NON-TARIFF BARRIERS IN RICH ECONOMIES: QUANTIFYING THEM, IDENTIFYING THEM, AND ASSESSING THEIR IMPACTS

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International trade negotiations have significantly reduced tariffs in rich economies, increasing the relative importance of non-tariff barriers (NTBs). Since reducing them often requires deeper integration, the resulting negotiations have been more fractious and difficult than earlier efforts. The Uruguay Round took almost eight years, by far the longest round on record. The Doha Round was launched only after much work following a failed attempt at Seattle two years earlier, and the talks recently collapsed again. Given these considerations, we need to weigh the benefits of reducing NTBs. If these benefits are small, then perhaps the time has come to place a lower priority on achieving deeper economic integration. On the other hand, if the barriers remain substantial, it could be worthwhile to invest considerable political capital in their elimination.

This paper presents a new method for estimating tariff equivalents of NTBs for final goods in OECD economies. The analysis exploits detailed, comprehensive, and careful price comparisons. Since this method does not identify policies, we strive to supplement the numbers by presenting preliminary information on possible sources of the barriers. We then use an applied general equilibrium model to provide a broad-brushed assessment of the impact of these NTBs. The results imply that NTBs greatly restrict trade in OECD economies and that removing them would bring large gains to them and to developing economies. Thus, this research implies that continued efforts to negotiate the reduction of NTBs will indeed exceed the costs.

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1 INTRODUCTION

International trade negotiations have significantly reduced tariffs in rich economies, greatly increasing the relative importance of non-tariff barriers (NTBs). This has presented two challenges for trade analysts and negotiators alike. First, since NTBs are harder to measure than tariffs, we have become less sure about how much protection remains in rich economies. Second, since NTBs lack tariffs' transparency and are often embedded within complex domestic regulatory regimes, reducing NTBs generally requires more work than reducing tariffs does.

This extra work stems not just from more difficult and technical subject matter but also from more intense political opposition to deeper integration. The Uruguay Round took almost eight years, by far the longest round on record, because the agenda included trade in services, government procurement, customs procedures, standards, certification procedures, intellectual property, and binding dispute settlement. The Doha Round, which also includes a heavy dose of NTB discussions, was launched only after a failed attempt at Seattle two years earlier and has recently suffered a collapse in the talks.

Despite this opposition, the desire for more integration still drives policy. Nations continue to negotiate regional agreements, many covering behind-the-border measures. The European Union (EU) has moved furthest in eliminating national borders. Many in Europe, though, still believe that further deepening is required, and efforts to promote European integration continue.[1] The other major economies are

[1] See for example "European single market has boosted wealth but more powers needed" *Financial Times* January 5th, 2003, page 4.

also pursuing integration. The United States has moved beyond preferential trade agreements (PTAs) with Canada (CUSFTA) and Mexico (NAFTA) towards deeper ties with other nations in the Western Hemisphere and beyond. In late 2002, the US concluded new PTAs with Chile and Singapore and announced its intention to negotiate several more. Japan, too, continues to implement measures to increase its international integration, through domestic deregulation and free trade agreements.

Given strong support for, and opposition to, reducing NTBs, we need to weigh the benefits of doing so. If they are small, then perhaps the time has come to place a lower priority on achieving deeper economic integration. On the other hand, if the barriers remain substantial, it could be worthwhile to invest considerable political capital in their elimination.

Assessing whether negotiating reducing NTBs is worthwhile involves two tasks: 1) Reliably measuring the height of NTBs, and 2) Using an economic model to infer the potential economic gains from their removal. Accordingly, we first present a new method for estimating tariff equivalents of NTBs for final goods in OECD economies. The analysis exploits detailed, comprehensive, and careful price comparisons. We also present some preliminary information on the policies behind the estimates. Then, we use an applied general equilibrium (AGE) model to provide a broad-brushed assessment of the impact of these NTBs.[2] The results imply that NTBs greatly restrict trade in OECD economies and that removing them would bring large gains to the world

[2] This analysis gives an overview of the size and shape of the protection forest, without describing individual trees. Assessing the effects of particular policies, however, is important future work since it would probably facilitate the negotiations that this paper implies is worthwhile.

economy, for rich and poor economies alike. Thus, this research implies that continued efforts to negotiate the reduction of NTBs will indeed exceed the costs.

2 MEASURING NTBS

The greatest obstacle to measuring the openness of markets accurately today is the fact that nations can protect their industries in many different ways that are difficult to measure. As trade agreements have caused reductions in tariffs, governments have relied on a variety of less visible but effective means for insulating domestic markets against foreign competition. These hidden barriers include subsidies, biased government procurement, lax antitrust enforcement, health and safety standards and other regulations, burdensome customs procedures, anti-dumping duties, and threats of protection. Even when not created with protectionist intent, these policies can inhibit international arbitrage, protect producers, and shrink the world economy.

2.1 Other Aproaches to Measuring NTBs

In this section, we discuss three prominent approaches to measuring NTBs: 1) Counting NTBs and computing coverage ratios, 2) Inferring protection from trade flows, and 3) Inferring protection from price gaps. We then discuss our method.

2.1.1 Compute NTB "Coverage Ratios"

The United Nations has developed "NTB coverage ratios" by computing what percentage of products within a sector has an NTB. Unfortunately, this measure does not take account of how restrictive each barrier is. One sector may have many products that are subject to minor NTB's. Another sector may have just a few products with very restrictive NTB's. The first sector would have a much higher NTB coverage ratio, while we would expect the second sector to actually have more restrictive trade barriers. Also, the UN's accounting probably does not cover all NTBs. For instance, these coverage ratios do not include inefficient customs procedures, even though they probably significantly restrict a wide variety of imports.

2.1.2 Infer Protection from Trade Flows

This approach seeks to measure the effects of NTBs by estimating their impact on the volume of trade in different industries. Researchers use models to predict trade patterns absent any barriers (on the basis of factors such as country size, distance from other economies, and factor endowments) and then use the gap between actual and predicted trade flows to infer protection. This method has the advantage of being able to capture the aggregate impact of all barriers combined, even ones not considered by NTB list-makers.[3] This approach, however, depends on having a trade model that can accurately account for all determinants of trade, besides barriers, which is an ambitious requirement for any trade model. One wonders how much of the gap between

[3] One popular version of this approach is to use so-called gravity equations. For an excellent review of this methodology, see Frankel 1997.

predicted and actual flows results from barriers and how much results from model misspecification or data mismeasurement or both? The fact that one has to specify demand elasticities in order to convert the quantity shortfalls into tariff-equivalents introduces another source of uncertainty.

2.1.3 Price Gaps

Like the second approach, this method has the virtue of capturing the full impact of all NTBs. It has the additional virtues of not relying on any single model and providing tariff-equivalent measures directly. Although it has pitfalls, we believe that the price gap approach has the most promise for measuring NTBs. With many possible barriers to trade, we believe that one can best account for all of them by using the information that prices concisely convey.

The basic philosophy behind this approach is that barriers to arbitrage across national borders should be considered barriers to trade.[4] If international markets are integrated, sellers cannot raise domestic prices above prices that would attract arbitrage from abroad. One needs to carefully account for unavoidable costs associated with shipping goods between economies. Once one has done this, however, if a price gap exists for equivalent goods in two different economies, then one can conclude that the higher-priced market is protected. Moreover, one can use the price gap as a measure of the extent of protection. Thus, a single number can give the total effect of all trade barriers. These gaps may be caused in part by policies that

[4] This does not depend on individual consumers engaging in arbitrage. Organized and well-informed trading companies and other international wholesalers can easily seize arbitrage opportunities.

are not explicitly designed to impede trade, such as certification requirements that are more restrictive than is needed. No matter what the intent, however, which can be difficult to judge anyway, we presume that policies that segment national markets are trade barriers.[5]

The major problem applying this approach is obtaining appropriate price measures. Such efforts confront three major challenges. The first is comparing prices of equivalent goods. Even if they have the same name, goods may have very different levels of quality. Thus, surveyors need to work hard to ensure comparability. Many researchers have used unit values as price proxies because they are widely available. These can provide reasonable estimates of price gaps at very detailed classification levels (eg, Harmonized System 10-digit), but, at higher levels of aggregation, unit values are notoriously inexact measures of prices because of large quality differences in products.

A second challenge is using producer, rather than consumer, prices. Most price surveys are undertaken with a view to comparing costs to the consumer. In order to accurately gauge protection for producers, though, one should compare producer prices. Data gathered at the retail level include non-traded value added, such as distribution margins and transportation costs. These prices may therefore provide an inaccurate picture of protection since they include elements that cannot be eliminated through arbitrage. The price of a pound of coffee purchased in a supermarket in Tokyo

[5] This notion corresponds to that of Knetter and Goldberg 1996, which argues that "A market is segmented if the location [sic] of the buyers and the sellers influences the terms of the transaction in a substantial way (i.e. by more than the marginal cost of physically moving the good from one location to another)." (pp 3-4.)

may be higher than a pound of the same brand of coffee purchased in New York, either because trade barriers raise the wholesale price of coffee or because the costs of distributing coffee in Tokyo are higher, or both. Since we seek to isolate the role of trade barriers, we need to compare producer, rather than consumer, prices.

A third challenge relates to the comprehensiveness of coverage. Samples of a few products gathered at selective retail outlets may not be representative of the full array of goods sold. In particular, many surveys focus heavily on consumer products sold at supermarkets and generally neglect to include capital and intermediate goods. Also, many international surveys were undertaken to establish differences in the cost of living experienced by business executives and their families. These naturally focus on a set of products that are not representative of all purchases.

2.2 Our Method[6]

Other studies have used price differentials as evidence of protection and to estimate the benefits of integration.[7] In this section, we discuss how we have tried to overcome the challenges mentioned above, in order to produce improved estimates of NTB protection and its effects. We use data in which every effort has been made to ensure comprehensive coverage and comparability. In addition, we have endeavored to compare producer prices by eliminating the effects of distribution margins. We also analyze the data at a fairly disaggregated level, to mitigate weighting problems.

[6] See Bradford and Lawrence 2003 and Bradford 2003 for more discussion of the methodology and data presented in this paper and for welfare analyses of total protection.
[7] See in particular Hufbauer et al 2002.

We start with carefully matched retail prices that the OECD collects on a regular basis in order to calculate purchasing power parity (PPP) estimates. With the cooperation of member governments, OECD researchers regularly sample prices of over 3000 final goods. They make every effort to compare equivalent products across economies. For most manufactured goods, they compare the same make and model, or make comparisons from a list of two or more models when each item on that list is thought to be equivalent. For other manufactured goods and food items, researchers rely on exact descriptions of the items to be priced. When they cannot find appropriate matches based on model or on descriptions, researchers from the economies involved travel abroad to determine which items would be most appropriate matches for the items in their country. This has occurred with grain, some vegetables, tobacco, textiles, footwear, stationary, and small housewares. The researchers also call upon the expertise of buyers for large stores, manufacturers, and trade associations in order to determine matches. On occasion, different goods that were "equivalent in use" have been compared. For instance, 220-volt bulbs in Europe have been matched with 120-volt bulbs in the US.

Prices are collected from many markets and outlets at different times during the year in order to obtain a single annual, national average (World Bank 1993, p10). Also, prices of the average-sized purchase for that country were compared. After collecting the data, apparent mismatches in quality are dealt with either by refining the specifications or discarding the data (OECD 1995, p5). This method does not produce perfect data, but the scale of resources expended on accurate matching indicates that these are excellent measures of price differences for equivalent products.

The researchers aggregate the most detailed price data into categories called "basic headings". These are defined as "groups of similar well-defined commodities for which a sample of products can be selected that are both representative of their type and of the purchases made in participating countries" (OECD 1995, p5). Thus, a basic heading should not be too broad or too narrow. It should not be so broad that very different products are compared; it should not be so narrow that few economies in the sample sell it. For instance, seaweed is too narrow, and food is too broad.

In multilateral comparisons, one usually cannot find products that are representative of the category and typical of what is bought in **every** country, since consumers in different economies buy different mixes of products. Thus, while most items are priced in most or all of the economies, not every product in the sample is priced in each country. To be included in the sample, a product needs to be a "representative product" in at least one country and it must be sold in large enough quantities in at least one other country so as to be price-able. A "representative product" is one that accounts for a large share of that country's expenditure on that basic heading. For instance, cheddar is a representative product for the cheese basic heading in France but not for Italy. Cheddar cheese, however, is price-able in Italy. As long as economies price their own major products and a share of all other products, relative prices for each product and country can be calculated indirectly as well as directly. For details on how the prices are combined into one average price for each country see Eurostat-OECD PPP Programme 1996. There are about 200 basic headings. We obtained unpublished basic heading price data for 1999 and trimmed

the sample to about 112 traded goods. We converted all prices to US dollars using the 1999 exchange rates. (See Table 1 for the list of categories).

We converted the consumer price measures to producer prices using data on margins—wholesale trade, retail trade, transportation, and taxes—which come from national input-output tables.[8] We did so for nine economies: Australia, Belgium, Canada, Germany, Italy, Japan, the Netherlands, the United Kingdom (UK), and the United States (US). Although we wanted to include more economies, such as France, the availability of detailed margins data determined which economies became part of the sample. We matched these margins with the OECD retail price data and derived estimates of producer prices by peeling off the relevant margins. Thus,

$$[1] \qquad p_{ij}^{p} = \frac{p_{ij}^{c}}{1 + m_{ij}},$$

p_{ij}^{p}: the producer price of good i in country j,
p_{ij}^{c}: the consumer price of good i in country j, as taken from the OECD data,
m_{ij}: the margin for good i in country j, as taken from the national IO table.

Unfortunately, margins data only become available with a considerable time lag.[9] The producer price estimates were therefore obtained by assuming that distribution margins were the same percentage of overall value-added as they were in the most recent year for which data were available.

[8] Roningen and Yeats 1976 also use retail prices and adjust for taxes and transport costs, but they do not adjust for wholesale and retail trade margins, which significantly outweigh taxes and transportation.
[9] The margins data come from the following years: Australia, 95; Belgium, 90; Canada, 90; Germany, 93; Italy, 92; Japan, 95; Netherlands, 90; UK, 90; and US, 92.

TABLE 1
Products in the Sample

Ingestible Products

Rice
Flour and other cereals
Bread
Other bakery products
Pasta products
Other cereal products
Fresh, frozen and chilled beef
Fresh, frozen and chilled veal
Fresh, frozen and chilled pork
Fresh, etc. lamb, mutton and goat
Fresh, frozen and chilled poultry
Delicatessen
Other meat preparations, extracts
Other fresh, frozen, chilled meat
Fresh, frozen or deep-frozen fish
Dried, smoked or salted fish
Fresh, frozen, deep-frozen seafood
Preserved or processed fish & seafood
Fresh, pasteurised, sterilised milk
Condensed, powdered milk
Other milk products excluding cheese
Processed and unprocessed cheese
Eggs and egg products
Butter
Margarine
Edible oils
Other animal and vegetable fats
Fresh fruit
Dried fruit and nuts
Frozen and preserved fruit and juices
Fresh vegetables
Dried vegetables
Frozen vegetables
Preserved vegetables, juices, soups
Potatoes and other tuber vegetables
Potato products
Raw and refined sugar
Coffee and instant coffee
Tea and other infusions
Cocoa excluding cocoa preparations
Jams, jellies, honey and syrups
Chocolate and cocoa preparations
Confectionery
Edible ice and ice-cream
Salt, spices, sauces, condiments
Mineral water
Other soft drinks nec
Spirits and liqueurs
Wine (not fortified or sparkling)
Beer
Other wines and alcoholic beverages
Cigarettes
Other tobacco products

Manufactured Household Goods

Men's clothing
Ladies' clothing
Children's clothing
Infant's clothing
Materials, yarns, accessories, etc.
Men's footwear
Ladies' footwear
Children's and infant's footwear
Furniture and fixtures
Carpets and other floor coverings
Household textiles, other furnishings
Refrigerators and freezers
Washing machines, driers, dishwashers
Cookers, hobs and ovens
Heaters and air-conditioners
Vaccuum cleaners, polishers, etc.
Other major household appliances
Glassware and tableware
Cutlery and silverware
Motorless kitchen & domestic utensils
Motorless garden appliances
Electric bulbs, wires, plugs, etc.
Cleaning and maintenance products
Other non-durable household goods
Drugs and medical preparations
Other medical supplies
Spectacle lenses and contact lenses
Orthopaedic and therapeutic appliances
Passenger vehicles
Motorcycles and bicycles
Tyres, tubes, parts, accessories
Motor fuels, oils and greases
Radio sets
Television sets, video recorders, etc.
Record-players, cassette recorders, etc.
Cameras and photographic equipment
Other durable recreational goods
Records, tapes, cassettes, etc.
Sports goods and camping equipment
Games, toys and hobbies
Films and photographic supplies
Flowers, plants and shrubs
Books
Newspapers and other printed matter
Durable toilet articles and repairs
Non-durable toilet articles
Jewellery, watches and their repair
Travel goods and baggage items
Goods for babies, personal accessories
Writing & drawing equipment & supplies

Capital Goods

Structural metal products
Products of boilermaking
Tools and finished metal goods
Agricultural machinery and tractors
Machine tools for metal working
Equipment for mining, metallurgy
Textile machinery
Machinery for food, chemicals, rubber
Machinery for working wood, paper
Other machinery & mechanical equipment
Office and data processing machines
Precision instruments
Optical instruments, photographic equip.
Electrical equipment including lamps
Telecommunication & electrical equip. nec
Electronic equipment, etc.
Motor vehicles and engines
Boats, steamers, tugs, platforms, rigs
Locomotives, vans, wagons
Aircraft and other aeronautical equipment
Other transport equipment

Producer prices allow us to get a sense of which industries in which economies have the lowest prices, but inferring the extent of insulation from foreign competition requires one more step: taking account of transport costs from one nation's market to another. A foreign good must travel from the foreign factory to the foreign border and then to the domestic border in order to compete with a domestic good.[10] Thus, one cannot infer protection simply by comparing producer prices. The domestic producer price must be compared to the import price of the foreign good. We do not, however, have import price data that can be matched with the domestic price data. So, we infer the import price by combining data on export margins, also available from national input-output tables, with international transport costs.[11]

We could only get detailed data on international transport costs for Australia and the US. Each of these economies reports import values for detailed commodities on both a basis that includes insurance and freight (cif) and one that does not—so-called free on board (fob). The cif/fob ratio is a good measure of all the costs of shipping goods from abroad to these economies. For costs between other economies we simply average the costs of the US with those of Australia. The ratios for both economies, however, are small, so that the gap between the two is also small. The average for all products for the US is 1.05, while the overall average for Australia it is 1.09. Thus, for each detailed sector, we take the average of the two cif/fob ratios and

[10] For a discussion of the importance of export margins, see Rousslang and To 1993.
[11] We have export margins for all countries except the UK, for which we used the Netherlands export margins. Export margins tend not to vary much by country, so we feel confident that using the Netherlands margins does not compromise our results.

use this as an estimate for the international transport cost for that product for all the economies.

We use this data on export margins and international transport costs to compute import prices for each product and country, as follows. By adding the export margins to the producer prices, we calculated the export price for each product in each country. The lowest export price plus the common international transport cost is the import price. Thus, the export price is given by:

[2] $p_{ij}^{e} = p_{ij}^{p}(1+em_{ij})$,

p_{ij}^{e}: the export price of good i for country j,
em_{ij}: the export margin of good i for country j.

The import price is then given by:

[3] $p_{i}^{I} = p_{iM}(1+tr_{i})$,

p_{i}^{I} : the import price of good *i* (the same for each economy),
tr_{i}: the international transport margin for good *i*,
$p_{iM} = min(p_{i1}^{e}, p_{i2}^{e}, ..., p_{i9}^{e})$, the minimum of the 9 export prices.

The ratio of each country's producer price to the import price gives us an initial measure of protection, pr_{ij}^{IN} :

[4] $pr_{ij}^{IN} = \frac{p_{ij}^{p}}{p_{i}^{I}}$.

For a given good, these measures will differ from true protection if all of the economies in the sample have barriers to imports for that good. For such goods, the calculated import price will exceed the true import price to the extent that the low cost producer has barriers against imports. This will bias the protection estimates downward. By the same token, if just one of the nine has no barriers to imports in that good, then pr_{ij}^{IN} will approximate true protection, because, in this case, the price in the free trading country will approximate the import price. Since the sample includes Australia, Canada, and the US, which are fairly free traders, the low price in the sample will approximate the import price the great majority of the time.

Nevertheless, we use data on trade taxes to correct, at least partially, for the possible downward bias. These tariff data come from the OECD tariff database. The final measure of total protection, pr_{ij}^{TOT}, is given by:

[5] $$pr_{ij}^{TOT} = max(pr_{ij}^{IN}, 1 + tar_{ij}),$$

tar_{ij}: the tariff rate for good *i* in country *j*.

We simply use the fact that tariffs provide a lower bound on protection. If our initial measures do not exceed the overall tariff rate, then that tariff rate is used as the measure of protection. This happened about one-third of the time. After this correction, the only time that these protection measures will be biased downward is when all economies in the sample have NTBs against the rest of the world.

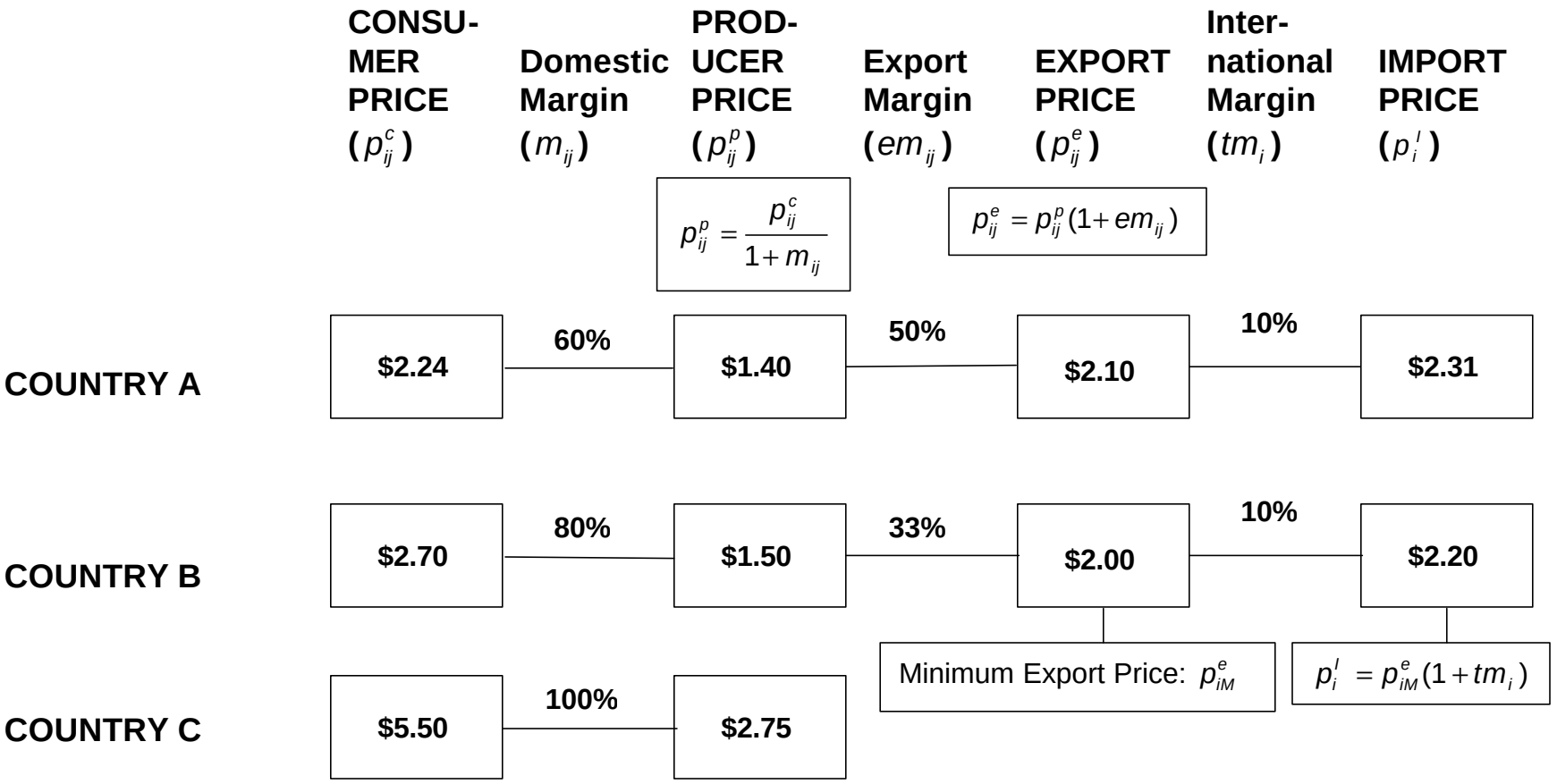
These measures provide estimates of the protective effect of all kinds of barriers—tariffs and NTBs alike. For our purposes, we want to focus on the impact of NTBs alone, so we perform one final, simple modification. We subtract out tariffs from these total protection numbers. Mathematically, NTB protection is given by

[6] $$pr_{ij}^{NTB} = pr_{ij}^{TOT} - tar_{ij} = max(pr_{ij}^{IN} - tar_{ij}, 1).$$

Note that, since we measure protection as a ratio of the world price, a value of 1 indicates no protection. Thus, we conclude that there is no **NTB** protection whenever $pr_{ij}^{IN} - tar_{ij} < 1 \Rightarrow pr_{ij}^{IN} < 1 + tar_{ij}$, that is whenever the percentage by which the producer price exceeds the import price does not exceed the tariff rate.

Figure 1 shows a schematic example that illustrates this methodology. Suppose that there are three economies, with consumer prices as shown: Country A with the lowest and Country C with the highest. C's consumer price is nearly 2.5 times that of A, but such a facile comparison can mislead. After peeling off domestic distribution costs for this good, the ratio of C's producer price to A's is lower, though still large. As is often the case in reality, in this example, the country with the high consumer price also has the highest percentage domestic distribution margin. Converting to producer prices gets us closer to our goal, since these provide a clearer indication of how efficient producers in different economies are. Still, as discussed above, a straight comparison of producer prices would overstate protection, since doing so would not take account of the costs required to sell in foreign markets. So, to each of the

FIGURE 1
NTB PROTECTION CALCULATION: SCHEMATIC EXAMPLE



➔ NTB Protection in C = $\frac{p_{iC}^p}{p_i^I} - tar_{ij} = \frac{2.75}{2.20} - tar_{ij} = 1.25 - tar_{ij}$, ie, (25% - tariff rate), if the tariff rate is 25% or less. Otherwise, NTB protection is inferred to be zero.

Note: *i* indexes products, and *j* indexes countries.

producer prices, we add the unavoidable export margins and the international transport costs. Note that, because of its relatively small export margin, Country B ends up with the lower border price, even though its consumer and producer prices were higher than A's. In the end, the NTB protection level for C that we calculate is (25% - the tariff rate) (if the tariff rate is lower than that), a much smaller gap than that between the underlying consumer and producer prices.

3 SUMMARY AND ASSESSMENT

3.1 Four Key Characteristics

We believe that these measures, while not perfect, shed useful new light on NTB protection because they possess, to a large degree, four key characteristics: completeness, comprehensiveness, accuracy, and internationally comparability.

3.1.1 Completeness

Using price gaps enables one, in principle, to capture the combined effects of **all** NTBs, which can include any number of regulations and bureaucratic procedures. For example, a UN study analyzed how excess paperwork and cumbersome customs procedures impede the international flow of goods. The study points out that, in addition to direct costs, these regulations impose indirect costs, such as losses due to "deterioration or pilferage" while cargo is waiting to be cleared, or the "strong disincentive for potential exporters" imposed by complicated procedures. (See United Nations Conference on Trade and Development (1992).) The study estimated that

these barriers imposed costs that averaged 10 to 15%, on top of any other trade barriers. Protection measures that rely on lists of individual barriers, such as the UN's own NTB measures, will tend to overlook subtle but real barriers such as these. Our method, however, will completely capture the protective impact of these barriers if one of the economies in our sample is free from them and, if this is not so, will partially capture such barriers (unless their price impact is exactly the same in each country).

3.1.2 Comprehensiveness

These measures cover all traded final goods, instead of a small subset thereof. Some other studies (such as Hufbauer and Elliott 1994) have limited their coverage to sectors in which protection had been previously thought to exist, without testing whether other sectors might enjoy well-disguised insulation from foreign competition. The approach in this paper does not allow preconceptions to limit the analysis. We thus have been able to construct a more comprehensive picture of final goods NTB protection in these economies. By the same token, this method does exclude non-final goods, which account for most output and trade. Nevertheless, final goods receive significantly more protection than do intermediate and primary products, so that this data probably covers most of the NTB protection that is out there.

3.1.3 Accuracy

Accuracy stems from comparing actual prices of identical or equivalent goods. Differences in quality have bedeviled attempts to use prices, except for certain

homogeneous goods. The data here, on the other hand, have resulted from intensive multilateral efforts to correct for quality differences.

3.1.4 International Comparability

Many other estimates have only been derived for a single country at a time, making it difficult to rank economies in terms of openness. Our measures use the same data and apply the same method to each country in the sample, thus allowing us to make such rankings, for individual products, for aggregated categories, and for each country as a whole.

3.2 Possible Concerns

3.2.1 Imperfect Competition

Is it possible that market power could lead to estimates that do not really reflect NTBs? We argue that this is not so. If the domestic producer price exceeds the prevailing import price by more than the tariff rate, an NTB must support that gap, no matter how those prices came to be. Market power does not change this fact. With market power, a trade barrier may endogenously change prices, but the fact remains: an un-arbitraged gap between the domestic price and the tariff-inclusive import price cannot persist without NTBs that segment the domestic and world markets, and the gap measures the amount of NTB protection.

3.2.2 Terms of Trade Effects

A related concern is the impact of terms of trade effects, for which our method makes no adjustment. If an NTB drives down the import price, should we measure NTB protection with respect to the NTB-ridden import price or the free trade import price? For instance, suppose that the latter is 1.00 and that a country imposes an NTB of 0.2 that drives the domestic price to 1.10 and the import price to 0.90. Is the amount of NTB protection 22% ($\frac{1.1}{0.9}-1$) or 10% ($\frac{1.1}{1}-1$)? While the barrier only raises domestic prices by 10%, we believe that the amount of NTB protection is 22%. We hold to the view that the amount of the barrier is the gap (or ratio) between the domestic and import price. With the barrier in place, domestic consumers have to pay 22% more than people who can buy the good at world prices. Consider a more extreme case. Suppose in the above example that the domestic price remains at 1.00, while the import price gets driven to 0.80. One cannot reasonably conclude that NTB protection is zero simply because the domestic price did not move. In practice, the terms of trade rarely, if ever, move as much as in the above examples and will usually not matter. Even if one does want to correct for terms of trade effects, one does not observe the free trade import price, so speculation would drive the correction, and it would introduce a fair amount of uncertainty into the measures. Thus, for theoretical and practical reasons, we do not correct for terms of trade effects.

3.2.3 Dumping

Dumping can possibly bias our inferred import price downward, which would bias our protection measures upward. While protectionists make much of dumping, true cases of dumping in which firms sell goods overseas below cost are rare to non-existent. Most economists would agree that, the vast majority of the time, policymakers use anti-dumping duties as alternative ways to protect inefficient industries, not as justified defenses against a predatory threat. Even if such dumping occurs, and the resulting import price is lower than otherwise, that does not invalidate it as a proper benchmark. Again, barriers need to support gaps between domestic and import prices, even if the latter are artificially low.

3.2.4 Demand Differences

One may wonder whether these measures are valid if consumers in different economies have different demands. The question arises: If Country A's citizens have a higher demand for good *X* than do Country B's citizens, won't that drive up the price of good *X* in Country A in the absence of trade barriers? Answer: Only if there is a barrier in Country A that allows such a gap to emerge. If Country A and Country B are truly integrated, then good *X* will have one single demand curve, and the price will be the same everywhere. Demand differences without barriers cannot sustain price gaps.

3.2.5 Price vs. Quantity Effects

Finally, in deriving these estimates, we realize that there is no clear connection between tariff equivalents and the amount by which imports are reduced. Quantity

changes depend on market structure and such key parameters as the elasticities of supply and of demand. Thus, a high NTB on a good with a low elasticity of demand may reduce imports by less than a small NTB on a good with a high elasticity of demand. We do not purport, however, to analyze prices and quantities at the same time. In order to assess the impact of the barriers on quantities, and thus on welfare, one would need a model of the particular sector in question. We claim that the cleanest, most effective way to measure NTB protection is to derive tariff equivalents and leave quantity and welfare analysis for the next step.

4 THE EXTENT OF NTB PROTECTION

Table 2 presents the NTB data for the nine economies. Again, we report these as the ratio of the domestic producer price to the world price. Thus, a reading of 2.00 would be a protection rate of 100%. As mentioned above, the measures were constructed using 112 categories, but, to facilitate the presentation, we have aggregated up to 26 sectors, which correspond to the GTAP sectors that we will use in our AGE analysis below. We also report weighted geometric means for each country. We used the value of consumption as weights in constructing these means. Two factors motivated this choice: 1) Protection skews the value of consumption less than protection skews the value of production or of imports, and 2) The OECD reports the value of consumption along with its price data, so we had consumption data that exactly matches the protection aggregation.

TABLE 2
NTB Estimates

	AUS	BEL	CAN	GER	ITA	JAP	NET	UK	US
Vegetables, fruit, nuts	1.055	1.031	1.046	1.257	1.036	2.048	1.000	1.317	1.203
Crops n.e.c.: Garden Products	1.000	2.231	3.227	1.956	1.326	2.478	1.197	2.529	1.524
Live Animals: Pets	1.000	1.081	1.000	1.321	1.113	2.305	1.000	1.473	1.000
Other Ag Products: Eggs	1.429	1.098	1.000	1.020	1.000	1.000	1.072	1.657	1.000
Fishing	1.137	1.181	1.114	1.206	1.000	1.398	1.000	1.056	1.301
Bovine cattle, sheep and goat, horse meat products	1.000	1.563	1.021	2.140	1.259	5.332	1.773	2.026	1.001
Meat products n.e.c.: Poultry, Pork	1.010	1.165	1.003	1.346	1.085	2.600	1.157	1.256	1.004
Vegetable oils and fats	1.313	1.472	1.204	1.249	1.087	2.348	1.000	1.000	1.447
Dairy products	1.274	1.164	1.237	1.022	1.065	1.759	1.056	1.081	1.145
Processed rice	1.000	1.067	1.000	1.028	1.023	2.773	1.000	1.000	1.119
Sugar	1.000	1.157	1.052	1.000	1.000	1.216	1.199	1.000	1.000
Food products n.e.c.	1.083	1.194	1.042	1.053	1.044	2.048	1.013	1.117	1.071
Beverages and tobacco products	1.488	1.012	1.166	1.004	1.009	1.519	1.047	1.234	1.063
Textiles	1.304	1.000	1.459	1.447	1.030	1.367	1.984	1.663	1.271
Wearing apparel	1.002	1.417	1.009	1.111	1.421	1.281	1.327	1.149	1.000
Leather products: Footwear	1.000	1.594	1.029	1.204	1.045	1.298	1.957	1.191	1.000
Wood products	1.000	1.096	1.000	1.000	1.000	2.103	1.119	1.396	1.000
Paper products, publishing	1.027	1.401	1.186	1.059	1.107	1.419	1.561	1.181	1.066
Petroleum, coal products	2.170	3.011	1.002	2.689	4.579	4.042	3.686	4.515	1.000
Chemical, rubber, plastic products	1.016	1.103	1.000	1.204	1.008	1.406	1.066	1.153	1.287
Mineral products n.e.c.: Glassware and Tableware	1.309	1.292	1.717	1.288	1.000	2.770	1.517	1.602	1.096
Metal products	1.000	1.487	1.000	1.253	1.042	1.581	1.503	1.291	1.192
Motor vehicles and parts	1.000	1.113	1.000	1.014	1.016	1.002	1.394	1.403	1.157
Electronic equipment	1.064	1.162	1.212	1.066	1.024	1.332	1.073	1.299	1.061
Machinery and equipment n.e.c.	1.159	1.433	1.051	1.239	1.100	1.447	1.313	1.613	1.085
Manufactures n.e.c.	1.052	1.369	1.045	1.206	1.000	1.473	1.376	1.095	1.016
WEIGHTED GEOMETRIC MEANS	**1.147**	**1.315**	**1.078**	**1.184**	**1.116**	**1.581**	**1.312**	**1.377**	**1.087**
WEIGHTED MEANS W/O PETROLEUM, COAL PRODUCTS	**1.102**	**1.224**	**1.078**	**1.131**	**1.083**	**1.528**	**1.222**	**1.284**	**1.087**

These results imply that Canada and the US and have the lowest NTB barriers, averaging less than 10%. Australia, Germany, and Italy rank in the middle, ranging from 12% to 18%. Belgium, the Netherlands, and the UK have average NTB protection in the 30s. Japan's NTBs restrict trade the most, with an average protective impact of 58%. Overall, this analysis suggests that there is considerable NTB protection among industrial economies. Also, NTB protection varies fairly widely across rich economies.

Looking at individual sectors, for each country we find evidence of NTB protection in textiles or apparel or both, presumably reflecting the impact of the Agreement on Textiles and Clothing. In food and agriculture, these data show that Japan has huge NTBs. Our results imply that efforts to reduce NTBs should include a focus on Japan's agriculture and food. We find evidence of substantial NTBs for meat in Europe, whose governments have taken actions to restrict imports of meat that most North Americans consider safe.

Interestingly, Japan shows no evidence of protection in automobiles. These numbers appear to support the claim that auto imports into Japan are low because they produce superior cars, not because of hidden barriers. Belgium, the Netherlands, the UK, and the US, on the other hand, appear to have regulations that restrict auto imports. Pharmaceuticals are a prominent part of the chemicals, rubber, and plastics industry, and here, Japan, the US, and, to a lesser extent, Germany and the UK have non-trivial NTBs. This result for the US probably reflects, at least in part, the regulatory power of the US Food and Drug Administration. The Europeans have long

complained that the FDA approval process creates longer delays for foreign-produced medicines than for US medicines.[12]

Finally, note the very large numbers for petroleum and coal products for all economies except Canada and the US. Large taxes on gasoline in these economies complicate these estimates. Canada and the US have significant but much lower gas taxes. Furthermore, these two economies collect most gasoline taxes from retailers, while the other seven economies collect from producers, before the gas enters the distribution system. Thus, for Canada and the US, gas taxes get peeled off with the margins, while they do not for the other economies. This means that the inferred producer prices are much higher for these seven: their producer prices include their very high gas taxes, while Canadian and American producer prices do not. The philosophy of our method is that, if producer prices are high for a country, no matter the reason, there must be barriers to trade. And in fact, all of these economies do greatly tax foreign gasoline as part of their high gas tax regime. One can conclude from this that such restrictions constitute NTBs. On the other hand, one may be reluctant to include these taxes with NTBs since the taxes hurt domestic and foreign producers alike and thus do not provide protection per se to domestic producers. We suspect that foreign producers would adapt the former interpretation, while domestic governments and producers would adapt the latter. Given the uncertainty created by the high taxes in this sector, we have reported the weighted averages without petroleum and coal products. Of course, the inferred average NTB protection for the

[12] See the EU's Market Access Sectoral and Trade Barriers Database at http://mkaccdb.eu.int/mkdb/mkdb.pl?METHOD=SECTOR.

seven economies declines. Italy's inferred NTB average drops below the US's. Otherwise, the ranking across economies remains the same.

For comparison purposes, we provide tariff data in Table 3. Not surprisingly, tariffs are generally lower and more tightly distributed. Canada, however, actually has a higher average tariff rate than NTB rate. One can use the tariff and NTB numbers to calculate a measure of "protection transparency", which we define as the ratio of NTB protection to total protection (which is simply the sum of NTB and tariff protection). We report transparency measures both with and without our inferred measures for petroleum and coal products. When we include the petroleum data, we see that these data imply that Japan has the most opaque protection regime, while Canada has the most transparent. When we exclude gasoline, Italy's transparency is on par with Canada's. In either case, Australia, Canada, Germany, Italy, and the US have more transparent protection, while Belgium, Japan, the Netherlands, and the UK have more opaque regimes.

5 OTHER EVIDENCE ON NTBS

Our conclusion that substantial NTBs restrict trade fits with a variety of other evidence. A large number of studies, using a variety of methodologies and asking somewhat different questions, find that international market segmentation is significant. One line of inquiry uses the gravity model that controls for the impact of income and distance in explaining trade volumes. McCallum 1995 found, for example, that, controlling for distance and size, trade between two Canadian provinces was

TABLE 3
Tariffs

	AUS	BEL	CAN	GER	ITA	JAP	NET	UK	US
Vegetables, fruit, nuts	1.009	1.119	1.053	1.119	1.119	1.098	1.119	1.119	1.064
Crops n.e.c.	1.000	1.092	1.054	1.092	1.092	1.003	1.092	1.092	1.020
Live Animals	1.106	1.058	1.097	1.058	1.058	1.074	1.058	1.058	1.043
Other Ag Products	1.000	1.060	1.044	1.060	1.060	1.220	1.060	1.060	1.092
Fishing	1.000	1.122	1.003	1.122	1.122	1.055	1.122	1.122	1.005
Bovine cattle, sheep and goat, horse meat products	1.000	1.000	1.192	1.000	1.000	1.497	1.000	1.000	1.108
Meat products n.e.c.	1.015	1.158	1.079	1.136	1.125	1.128	1.122	1.139	1.060
Vegetable oils and fats	1.052	1.136	1.105	1.127	1.091	1.100	1.174	1.146	1.065
Dairy products	1.006	1.086	1.099	1.088	1.110	1.250	1.086	1.083	1.082
Processed rice	1.000	1.120	1.006	1.120	1.120	1.000	1.120	1.120	1.054
Sugar	1.048	1.150	1.095	1.150	1.150	1.553	1.150	1.150	1.278
Food products n.e.c.	1.038	1.145	1.059	1.132	1.142	1.167	1.136	1.137	1.040
Beverages and tobacco products	1.070	1.384	1.141	1.403	1.507	1.163	1.430	1.317	1.126
Textiles	1.152	1.091	1.151	1.093	1.090	1.050	1.094	1.093	1.072
Wearing apparel	1.107	1.134	1.236	1.134	1.134	1.134	1.134	1.134	1.142
Leather products	1.337	1.116	1.221	1.116	1.116	1.509	1.116	1.116	1.143
Wood products	1.098	1.059	1.139	1.059	1.059	1.005	1.059	1.059	1.045
Paper products, publishing	1.051	1.022	1.034	1.017	1.018	1.003	1.027	1.028	1.008
Petroleum, coal products	1.000	1.045	1.079	1.045	1.045	1.023	1.045	1.045	1.008
Chemical, rubber, plastic products	1.046	1.067	1.085	1.069	1.066	1.028	1.069	1.068	1.049
Mineral products n.e.c.	1.079	1.084	1.092	1.084	1.084	1.027	1.084	1.084	1.087
Metal products	1.100	1.062	1.102	1.062	1.060	1.033	1.060	1.057	1.047
Motor vehicles and parts	1.138	1.099	1.081	1.099	1.100	1.000	1.098	1.099	1.034
Electronic equipment	1.050	1.063	1.045	1.071	1.071	1.001	1.064	1.067	1.042
Machinery and equipment n.e.c.	1.079	1.055	1.061	1.051	1.050	1.004	1.049	1.048	1.040
Manufactures n.e.c.	1.085	1.066	1.088	1.067	1.067	1.061	1.065	1.064	1.065
WEIGHTED GEOMETRIC MEANS	**1.073**	**1.104**	**1.092**	**1.105**	**1.101**	**1.068**	**1.095**	**1.112**	**1.058**
TRANSPARENCY WITH PETROLEUM PRODUCTS	**0.333**	**0.249**	**0.540**	**0.363**	**0.467**	**0.105**	**0.233**	**0.229**	**0.398**
TRANSPARENCY WITHOUT PETROLEUM PRODUCTS	**0.417**	**0.318**	**0.540**	**0.445**	**0.551**	**0.114**	**0.300**	**0.283**	**0.398**

more than 20 times larger than trade between Canadian provinces and US states in 1988-90. Others have replicated these findings qualitatively, although the size of the effect is sensitive to the period used and the precise specification.[13]

A variety of other studies have generally found large and persistent deviations from the law of one price (LOOP). Isard 1977, the classic study of this question, speculated that nominal exchange rate changes were an important reason for these deviations. Since then his results have been replicated many times. Froot et al. 1995 obtained data on eight commodities in England and Holland over a 700 year period and finds that the substantial deviations from the LOOP are no smaller or less persistent than they were in the past

A related phenomenon is that firms engage in international price discrimination, charging different prices in different markets for the same product. Knetter 1989 looks at 7-digit export unit values from a single source to different destinations and finds large and volatile differentials when similar goods are shipped to different destinations. Haskal and Wolf 2001 explores pricing within a single multinational furniture retailer and find typical deviations across branches in different economies for the same product of between 20 to 50%. This study also finds that differences in local costs (such as distribution and taxes) do not account for these deviations.

Overall, the literature based on price data supports the idea that border barriers are significant. Obstfeld and Rogoff 2000 concludes that "a recurring theme here is that the markets for most 'traded' goods are not fully integrated, and segmentation

[13] See, for example, Wei 1996, Helliwell 1998, and Anderson and Van Win Coop 2001.

due to various trade costs can be quite pervasive. In fact, the spectrum of goods subject to low trade costs may be very narrow."

6 POLICIES BEHIND THE PRICE GAPS

These NTB estimates may help policy makers in one of two ways. First, for known NTBs, these measures provide estimates of the extent to which those NTBs actually restrict trade. Thus, our results may provide useful information to trade negotiators as they decide how to efficiently focus their efforts on freeing up trade. Second, some sectors that have not reached the trade negotiation agenda may, in fact, enjoy significant disguised NTB protection that is worth negotiating down. This research can help to flag such sectors.

To illustrate how our results can help in the first way mentioned, we have compiled possible barriers for some of the NTB gaps, though much more work along these lines needs to be done. We have drawn on the *EU Market Access Database*, the USTR's 2000 *Report on Foreign Trade Barriers*, and 2000 WTO *Trade Policy Review* for the European Union, the US, and Japan. Table 4 shows the results of an initial survey of these sources. We are sure that a more detailed analysis would reveal more policies behind the NTBs. Also, for any given price gap, the policies we have listed may not be major causes, but they are initial candidates.

Looking back at Table 2, there are a number of NTBs for which we have not listed possible policies. In these cases, more detailed research may reveal particular sources of the gaps, which might then become subject to negotiation. Also, any of

TABLE 4
Potential NTB Policies

PANEL A

EU		SOURCE
Vegetables, fruit, nuts	Restrictive banana trade regime	USTR
	Tariff quotas on sweet potatoes and mushrooms	WTO
Crops n.e.c.: Garden Products	Unreasonable water solubility standards for fertilizers	USTR
Live Animals: Pets	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
Other Ag Products: Eggs	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
Fishing	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
	Italy has overly strict interpretation of sanitary requirements	USTR
Bovine cattle, sheep and goat, horse	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
	Ban on hormone beef	USTR
	Italy has overly strict interpretation of sanitary requirements	USTR
	Beef labeling requirementsw	WTO
Meat products n.e.c.: Poultry, Pork	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
	Ban on anti-microbial treatments for poultry	USTR
	Tariff quotas	WTO
Dairy products	Animal products have to be sourced from EU-approved 3rd country establishments	USTR
	Tariff quotas	WTO
Sugar	Tariff quotas	WTO
Food products n.e.c.	Modern biotech products face lengthy and unpredictable approval process	USTR
	Standards for flour	WTO
Beverages and tobacco products	Strict standards on wine-making practices for imported wine	USTR
	Alcohol and tobacco labeling requirements	USTR
Textiles	ATC	WTO
Wearing apparel	ATC	WTO
Chemical, rubber, plastic products	Price, volume, and access controls on pharmaceuticals inhibit imports	USTR
	Drug labeling requirements	WTO
	Regulations and standards	WTO
Mineral products n.e.c.	Quotas on tableware and kitchenware from China	WTO
Motor vehicles and parts	Regulations and standards	WTO
Electronic equipment	Overly restrictive limits on low frequency emissions from electronic equipment	USTR

TABLE 4
Potential NTB Policies

	PANEL B	SOURCE
US		
Fishing	Certification requirements for yellowfin tuna	EU
Beverages and tobacco products	Burdensome wine labelling requirements that vary by state	EU
Textiles	Customs requires overly detailed information	EU
	Burdensome labelling requirements	EU
Chemical, rubber, plastic products	Foreign drugs face lengthier approval process	EU
Motor vehicles and parts	Luxury tax, CAFE payments, guzzler tax	EU
	Labelling of proportion of content that is North American	EU
	Must declare which engines and gearboxes are not North American	EU
JAPAN		
Vegetables, fruit, nuts	Overly restrictive sanitary standards	EU
	Complex regulations	EU
Crops n.e.c.: Garden Products	Overly restrictive sanitary standards	EU
Fishing	Quotas	EU
Vegetable oils and fats	Tariff quotas	WTO
Processed rice	Import ban	
Food products n.e.c.	Licensing and distribution barriers for imports	USTR
	Tariff quotas for coffee and tea	WTO
	Quota for chocolate	WTO
Beverages and tobacco products	Burdensome wine testing	EU
	Term "mineral water" not backed by legal obligations in Japan	EU
	High taxes on beer and spirits	USTR
Textiles	Quotas	WTO
Wearing apparel	Quotas	WTO
Leather products: Footwear	Tariff quotas	EU
Chemical, rubber, plastic products	Ban on food supplements in form of capsules	EU
	Burdensome approval and testing procedures for drugs	EU
	Biased government procurement for drugs and other medical supplies	USTR
Metal products	Market barriers	USTR
Electronic equipment	Different standards	EU
Machinery and equipment n.e.c.	Elevator standards	EU
	Regulations on fork lifts and other industrial trucks	EU
	Very costly safety device required for wind turbines	EU

TABLE 4
Potential NTB Policies

	PANEL C	SOURCE
CANADA		
Vegetables, fruit, nuts	Overly restrictive sanitary standards	EU
	Packaging requirements	EU
Vegetable oils and fats	Rules on coloring of margarine	EU
Dairy products	Inspection requirements	EU
Food products n.e.c.	Different labeling requirements across provinces	EU
Beverages and tobacco products	Discriminatory price controls, taxes, listing procedures, delivery regulations	EU
AUSTRALIA		
Vegetables, fruit, nuts	Overly strict quarantine laws	EU
Other Ag Products: Eggs	Overly strict quarantine laws	EU
Fishing	Overly strict quarantine laws	EU
Vegetable oils and fats	Overly strict quarantine laws	EU
Dairy products	Overly strict quarantine laws	EU
Food products n.e.c.	Overly strict quarantine laws	EU

these gaps, as well the ones for which we **have** listed policies, could result from burdensome customs procedures and other administrative friction, as discussed above. Thus, efforts by trade negotiators to remove such widespread sand from the wheels of trade could potentially have large benefits across many sectors and economies.

7 THE WELFARE EFFECTS OF INTEGRATION

To provide insights into the importance of NTBs, in this section we simulate their removal. For eight of the nine economies, we seek to compare real incomes in the world as it is with one in which the NTBs are eliminated. (Unfortunately, data problems prevent us from analyzing Belgium separately.) We use an AGE model based on one developed by Harrison, Rutherford, and Tarr (HRT).[14] The model has considerable country and sectoral detail: 16 regions and 33 sectors (See Table 5).[15] The model also allows for both increasing returns to scale and dynamic adjustment of the capital stock. We first describe the model and then report the simulation results.

7.1 Description of the Model

7.1.1 Production Structure

Production involves the use of intermediate goods and five factors—capital, skilled labor, unskilled labor, land, and natural resources. Only capital can move across

[14] The model is based on the computer code provided by Glenn Harrison, Thomas F. Rutherford, and David Tarr. Their code is available for public access at http://theweb.badm.sc.edu/glenn/ur_pub.htm and was used in their 1995, 1996, and 1997 articles.
[15] The underlying data come from Version 5 (1997) of the Global Trade Analysis Project (GTAP) database.

TABLE 5
Sectors and Regions in the AGE Model

33 SECTORS	16 REGIONS
Fruits, Nuts, Vegetables	Australia
Other Crops	Japan
Other Agriculture	Korea
Live Animals	China
Other Animal Products	Rest of Asia
Fish	Canada
Coal, Gas, Oil	United States
Other Minerals	Brazil
Bovine Cattle, Sheep, Goat, and Horse Products	Rest of Latin America
Other Meat Products	Germany
Vegetable Oils and Fats	Italy
Dairy Products	Netherlands
Processed Rice	United Kingdom
Sugar	Rest of Europe
Other Food Products	Middle East
Beverages and Tobacco Products	Rest of World
Textiles	
Wearing Apparel	
Leather Goods	
Lumber and Wood Products	
Pulp, Paper Products, Publishing	
Coal and Petroleum Products	
Chemicals, Plastics,and Rubber	
Non-metallic Mineral Products	
Primary Ferrous Metals	
Non-ferrous Metals	
Fabricated Metal Products	
Motor Vehicles and Parts	
Electronic Equipment	
Machinery and Equipment	
Other Manufacturing Products	
Trade and Transport Services	
Other Services	
Investment Good	

Sectors in bold are the final goods sectors for which we inserted our protection measures.

Underlined sectors are the ones which are assumed to have increasing returns to scale.

national boundaries; all factors can move freely across sectors. Value added in each sector has a CES (constant elasticity of substitution) production function. This formulation means that, within each sector, the elasticity of substitution between any two of the factors is the same. We use HRT's values for these elasticities, which they estimated econometrically using US time series data from 1947 to 1982 and using the same functional form as is used in this AGE model. In their estimates, however, they used only three factors—capital, labor, and land—instead of five. See Table 6 for these estimates and their standard errors. The production function for intermediates and the value-added composite is Leontief.[16]

Some sectors are assumed to have constant returns to scale. Other sectors, though, are modeled with increasing returns to scale and imperfect competition.[17] In these sectors, there is firm-level product differentiation, with output being a composite of varieties. Firms have fixed costs and constant marginal costs, meaning that reducing the number of firms leads to rationalization gains. These firms compete using quantity conjectures, with entry and exit that drive profits to zero.

Dynamics are incorporated by allowing the capital stock to vary in response to changes in the rate of return caused by liberalization. If the rate of return increases, investment increases the capital stock until its return is driven back down to the long-run equilibrium. The results, therefore, reflect the model's predictions for what happens after the capital stock has changed enough to return the price of capital to its

[16] Relaxing this assumption does not significantly change the results.
[17] See Table 6 for the sectors and the mark-ups used. This table also presents alternative mark-ups from the GTAP model. The results are robust to the set of mark-ups used.

TABLE 6
Substitution Elasticities and Lerner Indices

SECTOR	Factor Substitution Elasticities	Lerner Indices* HRT	GATT
Fruits, Nuts, Vegetables	0.945 (0.041)	0	0
Other Agriculture	0.945 (0.041)	0	0
Other Crops	0.945 (0.041)	0	0
Live Animals	0.945 (0.041)	0	0
Other Animal Products	0.945 (0.041)	0	0
Fish	0.945 (0.041)	0.05	0
Coal, Gas, Oil	0.293 (0.102)	0.03	0.05
Other Minerals	0.426 (0.105)	0.08	0.05
Bovine Cattle, Sheep, Goat, and Horse Produ	0.945 (0.041)	0.10	0
Other Meat Products	0.945 (0.041)	0.10	0
Vegetable Oils and Fats	0.945 (0.041)	0.03	0
Dairy Products	0.945 (0.041)	0	0
Processed Rice	0.945 (0.041)	0.13	0
Sugar	0.945 (0.041)	0.03	0
Other Food Products	0.945 (0.041)	0.03	0
Beverages and Tobacco Products	0.945 (0.041)	0.03	0
Textiles	0.927 (0.077)	0.06	0.14
Wearing Apparel	0.927 (0.077)	0.13	0.13
Leather Goods	0.927 (0.077)	0.13	0.13
Lumber and Wood Products	0.945 (0.041)	0.05	0
Pulp, Paper Products, Publishing	1.202 (0.090)	0.05	0.15
Coal and Petroleum Products	0.293 (0.102)	0.03	0.05
Chemicals, Plastics,and Rubber	1.009 (0.027)	0.04	0.15
Non-metallic Mineral Products	0.426 (0.105)	0.08	0.05
Primary Ferrous Metals	0.911 (0.241)	0.05	0.13
Non-ferrous Metals	0.958 (0.132)	0.05	0.13
Fabricated Metal Products	1.189 (0.055)	0.05	0.12
Motor Vehicles and Parts	1.202 (0.090)	0.11	0.12
Electronic Equipment	1.202 (0.090)	0.06	0.15
Machinery and Equipment	1.202 (0.090)	0.06	0.15
Other Manufacturing Products	1.202 (0.090)	0.06	0.15
Trade and Transport Services	1.283 (0.525)	0	0
Other Services	3.125 (0.817)	0	0
Investment Good	1.988 (0.477)	0	0

Standard Errors in Parentheses

*(P-MC)/P

original level. The capital adjustment process is not modeled, and the time horizon implied by these results depends on how long one thinks it takes capital to respond to interest rate differentials. The model ignores the consumption foregone by the increased investment, which may overstate the estimated benefits. On the other hand, the model ignores any impact of growth on productivity and innovation, which leads to an underestimate of the gains.

7.1.2 Demand Structure

On the demand side, each region has a representative consumer and a single government agent, each of whom has a nested CES utility function and practices multi-stage budgeting. At the top level, demand across the 33 sectors is Cobb-Douglas. Consumers first decide how much to spend on each of the 33 aggregate goods, given total income and aggregate prices. Each of these goods is a CES composite of domestic output and an import composite, which are imperfect substitutes. In this second level, consumers divide spending between the domestic and import good by maximizing a CES utility function subject to the total spending they have allocated to that sector and given the aggregate prices in that sector. At the third level, the model invokes the Armington assumption in that imports of the same good from different economies are assumed to be imperfect substitutes. Preferences across these different goods from different economies are given by a CES utility function. At this third level, consumers choose quantities of each import subject to the amount they have budgeted for aggregate imports at the second level and subject to the various prices. We follow

HRT and set the elasticity of substitution across import varieties, s_{MM}, equal to 8 and the elasticity of substitution between the import composite and the domestic good, s_{DM}, equal to 4. These elasticities affect the magnitude of the results. Higher values of these parameters lead to greater substitution in response to price reductions and, in general, higher welfare gains from liberalization. Roughly speaking, cutting these elasticities in half reduces the gains by 10% to 50%, depending on the region and the simulation. Similarly, doubling these elasticities increases the estimated gains by about 20% to 100%. Even such wide changes in the calibration, however, do not change any of our main conclusions.

In the sectors with increasing returns, yet another level of constrained choice is introduced. In this set-up, the domestic good and each import good produced in each region, instead of being homogeneous goods, are themselves composites of different varieties produced by the different firms. Consumers have CES preferences over these varieties and allocate spending across them subject to the amount they budgeted for each good at the third level. The elasticity of substitution across these varieties is set at 15. All results are robust to wide changes in this parameter.

7.1.3 Incorporating Our Data

7.1.3.1 Protection Data

To simulate the impact of NTBs as we have measured them, we benchmarked the model with our total protection measures—NTBs plus tariffs—instead of the GTAP protection data, which consists almost entirely of tariffs. In the model, all policy

distortions enter as ad valorem price wedges[18], which, conveniently, is the form that our protection data takes. So, replacing the GTAP tariff equivalents with our own is fairly straightforward. We did not, however, simply use our measures since they apply only to final goods, while almost all of the sectors of the model contain a combination of final and intermediate goods. Instead, we used a weighted average of our data and the original GTAP data. The weight on our measure was the fraction of output in that sector sold to final demand; the weight on the GTAP measure was one minus our weight. Thus, letting B and GTAP be the two protection measures and a , the final demand fraction, the protection estimate used was $aB + (1-a)GTAP$. Using this method ensures that model sectors with a high proportion of final goods use a protection estimate close to ours, while sectors with a low fraction of final goods use a protection estimate close to the GTAP measure. Put another way, the lower the final demand fraction, the less we deviated from the standard GTAP data. See Table 7 for a comparison of these weighted data and the original GTAP data. As shown in the table, we have not used our NTB estimates for the sector containing gasoline (oil and gas products) in order to avoid any muddying of the waters that gasoline taxes might cause.

7.1.3.2 Distribution Margins Data

The margins data used to derive the protection measures allow us to model distribution more accurately within the AGE framework. Most AGE trade models do not

[18] Government revenue is held constant throughout all simulations by assuming that lump-sum taxes are used to replace any lost tax revenue.

TABLE 7
Protection Data for the AGE Model

	NEW DATA*								GTAP DATA							
SECTOR	**AUS**	**CAN**	**GER**	**ITA**	**JAP**	**NET**	**UK**	**US**	**AUS**	**CAN**	**GER**	**ITA**	**JAP**	**NET**	**UK**	**US**
Fruits, Nuts, Vegetables	4.6	6.0	35.1	15.3	94.1	13.9	34.0	17.4	2.0	1.9	14.5	14.5	44.9	14.5	14.5	4.7
Other Agriculture									1.0	2.0	3.0	18.0	30.0	4.5	23.0	3.0
Other Crops	2.1	66.8	83.0	6.9	52.5	9.7	89.1	32.2	2.7	2.4	3.1	3.1	22.1	3.1	3.1	21.5
Live Animals	1.0	0.3	36.6	31.4	149.1	34.9	38.2	1.1	0.8	0.2	36.6	36.6	149.1	36.6	36.6	1.1
Other Animal Products	7.2	19.3	6.7	6.4	7.8	7.2	25.6	2.3	0.5	19.8	6.7	6.7	5.0	6.7	6.7	0.6
Fish	8.6	1.2	11.4	11.4	16.2	8.7	7.7	5.1	0.3	0.4	6.8	9.6	4.9	7.5	6.9	0.6
Coal, Gas, Oil									0.0	0.0	0.0	0.0	-0.8	0.0	0.0	0.2
Other Minerals									0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Bovine Cattle, Sheep, Goat, I	0.0	18.1	109.7	39.0	265.4	80.6	99.6	8.3	0.1	16.3	88.9	88.9	36.4	88.9	88.9	5.3
Other Meat Products	3.0	29.3	41.8	23.3	119.8	29.6	37.6	5.5	4.1	72.4	30.9	30.9	58.2	30.9	30.9	3.6
Vegetable Oils and Fats	20.2	13.1	27.3	15.4	46.0	13.8	12.2	6.0	2.8	8.6	11.4	11.4	6.6	11.4	11.4	4.3
Dairy Products	19.1	77.8	30.8	33.8	173.7	53.0	43.4	32.0	7.3	214.8	87.7	87.7	287.0	87.7	87.7	42.5
Processed Rice	0.4	0.6	47.9	28.9	224.3	25.4	23.7	13.1	1.0	0.7	87.4	87.4	409.0	87.4	87.4	5.3
Sugar	11.7	8.3	66.3	37.2	111.0	72.4	69.2	46.9	13.9	4.9	76.4	76.4	116.1	76.4	76.4	53.4
Other Food Products	10.9	11.4	21.5	24.8	98.3	23.8	27.1	11.3	5.6	14.1	28.8	28.8	38.3	28.8	28.8	11.4
Beverages and Tobacco Proc	54.1	35.6	33.9	37.8	59.6	35.2	45.2	15.4	9.2	62.5	8.3	8.3	16.2	8.3	8.3	3.0
Textiles	24.9	26.3	30.1	9.4	16.6	29.8	29.9	16.8	17.0	15.7	9.7	9.2	8.5	9.8	9.5	11.2
Wearing Apparel	12.7	24.2	23.1	46.1	33.4	33.5	26.0	14.0	29.3	21.2	12.1	12.2	12.5	12.0	11.9	13.3
Leather Goods	27.9	22.8	27.5	12.2	71.4	84.1	20.9	14.1	13.0	15.3	8.4	6.5	15.3	8.7	8.7	13.5
Lumber and Wood Products	5.7	8.4	4.2	4.4	4.6	6.2	8.8	2.6	4.5	6.8	2.8	2.7	2.7	3.0	2.8	2.2
Pulp, Paper Products, Publish	3.9	5.6	3.2	4.2	4.7	12.7	5.7	2.3	3.1	1.9	2.9	2.4	0.5	2.7	2.6	1.0
Coal and Petroleum Products									0.0	6.2	2.7	3.0	3.3	3.1	2.9	2.2
Chemicals, Plastics,and Rubb	4.0	5.4	8.7	5.7	7.6	5.7	7.4	10.4	3.5	4.8	5.1	5.3	2.0	4.8	4.7	3.5
Non-metallic Mineral Product	6.0	13.4	8.6	5.3	10.8	7.3	8.2	6.8	4.7	5.7	5.4	5.2	1.2	5.2	5.1	6.1
Primary Ferrous Metals									4.7	4.7	3.2	3.2	2.5	3.2	3.4	3.4
Non-ferrous Metals									1.4	0.5	2.1	1.2	0.4	2.9	1.5	1.7
Fabricated Metal Products	6.6	6.5	3.7	4.2	3.5	5.6	5.9	4.6	6.4	6.3	3.7	3.9	1.2	4.0	3.8	3.8
Motor Vehicles and Parts	11.4	6.7	11.1	9.7	0.1	20.1	27.9	7.8	9.2	6.1	7.7	8.6	0.0	8.4	8.3	2.4
Electronic Equipment	3.4	10.6	5.7	5.6	5.9	4.9	8.5	2.4	1.6	1.2	4.3	4.5	0.0	4.2	4.2	1.2
Machinery and Equipment	7.2	4.1	4.7	3.7	2.6	4.4	9.7	4.2	4.3	3.3	3.1	3.1	0.3	3.1	3.1	2.7
Other Manufacturing Product	10.3	9.3	10.7	5.1	18.7	21.8	11.9	5.7	3.7	3.8	3.7	3.8	1.9	3.9	2.5	1.7
Trade and Transport Services									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Services									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Investment Good									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*A weighted average of our final goods protection data and the GTAP data, with the final demand fraction in each sector used as the weight on our data.

Sectors for which we did not use our protection data are left blank.

account for margins explicitly. All distribution services are lumped into the trade and transport sector and consumed as a separate good, instead of being linked to the goods that use those distribution services. Since margins vary across sectors, this obscures the role of distribution in the economy and can skew the results of AGE analyses. For instance, simulations of price reductions in other sectors may imply a large substitution out of trade and transport services, even though actual consumption of these will probably increase in order to facilitate commodity flows. Also, not accounting for margins implies that consumers base choices on producer prices instead of the higher consumer prices that include margins.

We attempt to address these problems by incorporating distribution explicitly into each final demand sector for which we have margins data. We do this by treating margins like taxes, since margins create a wedge between consumer and producer prices. For the eight economies involved, therefore, we inserted margin wedges into each of the relevant sectors.[19] We also reduced the value of the trade and transport sector by the total value of these margins. Finally, we reduced inputs into the trade and transport sector and re-distributed them across the final goods sectors in accordance the amount of distribution used in those sectors.[20]

[19] See Gohin 1998 and Komen and Peerlings 1996 for other examples of modeling margins in this way within AGE models. Bradford and Gohin 2002 explicitly model the distribution sector for the US within an AGE model.

[20] These modifications only apply to final goods. Due to lack of data, we do not modify the model to account for intermediate distribution. It turns out that these intermediate margins are quite a bit smaller than the margins for final goods.

7.2 Welfare Analysis

We now seek to estimate the potential gains from including NTBs on the trade negotiation agenda. Since tariffs presumably require much less work to remove, we do not think it likely that negotiators will remove NTBs and not tariffs. So we simulate two sets of scenarios: one in which economies remove all protection—NTBs and tariffs alike—and one in which economies only remove tariffs. For each of these two situations, we conduct three types of simulations: unilateral barrier removal in each of the eight economies; multilateral worldwide opening by all eight at once; and a Preferential Trade Agreement (PTA) in which the eight economies simultaneously remove barriers against each other but not the rest of the world. Analyzing these three scenarios will allow us to see differences among multilateral opening, regional opening, and unilateral opening. We focus on changes in equivalent variation (which, given the model structure, is the same as changes in real consumption) as a percentage of GDP.

Tables 8 and 9 show the main results for total protection and just tariffs. These tables report the permanent, annual effect of trade opening on consumption, as a percentage of GDP, once the capital stock has changed to its new equilibrium. Alternatively, they report the welfare costs, born at home and abroad, of tariff and total protection in the eight economies separately and as a group. Table 10 shows the difference between the two scenarios and thus the predicted extra gains from removing NTBs. For each table, Panel A reports these gains as a percentage of GDP, while Panel B shows them in billions of 1997 US dollars. We find that the efficiency

TABLE 8
PANEL A

TOTAL PROTECTION
NET WELFARE CHANGE (EQUIVALENT VARIATION) AS FRACTION OF GDP

IMPACT ON:	REGION IN WHICH PROTECTION IS REMOVED: AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	8 COUNTRY PTA
Australia	1.61	0.02	0.11	0.03	1.66	0.01	0.25	0.27	3.95	4.35
Canada	0.04	1.00	0.03	0.10	0.52	0.01	0.07	1.71	3.49	3.66
Germany	0.03	-0.01	1.28	0.25	-0.04	0.29	0.30	0.12	2.26	1.96
Italy	0.05	0.02	0.66	1.97	0.03	0.10	0.37	0.16	3.46	4.61
Japan	0.04	-0.01	-0.01	0.00	3.06	0.01	0.00	0.12	3.27	2.18
Netherlands	0.05	0.01	1.56	0.58	0.14	3.84	1.03	0.33	7.71	9.38
United Kingdom	0.01	0.02	0.27	0.10	0.23	0.21	3.21	0.21	4.29	2.79
United States	-0.01	0.20	0.03	0.01	0.40	0.01	0.06	0.40	1.02	1.35
China	0.04	0.05	0.12	0.04	0.77	0.02	0.05	0.55	1.49	-0.57
South Korea	0.04	0.00	0.03	0.01	0.62	0.00	0.03	0.25	0.96	-0.51
Rest of Asia	0.06	0.02	0.19	0.06	1.03	0.03	0.18	0.49	2.03	-0.81
Brazil	-0.03	0.02	0.18	0.06	0.41	0.03	0.10	0.32	1.05	0.00
Rest of Latin America	0.00	-0.01	0.15	0.07	0.55	0.02	0.09	0.86	1.94	-0.53
Rest of Europe	0.02	0.01	0.59	0.20	0.13	0.18	0.47	0.15	1.69	-0.88
Middle East	0.01	0.03	0.35	0.17	0.55	0.10	0.37	0.41	1.96	-0.05
Rest of the World	-0.01	0.02	0.36	0.16	0.43	0.06	0.21	0.11	1.34	0.03
DEVELOPING ECONOMIES	0.01	0.01	0.21	0.09	0.63	0.04	0.15	0.43	1.60	-0.36
RICH ECONOMIES	0.04	0.10	0.29	0.17	0.90	0.14	0.35	0.29	2.26	1.76
WORLD	0.04	0.09	0.27	0.16	0.84	0.12	0.31	0.33	2.11	1.25

TABLE 8
PANEL B

TOTAL PROTECTION
NET WELFARE CHANGE (EQUIVALENT VARIATION) IN BILLIONS OF 1997 DOLLARS.

	REGION IN WHICH PROTECTION IS REMOVED:									8 COUNTRY
IMPACT ON:	AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	PTA
Australia	5.677	0.071	0.388	0.106	5.853	0.035	0.881	0.952	13.927	15.338
Canada	0.208	5.189	0.156	0.519	2.698	0.052	0.363	8.873	18.109	18.991
Germany	0.543	-0.181	23.182	4.528	-0.724	5.252	5.433	2.173	40.930	35.497
Italy	0.510	0.204	6.727	20.078	0.306	1.019	3.771	1.631	35.264	46.984
Japan	1.761	-0.440	-0.440	0.000	134.732	0.440	0.000	5.284	143.978	95.985
Netherlands	0.153	0.031	4.764	1.771	0.428	11.726	3.145	1.008	23.544	28.643
United Kingdom	0.121	0.242	3.262	1.208	2.779	2.537	38.781	2.537	51.829	33.707
United States	-0.752	15.038	2.256	0.752	30.076	0.752	4.511	30.076	76.694	101.507
China	0.354	0.443	1.063	0.354	6.818	0.177	0.443	4.870	13.194	-5.047
South Korea	0.157	0.000	0.117	0.039	2.426	0.000	0.117	0.978	3.757	-1.996
Rest of Asia	0.783	0.261	2.478	0.783	13.436	0.391	2.348	6.392	26.480	-10.566
Brazil	-0.199	0.133	1.196	0.399	2.723	0.199	0.664	2.125	6.974	0.000
Rest of Latin America	0.000	-0.110	1.646	0.768	6.034	0.219	0.987	9.435	21.284	-5.815
Rest of Europe	0.559	0.280	16.496	5.592	3.635	5.033	13.141	4.194	47.252	-24.604
Middle East	0.057	0.170	1.981	0.962	3.112	0.566	2.094	2.320	11.091	-0.283
Rest of the World	-0.155	0.310	5.572	2.476	6.655	0.929	3.250	1.702	20.739	0.464
DEVELOPING ECONOMIES	0.646	0.646	13.558	5.811	40.674	2.582	9.684	27.762	103.299	-23.242
RICH ECONOMIES	7.973	19.933	57.806	33.886	179.399	27.906	69.766	57.806	450.490	350.824
WORLD	10.556	23.750	71.251	42.223	221.671	31.667	81.807	87.085	556.816	329.867

TABLE 9
PANEL A

TARIFFS
NET WELFARE CHANGE (EQUIVALENT VARIATION) AS FRACTION OF GDP

IMPACT ON:	REGION IN WHICH PROTECTION IS REMOVED: AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	8 COUNTRY PTA
Australia	0.91	0.02	0.08	0.02	1.07	0.03	0.15	0.12	2.37	2.79
Canada	0.02	0.63	0.03	0.10	0.49	0.01	0.07	-0.14	1.30	1.41
Germany	0.01	0.01	0.34	-0.08	-0.06	-0.08	-0.10	0.05	0.15	0.12
Italy	0.03	0.04	-0.15	0.78	-0.06	-0.03	-0.08	0.14	0.69	0.69
Japan	0.02	0.01	0.00	0.00	0.99	0.00	0.00	0.08	1.16	0.91
Netherlands	0.02	0.02	-0.49	-0.17	-0.06	1.62	-0.27	0.11	0.61	0.18
United Kingdom	-0.01	0.02	-0.04	-0.02	0.10	-0.03	0.70	0.07	0.81	0.57
United States	-0.01	0.04	0.02	0.01	0.15	0.02	0.04	0.06	0.30	0.48
China	0.06	0.07	0.12	0.03	0.27	0.05	0.08	0.38	1.01	-0.23
South Korea	0.04	0.03	0.07	0.03	0.21	0.01	0.05	0.23	0.68	-0.17
Rest of Asia	0.05	0.05	0.17	0.07	0.31	0.08	0.16	0.47	1.29	-0.37
Brazil	-0.02	0.02	0.10	0.12	0.23	0.08	0.09	0.18	0.79	0.10
Rest of Latin America	0.00	-0.01	0.16	0.10	0.23	0.05	0.09	0.13	0.73	-0.22
Rest of Europe	0.01	0.01	-0.08	-0.04	-0.01	-0.04	-0.08	0.05	-0.16	-0.26
Middle East	0.00	0.02	0.42	0.17	0.23	0.11	0.25	0.27	1.45	0.12
Rest of the World	-0.01	0.02	0.43	0.20	0.23	0.10	0.22	0.10	1.22	0.13
DEVELOPING ECONOMIES	0.01	0.03	0.23	0.11	0.25	0.07	0.14	0.25	1.06	-0.10
RICH ECONOMIES	0.02	0.04	0.01	0.03	0.29	0.01	0.03	0.06	0.52	0.51
WORLD	0.02	0.04	0.07	0.05	0.29	0.03	0.06	0.11	0.66	0.36

TABLE 9
PANEL B

TARIFFS
NET WELFARE CHANGE (EQUIVALENT VARIATION) IN BILLIONS OF 1997 DOLLARS.

	REGION IN WHICH PROTECTION IS REMOVED:									8 COUNTRY
IMPACT ON:	AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	PTA
Australia	3.086	0.068	0.271	0.068	3.629	0.102	0.509	0.407	8.037	9.462
Canada	0.100	3.161	0.151	0.502	2.458	0.050	0.351	-0.702	6.522	7.074
Germany	0.170	0.170	5.784	-1.361	-1.021	-1.361	-1.701	0.851	2.552	2.042
Italy	0.288	0.384	-1.441	7.495	-0.577	-0.288	-0.769	1.345	6.630	6.630
Japan	0.812	0.406	0.000	0.000	40.198	0.000	0.000	3.248	47.101	36.950
Netherlands	0.059	0.059	-1.438	-0.499	-0.176	4.754	-0.792	0.323	1.790	0.528
United Kingdom	-0.113	0.225	-0.450	-0.225	1.126	-0.338	7.881	0.788	9.120	6.418
United States	-0.718	2.872	1.436	0.718	10.770	1.436	2.872	4.308	21.539	34.463
China	0.531	0.620	1.063	0.266	2.391	0.443	0.708	3.365	8.944	-2.037
South Korea	0.157	0.117	0.274	0.117	0.822	0.039	0.196	0.900	2.661	-0.665
Rest of Asia	0.652	0.652	2.218	0.913	4.044	1.044	2.087	6.131	16.827	-4.826
Brazil	-0.133	0.133	0.664	0.797	1.528	0.531	0.598	1.196	5.247	0.664
Rest of Latin America	0.000	-0.110	1.755	1.097	2.523	0.549	0.987	1.426	8.009	-2.414
Rest of Europe	0.280	0.280	-2.237	-1.118	-0.280	-1.118	-2.237	1.398	-4.474	-7.269
Middle East	0.000	0.113	2.377	0.962	1.302	0.622	1.415	1.528	8.205	0.679
Rest of the World	-0.155	0.310	6.655	3.095	3.560	1.548	3.405	1.548	18.882	2.012
DEVELOPING ECONOMIES	0.646	1.937	14.849	7.102	16.140	4.519	9.039	16.140	68.436	-6.456
RICH ECONOMIES	3.792	7.583	1.896	5.688	54.980	1.896	5.688	11.375	98.584	96.688
WORLD	5.083	10.166	17.790	12.707	73.703	7.624	15.249	27.956	167.737	91.493

TABLE 10
PANEL A

NTBS
NET WELFARE CHANGE (EQUIVALENT VARIATION) AS FRACTION OF GDP

	REGION IN WHICH PROTECTION IS REMOVED:									8 COUNTRY
IMPACT ON:	AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	PTA
Australia	0.70	0.00	0.03	0.01	0.59	-0.02	0.10	0.15	1.58	1.56
Canada	0.02	0.37	0.00	0.00	0.03	0.00	0.00	1.85	2.19	2.25
Germany	0.02	-0.02	0.94	0.33	0.02	0.37	0.40	0.07	2.11	1.84
Italy	0.02	-0.02	0.81	1.19	0.09	0.13	0.45	0.02	2.77	3.92
Japan	0.02	-0.02	-0.01	0.00	2.07	0.01	0.00	0.04	2.11	1.27
Netherlands	0.03	-0.01	2.05	0.75	0.20	2.22	1.30	0.22	7.10	9.20
United Kingdom	0.02	0.00	0.31	0.12	0.13	0.24	2.51	0.14	3.48	2.22
United States	0.00	0.16	0.01	0.00	0.25	-0.01	0.02	0.34	0.72	0.87
China	-0.02	-0.02	0.00	0.01	0.50	-0.03	-0.03	0.17	0.48	-0.34
South Korea	0.00	-0.03	-0.04	-0.02	0.41	-0.01	-0.02	0.02	0.28	-0.34
Rest of Asia	0.01	-0.03	0.02	-0.01	0.72	-0.05	0.02	0.02	0.74	-0.44
Brazil	-0.01	0.00	0.08	-0.06	0.18	-0.05	0.01	0.14	0.26	-0.10
Rest of Latin America	0.00	0.00	-0.01	-0.03	0.32	-0.03	0.00	0.73	1.21	-0.31
Rest of Europe	0.01	0.00	0.67	0.24	0.14	0.22	0.55	0.10	1.85	-0.62
Middle East	0.01	0.01	-0.07	0.00	0.32	-0.01	0.12	0.14	0.51	-0.17
Rest of the World	0.00	0.00	-0.07	-0.04	0.20	-0.04	-0.01	0.01	0.12	-0.10
DEVELOPING ECONOMIES	0.00	-0.02	-0.02	-0.02	0.38	-0.03	0.01	0.18	0.54	-0.26
RICH ECONOMIES	0.02	0.06	0.28	0.14	0.61	0.13	0.32	0.23	1.74	1.25
WORLD	0.02	0.05	0.20	0.11	0.55	0.09	0.25	0.22	1.45	0.89

TABLE 10
PANEL B

NTBS
NET WELFARE CHANGE (EQUIVALENT VARIATION) IN BILLIONS OF 1997 DOLLARS.

	REGION IN WHICH PROTECTION IS REMOVED:									8 COUNTRY
IMPACT ON:	AUS	CAN	GER	ITA	JAP	NET	UK	US	ALL 8	PTA
Australia	2.591	0.003	0.117	0.038	2.224	-0.066	0.373	0.545	5.890	5.876
Canada	0.107	2.028	0.005	0.017	0.240	0.002	0.012	9.575	11.587	11.917
Germany	0.373	-0.351	17.397	5.889	0.296	6.613	7.135	1.323	38.378	33.455
Italy	0.221	-0.181	8.168	12.583	0.882	1.307	4.540	0.285	28.633	40.354
Japan	0.949	-0.846	-0.440	0.000	94.534	0.440	0.000	2.035	96.877	59.036
Netherlands	0.094	-0.028	6.202	2.270	0.604	6.972	3.938	0.685	21.754	28.115
United Kingdom	0.233	0.016	3.712	1.433	1.653	2.875	30.899	1.749	42.709	27.289
United States	-0.034	12.166	0.820	0.034	19.307	-0.684	1.640	25.768	55.155	67.044
China	-0.177	-0.177	0.000	0.089	4.428	-0.266	-0.266	1.505	4.250	-3.011
South Korea	0.000	-0.117	-0.157	-0.078	1.605	-0.039	-0.078	0.078	1.096	-1.331
Rest of Asia	0.130	-0.391	0.261	-0.130	9.392	-0.652	0.261	0.261	9.653	-5.740
Brazil	-0.066	0.000	0.531	-0.399	1.196	-0.332	0.066	0.930	1.727	-0.664
Rest of Latin America	0.000	0.000	-0.110	-0.329	3.511	-0.329	0.000	8.009	13.275	-3.401
Rest of Europe	0.280	0.000	18.733	6.710	3.914	6.151	15.378	2.796	51.725	-17.335
Middle East	0.057	0.057	-0.396	0.000	1.811	-0.057	0.679	0.792	2.886	-0.962
Rest of the World	0.000	0.000	-1.083	-0.619	3.095	-0.619	-0.155	0.155	1.857	-1.548
DEVELOPING ECONOMIES	0.000	-1.291	-1.291	-1.291	24.534	-1.937	0.646	11.621	34.863	-16.786
RICH ECONOMIES	4.182	12.350	55.910	28.199	124.419	26.011	64.079	46.431	351.906	254.136
WORLD	5.473	13.585	53.461	29.516	147.968	24.043	66.558	59.129	389.079	238.374

gains from full-fledged integration of goods markets among the economies in our sample would well exceed the gains from eliminating tariffs. In fact, in most cases, the **extra** gains from NTB removal would outweigh the gains from tariff removal, so that the total gains from including NTBs are generally more than twice the gains from just removing tariffs.

Focusing on Panel A of Table 10, each of the economies except Canada and the United States would get an extra annual boost of 0.7% or more to GDP from unilateral NTB opening (in addition to tariff removal). Multilateral opening from all eight would bring even larger extra gains of at least 2% of GDP for all economies except Australia and the United States. Global GDP would rise an additional 1.5% with NTB removal.

Two main forces drive the gains for any given country: the amount of protection removed and the share of trade in GDP for that country. The US's relatively low barriers **and** its low trade/GDP share lead to relatively low predicted gains for the US. Canada has about the same NTB protection as the US but, in relation to GDP, would gain more from its removal because Canada's trade share is much higher. Similarly, the Netherlands' high trade share amplifies its percentage gains. On the other hand, Japan's NTBs are so high that it reaps substantial extra gains from NTB liberalization—2.1% of GDP—despite the fact that Japan has the lowest trade share in the sample: only about 10%. Another factor at work is changes in the terms of trade, which mute gains for the US, Japan, and Germany. These economies account for fairly large shares of total world trade so that, when they open, they drive up their import prices and drive down their export prices.

The results also highlight some interesting international linkages and interactions. Canada actually loses from US unilateral tariff opening but would gain significantly from the US removing all barriers. (See the entry for the Canada row and the US column in Tables 8 and 9.) In fact, the extra gains from US NTB elimination (1.9% of GDP) would far exceed Canada's own NTB opening (0.4%). (Canada row in Table 10A) Likewise, the extra gains to the Netherlands from German NTB removal (2.1%) rival those that the Netherlands would get from its own unilateral NTB removal (2.2%).

It is striking that adding NTB removal to tariff removal in Japan would benefit the US about as much as the US itself doing this (about 0.3%). The benefits to Japan's neighbors would also be considerable, with extra boosts to GDP in China, South Korea, and the rest of Asia of 0.5%, 0.4%, and 0.7% of GDP, respectively. Overall, developing economies and the world as a whole would see their incomes rise by an additional 0.4%. Measured in 1997 dollars, Japanese incomes would rise by an extra 90 billion, while Japan's trading partners would see their incomes rise by 50 billion, of which 24 billion would accrue to developing economies. (Table 10B) Adding Japanese NTBs to the agenda would benefit the world more than twice as much as adding US NTBs would. Indeed, including Japanese NTBs would yield worldwide benefits of $148 billion—more than one third of the global benefits from adding all eight economies' NTBs. Aside from the Japanese NTBs, US NTBs impose the largest costs on developing economies: about 0.2% of GDP, or about 12 billion 1997 dollars. As with Japan, US NTBs impose costs on lower-income economies that cancel annual development aid given by the US.

For all economies except Japan and the UK, the extra gains from multilateral NTB opening are more than twice the extra gains from unilateral opening. These six economies have especially large incentives to engage in multilateral NTB reform, as opposed to going it alone. Also, for each economy except Japan, removing NTBs confer larger extra benefits on the rest of the world than they derive themselves. Indeed, the global benefits that result from Canadian NTB opening are six times larger than the benefits obtained by Canada (Table 10B). For Germany, the Netherlands, and the United States, these ratios are three or more.

Four of the eight economies in the sample actually get larger extra gains from NTB elimination within a PTA than with multilateral worldwide removal. These are Canada, Italy, the Netherlands, and the US. Apparently, NTBs from within the sample of eight impose greater burdens on these economies than do NTBs outside the sample. Developing economies, however, suffer losses from such an exclusionary arrangement. Instead of the 0.5% annual extra gains from multilateral NTB opening by all eight, adding NTBs to a PTA would reduce developing economies GDP by 0.3%.

Overall, our results imply that the potential gains to be reaped from deeper integration among the developed economies far exceed the gains from tariff removal alone, although these latter benefits are not trivial. Moreover, the NTB benefits would be widely shared within economies. Of course, such extensive liberalization in these economies is not on the table right now. Complete opening may not be an option because of short run political stresses caused by contraction in protected sectors. Our analysis does not provide a recipe for reform, but it does show that the potential gains from future attempts to integrate markets remain quite large.

While we have estimated the benefits of integration, we have not taken account of certain costs. In particular, differences in national languages, policies, and institutions may well create barriers to price arbitrage, but they may also provide benefits that would be lost if the world economy was to be deeply integrated in the sense we are exploring in this study.

While suppressing diversity could have costs that we have not accounted for, we may also have understated the costs of the barriers by treating them as if they were tariffs. In fact, removing barriers may actually save resources and therefore yield even larger benefits than we estimate here. As Anderson and van Wincoop 2002 emphasizes, trade barriers such as tariffs and quotas generate deadweight losses, but NTBs may consume resources directly. Suppose, for example, that two economies each require drugs to be certified as safe even though their criteria are very similar. Firms that wish to sell in both markets must expend real resources to determine and meet foreign requirements. Drugs approved in one economy cannot simply be sold abroad. Under these circumstances, in addition to the gains from removing the barriers, freeing the resources that are consumed by the (unnecessary) duplicative regulatory processes could produce additional gains. Our estimates are also conservative because they ignore the potential benefits from opening economies outside the sample of eight we have used in the study.

7.3 Winners and Losers

Despite overall gains from NTB opening, clearly some groups of people would lose, while others would win. An examination of real factor price changes sheds light on this issue. As mentioned above, the model contains five factors: capital, skilled labor, unskilled labor, land, and natural resources. We can therefore obtain broad results on income distribution among these large groups. Table 11 reports the effects of trade opening on after tax real factor prices for the different scenarios. Panel A shows the results for total protection and tariffs, and Panel B shows the results for NTBs.

Focusing on the NTB results, we see that, for all economies and all scenarios, both types of labor gain from adding NTBs to the mix, indicating that, for these developed economies at least, NTBs impose burdens on workers as a whole. The more efficient allocation of resources that opening would bring would raise workers' real income overall. Of course, some workers would have to pay the costs of adjusting between sectors in the short run, costs that the model does not capture. Capital would benefit from adding NTB opening as well, except in Canada (for all three scenarios) and in the US with multilateral opening and with the PTA. Japanese capital owners would gain more than their counterparts in other economies, which reflects the fact that Japan generally has a comparative advantage in capital-intensive goods.

These simulations imply large impacts on landowners in certain economies. In all scenarios involving Japan, the modeling predicts that Japanese landowners' real

TABLE 11
PANEL A
Percentage Changes in Real After Tax Factor Prices

	TOTAL PROTECTION								TARIFFS							
	SINGLE COUNTRY OPENING								SINGLE COUNTRY OPENING							
	Aus	Can	Ger	Ita	Jap	Net	UK	US	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	2.3	3.8	5.2	3.4	7.8	9.1	6.4	1.1	1.3	2.3	1.2	1.2	3.0	2.6	1.4	0.4
Unskilled Labor	2.5	3.8	5.3	3.2	7.0	10.7	6.6	1.1	1.5	2.1	1.2	1.0	2.6	2.9	1.3	0.3
Capital	0.2	1.3	3.4	1.6	6.8	2.5	1.5	0.4	-0.2	2.0	0.7	0.7	2.7	0.8	0.7	0.3
Land	5.5	3.0	-0.4	-14.0	-47.4	8.5	-6.4	-0.6	4.0	-4.0	-6.9	-5.4	-39.3	1.1	-12.4	-1.8
Natural Resources	9.6	7.7	6.6	0.0	-21.6	14.3	18.9	6.6	6.2	4.1	1.6	-0.5	-11.3	3.8	4.4	2.7
	8-COUNTRY WORLDWIDE OPENING								8-COUNTRY WORLDWIDE OPENING							
	Aus	Can	Ger	Ita	Jap	Net	UK	US	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	3.2	5.0	5.8	4.0	8.0	11.0	6.9	1.2	1.6	2.1	1.0	1.1	3.2	2.0	1.4	0.4
Unskilled Labor	4.5	5.7	6.1	4.3	7.3	14.2	7.3	1.4	2.8	2.5	1.1	0.9	2.7	2.2	1.3	0.5
Capital	-0.4	1.1	3.4	1.4	6.9	2.0	1.3	0.0	-0.7	1.8	0.6	0.5	2.7	0.6	0.6	0.2
Land	36.5	38.3	7.4	-7.9	-47.2	33.3	-1.0	6.4	4.9	42.5	-8.1	-10.1	-39.3	6.5	-10.8	2.9
Natural Resources	14.5	14.6	10.4	1.8	-21.1	19.7	25.7	11.0	8.3	13.3	3.8	0.3	-11.0	9.5	8.7	6.0
	8-COUNTRY PTA								8-COUNTRY PTA							
	Aus	Can	Ger	Ita	Jap	Net	UK	US	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	3.0	4.4	3.6	3.2	6.0	8.8	4.1	1.0	1.5	1.6	0.3	0.5	2.6	0.8	0.6	0.2
Unskilled Labor	4.8	5.7	4.1	4.4	5.4	13.6	4.8	1.3	3.1	2.4	0.4	0.7	2.2	1.0	0.7	0.3
Capital	-0.7	0.5	1.8	0.6	5.0	0.8	0.2	-0.2	-0.9	1.3	0.0	0.1	2.1	0.0	0.1	0.0
Land	49.9	45.0	15.5	2.8	-42.2	74.0	4.5	11.6	51.1	51.8	-0.9	5.3	-35.1	8.6	-3.8	6.6
Natural Resources	-2.5	4.1	4.8	1.5	-13.3	1.8	9.0	1.7	-3.3	7.5	1.3	0.4	-6.0	3.0	2.8	1.3

TABLE 11
PANEL B
Percentage Changes in Real After Tax Factor Prices

	NTBs							
	SINGLE COUNTRY OPENING							
	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	1.0	1.5	4.0	2.2	4.8	6.5	5.0	0.7
Unskilled Labor	1.0	1.7	4.1	2.2	4.4	7.8	5.3	0.8
Capital	0.4	-0.7	2.7	0.9	4.1	1.7	0.8	0.1
Land	1.5	7.0	6.5	-8.6	-8.1	7.4	6.0	1.2
Natural Resources	3.4	3.6	5.0	0.5	-10.3	10.5	14.5	3.9
	8-COUNTRY WORLDWIDE OPENING							
	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	1.6	2.9	4.8	2.9	4.8	9.0	5.5	0.8
Unskilled Labor	1.7	3.2	5.0	3.4	4.6	12.0	6.0	0.9
Capital	0.3	-0.7	2.8	0.9	4.2	1.4	0.7	-0.2
Land	31.6	-4.2	15.5	2.2	-7.9	26.8	9.8	3.5
Natural Resources	6.2	1.3	6.6	1.5	-10.1	10.2	17.0	5.0
	8-COUNTRY PTA							
	Aus	Can	Ger	Ita	Jap	Net	UK	US
Skilled Labor	1.5	2.8	3.3	2.7	3.4	8.0	3.5	0.8
Unskilled Labor	1.7	3.3	3.7	3.7	3.2	12.6	4.1	1.0
Capital	0.2	-0.8	1.8	0.5	2.9	0.8	0.1	-0.2
Land	-1.2	-6.8	16.4	-2.5	-7.1	65.4	8.3	5.0
Natural Resources	0.8	-3.4	3.5	1.1	-7.3	-1.2	6.2	0.4

incomes would decline significantly, 7-8%. Thus, we predict that they would oppose adding NTBs to the agenda. Landowners in other economies are helped by each scenario and thus should favor including NTBs, with the following exceptions: Italian landowners under unilateral opening and the PTA, Canadian landowners under multilateral opening and the PTA, and Australian landowners with the PTA. Australian landowners would much prefer multilateral NTB opening to a PTA, while Dutch landowners would gain much more from the PTA. As for the other six economies, if NTBs are added to the agenda, Canadian, Italian, and British landowners would prefer multilateral liberalization to a PTA, while landowners in Germany, the Netherlands, and the US would prefer the PTA.[21] Also, if NTBs are on the agenda, all landowners except those in Canada prefer some kind of multilateral opening to unilateral removal of NTBs and tariffs. The results also indicate that natural resource owners are heavily protected by NTBs in Japan. It should be noted that natural resource factors are the most difficult to measure, making their results the most uncertain.

Overall, these simulations imply that deeper international integration, involving the removal of NTBs as well as tariffs, in developed economies not only will benefit them as a whole but that most factors within each nation will gain. Thus, while opposition to including NTBs will always be strong, we infer from this research that a broad consensus of citizens in these economies would favor keeping them on the table.

[21] It should be kept in mind that small countries' large trade/GDP shares amplify the percentage changes.

8 CONCLUSION

This paper has presented evidence that rich economies harbor quite a bit more NTB protection than is commonly believed. Our data imply that agriculture and food industries in eight OECD economies enjoy extensive NTB protection, and we also find that NTBs significantly impede trade in manufacturing. Japan has unusually high NTBs, and Europe appears to have more than industrialized North America. AGE simulations imply that negotiating the removal of these barriers, especially in Japan, would bring large benefits to rich and poor economies alike, implying that the extra work required to include NTBs on the agenda would probably pay off. Thus, this research implies that future trade negotiations should build on previous efforts and continue to target NTBs.

Of course, the trade opening devil lurks in the details, and so trade analysts need to determine the actual policies that underlie the protection we have quantified in this paper. It is easy for governments to claim that certain policies in other economies act as trade barriers; the more difficult task is to provide evidence for these claims. We have taken an initial step toward this goal by matching up suspected policies with sectors for which we have evidence of NTB protection. As shown in Table 4, we find that, for agriculture and food products, overly restrictive sanitary requirements, apparently unfounded import bans of certain products, onerous labeling rules, and tariff quotas emerge as potentially damaging trade barriers and worthwhile targets of negotiations. In manufacturing, we have evidence that technical standards,

labelling requirements, and regulatory approval procedures in certain sectors may hinder imports.

We hope that the results in this paper have provided useful initial information on the extent of, the effects of, and the policies underlying NTB protection in OECD economies. We also hope this paper will stimulate much-needed future research in this area.

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