assessment paper

TRADE BARRIERS

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Costing Global Trade Barriers, 1900 to 2050

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Abstract

By how much have the costs of governmental barriers to trade changed over the past century or so, and how might they change by the middle of the present century? This paper addresses that question by first reviewing evidence on the changing extent of global trade restrictions since 1900, particularly for agricultural and manufactured goods. It then assesses prospects for trade policy changes over the coming four decades by drawing on current political economy theory and evidence. Those estimates and projections of the extent of price distortions due to trade policy measures are then drawn on to provide as lower-bound estimate of the annual cost, in terms of economic welfare foregone in high-income and developing countries, of those trade-restricting policies. A global economy-wide model (Linkage) is used to provide precise estimates for 2004 plus a pair of projections for 2050 and a backcast for the early 1980s. Those results for recent years plus the measures of the extent of past price distortions allow inferences to be drawn for costs of distortions to goods trade in earlier decades of the 20th century. Those costs grew after World War I and peaked in the early 1930s before declining from the 1960s and especially since the 1980s. The paper also provides a sense of by how much those costs understate the real welfare foregone by trade barriers because of not being able to include distortions to markets for services and a wide range of phenomena raised by the "new" trade theory and the empirical literature that is being stimulated by it. When informed guesses as to how much those additional features multiply the cost of trade barriers are included in the calculus, the estimated cost escalates to several times the standard calculated lower-bound estimates of around 1 percent of global GDP.

Introduction

The potential net economic and social benefits available to almost every country if they were to open their economies to international trade have been well known and clearly articulated since at least the 18th century (Irwin 1996). Yet national governments continue to intervene in markets for goods, services, capital and labor in ways that alter the location of production, consumer expenditure and thus also international commerce. Certainly transport and communication costs of doing business across borders have fallen enormously over the centuries, lowering natural barriers to trade. Governmental barriers to trade, however, have fluctuated widely around both upward and downward long-run trends.

The objectives of this paper are three-fold: to review evidence on the changing extent of global trade restrictions resulting from government policies over the past 100+ years; to assess prospects for trade policy changes over coming decades, drawing on current political economy theory and evidence; and to estimate the annual cost in terms of economic welfare foregone in high-income and developing countries of those trade-restricting policies at various points in time retrospectively from 1900 and prospectively to 2050.

To keep the task manageable, attention is initially confined to restrictions on goods trade, leaving aside until the end the less-certain effects of barriers to trade in services including financial flows.[1] This is necessary because methods for estimating the extent of (let alone the market and welfare effects of) barriers to services and capital flows between countries are far less developed than methodologies applicable to trade in goods. Preliminary studies to date to fill these lacunae suggest, however, that potential gains from just goods trade reform today are very much lower than the gains that could come from removing barriers for all products and financial flows. A sample of these studies is reviewed in the Appendix, and the penultimate section of the chapter provides an indication of how much greater the global cost of trade barriers could have been at different points in time with this more-comprehensive coverage of trade barriers.

There is a paucity of detailed historical data even on goods trade restrictions. There are also virtually no global economy-wide models capable of estimating costs of distortions through most of the previous century. Precision about the past is therefore impossible. Also, there is a broad range of projections of the world economy available for coming decades, and each of them depends on explicit or (most commonly) implicit assumptions about future trade and other economic policies. Hence even baseline shares of different countries in global GDP and trade in 2050, let alone projected trade barriers,

[1] How large the international movement of labor would be without restrictive immigration laws is impossible to guess, so it is ignored even though preliminary studies suggest the developing country and global economic welfare gains from even a modest expansion in access to jobs in high-income countries could be far greater than the gains from goods trade liberalization (Anderson and Winters 2009).

have an unmeasurable but wide confidence band around them. The use of global economy-wide models in estimating the costs of trade-distorting policies has grown considerably in recent years though (Anderson 2003, Francois and Martin 2010), so estimates of the cost of at least recent policies are available. They will be drawn on for their own sake, and also for providing guidance in estimating past and future costs.

The chapter begins, by way of background, with a brief history of trade policy and institutions. It then examines the changing extent of barriers to international trade in various parts of the world from the late 19th century to the present. That survey reveals the ups and downs of trade taxation over the past 100+ years. In the following section, a series of estimates of the global cost of trade barriers is presented: for 2004, for 2050 under two alternative scenarios (high and low protection) for 1980-84, and for earlier decades of the 20th century. The penultimate section of the chapter then explores how much those estimates might need to be adjusted to account for missing elements of the calculus, which are identified in the review of recent literature summarized in the Appendix. Those two sections provide the basis for the estimates reported in the final section of the costs of those changing trade barriers, expressed as a percentage of GDP in high-income countries, developing countries and globally.

The results suggest that while their cost may have come down over the past six decades, they are still high compared with those in 1900 (when transport costs were a more-important barrier to trade – see Jacks, Meissner and Novy 2010 and Jacks and Pendakur 2010). The results also reveal that their cost may not fall significantly over the next four decades unless a comprehensive liberalization is agreed to under the current Doha round of multilateral trade negotiations by member countries of the World Trade Organization (WTO). The chapter therefore concludes by exploring possible strategies to reduce remaining distortions over the next four decades. The most obvious of them is unilateral reform, but governments find it difficult politically to ignore protectionist lobbies unless there are counter-lobbies from other groups, such as exporters. Hence the on-going effort to reform in concert with other countries, including multilaterally via the WTO's Doha Development Agenda but also via new or expanding preferential trading agreements.

Trade policies and institutions since the 19th century[2]

During the 17th, 18th and early 19th centuries, trade negotiations were 'ever pending, never ending'. Frustration with that state of affairs set the stage for unilateral tariff cuts by the major economic power in the 19th century, namely Britain, with the repeal of its Corn Laws in 1846. British policymakers hoped that their European trading partners would see the benefits of unilateral liberalization and follow their example.

[2] This section draws on the Introduction in Anderson and Hoekman (2006).

That was not immediately forthcoming but, by 1860, with war clouds gathering over Austria's involvement in Italy, the governments of Britain and France felt a commercial treaty was needed to diffuse tensions and improve diplomatic relations. The resulting Cobden-Chevalier Treaty of 1860 contained a most-favoured-nation (MFN) clause. This required that the agreed cut in the tariff on each item in their bilateral trade was to be applied also to their imports from other countries. It also meant that every European country that subsequently signed a trade treaty with either Britain or France (and most had done so by 1867) signed onto MFN. Especially important was the Treaty of Frankfurt concluded by Bismarck with France in 1871: its Article XI provided for permanent, unconditional MFN and was thereby a key stabilizer of European commercial policy. The systemic effect of the 1860 Anglo-French accord was thus of much greater significance than its importance to either country alone, as it led to a network of treaties that lowered hugely both the average level of tariff protection and the extent of trade discrimination in Europe.

During the years from 1860 to 1913 the world enjoyed relative serenity in terms of international trade and monetary relations. Even though economic growth then was proceeding at less than half the post-World War II pace, it was very rapid by previous standards. In contrast to Europe, the United States during this period sought mainly exclusive reciprocity agreements or, at best, conditional MFN treaties. While those agreements freed up some trade, they explicitly retained a degree of discrimination and meant America entered the 20th century with among the highest tariffs of today's high-income countries.

When many of those European trade treaties were reaching their expiry date (nearly fifty of them were to expire in the first half of the 1890s), economic difficulties were making their renegotiation more contentious than earlier. Tariff wars ensued, so that the threat of retaliation – which had served as a deterrent to raising tariffs – was no longer a constraint on reform reversal. Even so, MFN was retained, and there was no recourse to anti-dumping[3] or countervailing duties or to export subsidies, despite the appearance of a 'fair trade' movement in Europe in the 1890s.

Great though that trade policy achievement of the period from 1860 to 1913 was, including the establishment of non-discrimination in Europe via the widespread use of the unconditional MFN clause, problems remained. One was the absence of bindings on tariffs (to prevent backsliding), and of constraints on non-tariff trade-distorting measures. Another was that there was no legal means of resolving trade disputes. Furthermore, the unwillingness of America or others to adopt the unconditional MFN principle (see Viner 1924) meant the sustainability of the European commercial policy achievements of that period was far from certain. Indeed, the bilateral treaty regime ended abruptly with the outbreak of World War I in 1914.

[3] The first anti-dumping legislation was not introduced until Canada did so in 1904. It was soon followed by similar legislation in most of the major trading nations prior to and just after World War I (Deardorff 2005).

Following that war, efforts to restore liberal trade centred on international conferences. However, despite the rhetoric in support of open markets, those meetings did not lead to renewed trade treaties with binding commitments to openness based on MFN. With no country willing or able to replace Britain as the hegemon, there was trade policy anarchy (Kindleberger 1989). When economic recession and low agricultural prices hit in the late 1920s, and the US introduced the Smoot-Hawley tariff hikes of June 1930, governments elsewhere responded with beggar-thy-neighbor protectionist trade policies that together helped drive the world economy into depression. The volume of world trade shrunk by one-quarter between 1929 and 1932, and its value fell by 40 percent.

The first attempts to reverse that growth in protection were discriminatory, benefitting colonies at the expense of other trading partners. Thus between 1929 and 1938 the share of imports from colonies rose from 30 to 42 percent for Britain, from 12 to 27 percent for France, and from 20 to 41 percent for Japan (League of Nations 1939, Anderson and Norheim 1993). By the end of the 1930s protectionism was far more entrenched than in the late 19th century when only non-discriminatory tariffs had to be grappled with. Indeed nontariff trade barriers were so rife as to make tariffs redundant and hence a return to MFN irrelevant unless and until 'tariffication' of those barriers occurred.

Out of the inter-war experience came the conviction that a return to the beneficent noncooperative equilibrium of the 19th century was highly unlikely. Instead, Britain and the United States were convinced that liberal world trade required a set of multilaterally agreed rules and binding commitments based on non-discriminatory principles. A proposal for such an agreement was put to the British War Cabinet in 1942 by Meade (1942), and was developed further at the Bretton Woods conference in 1944 out of which grew also the IMF and World Bank. In the Anglo-American view, the postwar international economic system was to be constructed in such a way as to remove the economic causes of friction that were believed to have been at the origin of the Second World War. An important element in this vision was the establishment of a stable world economy that would provide all trading nations with nondiscriminatory access to markets, supplies and investment opportunities. There was a strong perception that there was a positive correlation between trade and peace, and, as important, between nondiscrimination and good foreign relations.

As it happened, the efforts in the latter 1940s to create an International Trade Organization (ITO) to complement the International Monetary Fund and World Bank were unsuccessful (Diebold 1952). Nonetheless, many of the key elements of the ITO proposal were encapsulated in a General Agreement on Tariffs and Trade (GATT) that was signed in 1947 by 23 trading countries—12 developed and 11 developing— who at the time accounted for nearly two-thirds of the world's international trade. The GATT provided not only a set of multilateral rules and disciplines but also a forum to negotiate tariff reductions

and changes in rules, plus a mechanism to help settle trade disputes. Eight so-called rounds of negotiations took place in the subsequent 46 years, as a result of which many tariffs on at least manufactured goods were progressively lowered in most high-income countries. The last of those rounds culminating in numerous Uruguay Round agreements to further reduce trade barriers over the subsequent decade including – for the first time – in agriculture and services. Another of those agreements involved the GATT Secretariat being converted into the World Trade Organization (WTO) in January 1995, the membership of which now accounts for more than 95 percent of world trade.

Methodology for estimating the cost of trade-distorting policies

The key trade-distorting policies include import or export taxes or subsidies, quantitative restrictions such as import or export quotas or licences or bans (so-called non-tariff trade barriers or NTBs), or domestic policies that affect the price facing producers or consumers of tradable products. Multiple exchange rates also have been used in ways that effectively alter both exports and imports. The net effect of those measures on the domestic price of a tradable good is usually expressed in ad valorem terms as the percentage by which that domestic price exceeds the border price (ignoring domestic policies that may drive a wedge between the producer and consumer prices of a good, which are relatively minor apart from such generic and therefore less-distortionary measures as taxes on consumption or value added). That percentage is often referred to as the nominal rate of assistance to producers and the consumer tax equivalent affecting buyers (NRA and CTE, which are equal if the only distortions are trade measures). It will be negative if an export tax or import subsidy or equivalent is the sole trade distortion. In the absence of externalities and market failures, maximizing national economic welfare for a small economy typically requires those NRAs/CTEs to be zero.[4]

Import restrictions are the most common trade distortion, predominantly tariffs but also NTBs from time to time. Export restrictions have been less common, but certainly were used widely to tax exports of primary products in many (especially newly independent) developing countries in the 1960s and 1970s. At the same time those countries also protected some of their import-competing farm industries, just as in high-income countries. Production restrictions are even less common, the most notable exception being their use by members of the Organization of the Petroleum Exporting Countries (OPEC) since 1973. Trade subsidies are least-commonly used, apart from some farm export subsidies by high-income countries in the 1980s and 1990s.

[4] See Bhagwati (1971) or Corden (1997). The national welfare calculus is more complex than in simple international economic textbooks but is fundamentally based on the sum of changes in consumer surplus, in producer surplus, in government tax revenues and in the country's terms of trade as a result of introducing or changing a trade-related policy (Martin 1997).

Raising the price of importables relative to nontradables and exportables would appreciate the currency and draw mobile resources from the export sector. An export subsidy of the same size as the tariff could neutralize the trade- and welfare-reducing effects of the latter, whereas an export tax would exacerbate them. Thus it is important to have estimates not only of the tariff rate on imports but also of any trade taxes (or subsidies) applying to exportables.

It is not only the mean trade tax rates that matter though. Also relevant is their dispersion across industries/products within each sector. The greater the dispersion in price distortions within any sector in which productive factors are mobile, or within any group of products that are substitutes in consumption, the more production and consumption patterns will have been affected and so the greater will be the welfare cost (Lloyd 1974; Laborde, Martin and van der Mensbrugghe 2011). In the longer term, when non-natural resources (labor and capital) are more mobile between sectors, it also matters if there is a divergence of NRAs inter-sectorally.

If one had access to a global economy-wide model for each year of interest, with a great deal of individual country coverage and industry and product detail, and for which NRA and CTE estimates were available, the task of estimating the cost of trade-related policies that distort product prices would be straightforward. Such models have become increasingly common in recent years, although most rely on a single database, including for price distortion estimates, that has been compiled by the GTAP (Global Trade Analysis Project) consortium. Those models are being used not only for contemporary trade policy analysis but also to project forward to obtain cost estimates of prospective policies under specified assumptions about growth rates. However, they are not available for the earlier part of the 20th century, for which cruder 'guesstimates' based on sectoral average trade tax equivalent rates are relied upon.

Estimates of trade tax equivalents in the 20th century

The potential importance of various economies to global trade distortions is reflected not only in their trade tax equivalent rates but also in their shares of global GDP and trade (which are candidates for calculating weighted average trade tax rates across countries). Table 2 shows that Europe and North America accounted for around two-thirds of global GDP and international trade through most of the 1900s, with Asia's importance growing only in the last quarter of the century[5] and other developing countries accounting for barely one-sixth of world GDP and trade throughout that period.

Manufacturing and agriculture are the two main sectors producing tradables, with trade in minerals, energy raw materials and services being relatively minor until their trade costs began falling and

[5] China was almost completely closed for all but the last two decades of the 20th century (Keller, Li, and Hua Shiue 2010). In 1900 it accounted for 11 percent of global GDP (and a low of 5 percent in 1953), but up until the mid-1980s it accounted for only 1 percent of global trade (Table 2).

fossil fuel prices rose in the last quarter of the 20th century.[6] Thus agricultural and industrial price distortions matter most and will be the focus here.

Most distortions in manufacturing since 1900 can be captured by tariffs plus (especially from the early 1930s to the 1950s) the tariff equivalent of non-tariff import barriers. Unfortunately there are no comprehensive time series of those NTBs, so reliance will be on tariffs while keeping in mind that these provide a lower-bound estimate of overall import protection to manufacturing, particularly in the middle one-third of the 20th century. Even the available tariff estimates are imprecise, for several reasons associated with the differing methodologies adopted by those compiling and averaging them (see Lloyd 2008): unweighted vs trade-weighted vs production- or consumption-weighted averaging across tariff lines, the inclusion of all or only dutiable lines, whether tariffs serving as excise taxes on imported product are included (as with alcohol and tobacco, for example), the way specific tariffs are converted to ad valorem rates (that is, from a volumetric to a percentage-of-border-price basis), and whether account is taken of differing rates for different supplying countries (due to preferential trading agreements, for example).

When seeking a sectoral average rate of tariff protection, ideally the dispersion of rates across the import-competing industries in the sector should be taken into account, since the welfare cost of a barrier is proportional to the square of the tariff rate. The best way to capture that for obtaining a stand-alone measure is to estimate a trade restrictiveness index (TRI), as has been done recently for the United States by Irwin (2010) using the Anderson and Neary (2005) methodology as adapted by Feenstra (1995). Typically such an index will exceed the trade-weighted average tariff on dutiable items, which in turn will exceed the average over all tariff lines. TRIs are not available for other countries over the time period being considered here though, and they are not needed when an economy-wide model is available since the latter takes into account the dispersion in rates across the products in that model.[7]

Bearing those caveats in mind, Table 3 suggests that Europe's manufacturing import tariffs were mostly in the range 12-34 percent as of 1902 (and 9-20 percent as of 1913, key exceptions being Spain and Russia. The United States had very high industrial tariffs around that time (54 percent in 1902, 30 percent in 1913), but they were cut far more than Europe's by 1955 when they were slightly below those in the countries that formed Europe's Common Market (later to become the European Union). By contrast, industrial tariffs in Australia, New Zealand and many developing countries had been rising over that period and by the mid-1950s/early 1960s were two or three times those of Europe and North America.

[6] Services and non-agricultural primary products each accounted for less than one-sixth of global trade prior to the 1960s, while manufactured products accounted for less than one-half, the rest being agricultural products (Haberler 1958, GATT 1978).

[7] Such a model requires tariffs to be aggregated to the product categories identified in the model though, and for that it is important to use the TRI concept in aggregating up from, say, the 6- or 10-digit tariff lines (Laborde, Martin and van der Mensbrugghe 2011).

In the middle of that period, however, was a rapid escalation of trade barriers that contributed non-trivially to the Great Depression of the early 1930s. That sudden beggar-thy-neighbor protectionism is not evident on the tariff estimates for 1925 and 1937 in Table 3, but can be seen in Table 4: between 1927 and 1931 the unweighted average across European countries of their tariffs on manufactures rose from 33 to 39 percent, while it rose in the United States from 26 to a peak of 35 percent and in Australia from 33 to 63 percent. Tariffs on foods rose even more, almost doubling in Europe to 65 percent. They gradually came down through the latter 1930s though, before war interrupted trade; and by 1950 those rates were only about one-third of their peaks in the early 1930s.

Import tariffs in developing countries are less well documented, but Clemens and Williamson (2010) generate an index of them for 17 of the largest developing countries (accounting for 76 percent of developing country GDP in 1900), for the period from 1870 to 1938. Their index is simply import tariff revenue as a percentage of the value of total imports, and so may understate considerably the true tariff average. For those developing countries in that period, most tariffs and imports were manufactured goods. The estimates, reported in Table 5, suggest Asia has been much less protectionist of its manufacturing sector than Latin America before 1940, just as it was in the post-war period. Those rates for Latin America are well above those for the higher-income countries reported in Table 3.

As for primary agriculture, there has been a general tendency for poor agrarian economies to tax the farm sector relative to other sectors but, as nations industrialize, to gradually change from negatively to positively assisting farmers relative to other producers (and from subsidizing to taxing food consumers). Following the famous repeal of Britain's Corn Laws in the mid-1840s and the passage of the 1860 Anglo-French Treaty of Commerce, Britain moved close to freer trade in farm (and other) products followed by France and gradually other European countries. However, agricultural protection returned before the end of the 19th century to some European countries, and became widespread in the early 1930s (Kindleberger 1975, 1989; Swinnen 2010). In contrast to tariffs on manufactures, however, agricultural protectionism increased further over the next five decades.

Japan provides a striking example of the tendency to switch from taxing to increasingly assisting agriculture relative to other industries. Its industrialization began later than Europe's, after the opening up of the economy following the Meiji Restoration in 1868. By 1900 Japan had switched from being a small net exporter of food to becoming increasingly dependent on imports of rice (its main staple food and responsible for more than half the value of domestic food production). This led to calls from farmers and their supporters for rice import controls. Those calls were matched by equally vigorous calls from manufacturing and commercial groups for

unrestricted food trade, since the price of rice at that time was a major determinant of real wages and hence profitability in the nonfarm sector. The heated debates were not unlike those that led to the repeal of the Corn Laws in Britain six decades earlier. In Japan, however, the forces of protection triumphed, and a tariff was imposed on rice imports from 1904. That tariff then gradually rose over time, raising the domestic price of rice to more than 30 per cent above the import price during World War I. The Japanese government then extended its protection to its colonies of Korea and Taiwan, shifting from a national to an imperial rice self-sufficiency policy. By the latter 1930s imperial rice prices were more than 60 per cent above those in international markets (Anderson and Tyers 1992).

After the Pacific War ended and Japan lost its colonies, its agricultural protection growth resumed and spread from rice to an ever-wider range of farm products. In South Korea and Taiwan in the 1950s, as in many newly independent developing countries, an import-substituting industrialization strategy was initially adopted, which harmed agriculture. But in those two economies – unlike in most other developing countries – that policy was replaced in the early 1960s with a more-neutral trade policy and then from the 1970s with ever-higher levels of protection of farmers from import protection (Anderson and Hayami 1986, Ch. 2).

The other high-income countries that were settled by Europeans are far less-densely populated. They therefore have had a strong comparative advantage in farm products for most of their history following Caucasian settlement, and so have felt less need to protect their farmers than Europe or Northeast Asia.

Many less-advanced and less-rapidly growing developing countries not only adopted import-substituting industrialization strategies from the 1930s and especially in the 1950s and 1960s (Little, Scitovsky and Scott 1970; Balassa and Associates 1971) but also imposed direct taxes on their exports of farm products.[8] It was common in the 1950s and 1960s and in some cases through to the 1980s for developing countries to use dual or multiple exchange rates as well, thereby indirectly taxing both exporters and importers (Bhagwati 1978, Krueger 1978). This added to the anti-trade bias of developing countries' trade policies. By the early 1980s, however, both

[8] The precise extent of taxation of agriculture in developing countries as a group prior to the 1950s is not yet well documented, but is at least hinted at in Lindert (1991). Certainly it was occurring in Latin America (Bulmer-Thomas 1994, Bértola and Williamson 2006), Africa (Bates 1981), as well as in the Soviet Union and China where farmers were squeezed more than urban dwellers to fund State activities and the industrialization drive (Sah and Stiglitz 1992, Lin, Cai and Li 1996).

high-income and developing countries began to lower their barriers to agricultural trade, including not just import tariffs but also export restrictions that were imposed in the 1960s and 1970s on numerous farm products in developing countries.

A recent World Bank project has captured the extent of those changes since 1955 for a sample of 75 countries accounting for more than 90 percent of the global economy, and for both agricultural and non-agricultural tradable goods (Anderson 2009). That study suggests industrial tariffs by the first half of the 1980s were already low in high-income countries, while they had risen to quite high levels in developing countries (NRAs of 3 percent versus 35 percent). Table 6 shows that two decades later, however, they not only were reduced further in high-income countries but also were substantially lowered in developing countries (to just 6 percent). As for agricultural trade distortions, high-income countries lowered their export subsidies (a two-thirds drop, from 22 to 7 percent) but retained high barriers to imports so their overall agricultural NRA fell, from 56 to 34 percent.[9] Meanwhile developing countries since the mid-1980s have lowered their export taxes (from 41 to 3 percent) but raised their tariffs on farm imports (from 17 to 23 percent), and Europe's transition economies' rates are converging on those in the European Union for both agriculture and manufacturing.

Even though these average NRAs for recent years may not seem very high, it needs to be kept in mind that within each sector of each country there is a great deal of dispersion in rates of assistance across various farm and nonfarm industries. There is also a wide range of sectoral NRAs across the sample of 75 countries – and an even wider range when the relatively high distortions of many small least-developed countries not in that sample are taken into account (Anderson 2010, Ch. 2). The only feasible way to estimate the global welfare effects of that cross-product and cross-country dispersion of NRAs (and CTEs) is to employ global computable general equilibrium modeling. Such modelling can correctly capture the welfare effects of not only the intra-and inter-sectoral dispersion of price distortions within a country, but also of the effects of those and other countries' policies on each country's international terms of trade.

Before turning to such modelling, one final point needs to be made about price-distorting policies. It relates not to their longer-run trends but rather to their NRA changes from year to year

[9] Domestic producer subsidies also were rife in high-income countries, but made a relatively small contribution to trade distortions compared with border measures (Anderson, Martin and Valenzuela 2006; Anderson and Croser 2011).

as international product prices fluctuate. This is not a major issue for manufactured goods, apart from occasional use of anti-dumping duties on select products by a small (albeit growing) number of countries (Finger 2002). For agricultural products, by contrast, their annual changes in NRAs tend to be negatively correlated with movements in their international price, especially for food staples of developing countries. This is particularly evident when prices suddenly spike up or down, but it applies more broadly as well. It results from countries varying their trade barrier in the hope of not transmitting an international price shock to their domestic market: when the international price rises, importers lower their tariff and exporters raise their export tax (as happened in 2008), and when the international price falls the opposite tends to occur (Anderson and Nelgen 2010). The irony is that if both exporting and importing countries sought thereby to fully insulate their domestic market from the exogenous shock such as a crop shortfall, neither would succeed as the world trade volume would be the same as if neither country altered their trade barrier; yet both would cause the international price to spike more, so there would be an even larger transfer of welfare between importing and exporting countries than that due just to the initial external shock (Martin and Anderson 2012).[10] This is especially so for products in which most key countries are close to self-sufficient and so the share of global production traded internationally is small, as with rice. Large though the welfare transfer effects can be in any price spike year, they tend to be short-lived and to be offset by transfers in the opposite direction when the international price of the product spikes the other way. For that reason such fluctuations in NRAs around their longer-term trends will be ignored in the analysis below.

Modeling the welfare effects of trade barriers

The easiest years to estimate the welfare effects of trade-distorting policies are recent ones to which the databases of global economy-wide models have been calibrated. We therefore begin with that period. Such models have also been used to project prospective effects in future decades under various assumptions, so they will be considered next, before turning to the earlier decades of the 20th century.

[10] Large welfare transfers also occur between countries that are net exporters and net importers of fossil fuels. The transfer has been predominantly from importers to exporters since OPEC introduced production quotas in 1973, which caused petroleum prices to quadruple (and to double again in 1979-80). But net-importing countries that are unilaterally taxing carbon emissions explicitly or implicitly for local and global pollution reasons are causing the opposite terms of trade effect. Since OPEC's quotas are not subject to international disciplines in the same way tariffs are under the GATT, and since without OPEC quotas other countries may have raised their consumption taxes on petroleum products earlier for pollution reasons, this distortion will not be considered below.

The so-called GTAP database is by far the most widely used by global economic modelers, providing data for more than 100 countries and country groups spanning the world. Its current version is for 2004 (Narayanan and Walmsley 2008). The price distortions in that database have been carefully compiled from 6-digit applied bilateral tariff data, thereby taking account of preferential tariffs due to regional and other sub-global trade agreements that have grown so much over recent years. They also incorporate the production and export subsidy estimates for high-income countries, as compiled by OECD (2006). They do not, however, capture the other measures that distort developing country production and consumption of farm products, most notably export taxes and various NTBs that can only be estimated by careful comparison of domestic and border prices. Thus in the case of agriculture in developing countries, the distortion levels in the GTAP database have been replaced with an alternative set based on the NRAs estimated for 2004 that have come from the recent World Bank project (Anderson and Valenzuela 2008), as calibrated by Valenzuela and Anderson (2008). For comparison purposes Valenzuela and Anderson also show the distortions as they were in 1980-84 on average, to get a sense of the reform that has taken place since then and allow modelers to use backcasting to estimate the effects of those reforms.

According to this amended dataset, the weighted average applied tariff in 2004 for agriculture and lightly processed food was 21.8 percent for developing countries and 22.3 percent for high-income countries, while for nonfarm goods it was

7.5 percent for developing countries and just 1.2 percent for high-income countries.

Though export subsidies for farm products for a few high-income regions and export taxes in a few developing countries were still in place in 2004, these measures are generally small in their impact compared with tariffs, as are production subsidies and taxes (Valenzuela, van der Mensbrugghe and Anderson 2009, Table 13.1). While those average rates obscure large variations across countries and commodities, the effects of the dispersion are captured in the economy-wide models used because of the detailed country and commodity disaggregation in such models.

The model whose results are to be drawn on for the contemporary period (and also prospectively, for 2050, and retrospectively, for 1980-84) is the World Bank's global model known as Linkage (van der Mensbrugghe 2005). For more than a decade, this publicly available model has formed the basis for the World Bank's standard long-term projections of the world economy and for much of its trade (and more recently migration) policy analysis. In the application summarized below, the full database has been aggregated to 24 sectors and 52 regions to make computations and reporting more manageable.

Linkage is a relatively straightforward CGE model but with some characteristics that distinguish it from other comparative static models such as the GTAP model (described in Hertel 1997). Factor stocks are fixed, which means in the case of labor that the extent of unemployment (if any) in the baseline remains

unchanged. Producers minimize costs subject to constant returns to scale in production technology, consumers maximize utility, and all markets—including for labor—are cleared with flexible prices. There are three types of production structures. Crop sectors reflect the substitution possibilities between extensive and intensive farming; livestock sectors reflect the substitution possibilities between pasture and intensive feeding; and all other sectors reflect standard capital and labor substitution. There are two types of labor, skilled and unskilled, and the total employment of each is assumed to be fixed (meaning no change in their unemployment levels). There is a single representative household per modeled region, allocating income to consumption using the extended linear expenditure system. Trade is modeled using a nested structure in which aggregate import demand is the outcome of allocating domestic absorption between domestic goods and aggregate imports, and then aggregate import demand is allocated across source countries to determine the bilateral trade flows (Armington 1969).

Government fiscal balances are fixed in U.S. dollar terms in Linkage, with the fiscal objective being met by changing the level of lump sum taxes on households. This implies that losses of tariff revenues are replaced by higher direct taxes on households. The current account balance also is fixed. Given that other external financial flows are fixed, this implies that ex ante changes to the trade balance are reflected in ex post changes to the real exchange rate. For example, if import tariffs are reduced, the propensity to import increases and additional imports are financed by increasing export revenues. The latter typically is achieved by a depreciation of the real exchange rate. Finally, investment is driven by savings. With fixed public and foreign saving, investment comes from changes in the savings behavior of households and from changes in the unit cost of investment. The model solves only for relative prices, with the numeraire, or price anchor, being the export price index of manufactured exports from high-income countries. This price is fixed at unity in the base year.

Only comparative static results are reported in this section, so it needs to be kept in mind that they do not include the (often much larger) dynamic gains that result from an acceleration in investment that would accompany a reduction in trade barriers. And because the version of the Linkage model reported here assumes perfect competition and constant returns to scale, it captures none of the benefits of freeing markets that came from accelerated productivity growth, scale economies, product variety and the creation of new markets. There is also a dampening effect on estimates of welfare gains from trade because of product and regional aggregation, which hides many of the differences in NRAs and CTEs across products and countries. The results therefore should be treated as providing lower-bound estimates of the net economic welfare benefits from policy reform, as is true of most currently available models (see Anderson and Winters 2009, Francois and Martin 2010). An attempt is made in the chapter's penultimate

section to provide an order of magnitude of the extent to which the reported estimates should be raised to account for these missing elements in the calculus.

Cost of trade barriers as of 2004

What do the results show? Valenzuela, van der Mensbrugghe and Anderson (2009) estimate that the gains from the removal of trade barriers as of 2004 could have added $168 billion per year to the global economy. That is equivalent to 0.6 percent of the world's real income that year. They find that developing economies were being harmed by those policies nearly twice as much as were high-income economies on a percent of real income basis in 2004 (0.9 versus 0.5 percent). They also find that 70 percent of those costs globally, and 72 percent of those to developing countries, are due to agricultural policies, thanks to the huge price distortions that remain in markets for farm products as compared with those in manufacturing. For developing countries, 57 percent of the costs stem from policies of developing countries themselves, and the other 43 percent from policies of high-income countries.

Cost of trade barriers in 2050 if policies as of 2004 are unchanged

If policies as of 2004 were to remain in place until 2050, and given the projected faster growth of developing than high-income countries, liberalization of those trade barriers in 2050 would generate an even larger proportional gain to developing countries. According to results using the same global Linkage model as Valenzuela, van der Mensbrugghe and Anderson (2009), a new study by van der Mensbrugghe and Rosen (2010) estimates that the gain to developing countries would amount to a real income improvement of 1.4 percent per year, compared with again 0.5 percent for high-income countries and thus 0.9 percent globally.[11] This global number is slightly larger than in 2004, even though rates of price distortions are assumed to be unchanged, because the developing countries are projected to grow in relative importance in the global economy and they were suffering relatively more in 2004 from trade barriers at that time, particularly as it affected South-South trade.

However, it is unlikely trade-related policies will not change over the next four decades. We therefore consider two alternative scenarios in the next sub-section. They provide an opportunity to amend the above numbers for 2050 down or up, according to whether one assumes policies will distort prices of tradables less or more in four decades than now. A key uncertainly is the WTO's Doha round of multilateral trade negotiations

[11] That projections study is based on 2004 US dollars. The developing country shares of global GDP on that basis are shown in Table 2 to differ from those based on Geary-Khamis dollars, but the proportional changes in developing country shares between the present decade and four decades hence are very similar and so no adjustment is made to the van der Mensbrugghe and Rosen (2010) estimates.

Cost of trade barriers in 2050 if policies become more liberal (low protection case)

If the WTO's Doha Development Agenda were to be revived and eventually come to a successful conclusion such that the most comprehensive set of policy reform proposals as of 2008 were to be implemented, it would lock in recent reforms through lowered bindings on tariffs and subsidies and possibly lead to further opening of markets for services. The lower legal bindings would prevent temporary or long-term backsliding into protectionism (Francois and Martin 2004), and in addition there would be net gains from the phased liberalization itself. A study by Anderson, Martin and van der Mensbrugghe (2006), again using the global Linkage Model and hence again ignoring pro-competitive and dynamic gains from trade reform, suggests economic welfare in both developing and high-income countries would be around 0.2 percent higher after full implementation of the agreement (which would take until the early 2020s at least). A similar number has emerged from a forthcoming update of that study projected to 2025 (Martin and Mattoo 2011).

If the Doha round did conclude so successfully, it would be reason to expect yet another WTO round of reform commitments to be concluded and implemented by 2050. There would not be much liberalization of trade in manufactures to be done by high-income countries, but there would be ample scope for gains from reducing regulations in their services sectors as well as from providing greater market access in farm products. Hence another 0.2 percent of GDP gain could be expected for those countries. The scope for further gains from a successor to Doha is much greater for developing countries. Large middle-income countries in particular might be expected to forego the 'Special and Differential Treatment' still afforded developing country members of WTO, especially those also seeking membership of the OECD. That could lead to the gains (reduced costs) to developing countries of perhaps twice that estimated for the Doha round, that is, an extra 0.4 percent of GDP from 2025 or a total of 0.6 percent of developing country GDP between 2004 and 2050.

In this liberal (low protection) scenario, the van der Mensbrugghe and Rosen (2010) estimates of the cost of barriers in 2050 could be adjusted downwards by the extent of those gains from trade reform, that is, to 0.8 percent for developing countries, 0.1 percent for high-income countries and 0.5 percent globally (penultimate column of Table 7(b)).

Cost of trade barriers in 2050 if policies become less liberal (high protection case)

Alternatively, what if the Doha round of multilateral trade negotiations were to collapse and there were no other external trade barrier disciplines placed on national governments? The trade policy counterfactual in that case may not be the status quo. Manufacturing tariffs may not change a lot, especially in middle- and

high-income countries where applied tariffs are close to the relatively low rates at which countries bound them as part of the Uruguay Round. Even in lower-income countries there is now a broad consensus that industrial openness is sensible in today's globalized world of fragmented production processes. As for agricultural distortions, export restrictions are likely to remain low apart from their sporadic use in times of upward spikes in international prices, and export subsidies may well be used less as high-income countries continue their move towards more-targeted forms of farm income support (particularly in the EU as it gradually absorbs the new East European members). That same political force may restrain high-income countries from raising their agricultural import tariffs, even if it is insufficient, without external pressure from a new WTO agreement, to lower them. In rapidly growing developing countries, by contrast, their continuing industrial and service sector growth and urbanization is in many cases being accompanied by social tensions as rural areas feel left behind. Such countries may therefore follow the earlier example of today's high-income countries in allowing agricultural protection rates to rise (Anderson and Nelgen 2011). Since the per capita income of developing countries is projected by 2050 to be similar to that of high-income countries in the early 1980s, the latter's NRA for import-competing agriculture at that time (58 percent) might provide a guide as to what to expect. However, developing countries already have binding commitments in the WTO that prevent their average tariff from legally rising much above 45 percent (Bouët and Laborde 2010). We therefore have chosen the high-income countries' NRA for import-competing agriculture in 1960-64 (46 percent) as the counterfactual for developing countries in 2050 in the event of no further disciplines being agreed to in the WTO before then.

With those assumed distortions rates for 2050 (see final column of Table 7(a)), the van der Mensbrugghe and Rosen (2010) estimates of the cost of developing countries' barriers in 2050 need to be adjusted upwards to some extent. Bearing in mind that in 2004 agricultural policies were responsible for no less than 70 percent of the cost of all goods market distortions for developing countries and for the world, the doubling of the agricultural distortions in developing countries by 2050 would add substantially to the cost of distortions to those countries. For present purposes we assume it would rise from 1.4 to 1.8 percent. It would also add a little to the cost to high-income countries that are net exporters of farm products, but we assume that would be exactly offset by the improved terms of trade for high-income food-importing countries. That is, the cost of barriers in this case would be 0.5 percent for high-income countries (as in 2004) and thus 1.2 percent globally (final column of Table 7(b)).

Cost in 2004 if price-distorting policies had not changed since 1980-84

According to the global distortions dataset as amended Valenzuela and Anderson (2008), in 1980–84 developing countries had an average agricultural export tax of 11 percent compared with almost zero on

average in 2004, while high-income countries had an average farm export subsidy of 21 percent in 1980–84 compared with just 7 percent in 2004. The average agricultural import tariff was lower for developing countries (16 percent) in 1980–84 than for high-income countries (26 percent), as opposed to the situation in 2004 when the two groups of countries had equivalent average tariffs on farm products of 22 percent. In addition, tariffs on non-agricultural imports were more than three times higher in 1980–84 than in 2004 for developing countries (26 versus 8 percent), and twice as high for high-income countries but still small at an average of 2.4 percent as compared with 1.2 percent in 2004 (Valenzuela, van der Mensbrugghe and Anderson 2009, Table 13.1).

How much higher would have been the cost of trade barriers if the national policies in 2004 had instead been those that were in place in 1980-84? The Linkage model results reported in Valenzuela, van der Mensbrugghe and Anderson (2009, Table 13.2) suggest that global welfare would have been lower by US$233 billion

per year, or by 0.8 percent. Again, developing countries would have been hurt disproportionately, by 1.0 percent compared with 0.7 percent for high-income countries. These numbers, in conjunction with the earlier ones for 2004 policies, suggest that between 1980-84 and 2004 the world had come about three-fifths of the way towards free markets for goods. They imply that in 1980-84 the cost of global distortions would have been around 1.4 percent of global income, made up of 1.9 percent for developing countries and 1.2 percent for high-income countries. These higher numbers reflect not only the much higher rates of price distortion in the early 1980s than recently but also the facts that (a) welfare costs are proportional to the square of the price distortion rates and (b) developing countries accounted for just 32 percent of global GDP in 1982 (the proxy for 1980-84) compared with 46 percent in 2004.

Cost of price-distorting policies prior to 1980

According to Table 7(a), the extent of import protection in 1962 was slightly less than in 1982 for agriculture but much higher for manufacturing in both rich and poor countries. That would have been even more hampering for both North-North and South-North trade in manufactures. We therefore assume it would have raised the proportional cost of trade barriers by one-seventh for both groups of countries compared with 1982, hence to 1.6 percent of GDP globally for 1962.

The high-income countries' agricultural distortions in 1937 were similar to those in 1962, while their manufacturing tariffs averaged about twice those of 1962 (the latter having been lowered following the first few rounds of multilateral trade negotiations under the GATT). In developing countries, protection rates in 1937 were around half those of 1962, but the heavy taxation of agricultural exports, that followed in the wake of those countries' independence around 1960, was also much less prior to World War II. That

lesser export taxation helped high-income countries via better international terms of trade, offsetting somewhat the welfare-reducing effect for high-income countries of their higher manufacturing protection. The cost of global trade barriers in 1937 is thus assumed to be one-quarter lower for developing countries, and one-third higher for high-income countries, than in 1962.

The assumed agricultural distortion rates in 1925 were only one-third those in 1937 for high-income countries, while developing country manufacturing protection was only half that of 1937. That meant productive resources were far more efficiently employed globally in that earlier year, and so the welfare costs are assumed to be barely half as large in 1925 as in 1937 as a share of GDP. In 1900 manufacturing protection was higher in rich countries and lower in developing countries than in 1925 while agricultural distortions on average appear to have been similar. That would suggest a slightly greater welfare cost for high-income countries and a slightly smaller one for developing countries.

The worst year of the Great Depression, 1931, was an outlier. Agricultural protection rates were more than three times, and manufacturing protection as much as double, their 1925 rates. Export taxation evaporated temporarily though, as is commonly the case when international food prices slump (Anderson and Nelgen 2010). Since the welfare cost is proportional to the square of the distortion rate, the welfare cost for both developing and high-income countries would have briefly spiked at nearly three times the 1925 cost as a percent of GDP.

Adjusting for elements missing from the calculus

The above estimates of the costs of global trade barriers are based on the estimates for 2004 using a standard global economy-wide model (GTAP). That standard calculus is known to underestimate trade barrier costs for several reasons that relate to the following:[12]

- the measurement of the tariff equivalent of non-tariff barriers to goods trade,
- the averaging of tariffs at the detailed tariff line level for use at a more-aggregated level by CGE modelers,
- the measurement of distortions in markets for services and their incorporation in CGE models,
- the effect of allowing financial market integration,
- the inclusion of economies of scale and imperfect competition in some sectors,
- allowing for product quality and variety differences, and for the emergence of new products,

[12] If trade reforms were to be accompanied by reforms to domestic markets, the gains from trade opening would be further magnified, but this is ignored here. So too is greater freedom of movement for workers through less-restrictive immigration policies (but see Anderson and Winters 2009).

- administration, compliance and lobbying costs and, perhaps most importantly,
- the growth-enhancing impacts of trade openness.

When lower-bound guesstimates for all but the last of these are used to multiply the costs of global trade barriers in Table 7(b) – as discussed in the remainder of this section – they become those shown in Table 7(c). Adding the dynamic gains is problematic, though, because they involve an increase in the annual *rate of growth* of capital and outputs, not just a permanent one-off increase in the *level* of GDP. Its continued omission almost certainly ensures that even the adjusted numbers in Table 7(c) are still very much lower-bound estimates of the retrospective and prospective costs of the world's trade barriers.

Measuring the costs of trade barriers/benefits of trade liberalization is still an inexact science, despite the improvements since the 1950s in quantifying the extent of price distortions due to trade-related policies and the huge amount of progress made over the past two decades in global economy-wide (CGE) modelling. The remainder of this section illustrates how the progress made is drawn upon to adjust the estimates in Table 7.

Non-tariff barriers (NTBs) to goods trade

It has long been recognised that the only practical way for NTBs to be incorporated comprehensively in global economic models is for their ad valorem tariff equivalent to be estimated through comparing domestic and border prices of like products (Baldwin 1991). This is inherently difficult and enormously time consuming, which is why it tends to have been done only for a small sample of countries or products (Laird 1997). Fortunately there is now a set of NRA estimates from 1955 to 2007 for global agriculture that is based on price comparisons and so includes NTBs (Anderson and Valenzuela 2008), and those estimates have been incorporated in the Linkage model that is drawn on for the present study. Hence NRA adjustments need to be made only for manufacturing and for pre-1955 agriculture.

A study for four high-income countries by Roningen and Yeats (1976) suggests that the average tariff equivalents of NTBs on manufactures in 1973 were at least twice the average tariffs at that time, making the latter largely redundant other than for revenue collecting. The difference would have been at least as high in 1962 because NTBs were still being used for balance of payment reasons under fixed exchange rates, and could have even higher in the beggar-thy-neighbor period of the 1930s, if not earlier. A more comprehensive study of 16 high-income countries, accounting for 60 percent of world imports, reveals that NTBs became more-extensively used in the early 1980s. This followed the conclusion of the GATT's Tokyo Round in 1979 when those countries' tariffs had been lowered to an average of less than 8 percent, compared with five times that in the mid-1930s (Nogues, Olechowski and Winters 1986). The most prevalent were probably the import quotas and 'voluntary' export restraints on textiles and clothing trade,

but trade in cars and steel also were commonly restricted with quantitative measures. Since the mid-1980s many of these measures have gradually disappeared in high-income countries and to a lesser extent in developing countries.

Adjustments to the NRAs in Table 7(a) to include the tariff equivalent of NTBs might involve doubling those for manufactured goods from 1930 with more modest rises before that, and doubling those for import-competing farm products prior to 1940. The anti-agricultural bias of policies in the pre-World War II era might thereby not be altered greatly. As for the post-war era (for which NTBs on farm products are already incorporated in the NRAs in Table 7), the boost to manufacturing protection from NTBs would exacerbate the anti-agricultural bias in developing countries but reduce the pro-agricultural bias in high-income countries. These two effects might be offsetting. However, the anti-trade bias of policies in 1962 and 1982 would increase within sectors in both sets of countries.

Averaging of tariffs for including in models

In the Linkage model application cited in this study, the world economy has been aggregated to just 24 sectors or product groups and 52 countries or country groups. This has a number of consequences. One is that it restricts the extent to which the model can capture the reality that firms in a policy-reforming environment could exploit the increasing opportunities to lower costs through the recent fragmentation of the production process into ever-more pieces whose location is footloose internationally (Hanson, Mataloni and Slaughter 2005). A more-fundamental consequence is that it requires the averaging of price distortions from trade policy measures. This matters because trade barriers vary enormously across 10-digit tariff lines and across countries, and the cost of protection increases with the square of the tariff. Hiding that variation thereby leads to underestimation of the true cost of any given 'average' level of protection.

Necessarily, some degree of aggregation is unavoidable in modelling the real world because the available information on the structure of production and consumption is at a much higher level of aggregation than information on tariffs and trade. Further aggregation is necessarily employed for computational reasons too.

Commonly tariffs are averaged using import values as weights. This adds an additional problem because, as protection rates rise, the weights associated with these measures decline, so that a tariff that completely blocks trade has the same measured impact as a zero tariff.

A relatively new approach to tariff aggregation provides a possible means of dealing with the aggregation problem (Anderson and Neary 2005). Anderson (2009) has since developed a superior tariff aggregator that captures the welfare impacts of a non-uniform tariff regime. Building on this approach, Laborde, Martin and van der Mensbrugghe (2011) generate a set of national tariff aggregates at the level

used by CGE modelers in which the aggregate tariff for a product group is that which, if applied uniformly to all the tariff lines in that group, would allow the same level of expenditure on imported commodities in the group as the actual tariff structure. They then use the global Linkage model to see how much difference that method of aggregating makes to the results from liberalizing global goods trade as of 2004. They find that the global economic welfare cost of trade barriers is 46 percent greater than that generated using the standard tariff database (one-quarter larger for high-income countries, twice as large for developing countries). It may have been of more significance in the past – especially when NTBs are included – because there was probably more dispersion of tariff equivalents of border measures in the 20th century, especially prior to the 1950s (including for agriculture).

A conservative adjustment to compensate for this missing effect and the NTB phenomenon is to raise the estimated welfare cost for both sets of countries by 50 percent in 2004 and 2050, 40 percent in 1982, 30 percent in 1962 and 20 percent pre-World War II.

Barriers to trade in services

The potential gains from trade liberalization in services are rarely considered in CGE models, or at best are included only in rather rudimentary ways. This is because of a lack of good data on bilateral services trade, and methodological difficulties in modelling distortions in services markets. This is a serious omission, since there are indications that the costs of barriers to trade in services may be several times larger than the barriers presented by conventional trade measures such as merchandise tariffs and subsidies (Dee, Hanslow and Pham 2003; Brown, Kiyota and Stern 2005; Jensen, Rutherford and Tarr 2007; Francois and Hoekman 2010).

Konan and Maskus (2006) point out that the costs of services distortions are likely to be larger than those affecting merchandize trade because they typically involve restrictions not only on cross-border trade (Mode 1 of GATS), but also on supply by establishing enterprises in the country or by the movement of service suppliers (Modes 3 and 4 of GATS). That is, they raise the domestic cost of production of services, including those that are nontradable internationally.

In the absence of reliable estimates of the welfare cost of services trade barriers, a conservative adjustment to compensate for this missing effect – after amending to include the influences of NTBs and tariff aggregation issues – is to raise by 50 percent the estimated welfare cost for 2004 and beyond. For earlier eras, when costs of trading services were higher and so provided more of a natural barrier, the cost of government regulation of the service sector was probably lower. We therefore raise the estimated welfare cost of goods trade barriers by 20 percent pre-World War II, 30 percent in 1962 and 40 percent in 1982 to account for policies inhibiting services trade of both developing and high-income countries.

Allowing financial market integration

International trade requires international financial services to transfer the required payments and often to provide temporary credit to traders. Trade reform thus expands also the markets for financial services, which contributes to the long-term stability of financial markets. Openness also tends to reduce inflation. It can do so not only by increasing competition in domestic markets but also by providing more options for people to hold savings in foreign currencies, which reduces the ability of governments to inflate savings away (Rogoff 2003). Yet CGE models typically ignore financial markets. This is unfortunate also because their inclusion would allow an additional set of influences on real exchange rates (see, e.g., McKibbin and Stegman 2005).

A recent study by Hoxha, Kalemli-Ozcan and Vollrath (2009) examines potential gains from financial integration and find that a move from autarky to full integration of financial markets globally could boost real consumption by 7.5 percent permanently, even assuming no productivity dividend. We therefore raise the amended welfare cost of goods and services trade barriers by 7.5 percent for both sets of countries and all years.

Allowing economies of scale and imperfect competition

We have assumed constant returns to scale and perfect competition rather than allowing firms to enjoy increasing returns and some degree of monopoly power for their differentiated product. The so-called 'new' trade theory has shown how this can lead to underestimating the welfare gains from trade reform (Krugman 2009). Empirical case studies suggest that if opening an economy exposes monopolistic firms to greater competition and allows greater exploitation of scale economies, it generates additional gains from trade reform that could be several times the standard estimates based on constant returns to scale and perfect competition (see, e.g., Harris (1984) on Canada, Krishna and Mitra (1998) on India, Pavcnik (2002) on Chile).

A study by Francois, van Meijl and van Tongeren (2005) used the comparative static global GTAP model without and then with scale economies and imperfect competition and found that the estimated gains from freeing global trade as of 1997 were about half as large again in the latter case. Since small economies are more likely to benefit in this way than larger economies, other things equal, this difference may well have been larger in earlier decades. A conservative adjustment to the amended welfare cost of goods and services trade barriers and restrictions on financial integration is to add for both groups of countries a further 50 percent for each of the years considered in the present study.

Allowing for product quality and variety differences, and new product emergence

Another product aggregation issue has to do with the fact that, within any product classification, there is a wide range of qualities and varieties available. The only way product quality or variety differences enter most CGE models is by distinguishing between a product's country of origin. This is done using so-called Armington elasticities which can ensure domestically produced goods are imperfect substitutes for imported goods in aggregate, and imports from one country are an imperfect substitute for goods imported from any other country (Armington 1969).

In the real world, however, there is an ever-increasing array of qualities and varieties available for any product from each supplying country. It appears consumers (including producers using those products as intermediate inputs) are willing to pay for a greater variety of different quality products, even though that product differentiation may be costly in terms of shorter production runs and more advertising. Hummels and Klenow (2005) suggest that these improvements in quality are sufficiently rapid that the prices received by countries for the products that they continue to export—as distinct from their new exports—actually rise by 0.09 percent for each increase of 1 percent in national income. This result is at variance with traditional Armington models, which generate a reduction in export prices when economies grow and exports expand.

In a study of US import data from 1972 to 2001, Broda and Weinstein (2006) find that the upward bias in the conventional import price index, because of not accounting for the growth in varieties of products, is approximately 1.2 percent per year. Feenstra, Markusen and Zeile (1992) suggest the welfare cost of tariff protection can be underestimated by as much as a factor of ten when this consideration is not included in the analysis.

Also, standard models used to assess the implications of trade reforms are based on the assumption that expansion of exports following liberalization involves increasing the volume of the products initially being exported, but not of any other products. The Armington assumption also rules out expanding the markets to which goods are being supplied: if exports to a particular country are initially zero, then in most CGE models they remain zero following reform.

Recent research, however, highlights the key role of the "extensive" margin, where export expansion involves increases in the range of products exported (Hummels and Klenow 2005) and expansion in the range of markets supplied (Evenett and Venables 2002). Hummels and Klenow conclude that only about one-third of the export expansion associated with economic growth comes from the "intensive margin" where greater quantities of the same products are exported. And Evenett and Venables find that about one-third of the expansion of exports from developing countries was obtained by exporting products to countries to which they had not previously exported.

In a world where importers exhibit a preference for variety in the goods they purchase, these observations on the importance of extensive-margin growth have major implications. Increasing the volumes of the same products, as under the Armington assumption, has the inevitable consequence of driving down the price of exports and causing income losses to the exporter from deterioration in the terms of trade. Where exports are characterized by an expansion in the range of products supplied, the preference for variety exerts a counteracting force—helping to increase the demand for exports. In simulations introducing the Hummels-Klenow preference for variety in exports from China and India, Dimaranan, Ianchovichina and Martin (2007) found that the terms of trade for these exporters need not deteriorate significantly, despite very high projected rates of export growth.

Common treatments of new varieties, such as those based on monopolistic competition and a love-of-variety inspired by Krugman (1980), typically assume they apply mainly to manufacturing. However, as Rodrik (2004) notes, the process of discovering efficient new exports is just as important and difficult in primary and service sectors as in manufacturing. It may be even more important in emerging economies than in than in high-income countries. So too might issues of product quality. Jensen, Rutherford and Tarr (2007), for example, find that the benefits of reform in services trade, when allowing for productivity growth in trading a wider range of qualities of goods as the quality of business services rise (following Markusen, Rutherford and Tarr 2005), completely dominate as a source of potential benefits from reforms likely to follow Russia's eventual accession to the WTO.

To take account of these additional three missing elements, we raise the amended welfare cost of barriers to economic and financial integration for both groups of countries by a further 50 percent for 2004 and beyond and by 20 percent pre-World War II, 30 percent in 1962 and 40 percent in 1982.

Administration, compliance and lobbying costs

Savings in bureaucratic costs of administering trade barriers, in traders' costs of circumventing barriers (Bhagwati and Hansen 1973), and in lobbyists costs of rent-seeking to secure or maintain trade-distorting policies are all non-trivial elements of gains that can come from removing trade barriers, none of which are captured in most global economic modeling. Lobbying costs potentially could absorb all of the rents received by private agents from trade barriers, for example (Krueger 1974). For want of reliable estimates, these costs will be assumed to add just another 10 percent each year to the amended welfare cost of barriers to economic and financial integration.

Growth-enhancing impacts of reform

The comparative static GTAP model used here does not measure any of the dynamic gains that come from trade reform. Yet economists have long been convinced that participation in international trade provides a growth dividend additional to standard improvements in allocative efficiency. Dynamic gains arise in numerous ways. One of the more important is through encouragement of the more-efficient firms to take over from the less efficient in each country (Melitz 2003, Trefler 2004, Bernard et al. 2007, Melitz and Ottaviano 2008). Another way is through multinational firms sharing technologies and knowledge across countries within the firm (Markusen 2002). Offshoring is yet another mechanism through which heterogeneous firms are affected by trade liberalization, including via re-locating from small to larger nations (Baldwin and Okuba 2011). The greater competition that accompanies trade reform also can stimulate more innovation (Aghion and Griffith 2005), leading to higher rates of capital accumulation and productivity growth (Lumenga-Neso, Olarreaga and Schiff 2005).

Based loosely on Arrow's (1962) concept of learning-by-doing, major empirical contributions to this literature include Feder (1983), Dollar (1992) and Sachs and Warner (1995), all of which find strong links between export performance and economic growth. Rodriguez and Rodrik (2001) raised concerns about the robustness of the estimated relationship between aggregate exports and productivity growth. During the same period, Clerides, Lach and Tybout (1998) questioned the learning-by-doing framework based on firm-level findings that exporting firms were more efficient before entering export markets, rather than because of learning-by-doing after entering these markets. However, more-recent research on the aggregate links between exports and productivity growth has carefully re-examined the potential endogeneity of the relationship, and continues to find an aggregate positive relationship (Frankel and Romer 1999). A number of subsequent firm-level studies find evidence of productivity growth associated with learning-by-doing after firms enter exporting. Blalock and Gertler (2004) find an increase in firm productivity of between 2 and 5 percent after Indonesian firms enter export markets. Fernandes and Isgut (2007) find evidence of an increase in productivity from learning-by-exporting when Colombian firms entered export markets. Van Biesebrock (2005) finds that African exporting firms had higher productivity before entering export markets, and that their productivity levels, and their subsequent rates of productivity growth, increased after entering export markets. Girma, Greenaway and Kneller (2004) also find both higher initial levels of productivity and higher productivity growth rates after entry into exporting.

In a more macro study, Wacziarg and Welch (2008) estimate that countries that have liberalized their trade (defined as raising their trade-to-GDP ratio by 5+ percentage points) enjoyed 1.5 percentage points higher GDP growth compared with their pre-reform rate. Liberalizing international financial flows

also has been shown to have boosted economic growth, especially in the first wave of globalization up to 1913 (Schularick and Steger 2010).

Synopsis

A single paper that brings several of the above omissions together using a numerical open economy growth model is that by Rutherford and Tarr (2002). Its simulation model allows for product variety, imperfect competition, economies of scale and international capital flows. It is also dynamic, so it can trace out an adjustment path to trade reform. Furthermore, it is stochastic in that it draws randomly from uniform probability distributions for eight key parameters of the model. The authors simulate a halving of the only policy intervention (a 20 percent tariff on imports) and, in doing so, fully replace the government's lost tariff revenue with a lump-sum tax. That modest trade reform produces a welfare increase (in terms of Hicksian equivalent variation) of 10.6 percent of the present value of consumption in their central model. Systematic sensitivity analysis with 34,000 simulations showed that there is virtually no chance of a welfare gain of less than 3 percent, and a 7 percent chance of a welfare gain larger than 18 percent of consumption. Several modeling variants and sensitivity analysis on all the key parameters found that the welfare estimates for the same ten percentage point tariff cut ranged up to 37 percent when international capital flows are allowed, and down to 4.7 percent when using the most inefficient replacement tax (a tax of capital). The latter result shows that even a very inefficient tax on capital is superior to the tariff as a revenue raiser. Increasing the size of the tariff cuts beyond 50 percent results in roughly proportional increases in the estimated welfare gains.

Those results suggest the amendments proposed for each of the omissions discussed in this section are modest. In summary, the multipliers are the following, not including any amendment for dynamic gains from trade:

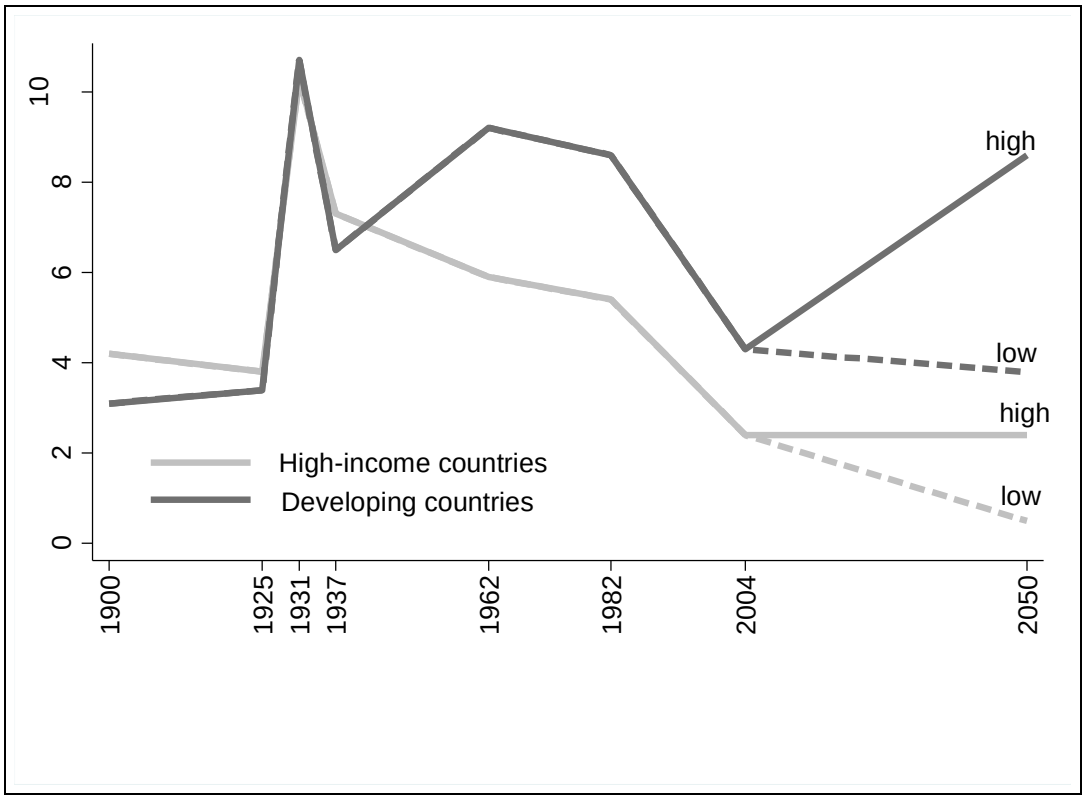
Table 1. Summary of multipliers

Source of multiplier to trade reform gain:	**1900-37**	**1962**	**1982**	**2004-50**
NTBs and tariff averaging	1.5	1.4	1.3	1.2
Services	1.2	1.3	1.4	1.5
Financial market integration	1.075	1.075	1.075	1.075
Scale economies & imperfect competition	1.5	1.5	1.5	1.5
Product quality, variety and newness	1.2	1.3	1.4	1.5
Admin., compliance & lobbying costs	1.1	1.1	1.1	1.1
Total	**3.83**	**4.19**	**4.52**	**4.79**

When the above Total multipliers are used to reduce the under-estimates in Table 7(b) they become those shown in Table 7(c). Combining these effects in this way may overstate the required adjustments, because of interactions between them (that is, econometricians focusing on one or only a subset at a time may have

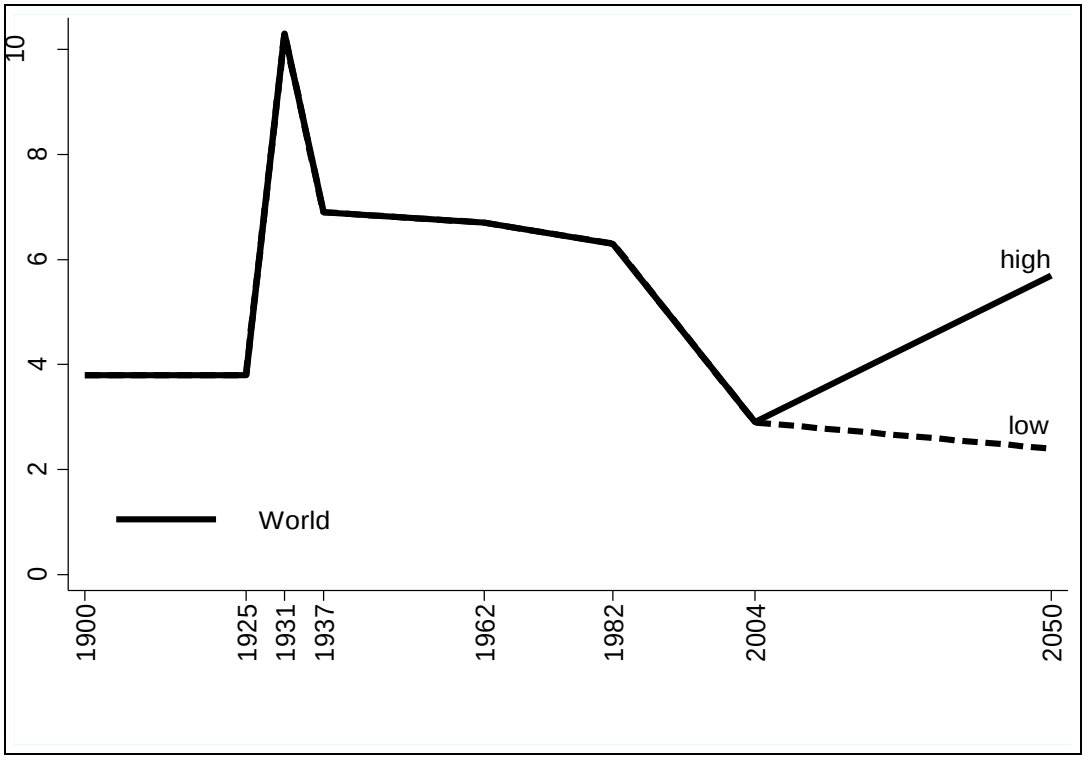
spuriously captured the effects of some of the others). However, by not including an adjustment for the dynamic gains from trade we are still omitting what is probably the most important of the missing effects discussed above. Adding the dynamic gains is problematic, though, because they involve an increase in the annual *rate of growth* of capital and outputs, not just a permanent one-off increase in the *level* of GDP. Its continued omission almost certainly ensures that even the adjusted numbers in Table 7(c) are still lower-bound estimates of the retrospective and prospective costs of the world's trade barriers.

Figure 1. Cost of price-distorting trade barriers as a percent of GDP, developing and high-income countries, 1900 to 2050 (percent)



Note: Low' and 'High' scenarios refer to whether it is assumed that price distortions from trade barriers fall or rise between 2004 and 2050. Source: see Table 7.

Figure 2. Cost of price-distorting trade barriers as a percent of GDP, the world, 1900 to 2050 (percent)



Note: Low' and 'High' scenarios refer to whether it is assumed that price distortions from trade barriers fall or rise between 2004 and 2050. Source: see Table 7.

Summary and conclusion

The above estimates of the cost of trade barriers to developing and high-income countries are summarized in Figure 1 and 2. If one leaves aside the spike in the Great Depression of the early 1930s, the pattern begins with relatively low costs at the start of the 20th century, which was the tail end of the world's first great policy reform-driven globalization wave. Those costs did not change greatly up to the late 1920s, were nearly three times as high in the early 1930s before falling back to two times as high by the latter 1930s, fell for high-income countries but rose further for developing countries after World War II (associated with the transition to independence for many former colonies), before falling rapidly during the second great globalization wave that began around the mid-1980s. Whether that fall continues over the next four decades is by no means certain. The difficulties WTO members are having in bringing the Doha round of multilateral trade negotiations to a successful conclusion is worrying. A collapse of those talks means more than just not reaping the gains they are estimated to be able to provide, for two reasons: it would diminish the chances of completing and implementing yet another round before 2050; and it would leave open the possibility for countries whose WTO-bound tariffs and subsidies are above currently applied rates to raise their trade barriers. Clearly a great deal hangs on the WTO membership finding the political will to fulfil the expectations of its Doha Development Agenda. Certainly countries have the additional

option of creating or joining preferential trading blocs or even broader economic integration agreements – and they will proliferate even more if Doha fails. However, they are typically choked with exceptions such that they are poor substitutes for a comprehensive multilateral agreement from a global welfare viewpoint.

Three points need reiterating by way of conclusion. The first is to keep in mind the paucity of historical data available to estimate the extent of price-distorting trade barriers prior to the 1960s. It means that any estimates of the costs of trade barriers that are dependent on them necessarily are subject to a considerable degree of uncertainty. The second is that, despite huge progress being made in building global economy-wide models capable of analysing trade policy issues, the type of model used in the present study still grossly under-estimates the global cost of trade barriers/benefits from trade policy reform, since dynamic gains from trade are still omitted. And thirdly, such models are best suited to analyse situations for which their database is pertinent. Using them to forecast or backcast many decades is necessarily an imprecise exercise, so the results for the outlying decades especially should be viewed with that in mind as well.

References

Aghion, P. and R. Griffith (2005), *Competition and Growth: Reconciling Theory and Evidence,* Cambridge MA: MIT Press.

Anderson, J.E. (2009), 'Consistent Trade Policy Aggregation', *International Economic Review* 50(3):903-27, August.

Anderson, J.E. and J.P. Neary (2005), *Measuring the Restrictiveness of International Trade Policy*, Cambridge MA: MIT Press.

Anderson, K. (2003), 'Measuring Effects of Trade Policy Distortions: How Far Have We Come?' *The World Economy* 26(4): 413-40, April.

Anderson, K. (2004), 'Subsidies and Trade Barriers', Ch. 10 in *Global Crises, Global Solutions***,** edited by B. Lomborg, Cambridge and New York: Cambridge University Press.

Anderson, K. (ed.) (2009), *Distortions to Agricultural Incentives: A Global Perspective, 1955-2007,* London: Palgrave Macmillan and Washington DC: World Bank.

Anderson, K. (ed.) (2010), *The Political Economy of Agricultural Price Distortions*, Cambridge and New York: Cambridge University Press.

Anderson, K. and J.L. Croser (2011), 'Changing Contributions of Different Agricultural Policy Instruments to Global Reductions in Trade and Welfare', *World Trade Review* 10 (forthcoming).

Anderson, K. and Y. Hayami (1986), *The Political Economy of Agricultural Protection: East Asia in International Perspective*, Boston, London and Sydney: Allen and Unwin.

Anderson, K. and B. Hoekman (eds.) (2006), *The WTO's Core Rules and Disciplines*, London: Edward Elgar.

Anderson, K., W. Martin and E. Valenzuela (2006), 'The Relative Importance of Global Agricultural Subsidies and Market Access', *World Trade Review* 5(3): 357-76, November.

Anderson, K., W. Martin and D. van der Mensbrugghe (2006), 'Market and Welfare Implications of the Doha Reform Scenarios', Ch. 12 in *Agricultural Trade Reform and the Doha Development Agenda*, edited by K. Anderson and W. Martin, London: Palgrave Macmillan (co-published with the World Bank).

Anderson, K. and S. Nelgen (2010), 'Trade Barrier Volatility and Agricultural Price Stabilization', CEPR Discussion Paper 8102, London, November.

Anderson, K. and S. Nelgen (2011), 'Projecting Agricultural Distortions for a 2030 GTAP database", Contributed Paper for the 14th Annual Conference on Global Economic Analysis, Venice, 16-18 June.

Anderson, K. and H. Norheim (1993), 'History, Geography and Regional Economic Integration', Ch. 2 in *Regional Integration and the Global Trading System*, edited by K. Anderson and R. Blackhurst, London: Harvester Wheatsheaf and New York: St. Martins Press.

Anderson, K. and R. Tyers (1992), 'Japanese Rice Policy in the Interwar Period: Some Consequences of Imperial Self Sufficiency'. *Japan and the World Economy* 4(2): 103-27, September.

Anderson, K. and E. Valenzuela (2008), *Global Estimates of Distortions to Agricultural Incentives, 1955 to 2007*, data spreadsheets at www.worldbank.org/agdistortions

Anderson, K. and L.A. Winters (2009), 'The Challenge of Reducing International Trade and Migration Barriers', Ch. 8 in *Global Crises, Global Solutions* (2nd edition), edited by B. Lomborg, Cambridge: Cambridge University Press.

Armington, P. (1969), 'A Theory of Demand for Products Distinguished by Place of Production', *IMF Staff Papers* 16(1): 159-78, March.

Arrow, K. (1962) 'The Economic Implications of Learning by Doing', *Review of Economic Studies* 29(3):155-173. June.

Balassa, B. and Associates (1971), *The Structure of Protection in Developing Countries*, Baltimore: Johns Hopkins University Press.

Baldwin, R.E. (1991), 'Measuring the Effects of Nontariff Trade-Distorting Policies', in J. De Melo and A. Sapir (eds.), *Trade Theory and Economic Reform: North, South and East: Essays in Honour of Bela Balassa*, Cambridge MA: Basil Blackwell.

Baldwin, R. and T. Okuba (2011), 'International Trade, Offshoring and Heterogeneous Firms', NBER Working Paper 16660, Cambridge MA, January.

Bates, R. (1981), *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*, Berkeley: University of California Press.

Bernard, A.B., J.B. Jensen, S.J. Redding and P.K. Schott (2007), 'Firms in International Trade', *Journal of Economic Perspectives* 21(3): 105-30, Summer.

Bértola, L. and J.G. Williamson (2006), 'Globalization in Latin America Before 1940', Ch. 1 in *The Cambridge Economic History of Latin America, Vol. II,* edited by V. Bulmer-Thomas, J.H. Coatsworth and R. Cortés Conde, Cambridge and New York: Cambridge University Press.

Bhagwati, J.N. (1971), 'The Generalized Theory of Distortions and Welfare', in *Trade, Balance of Payments and Growth,* edited by J.N. Bhagwati et al., Amsterdam: North-Holland.

Bhagwati, J.N. (1978), *Foreign Trade Regimes and Economic Development: Anatomy and Consequences of Exchange Control Regimes*, Cambridge, MA: Ballinger.

Bhagwati, J.N. and B. Hansen (1973), 'A Theoretical Analysis of Smuggling', *Quarterly Journal of Economics* 87(2): 172-87, May.

Blalock, G. and P. Gertler (2004), 'Learning from Exporting Revisited in a Less Developed Setting', *Journal of Development Economics* 75: 397–416.

Bouët, A. and D. Laborde (2010), 'Assessing the Potential Cost of a Failed Doha Round', *World Trade Review* 9(2): 319–351.

Broda, C.M. and D.E. Weinstein (2006), 'Globalization and the Gains from Variety', *Quarterly Journal of Economics*, 121(2): 541-85.

Brown, D.K., K. Kiyota and R.M. Stern (2005), 'Computational Analysis of the Free Trade Area of the Americas (FTAA)', *North American Journal of Economics and Finance* 16: 153-85.

Bulmer-Thomas, V. (1994), *The Economic History of Latin America Since Independence,* Cambridge and New York: Cambridge University Press.

Clemens, M.A. and J.G. Williamson (2010), 'Endogenous Tariffs and Growth: Asia versus Latin America, 1870-1940', mimeo, Harvard University, Cambridge MA, June.

Clerides, S., Lach, S. and Tybout, J. (1998), 'Is Learning by Exporting Important? Micro-dynamic Evidence from Colombia, Mexico and Morocco', *Quarterly Journal of Economics* 113(3): 903-47.

Corden, W.M. (1997), *Trade Policy and Economic Welfare,* (revised edition), Oxford: Clarendon Press.

Deardorff, A.V. (2005), 'A Centennial of Anti-dumping Legislation and Implementation: Introduction and Overview', *The World Economy* 28(5): 633-40, May.

Dee, P., Hanslow, K. and D.T. Pham (2003), 'Measuring the Cost of Barriers to Trade in Services', in T. Ito and A.O. Krueger (eds.), *Services Trade in the Asia-Pacific Region*, Chicago: University of Chicago Press for the NBER.

Diebold, W., Jr. (1952), *The End of the ITO,* International Finance Section, Essays in International Finance No. 16, Princeton NJ: Princeton University Press.

Dimaranan, B., E. Ianchovichina and W. Martin (2007), Competing with Giants: Wwho Wins, Who Loses? Ch. 3 in L.A. Winters and S. Yusuf (eds.), *Dancing with Giants: China, India and the Global Economy,* Washington DC: World Bank.

Dollar, D. (1992), Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976–1985, *Economic Development and Cultural Change* 40(3): 523–44.

Evenett, S. and A. Venables (2002), 'Export Growth in Developing Countries: Market Entry and Bilateral Trade Flows', mimeo, November. Available at www.alexandria.unisg.ch/Publikationen/22177

Feder, G. (1983), 'On Exports and Economic Growth', *Journal of Development Economics* 12: 59-73.

Feenstra, R.C. (1995), 'Estimating the Effects of Trade Policy', in G.N. Grossman and K. Rogoff (eds.), *Handbook of International Economics, Vol. 3*, Amsterdam: Elsevier.

Feenstra, R.C., J.R. Markusen and W. Zeile (1992), 'Accounting for Growth with New Inputs', *American Economic Review* 82(2): 415-21, May.

Fernandes, A. and A. Isgut (2007), 'Learning-by-Exporting Effects: Are They for Real?' MPRA Working Paper No. 3121, http://mpra.ub.uni-muenchen.de/3121/.

Finger, J.M. (2002), 'Safeguards: Making Sense of GATT/WTO Provisions Allowing Import Restrictions', Ch. 22 in *Development, Trade and the WTO: A Handbook*, edited by B. Hoekman, A. Mattoo and P. English, Washington DC: World Bank.

Francois, J.F. and B. Hoekman (2010), 'Services Trade and Policy', *Journal of Economic Literature* 48(3): 642-92, September.

Francois, J.F. and W. Martin (2004), 'Commercial Policy, Bindings and Market Access', *European Economic Review* 48: 665-79, June.

Francois, J.F. and W. Martin (2010), 'Ex Ante Assessments of the Welfare Impacts of Trade Reforms with Numerical Models', Ch. 13 (pp. 379-434) in *New Developments in Computable General Equilibrium Analysis for Trade Policy*, edited by H. Beladi and E.K. Choi, London: Emerald Group Publishing.

Francois, J.F., van Meijl, H. and van Tongeren, F. (2005), 'Trade Liberalization in the Doha Development Round', *Economic Policy* 20 (42): 349-91.

Frankel, J.A. and D. Romer (1999), 'Does Trade Cause Growth?' *American Economic Review* 89(3): 379-99, June.

GATT (1972), *Basic Documentation of the Tariff Study,* Geneva: GATT Secretariat.

GATT (1978), *Network of World Trade by Areas and Commodity Classes, 1955 to 1976,* GATT Studies in International Trade No. 7, Geneva: GATT Secretariat.

Girma, S., D. Greenaway and R. Kneller (2004), 'Does Exporting Increase Productivity? A Microeconometric Analysis of Matched Firms', *Review of International Economics* 12(5): 855–866.

Gootiiz, B. and A. Mattoo (2009), 'Restrictions on Services Trade and FDI in Developing Countries', mimeo, World Bank, Washington DC.

Haberler, G. (1958), *Trends in International Trade: A Report by a Panel of Experts*, Geneva: General Agreement on Tariffs and Trade, October.

Harris, R.G. (1984), 'Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition', *American Economic Review* 74(5): 1016–32, December.

Hertel, T.W. (ed.) (1997), *Global Trade Analysis: Modeling and Applications*, Cambridge and New York: Cambridge University Press.

Hoxha, I., S. Kalemli-Ozcan and D. Vollrath (2009), 'How Big are the Gains from International Financial Integration?', NBER Working Paper 14636, Cambridge MA, January.

Hummels, D. and P. Klenow (2005), 'The Variety and Quality of a Nation's Exports', *American Economic Review* 95(3): 704-23.

Irwin, D. (1996), *Against the Tide: An Intellectual History of Free Trade,* Princeton NJ: Princeton University Press.

Irwin, D. (2010), 'Trade Restrictiveness and Deadweight Losses from U.S. Tariffs, 1859-1961', *American Economic Journal: Economic Policy* 2(3): 111–133, August.

Jacks, D.S., C. Meissner and D. Novy (2010), 'Trade Booms, Trade Busts, and Trade Costs', *Journal of International Economics* 83: 185-201, November.

Jacks, D.S. and K. Pendakur (2010), 'Global Trade and the Maritime Transport Revolution', *Review of Economics and Statistics* 92(4): 745-55, November.

Jensen, J., T. Rutherford and D. Tarr (2007), 'The Impact of Liberalizing Barriers to Foreign Direct Investment in Services: The Case of Russian Accession to the World Trade Organization', *Review of Development Economics* 11(3): 482-506, August.

Keller, W., B. Li, and C. Hua Shiue (2010), 'China's Foreign Trade: Perspectives from the Past 150 Years', CEPR Discussion Paper 8118, Centre for Economic Policy Research, London, November.

Kindleberger, C.P. (1975), 'The Rise of Free Trade in Western Europe, 1820-1875', *Journal of Economic History* 35(1): 20-55, March.

Kindleberger, C.P. (1989), 'Commercial Policy Between the Wars', in P. Mathias and S. Pollard (eds.), *The Cambridge Economic History of Europe, vol. 8*. Cambridge: Cambridge University Press.

Konan, D. and K. Maskus (2006), 'Quantifying the Impact of Services Liberalization in a Developing Country', *Journal of Development Economics* 81(1): 142-62.

Krishna, P., and D. Mitra (1998), 'Trade Liberalization, Market Discipline and Productivity Growth: New Evidence from India', *Journal of Development Economics* 56: 447-62.

Krueger, A.O. (1974), 'The Political Economy of the Rent-seeking Society', *American Economic Review* 64(3): 291–303.

Krueger, A.O. (1978), *Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences*, Cambridge, MA: Ballinger.

Krugman, P. (1980), 'Scale Economies, Product Differentiation, and the Pattern of Trade', *American Economic Review* 70(5): 950-59.

Krugman, P. (2009), 'The Increasing Returns Revolution in Trade and Geography', *American Economic Review* 99(3): 561-71, June.

Laborde, D., W. Martin and D. van der Mensbrugghe (2011), 'Measuring the Benefits of Global Trade Reform with Optimal Aggregators of Distortions', Ch. 11 in W. Martin and A. Mattoo (eds.), *The Doha Development Agenda*, Washington DC: World Bank (forthcoming).

Laird, S. (1997), 'Quantifying Commercial Policies', Ch. 2 in Francois, J.F. and K.A. Reinert (eds.), *Applied Methods in Trade Policy Analysis: A Handbook*, Cambridge and New York: Cambridge University Press.

League of Nations (1927), *Tariff Level Indices,* Geneva: League of Nations.

League of Nations (1939), *Review of World Trade 1938,* Geneva: League of Nations.

Liepmann, H. (1938), *Tariff Levels and the Economic Unity of Europe,* London: Allen and Unwin.

Lin, J.Y., F. Cai and Z. Li (1996), *The China Miracle: Development Strategy and Economic Reform,* Hong Kong: The Chinese University Press for the International Center for Economic Growth.

Lindert, P.H. (1991), 'Historical Patterns of Agricultural Policy', in C. Timmer (ed.), *Agriculture and the State: Growth, Employment, and Poverty,* Ithaca NY: Cornell University Press.

Little, I.M., T. Scitovsky and M. Scott (1970), *Industry and Trade in Some Developing Countries: A Comparative Study,* London: Oxford University Press for the OECD.

Lloyd, P.J. (1974), 'A More General Theory of Price Distortions in an Open Economy', *Journal of International Economics* 4(4): 365-86, November.

Lloyd, P.J. (2008), '100 Years of Tariff Protection in Australia'**,** *Australian Economic History Review* 48(2): 99-145, July.

Lumenga-Neso, O., M. Olarreaga and M. Schiff (2005), 'On 'Indirect' Trade-Related R&D Spillovers', *European Economic Review* 49(7): 1785-98, October.

Maddison, A. (2008), *Historical Statistics of the World Economy: 1-2008 AD*, available at http://www.ggdc.net/maddison/

Maizels, A. (1963), *Industrial Growth and World Trade,* Cambridge: Cambridge University Press.

Markusen, J., T. Rutherford and D. Tarr (2005), 'Foreign Direct Investment in Services and the Domestic Market for Expertise', *Canadian Journal of Economics* 38(3): 758-77.

Martin, W. (1997), 'Measuring Welfare Changes with Distortions', Ch. 3 in Francois, J.F. and K.A. Reinert (eds.), *Applied Methods in Trade Policy Analysis: A Handbook*, Cambridge and New York: Cambridge University Press.

Martin, W. and K. Anderson (2012), 'Export Restrictions and Price Insulation During Commodity Price Booms', *American Journal of Agricultural Economics* 94(1), January (forthcoming).

Martin, W. and A. Mattoo (eds.) (2011), *The Doha Development Agenda*, Washington DC: World Bank (forthcoming).

McKibbin W. and A. Stegman (2005) 'Asset Markets and Financial Flows in General Equilibrium Models', pp. 3-16 in *Quantitative Tools for Microeconomic Policy Analysis*, Canberra: Productivity Commission.

Meade, J. (1942), 'A Proposal for an International Commercial Union', unpublished Cabinet paper reproduced in *The World Economy* 10: 399-407, 1987, and in S. Meade (ed.), *The Collected Papers of James Meade, Volume III: International Economics,* London: Unwin Hyman, 1988.

Melitz, M.J. (2003), 'The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity', *Econometrica* 71(6): 1692-1725.

Melitz, M.J. and G.I.P. Ottaviano (2008), 'Market Size, Trade and Productivity', *Review of Economic Studies* 75(1): 295-316, January.

Narayanan, G., and T.L. Walmsley (eds.) (2008), *Global Trade, Assistance, and Production: The GTAP 7 Data Base.* West Lafayette, IN: Center for Global Trade Analysis, Purdue University. http://www.gtap.org.

Nogues, J.J., A. Olechowski, and L.A. Winters (1986), 'The Extent of Nontariff Barriers to Industrial Countries' Imports', *World Bank Economic Review* 1(1): 181-99.

OECD (2006), *Producer and Consumer Support Estimates, OECD Database 1986-2005*. http://www.oecd.org.

Pavcnik, N. (2002), 'Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants', *Review of Economic Studies* 69: 245-76.

Rodrigeuz, F. and D. Rodrik (2001), 'Trade Policy and Economic Growth: A Skeptic's Guide to Cross-National Evidence', in B.S. Bernanke and K.S. Rogoff (eds.), *NBER Macroeconomics Annual 2000*, Cambridge MA: MIT Press.

Rogoff, K.S. (2003), 'Disinflation: An Unsung Benefit of Globalization,' *Finance and Development* 40(4): 54-55, December.

Roningen, V. and A Yeats (1976), 'Nontariff Distortions of International Trade: Some Preliminary Empirical Evidence', *Weltwirtschaftliches Archiv* 122(4): 613-25, December.

Rutherford, T.F. and D.G. Tarr (2002), 'Trade Liberalization, Product Variety and Growth in a Small Open Economy: A Quantitative Assessment', *Journal of International Economics* 56**(2):** 247-72.

Sachs, J.D. and A. Warner (1995), 'Economic Reform and the Process of Global Integration', *Brookings Papers on Economic Activity* 1: 1-95.

Sah, R. and J.E. Stiglitz (1992), *Peasants versus City-Dwellers: Taxation and the Burden of Economic Development,* London: Oxford University Press.

Schularick, M. and T.M. Steger (2010), 'Financial Integration, Investment, and Economic Growth: Evidence from Two Eras of Financial Globalization', *Review of Economics and Statistics* 92(4): 756-68, November.

Swinnen, J.F.M. (2010), 'Agricultural Protection Growth in Europe, 1870 to 1969', Ch. 6 in *The Political Economy of Agricultural Price Distortions*, edited by K. Anderson, Cambridge and New York: Cambridge University Press.

Trefler, D. (2004), 'The Long and Short of the Canada-US Free Trade Agreement', *American Economic Review* 94(4): 870-895, September.

Tyers, R. and K. Anderson (1992), *Disarray in World Food Markets: A Quantitative Assessment*, Cambridge and New York: Cambridge University Press.

van Biesebrock, J. (2005), 'Exporting Raises Productivity in Sub-Saharan African Manufacturing Firms', *Journal of International Economics* 67: 373-91.

Valenzuela, E. and K. Anderson (2008), 'Alternative Agricultural Price Distortions for CGE Analysis of Developing Countries, 2004 and 1980-84', GTAP Research Memorandum No 13, December. Available at www.gtap.agecon.purdue.edu/resources

Valenzuela, E., D. van der Mensbrugghe and K. Anderson (2009), 'General Equilibrium Effects of Price Distortions on Global markets, Farm Incomes and Welfare', Ch. 13 in *Distortions to Agricultural Incentives: A Global Perspective, 1955-2007***,** edited by K. Anderson, London: Palgrave Macmillan and Washington DC: World Bank.

van der Mensbrugghe, D. (2005), 'LINKAGE Technical Reference Document: Version 6.0', *mimeo*, World Bank, Washington DC, January and at www.worldbank.org/prospects/linkagemodel

van der Mensbrugghe, D. and R. Rosen (2010), 'Climate, Trade and Development', Paper presented at the 13th Global Economic Analysis Conference, Penang, 9-11 June.

Venables, A.J. (2004), 'Small, Remote and Poor', *World Trade Review* 3(3): 453-57, November.

Venables, A.J. and N. Limao (2002), 'Geographic Disadvantage: a Heckscher-Ohlin-von Thunen Model of International Specialization', *Journal of International Economics* 58: 239-63.

Viner, J. (1924), 'The Most-Favored-Nation Clause in American Economic Treaties', *Journal of Political Economy* 32(1), February. (Reprinted as Ch. 1 in his *International Economics: Studies by Jacob Viner,* Glencoe IL: The Free Press.)

Wacziarg, R. and K.H. Welch (2008), 'Trade Liberalization and Growth: New Evidence', *World Bank Economic Review* 15(3): 393-429, October.

Woytinsky, W.S. and E.S. Woytinsky (1955), *World Commerce and Governments: Trends and Outlook,* New York: Twentieth Century Fund.

WTO (2010), *World Trade Statistics 2009,* Geneva: World Trade Organization.

Table 2. Shares of world GDP and merchandise trade, by region, 1913 to 2050

a) GDP shares (percent, based on 1990 International Geary-Khamis dollars except last 2 columns)

	1900	**1913**	**1953**	**1983**	**2008**	**2050**[a]	**2010**[b]	**2050**[b]
Europe (incl. CIS)	47	47	39	35	23	14	33	24
United States + Canada	17	20	29	23	20	15	31	21
Australia + New Zealand	1	1	1	1	1	1	1	1
Japan	3	3	3	9	6	6	10	5
All high-income (+CIS)	**68**	**71**	**72**	**68**	**50**	**36**	**75**	**51**
Developing Asia	22	20	14	15	35	50	12	32
of which China	*11*	*9*	*5*	*6*	*17*	*na*	*6*	*19*
Latin America	5	4	8	9	8	7	6	7
Africa	3	3	4	4	3	3	2	5
Middle East	2	2	2	4	4	4	5	5
All developing	**32**	**29**	**28**	**32**	**50**	**64**	**25**	**49**
WORLD	100	100	100	100	100	100	100	100
Value (1990 $ billion)	*1,972*	*2,733*	*5,911*	*19,633*	*50,974*			

b) Trade shares (average of export and import shares, percent)

	1913	**1953**	**1983**	**2008**	**2008** (excl. intra-EU27)
Europe (incl. CIS)	57	45	49	45	17
United States + Canada	14	22	18	13	18
Australia + New Zealand	1	1	1	1	2
Japan	2	2	8	5	6
All high-income (+CIS)	**74**	**70**	**76**	**64**	**43**
Developing Asia	10	9	9	22	35
of which China	*1*	*1*	*1*	*8*	*11*
Latin America	8	10	5	6	9
Africa	4	7	4	3	5
Middle East	4	4	6	5	8
All developing	**26**	**30**	**24**	**36**	**57**
WORLD	100	100	100	100	100
Memo:					
EU[c]			*31*	*38*	
GATT/WTO members[d]		*68*	*90*	*95*	

[a] Projections provided by the Copenhagen Consensus Centre.

[b] Projections provided by van der Mensbrugghe and Roson (2010), in 2004 USdollars.

[c] 6 members in 1963, 10 in 1983, 27 in 2008.

[d] 23 countries in 1948, 103 by 1986, 153 by 2010.

Sources: GDP data from Maddison (2008); trade data from Woytinsky and Woytinsky (1955) for 1913, and otherwise from WTO (2010, Tables 1.6 and 1.7).

Table 3. Import tariffs on manufactures, key trading countries, 1902 to 1970 (percent)

	1902	1913	1925	1937	1950	1955	1962	1970
Europe								
Austria		16	27		18			
Belgium	13	9	15	11	11	7	11	6
Czechoslovakia		18	27					
Denmark	19	14	10		3			
France	34	20	21	17	18	19[b]	11	6
Germany	25	13	20	14	26	16[b]	11	6
Greece					39			
Hungary		18	27					
Italy	27	18	22		25	24[b]	11	6
Netherlands	3	4	6				11	6
Norway	12			14	11	10		11
Poland			32					
Portugal					18			
Russia	131							
Spain	76	41	41					
Sweden	23	20	16	13	9	6	7	7
Switzerland	7	9	14	13		8		3
United Kingdom			17[a]		23	17[b]		
Yugoslavia			23					
Other high-income countries								
Australia	32[c]	31	31	45	25	22	22	24
New Zealand						21	22	23
Japan	1	20	13	11		14[b]	16	12
United States	54	30	24	28	12	11	12	9
Canada	17	26	23	16		12[b]	12	14
Developing countries								
Argentina		28	29					
Brazil[d]		40[e]		70		29		
Chile				34		39		
India	3	4	16	29		30		

Notes: [a] 1931 [b] 1952 [c] 1903-04 [d] Import duties as a % of the value of imports were (often well) above 30 percent in 1913 also for Paraguay, Peru, Uruguay and Venezuela, according to Bulmer-Thomas (1994, pp. 141-42).

Sources: League of Nations (1927), Little, Scitovsky and Scott (1970), Woytinsky and Woytinsky (1955), Maizels (1963), Irwin (2010, Table A1) for the United States, Lloyd (2008, Table 5) for Australia and, for other 1970 estimates, GATT (1972)

Table 4. Import tariffs on food and manufactures, Western and Central European countries, 1913, 1927, 1931 and 1950 (percent)

	Food				Manufactures	
	1913	**1927**	**1931**	**1950**	**1927**	**1931**
Austria	29	17	60	36	21	28
Belgium	26	12	24	7	12	13
Bulgaria	25	79	133		75	90
Czechoslovakia	29	36	84		36	37
Denmark				1		
Finland	49	58	102		18	23
France	29	19	53	27	26	29
Germany	22	27	83	27	19	18
Greece				45		
Hungary	29	32	60		32	43
Italy	22	25	66	22	28	42
Norway				8		
Poland	67	72	110		56	52
Portugal				42		
Romania	35	46	88		49	55
Spain	42	45	81		63	76
Sweden	24	22	39	5	21	24
Switzerland	15	22	42		18	22
United Kingdom				9		
Yugoslavia	32	44	75		28	33
Unweighted average of above	**32**	**37**	**65**	**21**	**33**	**39**
United States					26	35[a]
Australia					33	63

[a] 1932

Source: Liepmann (1938), plus Woytinsky and Woytinsky (1955, page 285) for 1950 food, Irwin (2010, Table A1) for the United States and Lloyd (2008, Table 5) for Australia.

Table 5. Import tariffs on manufactures, major developing countries, 1870 to 1938 (import duties as a percent of total imports)

	1870-99	**1900-13**	**1913-38**	*Weight, based on GDP in 1900*
Asia				
China	3	3	11	*41.1*
India	3	5	17	*32.1*
Indonesia	5	5	10	*6.0*
Mynmar	4	11	23	*1.5*
Philippines	10	21	8	*0.9*
Sri Lanka	6	7	13	*0.9*
Thailand	4	7	15	*1.1*
Average, Asia[a]	***4***	***5***	***13***	***83.6***
Latin America				
Argentina	26	23	18	*2.5*
Brazil	35	40	23	*2.3*
Chile	19	18	22	*1.1*
Colombia	34	47	29	*0.8*
Cuba	23	26	26	*0.4*
Mexico	17	22	21	*3.5*
Peru	32	23	16	*0.6*
Uruguay	30	33	20	*0.4*
Average, LA[a]	***25***	***28***	***21***	***11.5***
Egypt	11	14	26	*1.9*
Turkey	7	10	31	*2.8*
Average, all 17[a]	***7***	***8***	***15***	***100***

[a] Averages are weighted by this chapter' author, using 1900 GDP as weights (see final column), from Maddison (2008). This set of countries accounts for 76 percent of all of today's developing country GDP in 1900, which in turn is 35 percent of global GDP o 1900.

Source: Clemens and Williamson (2010, Table 8).

Table 6. Nominal rates of assistance to agricultural and nonagricultural tradables, by region, 1955 to 2004 (percent)

	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Developing countries[a]										
NRA agriculture	na	-24	-27	-32	-26	-21	-16	-4	4	7
- exportables	na	-47	-45	-45	-44	-41	-36	-19	-6	-3
- import-competing	na	13	14	8	13	17	38	23	22	23
NRA non-agric. tradables	na	58	60	46	37	35	27	17	10	6
European transition econs.										
NRA agriculture	na	na	na	na	na	na	na	10	18	16
- exportables	na	na	na	na	na	na	na	-3	-1	-1
- import-competing	na	na	na	na	na	na	na	33	35	36
NRA non-agric. tradables	na	na	na	na	na	na	na	10	6	5
High-income countries										
NRA agriculture	23	31	37	27	35	43	56	48	37	34
- exportables	4	7	14	10	11	12	22	16	8	7
- import-competing	31	46	50	37	47	58	71	62	54	51
NRA non-agric. tradables	7.5	8.5	7.7	5.4	3.6	3.4	3.2	2.5	1.7	1.3
World[a]										
NRA agriculture	na	6	8	1	3	6	19	20	18	19
- exportables	na	-23	-20	-23	-25	-24	-17	-7	-1	0
- import-competing	na	35	37	27	34	38	57	43	38	36
NRA non-agric. tradables	na	19	21	16	14	10	10	8	6	4

[a] Estimates for China pre-1981 and India pre-1965 are based on the assumption that the agricultural NRAs in those years were the same as the average NRA estimates for those countries for 1981-84 and 1965-69, respectively, and that the 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.

Source: Author's derivation, using data in Anderson and Valenzuela (2008), based on a sample of more than 40 developing countries and more than a dozen of Europe's transition economies in addition to all OECD member countries.

Table 7. Assumed NRAs and their estimated welfare cost to developing and high-income countries,[a] 1900 to 2050

a) NRAs (percent)

	1900	1925	1931	1937	1962	1982	2004	2050 Low	2050 High
Developing countries									
NRA agriculture	-15	-15	5	-14	-24	-21	9	6	19
- exportables	-20	-20	0	-20	-47	-41	0	0	0
- import-competing	5	5	20	10	13	17	22	16	46
NRA non-agric. tradables	10	15	30	30	58	35	8	4	8
High-income countries[b]									
NRA agriculture	10	10	30	30	31	43	16	9	15
- exportables	0	0	0	0	7	12	7	0	5
- import-competing	15	15	50	45	46	58	22	14	22
NRA non-agric. tradables	30	23	37	21	11	3	1	1	1

b) Lower-bound estimates of welfare cost (percent of GDP), extrapolated from simplest global economy-wide model for 2004

	1900	1925	1931	1937	1962	1982	2004	2050 Low	2050 High
Developing countries	0.8	0.9	2.8	1.7	2.2	1.9	0.9	0.8	1.8
High-income countries[b]	1.1	1.0	2.7	1.9	1.4	1.2	0.5	0.1	0.5
World	**1.0**	**1.0**	**2.7**	**1.8**	**1.6**	**1.4**	**0.6**	**0.5**	**1.2**

c) Amended estimates of welfare cost (percent of GDP), after adjusting for some elements[c] missing from the simplest global economy-wide modeling

	1900	1925	1931	1937	1962	1982	2004	2050 Low	2050 High
Developing countries	3.1	3.4	10.7	6.5	9.2	8.6	4.3	3.8	8.6
High-income countries[b]	4.2	3.8	10.3	7.3	5.9	5.4	2.4	0.5	2.4
World	**3.8**	**3.8**	**10.3**	**6.9**	**6.7**	**6.3**	**2.9**	**2.4**	**5.7**

[a] The weights used to obtain regional and global averages for 1900 to 1937 are as follows: exportables are four-fifths of agriculture in developing countries and one-third in high-income countries; and developing countries are one-quarter of both global agriculture and global non-agricultural tradables. The NRAs for 1962 and 1982 are the averages for the 5-year periods 1960-64 and 1980-84, respectively. The 'Low' and 'High' in the final two columns refer to whether it is assumed that price distortions from trade barriers fall or rise between 2004 and 2050, as shown in the final two columns of part (a) above.

[b] High-income countries include Eastern Europe and the former Soviet Union (whose NRAs are assumed to equal the averages for high-income countries).

[c] Based on guesstimates of the impact of missing elements discussed in the text, from which on the cost of trade barriers are made so as to be able to multiply the estimates in part (b) to obtain those in part (c) above (which do not include any adjustment for the growth dividend expected to result from openness).

Source: Author's compilation from Tables 2 and 3 and from global Linkage model results and as described in text.