

What's the appropriate agricultural protection counterfactual for trade analysis?

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Paper to be presented at the 15th GTAP conference on Global Economic Analysis, Geneva, 27-29 June 2012. Thanks are due to Anna Strutt and Ernesto Valenzuela for invaluable help with GTAP data and projections, and to the Australian Research Council, the Rural Industries Research and Development Corporation and the World Bank for financial assistance. Views expressed are the authors' alone. Published as Ch. 13 (pp. 325-54) in *Unfinished Business? The WTO's Doha Agenda*, edited by W. Martin and A. Mattoo, London: Centre for Economic Policy Research and the World Bank, November 2011.

Abstract

When sectoral and economy-wide modelers seek to analyse the effects of prospective structural and policy changes over coming decades, a common assumption in the baseline scenario is that trade-related policies do not change over the projection period. That may be reasonable for manufacturing protectionism, now that most major countries have liberalized most of their markets for industrial products. Agricultural policies, however, remain highly distortive – and they have been evolving in fairly systematic ways. How different might such farm policy interventions be in, say, 2030 from those in 2004 (the base year of the latest GTAP protection database) in the absence of a Doha agreement to undertake multilateral policy reform? This paper addresses that question by drawing on the World Bank's agricultural distortions database for 75 countries, political economy theory, a set of political econometric equations for the most important agricultural products, and knowledge of current WTO-bound tariffs. With those equations plus projections of pertinent variables from recent economywide modeling, a set of agricultural price distortions is generated for the world in 2030. This provides an alternative to the common 'business-as-usual' projections approach of assuming the status quo will prevail on the policy front, and thus an opportunity for modelers to explore the extent to which results could differ depending on the chosen counterfactual against which future trade-liberalizing scenarios are compared.

Keywords: agricultural protection, trade policy counterfactuals, economy-wide projections

JEL codes: F13, F14, F17, Q17, Q18

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What's the appropriate agricultural protection counterfactual for trade analysis?

In recent years there has been renewed interest in projecting global commodity markets and the overall economy two to four decades ahead. Demand for such long-term projections has been driven by such things as the recent rises in food and energy prices, rapid growth in large emerging economies, and worries about greenhouse gas emissions and policy responses to them. Such projections are also sought by trade policy analysts as a baseline for estimating the effects of proposed or alternative trade policy reforms that tend to be phased in over anything up to two decades. One such proposal is the Doha Development Agenda of the World Trade Organization (WTO). There are also numerous regional and other plurilateral economic integration proposals also under discussion, including a Trans-Pacific Partnership.

A common assumption in developing baseline projections for such analytical purposes is that trade-related policies do not change over the projection period. That may be reasonable for manufacturing protectionism, now that most major countries have liberalized most of their markets for industrial products. Agricultural policies, however, remain highly distortive – and they have been evolving in fairly systematic ways. How different might farm policies be in, say, 2030 from those in 2004 (the base year of the latest GTAP protection database) in the absence of a Doha agreement to undertake multilateral policy reform and any other plurilateral trade agreements?

This chapter addresses that question by drawing on the World Bank's agricultural distortions database for 75 countries, political economy theory, a set of political econometric equations for the most important agricultural products, and knowledge of current WTO-bound tariffs. With those equations plus projections of pertinent variables from recent economywide modeling, agricultural price distortion rates are generated for the world in 2030. This provides an alternative to the common 'business-as-usual' projections approach of assuming the status quo will prevail on the policy front. It thereby offers an opportunity for modelers to explore the extent to which results could differ depending on the chosen counterfactual against which future trade-liberalizing scenarios are compared.

The chapter begins with a brief summary of the post-World War II history of distortions to agricultural (relative to industrial) incentives globally. The second section draws on political economy theory and institutional history to propose a set of political econometric equations for the most important agricultural products, aimed at providing a means of projecting future agricultural distortions for any country in the absence of further trade reform.¹ The third section presents the econometric results, and the fourth section shows how different the welfare effects of trade-distorting policies are when these alternative price distortions are inserted into a global economywide model (Version 7.1 of GTAP). The key finding is that the contribution of farm policies to the estimated welfare cost of trade-distorting policies by 2030 is considerably higher – especially for developing countries – than if one assumes no change in farm policies over the next two decades. The final section draws out some policy implications.

Brief history of distortions to agricultural incentives globally

Some agricultural and other trade policy developments over the past half century or so have happened quite suddenly, been unpredicted, and been transformational. But others have been more gradual, therefore less noticed, but nonetheless understandable in political economy terms. Events surrounding the former include the end of colonization in many of today's developing countries from the late 1950s, the creation of the Common Agricultural Policy in Europe in 1962, the floating of exchange rates and associated liberalization, deregulation, privatization, and democratization from the mid-1980s in many countries, and the opening of markets in China from 1979, Vietnam from 1986, and Eastern Europe following the fall of the Berlin Wall in 1989 and the demise of the Soviet Union in 1991.

What about policy trends either side or in the absence of such shocks? For advanced economies, the most commonly articulated reason for farm policy interventions has been to protect domestic producers from import competition as they come under competitive pressure to shed labor as the economy grows and real wages rise. In the process, however, those protective measures hurt not only domestic buyers of food and producers of other products, but also foreign producers and traders of farm products. They also reduce national and global

¹ Bouët and Laborde (2010) also seek to assess the implications for the world economy of protection growth that might result if the WTO's Doha round fails to agree to liberalize trade multilaterally. However, their assumed alternative protection rates are more ad hoc than in the present study.

economic welfare. For decades, agricultural protection and subsidies in high-income (and some middle-income) countries have been depressing international prices of farm products, which lowers the earnings of farmers and associated rural businesses in developing countries. The Haberler (1958) report to GATT Contracting Parties forewarned that such distortions might worsen, and indeed they did between the 1950s and the early 1980s (Anderson, Hayami and Others 1986).

In addition to this external policy influence on developing countries, the governments of many of them have directly taxed their farmers over the past half century. A well-known example is the taxing of exports of plantation crops in post-colonial Africa (Bates 1981). At the same time, many developing countries chose also to overvalue their currency and to pursue an import-substituting industrialization strategy by restricting imports of manufactures. Together, those latter 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). Thus the price incentives facing farmers in many developing countries have been depressed by both own-country and other countries' agricultural price and international trade policies.

This disarray in world agriculture, as D. Gale Johnson (1973) described it in the title of his seminal book, means there has been overproduction of farm products in high-income countries and underproduction in low-income countries. During the past twenty-five years, however, numerous countries have begun to reform their agricultural price and trade policies. This has raised the extent to which farm products are traded internationally, but not nearly as fast as globalization has proceeded in the nonfarm sectors of the world's economies.

Empirical indicators of agricultural price distortions (called Producer and Consumer Support Estimates or PSEs and CSEs) have been provided in a consistent way for more than twenty years by the Secretariat of the OECD (2010) for its thirty member countries. However, the OECD provides no comprehensive time series rates of assistance to producers of nonagricultural goods to compare with those PSEs, nor of farm assistance rates in those advanced economies in earlier decades. As for developing countries, almost no comparable time series estimates were generated in the two decades following the first paper by Krueger, Schiff and Valdés (1988), which covered the 1960-84 period for just seventeen developing

countries.² However, a new database of agricultural distortions has been developed recently by the World Bank (Anderson and Valenzuela 2008) which complements and extends the OECD's PSE/CSE work and the seminal Krueger, Schiff and Valdés (1988, 1991) study. It builds on them by providing similar estimates for other significant (including many low-income) developing economies, by developing and estimating new, more comprehensive policy indicators (defined in the next sub-section), and by providing estimates for nonagricultural tradables to compare with the average for the agricultural sector (summarized in the following sub-section, drawing on Anderson (2009 Ch. 1 and 2010a Ch. 2)).³

Indicators of price distortions

Trade measures (taxes and non-tariff barriers or NTBs), both agricultural and nonagricultural, plus the use of multiple exchange rates, historically have distorted product prices at the border much more commonly than trade subsidies or direct domestic producer or consumer subsidies or taxes that alter product or input prices. In high-income countries from the 1970s, however, agricultural export subsidies grew in importance, and since the 1980s domestic farm support measures that are decoupled from production to varying extents have begun to play a bigger role. Also, most NTBs were converted to tariffs following the inception of the WTO in 1995. Those tariffs, however, have been legally bound at well above applied rates in many countries, leaving ample room for such countries to continue to vary border measures as international prices (or domestic supplies) fluctuate from year to year or as the demands for protection rise.

Government-imposed distortions that create a gap between domestic prices and what they would be under free markets are indicated by the Nominal Rate of Assistance (NRA). This has been computed for each farm product as the percentage by which government

² An exception is a set of estimates of nominal rates of protection for key farm products in China, India, Indonesia, and Vietnam since 1985, by Orden et al. (2007). The OECD (2009) also has released PSEs for Brazil, China, and South Africa, as well as several East European countries.

³ The new database includes estimates for 75 countries that together account for between 90 and 96 percent of the world's population, farmers, agricultural GDP, and total GDP. The sample countries also account for more than 85 percent of farm production and employment in each of Africa, Asia, Latin America, and the transition economies of Europe and Central Asia, as well as virtually 100 percent of agriculture in OECD countries. Price distortions are estimated for more than 70 different products, with an average of almost a dozen per country. That product coverage represents around 70 percent of the gross value of agricultural production in each of the focus countries and just under two-thirds of global farm production valued at undistorted prices over the period covered. Not all countries had data for the entire 1955–2007 period, but the average number of years covered is 41 per country. For a comparison of those estimates with those of Krueger/Schiff/Valdés, see Anderson (2010b).

policies have raised gross returns to farmers above what they would be without the government's intervention -- or lowered them, if $NRA < 0$.⁴ Included are any product-specific input subsidies. In Appendix Figure A the NRA averages and ranges are shown for 25 key farm products, for each of the developing country regions and for all 75 countries for the periods before and from 1985.

A weighted average NRA for all covered products is derived using the value of production at undistorted prices as product weights. To that NRA for covered products is added a 'guesstimate' of the NRA for noncovered products (which on average account for around 30 percent of the total in value terms) and an estimate of the NRA from non-product-specific forms of assistance or taxation. Since the 1980s, some high-income country governments have also provided so-called 'decoupled' assistance to farmers. Because that support in principle does not distort resource allocation as much as direct price supports, its NRA has been computed separately and is not included for 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 generated is a production-weighted average NRA for nonagricultural tradables, for comparison with that for agricultural tradables via the calculation of a Relative Rate of Assistance (RRA), defined in percentage terms as:

$$RRA = 100 * [(100 + NRA_{ag}^t) / (100 + NRA_{nonag}^t) - 1]$$

where NRA_{ag}^t and NRA_{nonag}^t are the percentage NRAs for the tradable parts of the agricultural (including noncovered) and nonagricultural sectors, respectively.⁵ Since the NRA cannot be less than -100 percent if producers are to earn anything, neither can the RRA (since the weighted average NRA_{nonag}^t is non-negative in all the country case studies). And if both of those sectors are equally assisted, the RRA is zero.

⁴ Also calculated is a Consumer Tax Equivalent (CTE), which is equal to the NRA if and only if no domestic producer or consumer measures also are in place.

⁵ The RRA is generated because 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 to prove 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 (Vousden 1990).

Anderson and Neary (2005) show that it is possible to develop a single index that captures the extent to which both the mean and the standard deviation of protection rates within a sector each year together contribute to the welfare cost of that sector's distortionary policies. Their index recognizes that the welfare cost of a government-imposed price distortion is related to the square of the price wedge, and so is larger than the mean, and more so the bigger the dispersion of industry protection rates within the sector; and it is positive regardless of whether the government's policy is favoring or hurting producers in that sector. Lloyd, Croser and Anderson (2010) show that, once NRAs and CTEs have been calculated, they can be used to generate such an index even in the more complex situation where there may be domestic producer or consumer taxes or subsidies in addition to not only import tariffs but any other trade taxes or subsidies or quantitative trade restrictions. Lloyd, Croser and Anderson call it a Welfare Reduction Index (WRI), which is the percentage agricultural trade tax (or uniform NRA and CTE) that, if applied equally to all agricultural tradables, would generate the same reduction in national economic welfare as the actual intrasectoral structure of distortions to domestic prices of farm goods. They show that, if the domestic price elasticities of supply (demand) are equal across farm commodities, then the only information needed to estimate the WRI, in addition to the NRAs and CTEs, is the shares of each commodity in the domestic value of farm production and consumption at undistorted prices.

Sectoral distortion differences across countries

Historically, national nominal rates of assistance to agriculture (NRAs) have tended to be higher, the higher a country's income per capita and the weaker a country's agricultural comparative advantage. There has also been a (somewhat weaker) tendency since the 1960s for manufacturing protection to be lower, the higher a country's income per capita and the stronger a country's manufacturing comparative advantage. Together these tendencies would expect one to observe the relative rate of assistance to farmers (RRA) to be positively correlated with per capita income and negatively correlated with an index of comparative advantage in farm products. This is indeed what the World Bank's agricultural distortions panel database reveals (Figure 1). Figure 2 shows the RRA has been rising over time for developing countries as a group, and also for high-income countries prior to the 1990s. The

developing countries' RRA rose from around -50 percent in the latter 1960s to almost zero in 2000-04, while the RRA for high-income countries rose from 14 percent in the latter 1950s to a peak of just above 50 percent in the latter 1980s. A movement in the RRA towards (away from) zero might indicate an improvement (worsening) in economic welfare, suggesting that the welfare cost of developing country policies may have been falling but may begin increasing if they follow the high-income countries' earlier example in raising their now-positive average RRA further. That is certainly what Korea and Taiwan did in following Japan, and China and India appear to be on a similar trajectory (Figure 3).

A disaggregation of the NRA estimate for the agricultural sector into the NRAs for the export and import-competing sub-sectors, as in Figure 4, reveals that developing country exporters of farm products faced a tax of around 50 percent on average in the first decades of post-colonial government; but that rate of taxation has gradually fallen to almost zero since the mid-1980s. Meanwhile, however, the NRA for import-competing farmers in developing countries has been positive and steadily rising throughout this period (apart from a spike in the mid-1980s when international prices fell to a near-record low as a consequence of a farm export subsidy war between the two sides of the North Atlantic). The trend for exporters could have reduced the welfare cost of agricultural distortions in developing countries, but the fact that import-competing farmers were increasingly assisted reduces that possibility. As for high-income countries, Figure 4(b) shows that their exporters received rising support until the end of the North Atlantic farm export subsidy war, but that import-competing farmers enjoyed higher and faster-rising support over that period than exporters.

Together these estimates suggest a mapping of the WRI against the log of per capita income may at first decrease but would then increase beyond some middle-income level. And that is indeed what both the combined panel dataset of national WRIs, and even the set for just developing countries, reveal (Figure 5). When the border component of the WRI for developing countries is tracked across time and broken down by trade policy instrument, it indicates that export taxation contributed increasingly to the welfare cost of agricultural distortions there until the late 1980s, but that the welfare cost of agricultural import restrictions also was sizeable and grew somewhat each decade (Figure 6).

What determines the evolution of NRAs over time?

Political economy theory to explain the pattern of agricultural distortions across countries and over time made some progress in the 1980s, but then it stalled. Only now are theorists beginning again to focus on improving our conceptualization of the issue, suggest hypotheses, compile appropriate data, and use political econometrics to test those hypotheses (see, e.g., Anderson 2010a; Rausser, Swinnen and Zusman 2011). But even the earlier analysis can take us some way towards understanding the evolution of agricultural price-distorting policies. Anderson (1995), for example, suggests the following factors distinguish the domestic politics of developing and high-income countries.

First, in a poor agrarian economy (PAE), urban wage-earners and hence their employers care a great deal about the price of food, and are relatively well organized. Farmers by contrast, are numerous but poorly organized, and many are so small as to be able to sell only a little or none of their output in the market. In a rich industrial economy (RIE), by contrast, farm products (especially net of post-farmgate costs) represent a small fraction of urban household expenditure and hence of real wages. As well, urban households are far more numerous and so suffer from a free-rider problem of collective action in RIEs, just as farmers do in PAEs.

Second, a typical PAE has the majority of its workforce employed in agricultural pursuits and relatively few in manufacturing, whereas in RIEs there could be up to ten times as many engaged in industrial jobs as on farms. Altering the domestic price of farm relative to industrial products thus has a far bigger impact on the price of mobile labor in a PAE than in a RIE. Industrial capitalists therefore are more likely to be able to lobby successfully for (and governments face less opposition to) taxes on agricultural exports and on imports of manufactured goods in PAEs, whereas agricultural interests are more likely to be able to lobby successfully for (and governments face less opposition to) agricultural subsidies and import tariffs in RIEs.

And third, high costs of collecting taxes other than at the border in PAEs make them much more likely than RIEs to employ trade taxes and thus be prone to an anti-trade bias in their sectoral policies, and high costs of dispersing funds make PAEs less fiscally capable of subsidizing any sector. By definition the PAE has a comparative advantage in agricultural goods, hence this anti-trade bias adds to the anti-agricultural bias in PAE policies.

Together these forces lead one to expect to observe countries gradually switching from a negative to a positive RRA as their per capita income grows, and more so if their agricultural comparative declines in the process of that development. That is consistent with the evidence presented in Figure 1 above. It is also consistent with a formal econometric test using those two variables for the full sample of countries in the Anderson and Valenzuela (2008) panel dataset, as well as separately for each of the three developing country regions and for high-income countries (Anderson 2010a, Table 2.12).

The domestic polity also can come under pressure from outside from time to time. Three sets of external forces during the past quarter-century are worth mentioning. One is the Uruguay Round Agreement on Agriculture, negotiations for which began in 1986 and implementation of which concluded in 2004. That led to agreements to convert non-tariff barriers to tariffs, to set caps (bindings) on those tariffs, and to phase down and cap domestic and export subsidies.⁶ The caps were somewhat above applied rates in high-income countries, but they were very much above applied tariffs in the case of middle- and especially low-income countries. Hence those bindings currently provide little discipline on the agricultural policies of most developing countries.⁷

A second and complementary force in Europe was the likelihood and then reality of an eastern enlargement of the European Union, which required the budget for subsidies under the Common Agricultural Policy gradually to be spread over a dozen more countries. One consequence was a move away from price-support instruments to more-decoupled measures including single farm payments. The reforms came in various stages, under McSharry in 1992 and under Fischler in the early 2000s (Swinnen 2008), which explains much of the gradual fall in EU and hence high-income agricultural NRAs after the late 1980s (Figure 4(b)). For intra-EU political and budgetary reasons they are unlikely to trend back upwards in the foreseeable future.

⁶ A further consequence of the Uruguay Round was that it contributed to the unilateral decisions in Australia and New Zealand to phase out most of their agricultural assistance, although the main political drivers there were domestic and they led to even larger cuts to what had been high rates of manufacturing protection. Hence the (negative) RRA in those countries rose to zero, just as happened in developing countries (Anderson, Lloyd and MacLaren 2007).

⁷ They are still valuable in limiting the scope for countries to raise tariffs when international food prices spike downwards though (Francois and Martin 2004) – as they have tended to do in the past, thereby accentuating the fall in the international price (Anderson and Nelgen 2011).

The third external force came from international financial institutions whose loans and other assistance to developing countries became somewhat conditional on better economic governance including more openness of their economies. That helped to bring down their NRAs for non-farm tradable sectors (Figure 2(a)) and to phase out their taxes on farm exports (Figure 4(a)). However, with so little discipline on farm import tariffs coming from the Uruguay Round Agreement on Agriculture, those tariffs have continued to drift upwards for developing countries over the past two decades.⁸ It also means it has been difficult for the WTO membership to demand tight constraints on out-of-quota farm tariffs of countries seeking to accede to the WTO. This is the case even for China, where strong pressure resulted in low tariffs only on in-quota volumes of imports.

The above suggests high-income countries (including Eastern Europe's transition economies that are now part of the European Union) are unlikely in the foreseeable future to raise their assistance to farmers via price-distorting measures, developing countries are unlikely to return to farm export taxation (apart from temporarily at times of price spikes, discussed in footnote 8), and all countries are unlikely to return to high levels of protection for the manufacturing sector. But if the WTO's Doha Development Agenda fails to conclude with an agreement to greatly reduce developing countries' bindings on agricultural import tariffs, political economy theory and past experience suggest their agricultural protection growth may well continue. More specifically, such protection increases could be expected to be related to growth in per capita income and in agricultural comparative disadvantage, and to be higher for import-competing than exported farm products. According to the econometric evidence reported in Anderson (2010a, Table 2.12), an equation worth considering for projecting each country's tradable food products is the following:

$$(1) \quad \text{NRA}_i = f(\text{YPC}, \text{LPC}, \text{TSI}_i)$$

where YPC is the log of real per capita national income, LPC is the log of arable land per capita (an indicator of agricultural comparative advantage), and TSI_i is a trade specialization

⁸ There are virtually no effective WTO disciplines on export taxes though. Some developing countries have chosen to use that freedom to impose export taxes (and lower import taxes) temporarily when international food price spike upwards, so as to not transmit all of such price spikes to their domestic food market. As already mentioned, the gap between their applied and bound import tariff also gives them latitude to raise applied rates when international prices fall, so as to protect their farmers from that slump. Evidence of extensive use of these freedoms is provided by Anderson and Nelgen (2011).

index for product i (exports minus imports as a fraction of exports plus imports of i) which, by definition, ranges between minus and plus one.

Projecting developing country NRAs from 2004 to 2030

Most modelers of trade-related policies for the global economy make use of the GTAP database, the latest version of which is for 2004 (Narayanan and Walmsley 2008).⁹ Modelers wishing to estimate the likely effects of a future structural or policy shock need first to project a baseline of the global economy to a target future date such as 2030 in the absence of that shock. This can then serve as the counterfactual against which to compare the economy in that year in the presence of the shock of interest (e.g., the implementation of a multilateral trade agreement such as that being sought under the WTO's Doha Development Agenda).

Typically modelers would assume for their baseline that trade-related policies remain unchanged over the projection period. The purpose of this section is to provide an alternative counterfactual. It does so by reporting estimates of Equation (1) for ten key traded farm products as of 2004, and of projections of NRAs for each of those products to 2030 for each developing country in the World Bank distortion database compiled by Anderson and Valenzuela (2008). The sample for the regression equation is all 75 countries in the World Bank distortion database in 2004.

The regression equations are reported in Table 1. The results are not highly significant, but apart from maize at least one of the 3 explanatory variables is statistically significant in each equation. The insignificant result for maize is not surprising in view of the very small range of its NRAs in the panel data and their average of almost zero (see Appendix Figure A(e)). For the other nine products, the R^2 values are between 0.21 and 0.55. All product equations have a positive coefficient for YPC and a negative coefficient for LPC, as predicted by theory. All except soybean have a negative coefficient for TSI, again consistent with the above theory. (Appendix Figure A(e) shows that in the panel data soybean has an even smaller range of NRAs around its zero average than does maize.)

⁹ For those modelers with a particular interest in developing country agriculture, an alternative set of distortion estimates has been provided by Valenzuela and Anderson (2008), based on the World Bank distortion database compiled by Anderson and Valenzuela (2008). This alternative set goes beyond the GTAP set, which mainly includes only import tariffs, to incorporate also export taxes, import subsidies, and domestic producer or consumer taxes or subsidies. It is the set adopted in the present study.

To use these equations to project NRAs, it is necessary to have projected values for the three exogenous variables. These are taken from a recent exercise that employs the GTAP economy-wide model to project the world economy to 2030 (Anderson and Strutt 2011). That projection assumes the 2004 trade-related policies of each country do not change over that 26-year period but that national real GDP, population, unskilled and skilled labor, capital, agricultural land and other natural resources (oil, gas, coal and other minerals) grow at exogenously set rates. Those exogenous growth rates are based on ADB, OECD, USDA and World Bank projections, plus historical trends in mineral and energy raw material reserves. Given those exogenous growth rates, the model is able to derive implied rates of growth in total factor productivity and GDP per capita. For any one country the rate of total factor productivity growth is assumed to be the same in each of its non-primary sectors, and to be somewhat higher in its primary sectors. Higher productivity growth rates for primary activities were characteristic of the latter half of the 20th century (Martin and Mitra 2001), and are necessary in this projection if real international prices of primary products (relative to the aggregate change for all products) are to rise only modestly to 2030.¹⁰ Once those higher TFP growth rates for primary sectors are determined, the uniform rates for non-primary sectors are re-calculated to ensure the targeted GDP levels are obtained.

In addition to taking the real GDP, land and population values for 2030 from the Anderson and Strutt (2011) study, we also use its estimated trade structure for 2030 to estimate a value for TSI for each product and country. That provides all the exogenous variables needed to estimate a potential endogenous value for the NRA for each product and country. That estimated value is then subjected to the following series of tests. First, if a farm product was in 2004 and is projected still to be a net export product in 2030 ($TSI > 0$), then its 2030 NRA is assumed to be the lesser of its 2004 NRA or zero. That is, we assume all export taxes will be phased out by 2030, and that no new export subsidies will be introduced. And second, if it is projected to be an import-competing product in 2030 ($TSI < 0$), then its 2030 NRA is assumed to be the lesser of the equation's projected NRA or its WTO-bound tariff

¹⁰ That calibration is consistent with the World Bank's projections over the coming decades (see van der Mensbrugghe and Roson 2010) and with the calibration of the Linkage model used below. An alternative in which agricultural prices fall is considered unlikely over the next two decades, given the slowdown in agricultural R&D investment since 1990 and its consequent delayed slowing of farm productivity growth (Alston, Babcock and Pardey 2010). It is even less likely for farm products if fossil fuel prices and biofuel mandates in the US, EU and elsewhere are maintained over the next decade. Another alternative is that real international primary product prices will rise over coming decades, in which case assistance to farmers might be less everywhere than suggested below. For reasons of space, neither of these alternatives are considered below, but they could be worthy of subsequent analysis.

rate. That is, we assume that all developing country governments respect their commitment to WTO not to exceed their tariff bindings but otherwise that they feel free to respond to domestic political forces in determining the degree of protection provided to import-competing farm industries.

Using this methodology and set of selection criteria, we obtain projected values for each of the ten products and for each of the 39 developing countries in the World Bank sample. Their averages across countries for each region and across products for each country are reported in Tables 2 and 3, respectively.

What do those estimates reveal? For developing countries as a whole, the average NRA for these products is projected to rise from 7 percent in 2004 to 35 percent by 2030. It happens that 35 percent is the 2004 average for high-income countries (including Europe's transition economies). Since we assume the NRAs for the latter countries do not change over the projection period, it means the NRA for these ten products for the world as a whole is projected to rise, from 20 percent in 2004 to 35 percent by 2030, other things equal. As shown in Table 3(b), the biggest increase is in developing Asia, where the average NRA rises from 11 to 42 percent over the projection period, followed by Africa (a rise from -9 to 16 percent) and Latin America (a rise from -1 to 17 percent). The biggest rises are in rice and sugar, which is not surprising since they are the most distorted products in high-income countries (see bottom of Table 2).

For farm products other than these ten major ones, and for highly processed food and other merchandise, we assume developing country import protection rates in 2030 are the same as in 2004, and that any agricultural export taxes in 2004 are eliminated by 2030.

Projecting the cost of trade-distorting policies as of 2030

What would those projected NRAs imply about the cost of agricultural and other price- and trade-distorting policies in the world economy in 2030, compared with assuming no changes in trade policies since 2004? To answer that question requires comparing results from two global trade liberalization simulations with a global economy-wide model that has been projected to 2030 with the 2004 GTAP protection database amended using the alternative fuller agricultural distortions for developing countries in Valenzuela and Anderson (2008).

The first experiment would assume those 2004 distortions remain unchanged over the projection period, while the second would assume those 2004 distortions changed in ways described in the previous section for developing countries but that tariffs in high-income countries stay the same as in 2004. The import tariffs for the first simulation are shown in the first three columns of Table 4, while the average tariffs for all of agriculture and processed food for the second simulation are shown in the final column of Table 4.

Such an exercise has been undertaken recently by Anderson and Strutt (2011), using the standard GTAP Model of the world economy (Hertel 1997) and its Version 7.1 database for 2004. They aggregate the model to 33 countries/country groups and 26 sector/product groups, and then project the global economy to 2030 by first assuming no policy changes and then assuming the above-described agricultural protection growth in developing countries. Welfare results from those two simulations are summarized in Tables 5 and 6.

Table 5 shows the distribution of the gains that would come from full global liberalization of all merchandise trade as of 2030. A comparison of parts (a) and (b) of that table suggest, unsurprisingly, that the global welfare cost of trade policies would be somewhat higher with that agricultural protection growth. In particular, the welfare cost of developing countries' agricultural policies would be more than one-quarter higher, increasing the cost of their policies overall by one-ninth – and raising agriculture's contribution to the global cost of all goods trade distortions from 62 to 64 percent.

Table 6 disaggregates those results to reveal their effects on major economies. The differences in the two sets of effects are a combination of higher protection rates and thus also consumer prices for some farm products in some developing countries, substitution towards the production and away from the consumption of those more-protected products in those countries, and, as a consequence of those adjustments, terms of trade changes for all countries. For most but not all of the countries/country groups shown in Table 6, their welfare would be lower (their gain from liberalization greater) in the scenario in which agricultural protection was greater. The exceptions are food-importing Japan, China and Rest of South Asia, all of whom would have benefitted from the lower international prices associated with higher agricultural protection and thus would suffer a greater terms of trade deterioration with reform.

Conclusions

The above analysis suggests the common assumption in developing baseline projections for the world economy, namely that trade-related policies do not change over a projection period as long as a quarter-century, may lead to underestimation of the gains from the phased implementation of prospective trade agreements. Had Japan and Korea been required to bind their agricultural tariffs at the rates in place when they signed onto the GATT in 1955 and 1967 respectively, estimates of the economic benefits of their membership of that club would have differed greatly had it been assumed their farm tariffs would remain unchanged over the following quarter-century rather than rise – as indeed they did, and spectacularly so (Figure 7).

At the time of China's accession to WTO in December 2001, its NRA was less than 5 percent (see Figure 7), or 7.3 percent for just import-competing agriculture according to Anderson and Valenzuela (2008). Its average bound import tariff commitment was about twice that (16 percent in 2005), but what matters most is out-of-quota bindings on the items whose imports are restricted by tariff rate quotas. The latter tariff bindings as of 2005 for China were 65 percent for grains, 50 percent for sugar and 40 percent for cotton (WTO, ITC and UNCTAD 2007, p. 60). Hence it too has scope to raise its agricultural protection substantially, making the assumed doubling in the present study (see Table 4) look quite feasible.

The alternative to the common 'business-as-usual' approach projections of assuming the status quo will prevail on the policy front, as developed in this study, illustrates the extent to which results could differ depending on the chosen counterfactual against which future trade-liberalizing scenarios are compared. The key finding is that the contribution of farm policies to the estimated welfare cost of trade-distorting policies by 2030 is considerably higher – especially for developing countries – than if one assumes no change in farm policies over the next two decades.

If developing countries are concerned that their food import dependence would increase if they did not raise their import tariffs over time, greater farm productivity growth could alleviate that concern. Since further investments in agricultural R&D typically have very high expected payoffs in developing countries (Alston et al. 2000), and are very likely to

reduce poverty as well (Ivanic and Martin 2010), a boost to such public investment would be welfare-enhancing, in contrast to the costly alternative of agricultural protection growth.

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Table 1: Relationship between NRA and income, arable land endowment and a product's trade status, developing countries, 2004

(endogenous variable: NRA)

	Beef	Cotton	Maize	Milk	Pigmeat	Poultry	Rice	Soybean	Sugar	Wheat
Exogenous variables:										
YPC	0.378*** (0.0662)	0.150** (0.0655)	0.0222 (0.0306)	0.198*** (0.0594)	0.0895 (0.0579)	0.197** (0.0928)	0.396*** (0.0891)	0.330* (0.173)	0.268*** (0.0542)	0.0555* (0.0306)
LPC	-0.200** (0.0977)	-0.0477 (0.120)	-0.0735 (0.0717)	-0.265*** (0.0817)	-0.135* (0.0776)	-0.265* (0.145)	-0.725*** (0.173)	-0.849** (0.311)	-0.122 (0.112)	-0.122* (0.0691)
TSI _i	-0.169 (0.120)	-0.00249 (0.107)	-0.00486 (0.0747)	-0.0383 (0.101)	-0.0795 (0.0973)	-0.354* (0.187)	-0.369** (0.159)	0.115 (0.328)	-0.176 (0.126)	-0.114 (0.0733)
Constant	-2.978*** (0.592)	-1.227** (0.552)	-0.141 (0.261)	-1.483*** (0.530)	-0.693 (0.522)	-1.439* (0.833)	-3.701*** (0.766)	-3.517** (1.561)	-1.295*** (0.482)	-0.481* (0.271)
Observations	44	22	56	41	35	42	37	26	57	53
R-squared	0.554	0.241	0.031	0.410	0.214	0.268	0.527	0.309	0.336	0.265
Adj. R-squared	0.521	0.114	-0.0248	0.362	0.138	0.210	0.484	0.215	0.298	0.220

Standard errors are shown in parentheses

Significance levels are *** p<0.01, ** p<0.05, * p<0.10

Source: Authors' estimates, based on NRA estimates and other variable data compiled from the World Bank (World Development Indicators) and the United Nations (COMTRADE data) by Anderson and Valenzuela (2008).

Table 2: NRA averages by region and product, estimated 2004 and projected 2030
(percent, using 2004 value of production at undistorted prices as weights)

Asia	2004	2030
Beef	72	38
Cotton	1	7
Maize	7	23
Milk	21	14
Pigmeat	2	18
Poultry	4	17
Rice	14	85
Soybean	9	33
Sugar	49	92
Wheat	13	30
Africa		
Beef	-23	17
Cotton	-35	0
Maize	-13	12
Milk	-2	13
Poultry	20	5
Rice	-5	34
Soybean	-49	0
Sugar	51	51
Wheat	2	14
Latin America		
Beef	-8	24
Cotton	1	0
Maize	-9	14
Milk	32	51
Pigmeat	-8	25
Poultry	11	15
Rice	31	55
Soybean	-8	0
Sugar	22	21
Wheat	-7	13
High-income countries		
Beef	36	36
Cotton	26	26
Maize	17	17
Milk	62	62
Pigmeat	15	15
Poultry	23	23
Rice	328	328
Soybean	3	3
Sugar	162	162
Wheat	3	3

Source: Authors' compilation (see text for methodology)

Table 3: NRA ten-product averages by country, estimated 2004 and projected 2030

(percent, using 2004 value of production at undistorted prices as weights)

(a) by country

	2004	2030
Bangladesh	-4	172
China	2	30
India	22	27
Indonesia	15	113
Korea	258	166
Malaysia	65	71
Pakistan	-1	22
Philippines	10	91
Sri Lanka	-9	0
Thailand	1	27
Vietnam	26	48
Benin	0	0
Burkina Faso	0	0
Cameroon	0	12
Chad	0	0
Cote d'Ivoire	9	19
Egypt	-11	9
Ethiopia	-2	15
Ghana	46	20
Kenya	7	15
Madagascar	11	30
Mali	43	1
Mozambique	65	55
Nigeria	-16	32
Senegal	4	27
South Africa	4	26
Sudan	-15	9
Tanzania	-1	22
Togo	6	1
Uganda	6	34
Zambia	-41	16
Zimbabwe	-75	15
Argentina	-23	0
Brazil	5	4
Chile	0	72
Colombia	25	67
Dominican Rep.	24	11
Mexico	0	43
Nicaragua	-6	8

Table 3 (cont.): NRA ten-product averages by country, estimated 2004 and projected 2030
(percent, using 2004 value of production at undistorted prices as weights)

(b) by region

	2004	2030
Asia	11	42
Africa	-9	16
Latin America	-1	17
All developing	7	35
All high-income	35	35
World	20	35

Source: Authors' compilation (see text for methodology)

Table 4: Average import-weighted tariff protection rates, by sector, 2030

(percent)

	<i>2030 rates assuming no policy changes (same as 2004)^a</i>			<i>2030 agric & food rates, assuming higher developing country agric protection^a</i>
	Agric & processed food	Other Primary	Manuf- actures	
Western Europe	5.0	0.1	1.1	5.0
Eastern Europe & Russia	12.9	0.6	5.5	12.8
United States & Canada	5.9	0.2	1.8	6.1
Australia & New Zealand	2.2	0.0	4.1	2.2
Japan	24.2	0.0	1.1	24.7
China	10.9	0.8	6.5	20.4
ASEAN	13.1	0.7	4.6	19.6
Pacific Islands	22.4	0.6	7.9	32.4
Rest of East Asia	26.6	4.3	3.4	36.8
India	11.8	10.5	13.5	30.0
Rest of South Asia	13.1	5.3	14.8	18.9
Central Asia	10.3	0.1	5.5	23.4
Latin America	7.5	1.6	7.0	20.0
Middle East & Africa	13.1	2.6	9.4	26.6
High-income countries	7.3	0.2	1.7	7.3
Developing countries^b	12.3	3.3	6.7	23.0
of which: Asia	12.6	3.4	5.9	22.6
Total	10.3	2.1	3.7	16.2

^a See text for description of the two alternative simulations.^b Developing countries are defined as all but the first five in the above list (and so include Central Asia). Turkey is included in 'Eastern Europe'; the new EU27 members of Central and SE Europe are included in 'Western Europe'.

Source: Anderson and Strutt (2011).

Table 5: Effects of full global liberalization of agricultural and other merchandise trade on global economic welfare, by sectoral policies and regions,^a 2030

(a)	Core simulation					
	Regional gain (2004\$USbillion)			Regional gain (%)		
	Developing countries	High-income countries	All countries	Developing countries	High-income countries	All countries
Developing countries liberalize						
Agric and food	68	15	84	34	11	25
Other products	87	29	116	43	22	34
All products	155	45	200	76	33	59
High-income countries liberalize						
Agric and food	20	105	125	10	78	37
Other products	29	-15	15	14	-11	4
All products	49	91	140	24	67	41
All countries liberalize						
Agric and food	88	121	209	43	89	62
Other products	116	15	131	57	11	39
All products	204	136	340	100	100	100
(b) Assuming agricultural protection growth in developing countries						
(b)	Regional gain (2004\$USbillion)			Regional gain (%)		
	Developing countries	High-income countries	All countries	Developing countries	High-income countries	All countries
	Developing countries	High-income countries	All countries	Developing countries	High-income countries	All countries
Developing countries liberalize						
Agric and food	87	26	114	38	18	30
Other products	90	30	120	39	20	32
All products	177	56	233	78	38	62
High-income countries liberalize						
Agric and food	20	107	126	9	72	34
Other products	32	-15	17	14	-10	4
All products	51	92	143	23	62	38
All countries liberalize						
Agric and food	107	133	240	47	90	64
Other products	121	15	136	53	10	36
All products	228	148	376	100	100	100

Source: Anderson and Strutt (2011).

Table 6: Effects of full global liberalization of agricultural and other merchandise trade on global economic welfare, by country/region, without and with developing country agricultural protection growth, 2030

(per year)

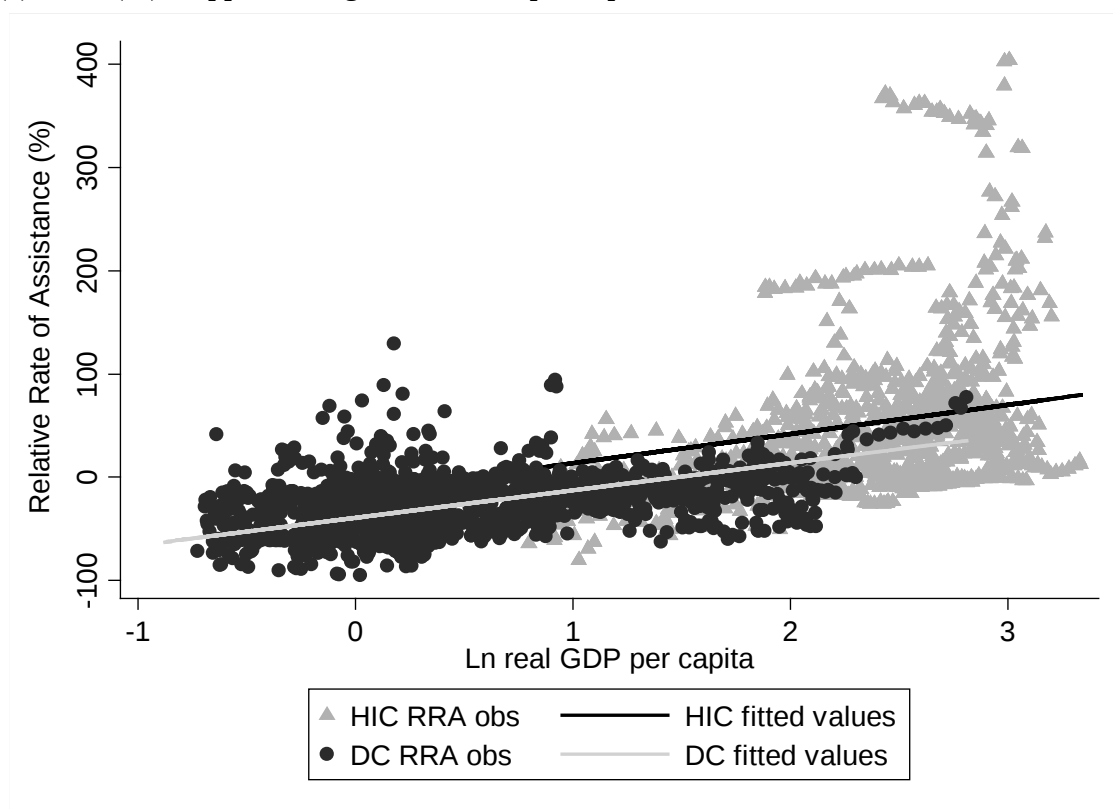
	Global MFN from 2004 prot rates^a	Global MFN from higher ag prot case^a
Western Europe	60.2	65.2
Eastern Europe & Russia	17.0	20.4
United States & Canada	5.0	18.7
Australia & New Zealand	6.8	8.4
Japan	32.1	30.8
China	30.2	25.2
ASEAN	37.6	38.5
Pacific Islands	1.0	1.2
Rest of East Asia	38.8	37.2
India	28.4	35.1
Rest of South Asia	6.3	0.3
Central Asia	3.3	4.4
Latin America	25.6	34.3
Middle East & Africa	47.8	56.6
High-income countries	121.1	143.6
Developing countries^b	218.8	232.8
of which: Asia	145.5	141.9
Other ^b	73.4	90.9
Total	339.9	376.4

^a See text for description of the two alternative simulations.

^b Developing countries are defined as all but the first five in the above list (and so include Central Asia). Turkey is included in ‘Eastern Europe’; the new EU27 members of Central and SE Europe are included in ‘Western Europe’.

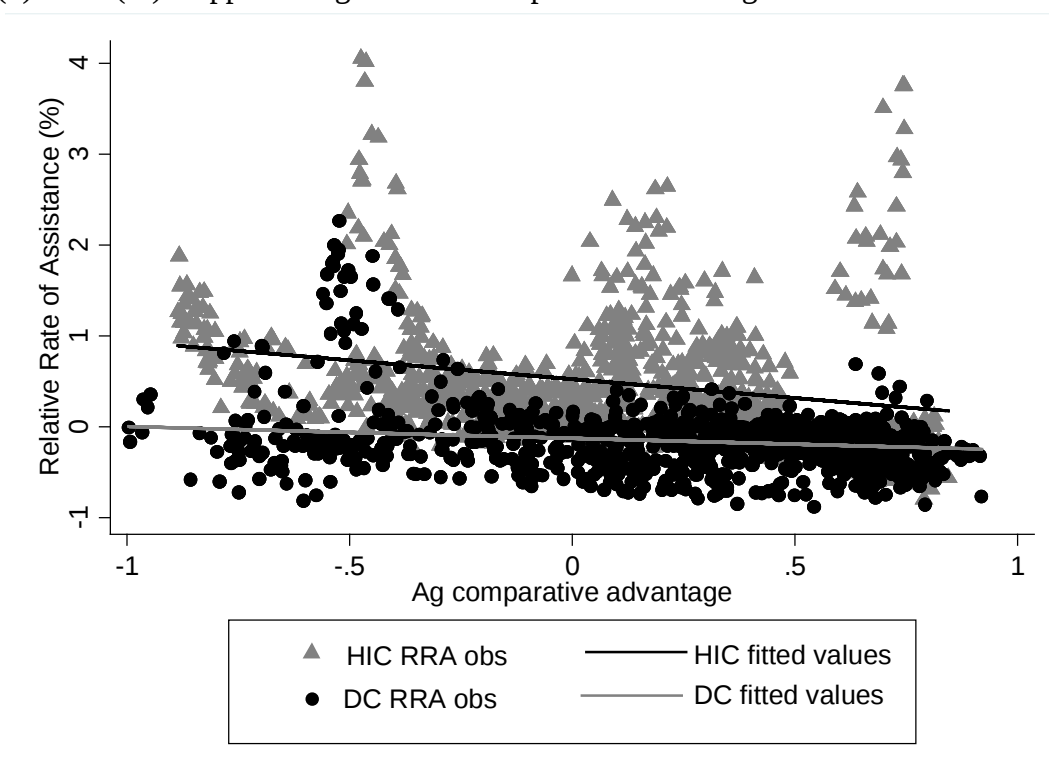
Source: Anderson and Strutt (2011).

Figure 1: RRA mapped on real income and agricultural comparative advantage,^a 1955 to 2007
(a) RRA (%) mapped on log of real GDP per capita



(b)

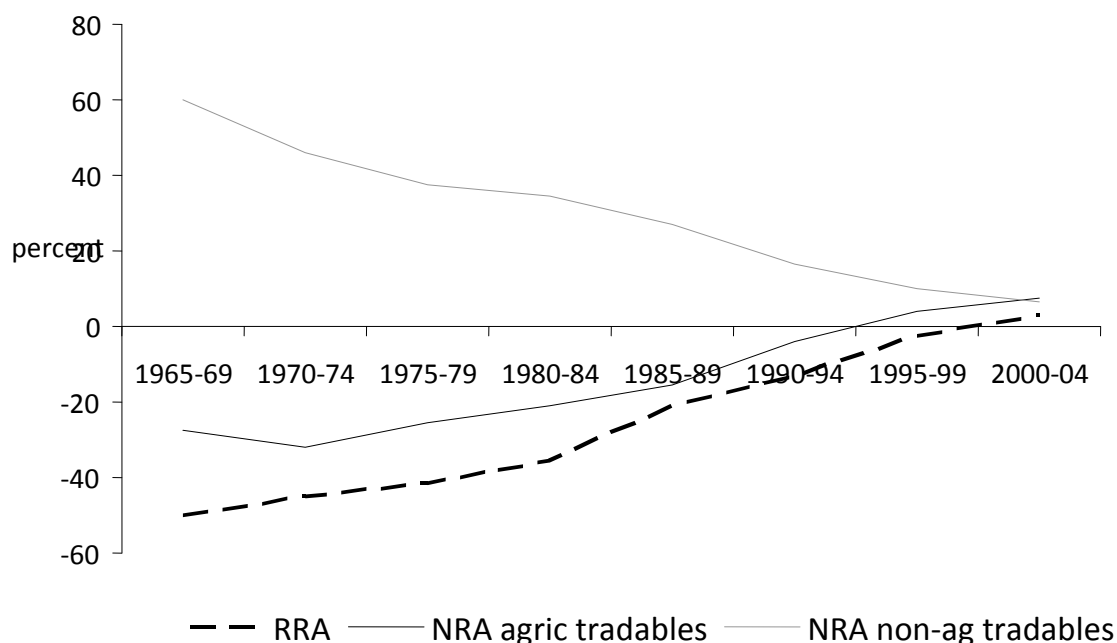
(b) RRA (%) mapped on agricultural comparative advantage^a



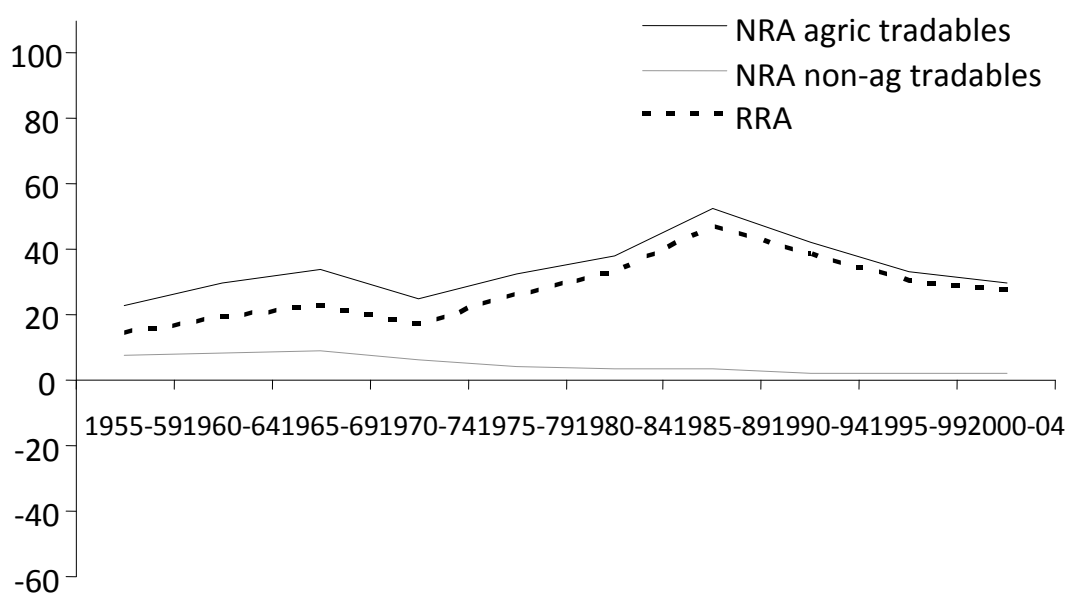
^a Defined as agricultural net exports divided by the sum of agricultural exports and imports.
Source: Anderson (2010a, Figures 2.2 and 2.3)

Figure 2: 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
(percent, farm production-weighted averages across countries)

(a) Developing countries



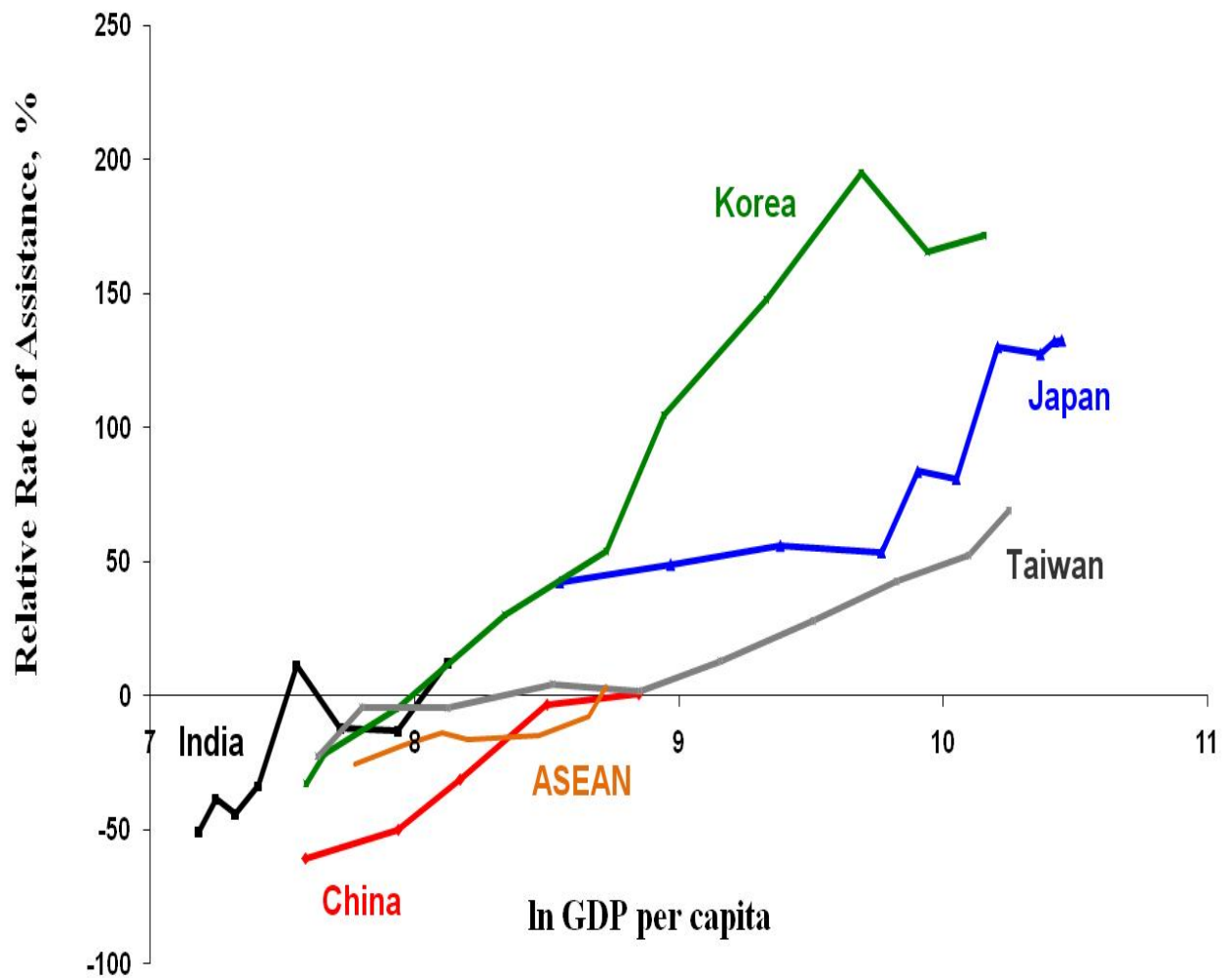
(b) High-income countries



^a The RRA is defined as $100 * [(100 + NRA_{ag}^t) / (100 + NRA_{nonag}^t) - 1]$, where NRA_{ag}^t and NRA_{nonag}^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).

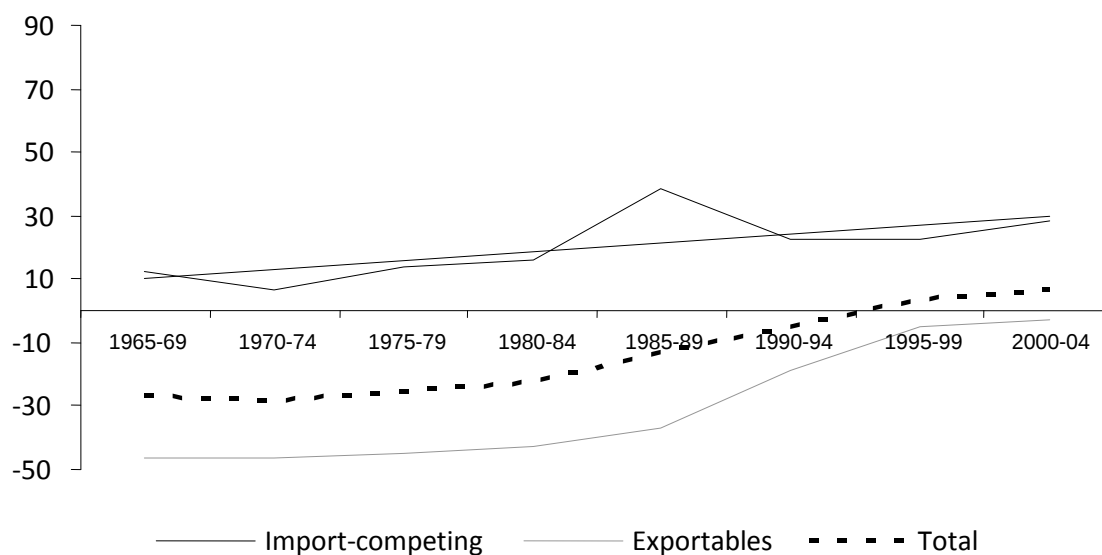
Figure 3: RRAs and log of real per capita GDP, India and East Asian focus economies, 1955 to 2005



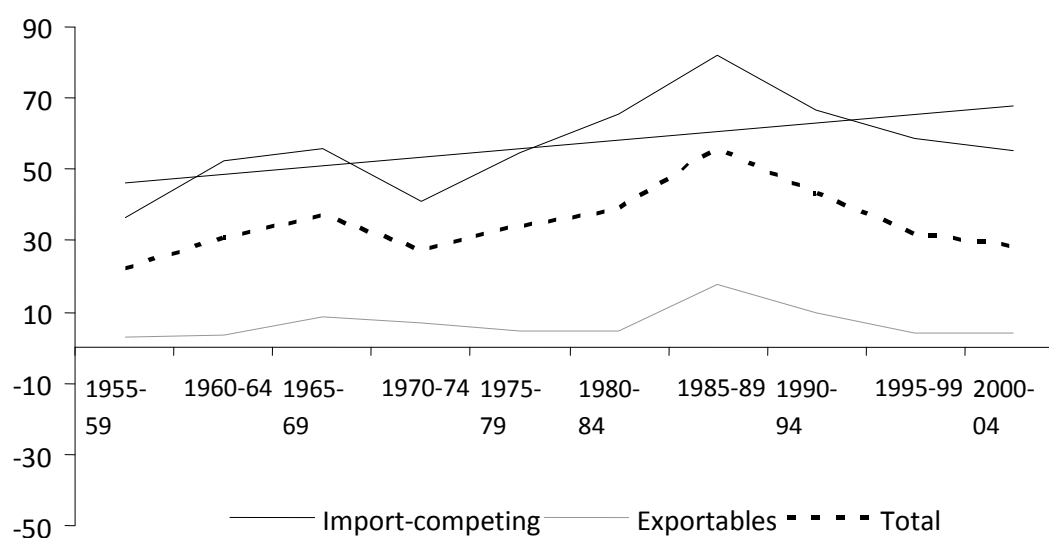
Source: Anderson and Martin (2009, Ch. 1).

Figure 4: Nominal rates of assistance to exportable, import-competing and all covered agricultural products,^a high-income, transition and developing countries, 1955 to 2004 (percent, 5-year weighted averages)

(a) Developing countries



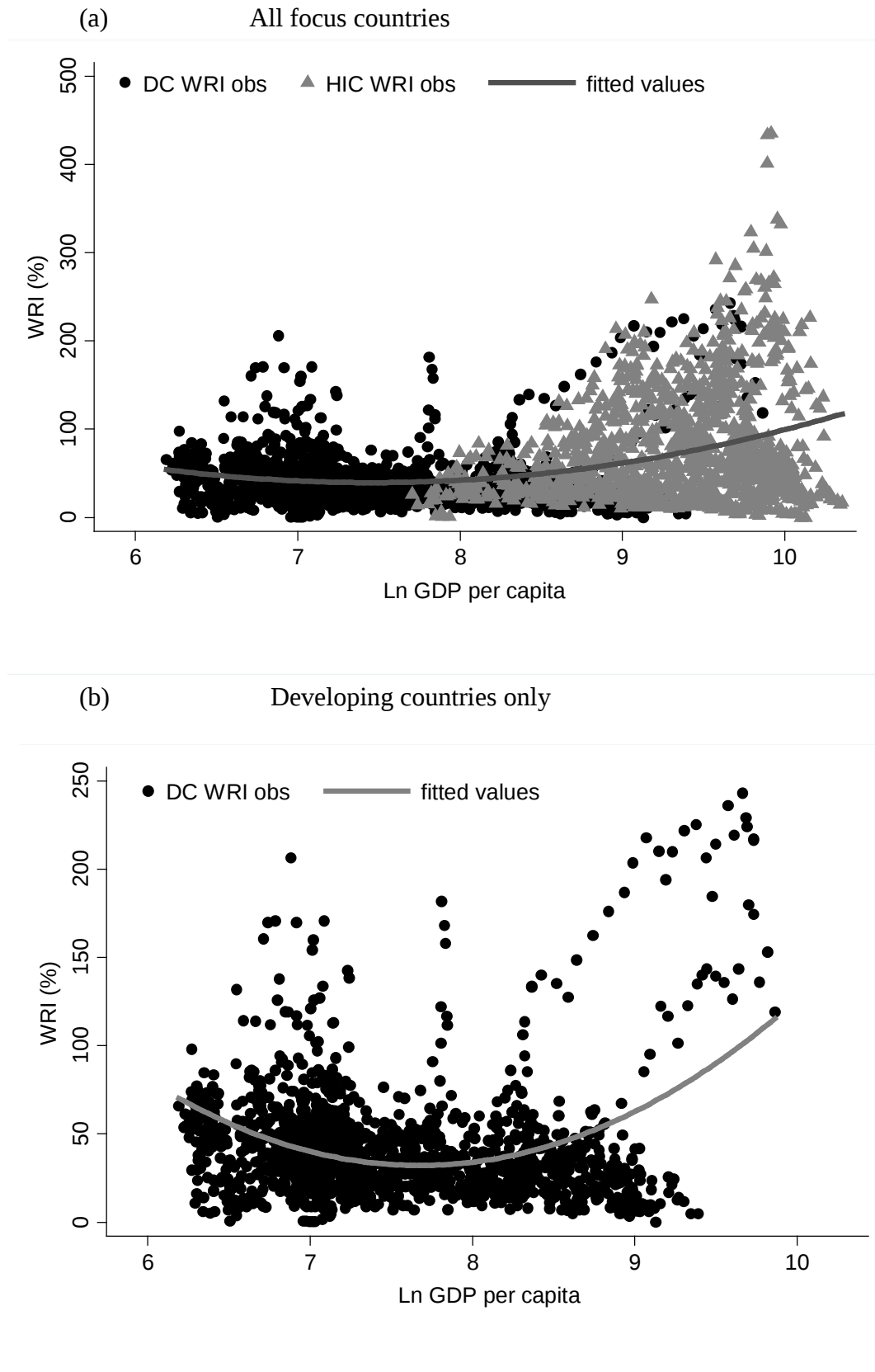
(b) High-income countries plus Europe's transition economies



^aCovered products only. The total also includes nontradables. The straight line in the upper segment of each graph is from an ordinary-least-squares regression based on annual NRA estimates for agriculture's import-competing sub-sector.

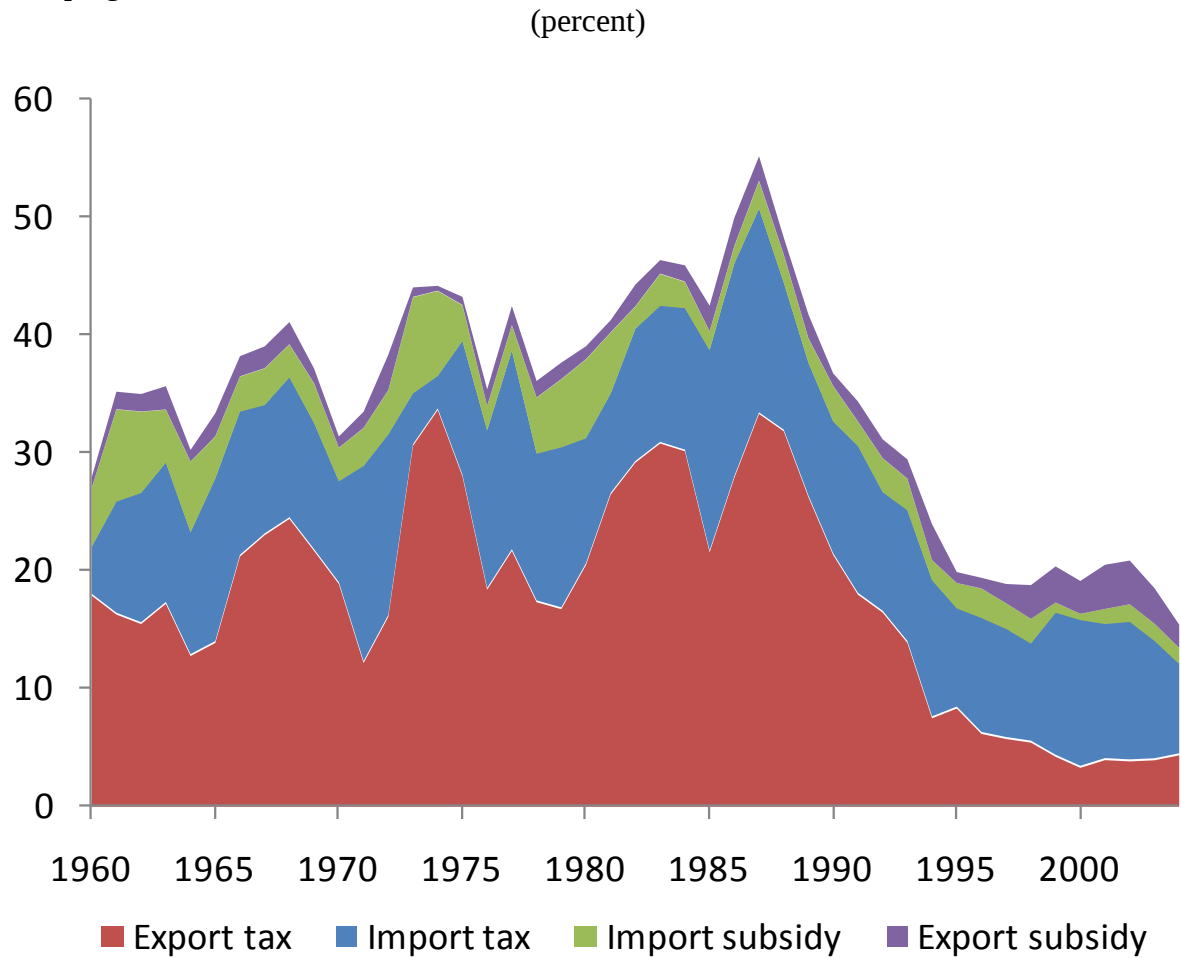
Source: Anderson (2009, Ch. 1), based on estimates in Anderson and Valenzuela (2008).

Figure 5: Agricultural WRI mapped on real GDP per capita,^a 1955 to 2007



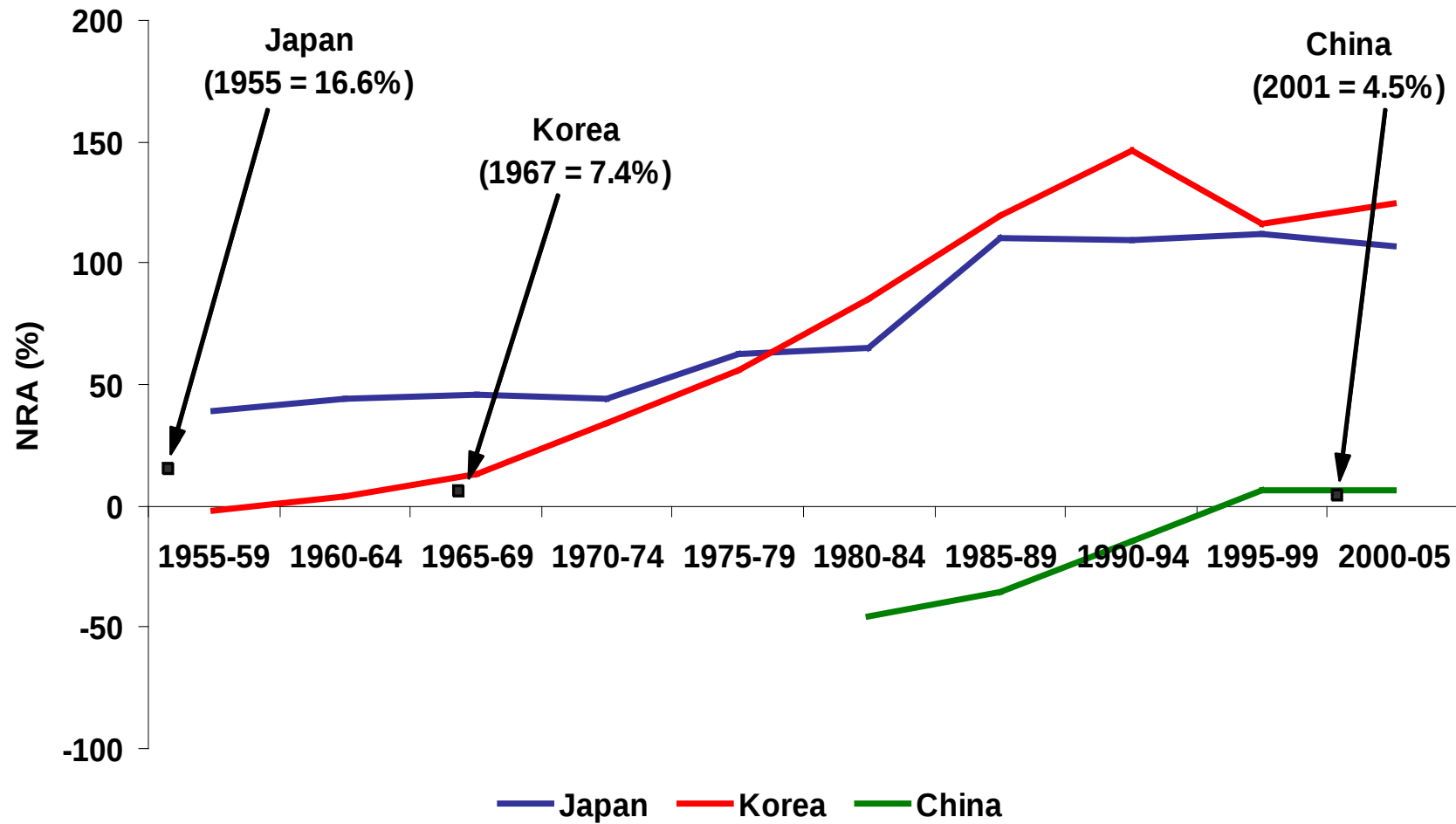
^a The GDP per capita data are 1990 international Geary-Khamis dollars (Maddison 2003).
Source: Authors' derivation, based on WRI estimates in Anderson and Croser (2009).

Figure 6: Contributions of different instruments to the border component of the WRI for developing countries, 1960 to 2004



Source: Authors' derivation, based on estimates reported in Croser and Anderson (2010).

Figure 7: Agricultural NRAs for Japan, Korea and China and date of accession to GATT or WTO, 1955 to 2005
(percent)

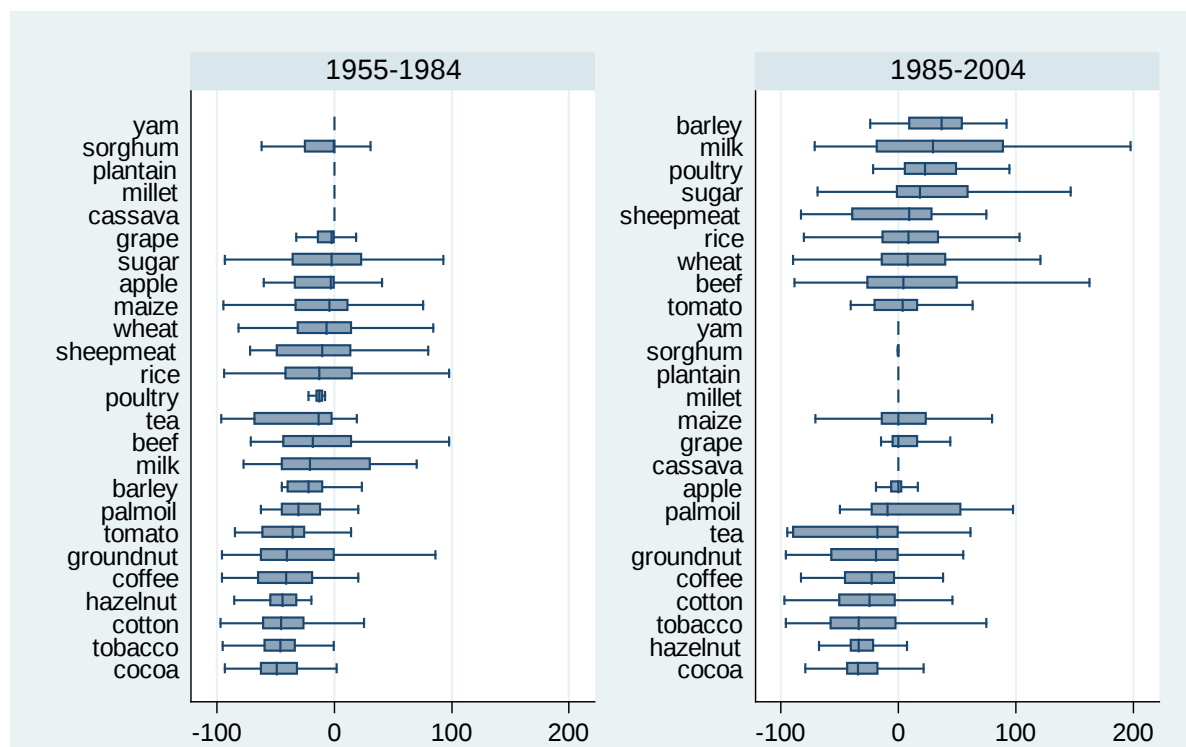


Source: Anderson and Martin (2009, Figure 1.16), based on estimates in Anderson and Valenzuela (2008)

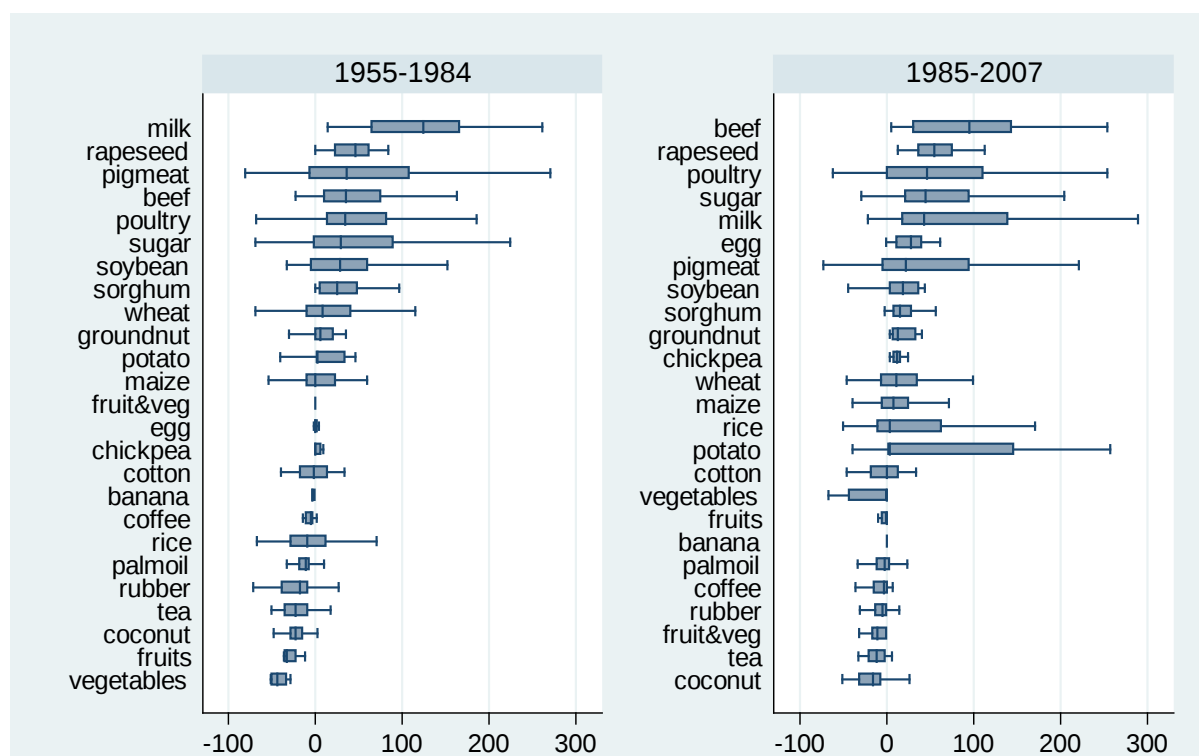
Appendix Figure A: Box plot distributions of NRAs for 25 major agricultural products, various regions of the world, 1955 to 2007

(long bar shows range within which 95 percent of the NRAs fall: 50 percent fall in the shaded area, and the vertical line within the shaded area is the median NRA for the sample period)

(a) All 21 focus African countries, plus Turkey (n = 7988)

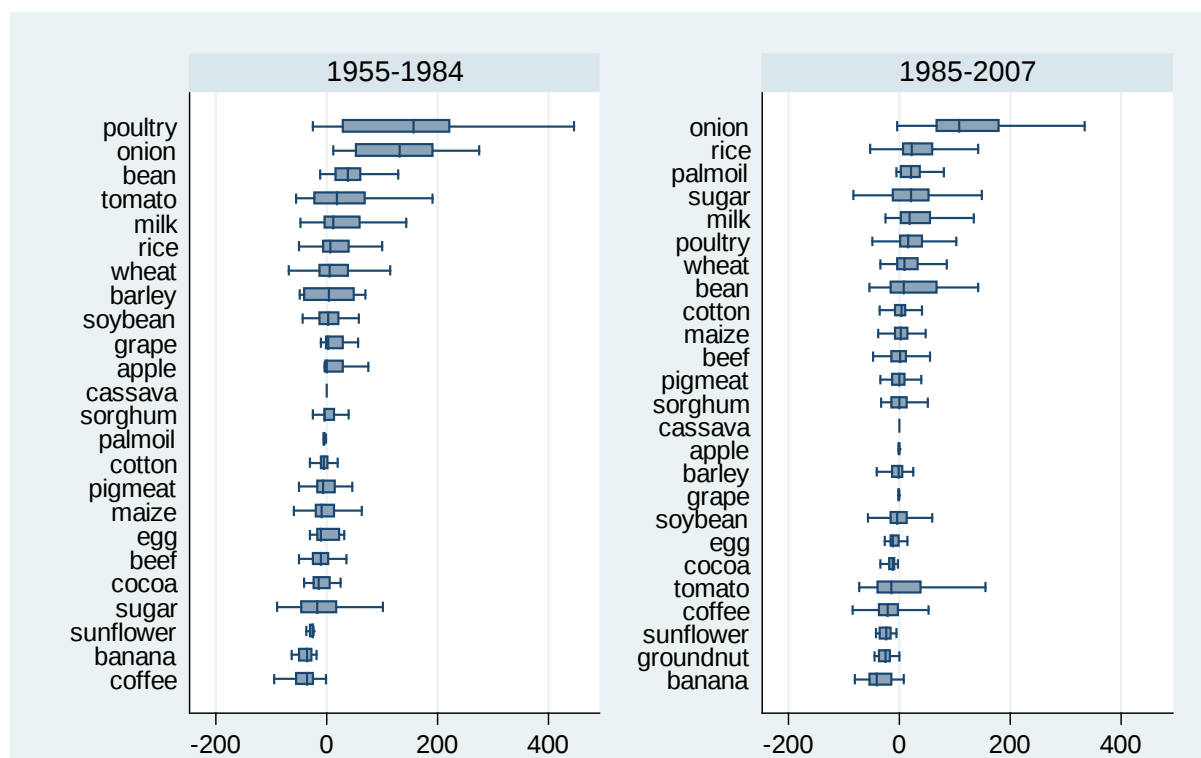


(b) All 12 focus Asian developing economies (excluding Japan) (n = 5410)

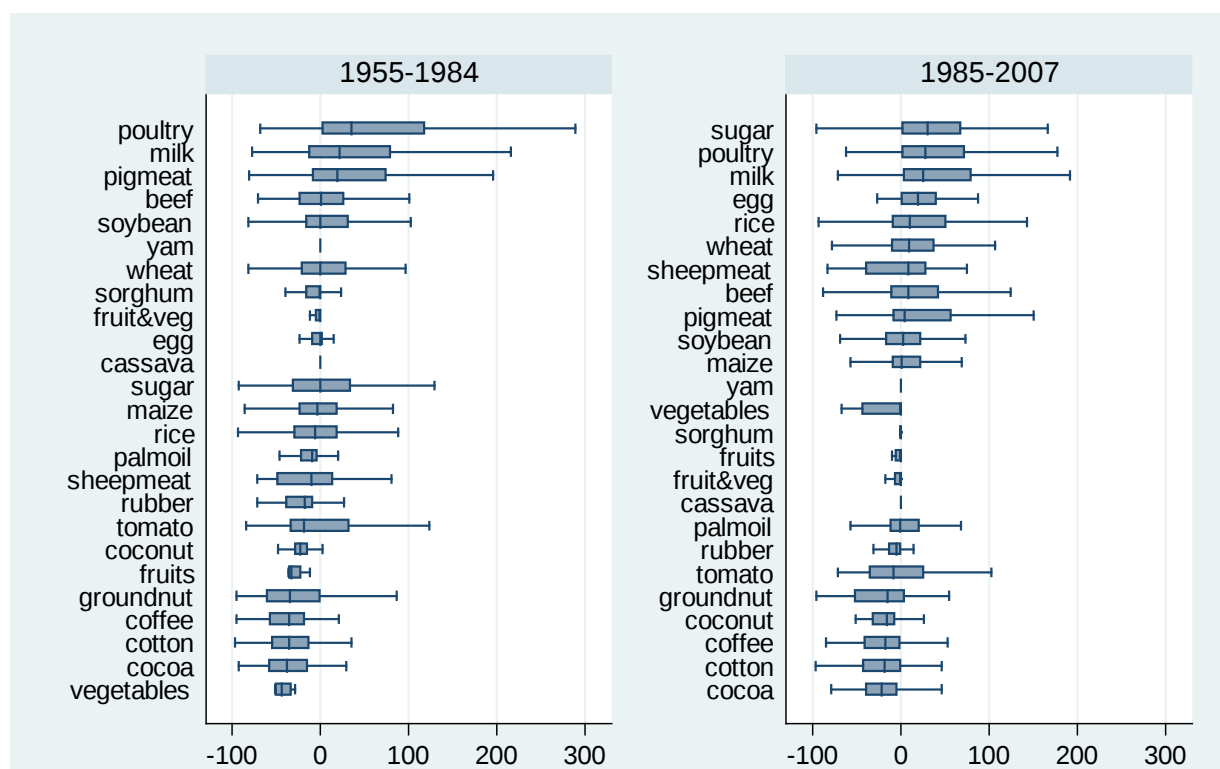


Appendix Figure A (continued): Box plot distributions of NRAs for 25 major agricultural products, various regions of the world, 1955 to 2007

(c) All 8 focus Latin American countries (n = 4180)

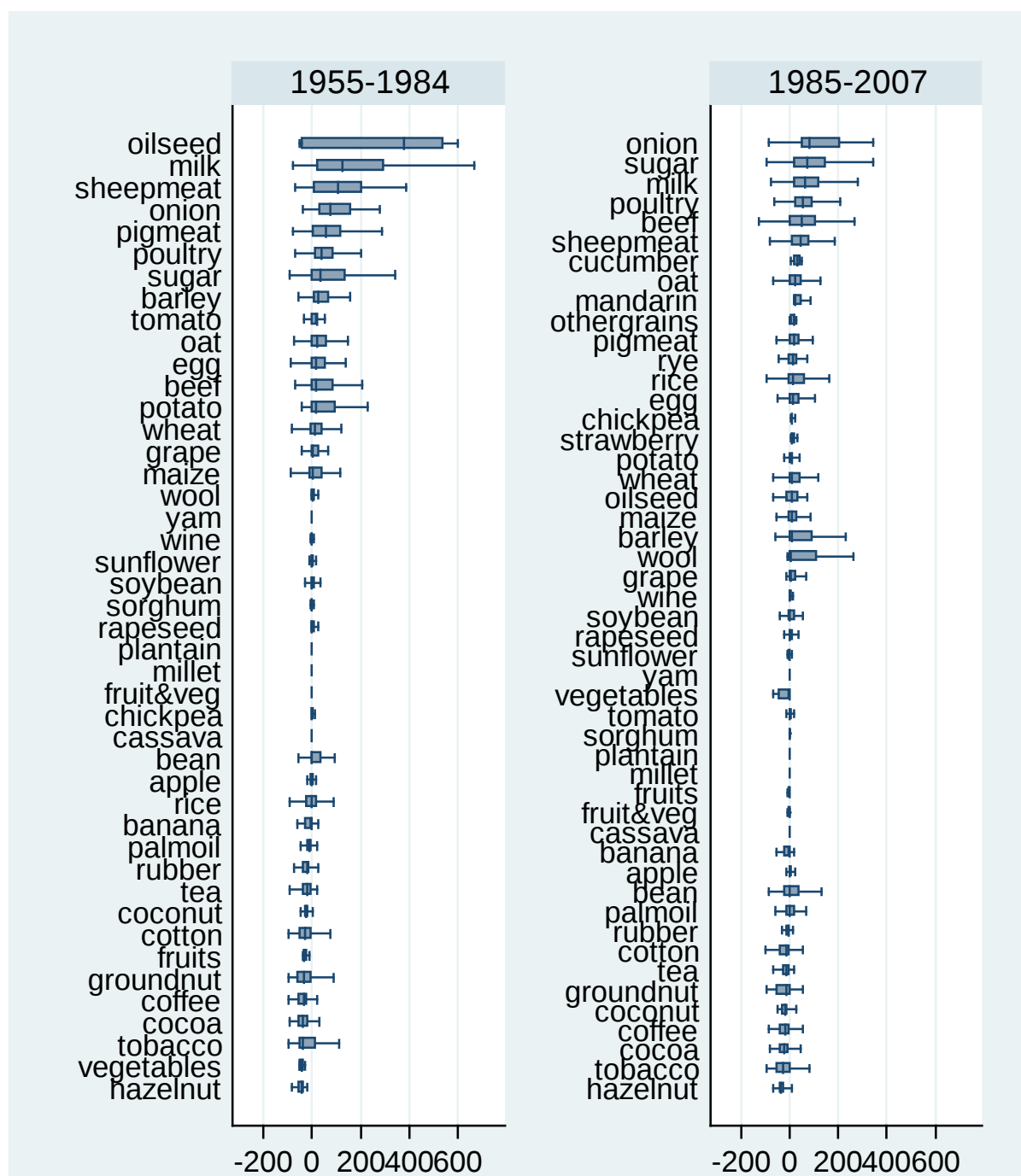


(d) All 41 focus developing economies (including Turkey) (n = 14392)



Appendix Figure A (continued): Box plot distributions of NRAs for 25 major agricultural products, various regions of the world, 1955 to 2007

(e) All 73 focus economies of the world including high-income and transition economies (n = 34833)



Source: Anderson (2010a, Appendix), drawn from estimates in Anderson and Valenzuela (2008).