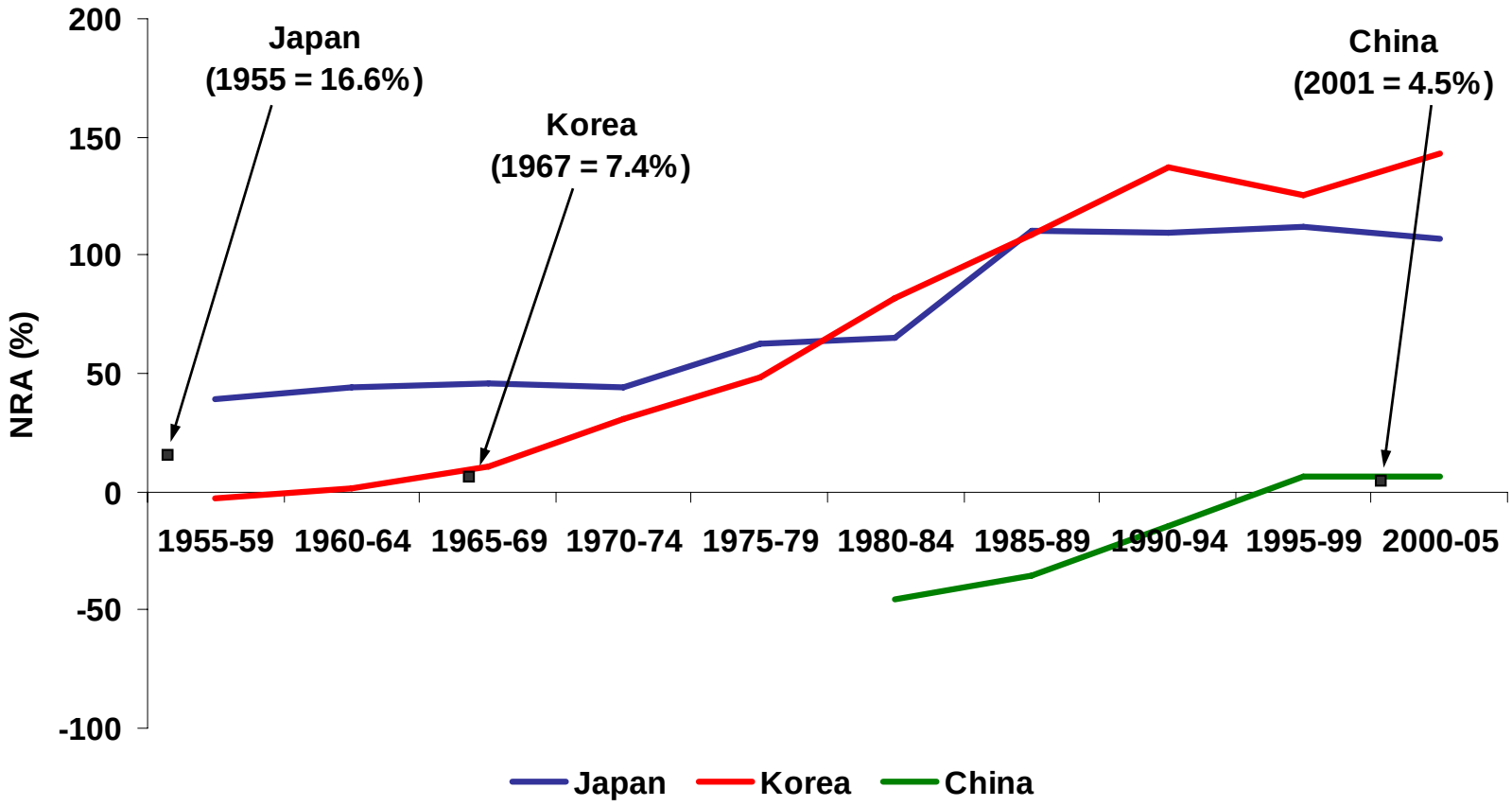
Figure 5: RRAs and log of real per capita GDP, India and Northeast Asian focus economies, 1955 to 2005



Source: Calculated from Anderson and Valenzuela (2008), which draws on national estimates reported in Anderson and Martin (2009).

Figure 6: NRAs for Japan, Korea and China and date of accession to GATT or WTO, 1955 to 2005

(percent)



Source: Calculated from Anderson and Valenzuela (2008), which draws on national estimates reported in Anderson and Martin (2009).