Gauging the WTO negotiation's potential gains

Doha Round

SUMMARY

The Doha Round faced a long series of launch-delays and a spectacular launch-failure in Seattle in 1999. While the talks did take off in 2001, the negotiating agenda is still ambiguous in a number of crucial areas. This paper argues that these ambiguities matter greatly. Such ambiguities include the meaning of 'flexibility and exemptions', which are part of the evolving framework for market access negotiations. This may (or may not) be read as allowing developing countries to opt for much smaller concessions than those to be undertaken by the OECD, or even for no concessions. To explore these issues, we examine the impact of multilateral liberalization, developing possible trade liberalization under the Doha Round, starting from a realistic 'baseline' including Chinese WTO Accession and the 2004 EU enlargement. This allows us to focus on effects specifically attributable to trade liberalization under the Doha Round and the potential impact of the Doha Round itself. To this end we employ a global applied general equilibrium model, featuring imperfect competition and variety effects. Scenarios include agriculture, manufactures, and services liberalization, as well as trade facilitation. We conclude that active developing country participation in terms of market access concessions is critical to their prospects. If developing countries continue for the most part with business as usual after the round, in terms of trade policy, there is little scope for actual benefits accruing to developing countries. South-South trade liberalization is key to the 'development' part of the Doha Development Agenda.

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Trade liberalization in the Doha Development Round

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1. INTRODUCTION

The international trading system is a cornerstone of the world economy, and the World Trade Organization (WTO) is the foundation of the international trading system. It is therefore of great concern that the WTO's latest round of multilateral trade negotiations is struggling with a poorly defined agenda.

The Doha Round – known to specialists as the 'Doha Development Agenda' – faced a long series of launch-delays and a spectacular launch-failure in Seattle in 1999. While the talks did take off in 2001, the negotiating agenda is still ambiguous in a number of crucial areas.

This paper argues that these ambiguities matter greatly. We find that the Round could provide anything from negligible to substantial gains – especially for developing nations – depending on how the ambiguities are clarified. The negotiators, in other words, are coming up to some important forks in the road. Our findings show that

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the world should be very concerned with the choices they make. It is too early to make clear predictions about the directions they will take. The general tendency, however, suggests that the choices that are likely to be made will be suboptimal, resulting in an eventual trade deal that yields only meagre benefits for developing nations. Somewhat paradoxically, it is the negotiating demands of the developing nations themselves that may be ultimately responsible for this inferior outcome.

The core of our analysis is the simulation of a set of scenarios – what-if experiments – based on alternative liberalization approaches for three principal areas:

- agriculture liberalization;
- tariff liberalization for manufactured goods; and
- trade liberalization for services trade.

These scenarios are meant to illustrate the implications of the various choices that must be made in the near future. As such, they should be viewed as stylized possibilities rather than exact representations. For example, it has not been decided whether developing nations will participate in the industrial-goods tariff-cutting on the same basis as developed nations. We evaluate the economic impact first assuming they do participate equally, and then assuming that they do not.

1.1. The methodology and caveat emptor

Judging the economic impact of a WTO agreement is massively complex, even when it comes to issues as straightforward as tariff cutting. The eventual Doha Round agreement should lower thousands of individual tariffs in each WTO member country and there are about 150 members. The result would be important shifts of resources among sectors in most nations in the world, along with attendant changes in the prices of goods and productive factors. Due to international trade, the supply and demand factors in each nation affect resource allocation in all other nations. How can economists evaluate the impact of these choices? The most practical way of proceeding is to employ a large-scale computable general equilibrium model that allows simultaneous consideration of all the effects. This is the approach we adopt.

While the methodology employed is comparable to that used in recent studies of these issues, we extend this literature by including market structure in the modelling exercise, and by stressing a policy benchmark including China's accession to the WTO, the Agenda 2000 reforms to the CAP, the 2004 enlargement of the EU, and the elimination of textile and clothing quotas.[1] We cover the areas of agricultural liberalization, liberalization in industrial tariffs, liberalization in services trade, and trade facilitation measures. Our services scenarios build on estimates of tariff equivalents for cross-border services trade.

[1] Recent work in this area includes studies by Anderson *et al.* (2001), the World Bank (2002, 2003, 2005), and the WTO (2004).

Given the necessarily speculative nature of the scenarios we evaluate, and the simplifications that are obviously necessary in modelling the entire world economy, our results should not be taken as precise predictions. The real value-added in the exercise lies in a comparison of the simulated effects of the various choices facing nations in the Doha Round. Take, for example, the choices that must be made before the agricultural liberalization talks can be completed. Domestic subsidies may or may not be affected, developing countries may or may not have to liberalize, and certain politically sensitive food sectors may yet again escape from meaningful liberalization. Comparing the gains and losses of various nations and groups of nations under the various alternatives, we believe our work should help negotiators make more informed choices on these issues.

1.2. Summary of our findings

Our key finding concerns the importance of effective participation by developing countries. Put simply, developing nations will gain only modestly from the Doha Round if they fail to liberalize their own barriers. For example, in the area of manufacturing tariff liberalization, previous WTO Rounds have lowered rich-nation tariffs on industrial good to very low levels, except on a few sectors like clothing. Tariff cutting by developing nations is therefore necessary if the Round is to have a large impact on industrial trade flows. In this sense, liberalization by developing nations is critical to the 'development' part of the Doha Development Agenda. We note, however, that this is regrettably downplayed in the current negotiations by all WTO-partners. The emphasis instead is on exemptions for developing countries (called Special and Differential treatment).

A similar story emerges in agriculture. Liberalization of domestic and export subsidies by the rich nations – the EU and US in particular – would raise the world price of food. Because some developing nations are net food exporters and some net food importers, a narrow focus on rich-nation agricultural liberalization would have mixed effects on the 'South'. The point is that regardless of how unfair they may be, EU and US subsidies foster terms of trade gains for food importers and terms of trade losses for food exporters. Moreover, some of the biggest food exporters – Canada, New Zealand and Australia – are not developing nations. Thus, a narrow focus on rich-nation agriculture liberalization will produce substantial gains for rich-nation consumers and rich-nation food exporters, but very uneven gains for developing nations. We find that the South would gain more if the developing and the developed nations simultaneously liberalized their agricultural sectors.

We also find that the so-called trade facilitation aspects of the talks (measures that cut bureaucratic barriers to trade), and the liberalization in services are likely to yield substantiation gains to developing nations. This suggests that developing country negotiators might be wise to give these aspects of the Doha Round a higher valuation vis-à-vis, for example, agriculture liberalization.

1.3. The paper's organization

The paper is organized as follows. Section 2 discusses the market access aspects of the Doha Round negotiations. This leads to our liberalization scenarios for the subsequent quantitative analysis. Section 3 describes briefly the modelling framework used. Section 4 discusses the results of our liberalization scenarios. It starts with trade, and moves through production and income effects. We also examine the implications of the likely outcome of little actual liberalization by developing countries as part of this round of negotiations.

2. THE BASIC ISSUES IN THE DOHA ROUND

The situation facing Doha Round negotiators is conditioned in an important way by the history of earlier Rounds. In this section, we explain the necessary background and discuss the basic issues that remain to be decided in the on-going Doha Round talks.

2.1. The 'market access' agenda

While the Doha Round was officially launched in November 2001, some sector-specific negotiations had already started in 2000. The Doha Declaration – the document that establishes the agenda for the on-going talks – mandates negotiations on a broad range of issues (see Neary, 2004). These can be grouped, roughly, into basic market access issues on the one hand, and the so-called Singapore issues on the other. The Singapore issues include such topics as trade and competition linkages, labour market linkages to trade, and trade and the environment. It also includes efforts at improved trade facilitation. We focus here on the set of issues related directly to market access, meaning tariffs and export subsidies, in combination with trade facilitation. The market access negotiations include agriculture, manufactured goods and services. The negotiations on agriculture and services had already started separately in early 2000, as mandated by the Uruguay Round Agreements. They were simply folded into the broader Doha mandate with the Ministerial declaration in 2001.[2]

2.2. Industrial tariff negotiations

A key distinction in WTO tariff-cutting talks is the difference between so-called 'bound' tariff rates and 'applied' tariff rates. The bound rate is the maximum tariff a

[2] As of December 2004, the WTO's Internet site still lists January 2005 as the closing date for most negotiations, with some negotiations expected to be closed by 2003 (i.e. a pending closure dated in the past) and others to be reviewed at that time. In reality, all of the deadlines have slipped somewhere into the future. Given the history of past rounds (like the Uruguay Round), this is simply a normal part of the process, which takes much longer than originally planned. The 'July Package', adopted by WTO ministers on 1 August 2004, defines the current state of play.

WTO member can charge, with these limits having been negotiated either in earlier Rounds, or when the nation joined the WTO. Applied rates are the rates nations actually apply to imports. Traditionally, WTO tariff-cutting concerned cuts in the bound rates, not cuts in applied rates. The coverage and level of these bindings is an important element of the initial conditions for the negotiations. Table 1 provides information on the share of industrial-product tariffs under negotiation that remain either unbound or bound above applied rates. The key points are:

- While tariffs in the OECD (and Latin America) are generally bound, many Asian and African economy tariffs remain unbound despite more than a four-fold increase in the coverage of developing-country tariff bindings in the Uruguay Round (Abreu, 1996).
- For almost all developing countries, existing bindings are, on average, well above applied rates, reflecting a combination of relatively high initial bindings, and the subsequent wave of reductions in applied rates (see Blackhurst *et al.*, 1996; Francois, 2001).

In addition to the impact of general Uruguay Round commitments on tariffs now under negotiation, some of these tariffs also reflect more recent sector-based tariff-cutting talks. These talks committed the participating nations to implement zero tariffs in the specific sectors concerned (called 'zero-for-zero' in WTO parlance). This is reflected in the next-to-last column of Table 1.

- As a result of zero-for-zero efforts, OECD economies have between roughly 10% and 30% of tariff lines bound at 0%.
- Most developing countries have opted out of this process. Zero-for-zero increased developed country duty-free imports to 43% of total imports (Laird, 1998).

The process itself ground to a halt after the initial talks that focused on the information sectors, called the Information Technology Agreement (ITA). This seems to have been for two reasons: (1) the sectors in which OECD economies could easily reach agreement had already been included, and (2) those sectors remaining involve North-South issues not susceptible to this approach. In other words, the cherries have been picked, leaving us with the hard nuts to work over in the current negotiations.

2.2.1. Tariff 'peaks' and the 'binding overhang'. With the implementation of Uruguay Round commitments, average *ad valorem* tariffs in the industrial countries generally are around 3%. This is reflected in the first columns of Table 2. However, there are important exceptions. In the textiles and clothing sector the average rate is roughly three times the overall average. This is reflected in the standard deviation and maximum tariff columns. Specifically,

- With full implementation of current commitments, the estimated simple average industrial tariff in the United States is 3.2%, with a standard deviation of 4.3, and a maximum tariff of 37.5%.

Table 1. Industrial tariff rates and bindings – post Uruguay Round and Information Technology Agreement

	% of MFN imports subject to:				
	Bound tariffs	Tariffs bound above applied rates	Tariffs unbound or bound above applied rates	Share of bound duty free tariff lines to total tariff lines	Total tariff lines
Australia	96.9	31.7	34.8	17.7	5,520
Canada	99.8	45.7	45.9	34.5	6,261
Japan	95.9	0.1	4.2	47.4	7,339
Korea	89.8	3.4	13.6	11.6	8,882
European Union	100.0	17.7	17.7	26.9	7,635
New Zealand	100.0	46.5	46.5	39.5	5,894
Norway	100.0	36.5	36.5	46.6	5,326
United States	100.0	14.0	14.0	39.4	7,872
Poland	92.8	44.6	51.8	2.2	4,354
Hungary	93.6	3.3	9.7	10.4	5,896
India	69.3	14.8	45.5	0.0	4,354
Indonesia	92.3	86.6	94.3	0.0	7,735
Malaysia	79.3	31.0	51.7	1.6	10,832
Philippines	67.4	15.5	48.1	0.0	5,387
Singapore	36.5	11.7	75.2	15.2	4,963
Sri Lanka	9.2	1.4	92.2	0.1	5,933
Thailand	67.4	8.9	41.5	0.0	5,244
Brazil	100.0	91.0	91.0	0.5	10,860
Argentina	100.0	99.9	99.9	0.0	10,530
Chile	100.0	99.7	99.7	0.0	5,055
Colombia	100.0	97.7	97.7	0.0	6,145
El Salvador	97.1	96.0	98.9	0.0	4,922
México	100.0	98.4	98.4	0.0	11,255
Uruguay	100.0	96.3	96.3	0.0	10,530
Venezuela	100.0	90.3	90.3	0.0	5,974
Peru	100.0	98.5	98.5	0.0	4,545
Tunisia	67.9	41.5	73.6	0.0	5,087
Turkey	49.3	0.0	50.7	1.4	15,479
Zimbabwe	13.6	3.9	90.3	3.0	1,929

Note: Shares are trade weighted.
Source: Francois (2001), based on WTO and World Bank data on Uruguay Round and post-Information Technology Agreement schedules.

- The EU has a higher average, but less dispersion. (The EU has an average of 3.7%, a standard deviation of 3.6%, and a maximum tariff of 17%.)

For the developing countries in Table 1, average industrial tariffs range from a low of 3–4% to a high of more than 20%. Table 2 presents detailed data for three developing countries: Brazil, India and Thailand. These countries span the spectrum of developing country bindings as reflected in Table 1.

- Brazil's tariffs are all bound, though the average rate for industrial products is 14.9 percentage points above the current applied rate. This gap is called a '*binding overhang*' (see Francois and Martin, 2003.)

Table 2. Applied manufactures tariffs before and after a 50% cut in average tariff bindings

	Post-UR and ITA tariffs				Effect of cut in bindings on applied tariffs				
	Simple average	Standard deviation	Maximum tariff	Binding overhang	Simple average	Standard deviation	Maximum tariff	Binding overhang	Percent reduction in average
EU	3.7	3.6	17	0	1.9	1.4	5	0	−47.7
Japan	2.3	3.4	30.9	0	1.2	1.4	5.6	0	−48.5
USA	3.2	4.3	37.5	0	1.7	1.6	6.1	0	−48.3
Brazil	15.9	6	35	14.9	13.5	4.2	16.7	1.9	−15.4
India	19.2	16.5	40	3.9	11.3	9.2	30.5	0.3	−41.3
Thailand	10.5	10.8	80	7.8	7.2	6.1	20.7	2	−31.6

Source: Francois and Martin (2003).

- India and Thailand's tariffs are partially covered by bindings, again with significant binding overhang.
- In general, for developing countries, binding overhang is large enough that reductions in the range of 50% are necessary to force any reductions at all in average applied rates for countries like Brazil.
- For many countries, even this will have little or no effect, as tariffs are largely unbound.

Of course, this limits severely the negotiating leverage of developing countries in the WTO in the current round. This is also why the debate over using bound, applied or 'historic' rates in the WTO as a starting point for negotiations is important in current negotiations.

2.2.2. Tariff preference erosion. One of the big issues for developing nations is known as 'preference erosion'. As a result of past WTO Rounds, rich nations have systematically charged a lower tariff on industrial imports from poor nations. These preferences were granted under a variety of different agreements. Indeed, South-North trade is governed by a virtual alphabet-soup of preferential agreements, e.g. GSP, ACP, EBA, and AGOA. They often excluded or put limits on 'sensitive' goods; industrial and agricultural products are typically excluded from such agreements (although the EU grants some preference to the food exports of former French and British colonies). Since the preference in these agreements depends on the fact that developing countries enjoy tariffs that are lower than the standard WTO tariff rate (known as most favoured nation, or MFN rates), cuts in rich nations' MFN tariffs reduces that value of these preferences – hence the moniker, preference erosion (see Bouët *et al.*, 2004b, for an empirical study, and Achterbosch *et al.*, 2004, for an analysis for Africa).

While this concern is frequently raised in Doha talks, there are big question marks as to how much the preferences are actually used. For example, Manchin (2004) and World Bank (2005) find that many developing nations do not use their preferences. Low utilization rates may result from administrative complexity, and associated costs, information deficiencies and from complex rules of origin. Since preferential trade agreements provide member countries with reductions on tariffs, rules of origin are needed in order to establish whether a given good is actually eligible for duty reductions. These rules of origin are usually extremely detailed and complex, and may contribute to the low level of preference utilization.

Obviously, if preferences are not effectively utilized to begin with, then erosion is less of an issue. Instead, preferential regimes should be more transparent and less restrictive. For example, rules of origin should be simplified (Augier *et al.*, 2004).

2.3. Agriculture negotiations

The stage for current agriculture negotiations was also set by the Uruguay Round outcome, specifically by the Uruguay Round Agreement on Agriculture (URAA).

One key difference from industrial products is that essentially all agricultural tariffs are bound. Indeed, one of the key principles in the Uruguay Round agriculture talks was 'tariffication', that is, the principle that all non-tariff barriers should be turned into tariffs and those tariffs should be bound. However, in both industrial and developing countries, there is a large degree of binding overhang resulting from 'dirty tariffication' or the use of 'ceiling bindings' (Hathaway and Ingco, 1996). That is, when translating their non-tariff barriers into tariff equivalents, WTO members often far overestimated the equivalent tariff. As a result, the tariffication often resulted in little liberalization and nations often found themselves voluntarily applying tariffs that were far below the bound rates. Commitments not to erode current market access were meant to limit the scope for increased protection through dirty tariffication. As the name implies, dirty tariffication involved violations of the spirit, if not the letter, of the URAA text. It involved setting tariff bindings at rates far above then current effective protection rates. The practice of setting high bindings complicated the problem of measuring the impact of further commitments to reduce bindings.

The current round of agricultural negotiations was agreed to as part of the Uruguay Round agreement, while the negotiating parameters (tariffs, tariff-rate-quota levels, subsidy commitments, etc.) must also be viewed in the context of the schedules of URAA commitments. The system that has emerged is complex and similar to the old Multi-Fibre Agreement – the maze of bilateral, product-specific quotas that restricted trade in textile and clothing until 1 January 2005. The equivalent in agriculture features a mix of bilaterally allocated tariff-rate-quotas (i.e. quantitative limits on the amount of imports to be granted the below-the-binding tariff rate) and tariffs.

Similar slips in the URAA's stated goal of no backsliding and modest liberalization occurred with respect to the two other main pillars of URAA: 'domestic support' (i.e. production subsidies of various sorts) and export subsidies. Negotiating parties (generally the relevant agriculture ministries) gave considerable leeway to themselves with regard to selection of the appropriate reference period from which to measure export subsidy reductions. In addition, the move to a price-based system for protection has, in many cases, been subsumed into an effective adoption of explicit quotas. The disciplines on domestic subsidies have also been weakened by a relatively soft definition of the aggregate measure of support (AMS) vis-à-vis individual subsidies and the scope for reallocation of expenditures within the AMS (see Tangermann, 1998 for discussion).

Basically, in agriculture, we are in a world that allows scope for great policy discretion and uncertainty as a result of the loose nature of the commitments made. In addition, the setting of high bound rates made possible the conversion of NTBs into even more restrictive import tariffs. This in turn made quantity disciplines necessary to avoid backsliding. As a result, despite the stated goals of subsidy reductions and a shift toward price-based border measures, one of the more striking features of the regime that has actually emerged from the URAA is the prominent role that quantity measures have taken in the new architecture. Basically, the agricultural trading system is complicated and

still evolving. Policy measurement in this area has converged on the use of price-based measurements that emphasize the tax/subsidy equivalent of policy. (As this approach reflects available data, this is the approach we employ in this paper as well.)

Viewed in conjunction with industrial protection, the basic pattern is that the industrial countries protect agriculture and processed food, while protection in developing countries is more balanced (though also higher overall) in its focus on food and non-food manufactured goods.

2.4. Services negotiations

For services, market opening is difficult to define. For example, it is hard to judge just how open a particular nation is to foreign banks since the barriers are thoroughly mixed in with domestic regulation, standards and business practices. For this reason, 'market access' – as 'market opening' is known in WTO jargon – has been 'qualitative' in service sectors. There have not been targeted numeric measures *per se*, but rather commitments in the cross-border movement of consumers and providers and the establishment of foreign providers.

In fact, for academics, the General Agreement on Trade in Services (GATS) seems to confuse both foreign direct investment (FDI) and migration with international trade, defining all three as trade (see Deardorff, 2001). This means that the current negotiations involve a mix of rules on FDI, movement of persons, and cross-border commerce. Ultimately, cross-border commerce is the actual 'trade' following from commitments in these areas, though it is governed by investment rules and rules governing movement of persons. It is also affected by yet more WTO agreements on procurement in public sectors.

These factors have meant that academic efforts to quantify market access in services (a basic requirement if we want to quantify liberalization) have been problematic. The initial approach (see Hoekman, 1995) was to establish an inventory measures. As an alternative approach, there has also been a recent set of research based on price-cost comparisons (see Kalirajan *et al.*, 2000; Nguyen-Hong, 2000; OECD, 2001). We work here with estimates of 'tariff equivalents' for services trade (see Francois *et al.*, 2003 for details). These are based on the pattern of residuals from a simple econometric model of national imports, estimated from the detailed global trade data for services trade that serve as the basis for our model dataset. The estimates we work with are summarized in Table 3. They are admittedly crude, but they are the best available for the purposes of simulating liberalization; they are our preferred estimates as they map directly to the pattern of data in our worldwide model.

The pattern that emerges is consistent with that for industrial tariffs. It appears that barriers to services trade are higher (often much higher) in developing countries than in the OECD. Hence, as in the case of industrial tariffs, the effects of further GATS negotiations will hinge critically on developing country participation or non-participation, and the extent to which they commit to actual liberalization rather than stand-stills (the qualitative equivalent of ceiling bindings).

Table 3. Estimated services trade barriers (percentage trade cost equivalents)

Abbrev.	Region	Trade	Transport and logistics	Business services	Other services
NLD	Netherlands	0.0	0.0	0.0	0.0
FRA	France	12.3	12.1	18.3	19.2
DEU	Germany	0.0	13.7	9.5	0.0
REU15	Rest of EU	12.3	0.0	0.0	0.0
CEEC	CEECs Mediterranean and Middle	1.6	0.0	0.0	0.0
MED	East	2.3	0.0	0.0	0.0
NAM	North America	0.0	22.6	1.2	16.0
SAM	South America	13.8	10.4	8.6	5.9
CHINA	China	0.0	14.5	37.4	3.7
INDIA	India	61.3	63.9	32.1	62.2
HINCAS	High income Asia	0.0	0.0	6.3	0.0
OASPAC	Other Asia-Pacific	0.0	0.0	0.0	0.0
AUSNZ	Australia and New Zealand	0.0	2.3	9.5	15.2
SAF	South Africa	28.3	17.5	32.8	22.6
SSA	Sub-Saharan Africa	0.0	0.0	0.0	0.0
ROW	Rest of World	7.2	0.0	0.0	0.0

Source: Francois *et al.* (2003).

2.5. Trade facilitation

In addition to fairly standard WTO issues, such as tariff cutting and agriculture liberalization, one non-standard issue was included in the Doha Round, namely 'trade faciliation'.[3] Basically, this is an effort to reduce red-tape barriers to trade such as delays at customs, excessive paper-work, etc. In particular, the document that set the broad agenda for the Doha Round, the Doha Declaration, calls for 'negotiations on trade facilitation . . . [for] further expediting the movement, release and clearance of goods, including goods in transit' (Doha Declaration, para. 27). Areas covered by current negotiations include freedom of transit, fees and formalities in connect with importation and exportation, and publication and administration of trade regulations.

Studies of regional integration initiatives (Baldwin and Francois, 1999; Smith and Venables, 1988) have emphasized the potential for liberalization initiatives to substantially reduce the barriers covered in these negotiations. Conceptually, these costs are different from the price and quantity protectionist measures used for manufactures and agriculture. They are basically transaction costs and thus primarily a deadweight loss, involving increased costs for commerce without actual collection of revenues.

Available estimates of the trading costs targeted by these negotiations are very rough at best. Nonetheless, they provide some sense of the magnitudes involved. An overview of estimates is provided in Table 4. In the context of the EC single market

[3] This and three other, non-standard issues were first brought into WTO's ken at the 1996 Singapore Ministerial Conference; they are referred to as the 'Singapore Issues' by cognoscenti.

Table 4. Estimated cost savings from trade facilitation

Source of study	Estimate and comments
European Commission (1992)	In the context of the Single Market program, savings may amount to 1.6–1.7% of the value of trade due to savings on administrative costs of transactions representing 7 to 10% of the value of trade.
UNCTAD (1994)	Trade facilitation could reduce this to 5–8%.
Australian Industry Commission (1995)	Trade facilitation may save 5–10% of the total value of trade, through reduced transaction costs, in the APEC context.
Japan EPA (1997)	A 'modest' APEC initiative may lead to 2% savings (as a share of the value of trade) due to reduced transaction costs.

programme, elimination of internal customs procedures and related administrative streamlining were projected to reduce trading costs by up to 2% of the value of trade (EC, 1988). Globally, UNCTAD (1994) has noted that trading costs represent 7–10% of the cost of delivered goods. Like the EC, UNCTAD also estimates that simple trade facilitation measures could reduce these costs by 2% of the value of trade. The Australian Industry Commission (1995) has estimated potentially higher savings in the context of APEC, ranging from 5 to 10% of the value of trade. Under more modest facilitation initiatives, the Japanese Economic Planning Agency (1997) has estimated savings at 2% in an APEC context, while Francois (2001) has employed a similar range of estimates. Manchin's (2004) analysis of EU preferences suggests that even for preference-based free trade, transaction costs may be 4–5% of the value of trade.

3. THE MODEL AND DATA

We turn to a brief overview of the global computable general equilibrium (CGE) model used here. The full set of model code, datasets and background documentation is available for download.[4]

The theoretical backbone of the model is the standard textbook Helpman–Krugman model that combines elements of the 'new' trade theory that emphasizes increasing returns and imperfect competition with elements of the 'old' trade theory that stresses factor endowment and technology differences. In addition, it includes the basic features of the 'new economic geography' models (Krugman, 1991), namely agglomeration economies that operate via intermediate goods. Consequently, the model considers returns to scale gained from increased varieties and expansion of

[4] Files can be downloaded at http://www.intereconomics.com/francois. This includes a technical annex describing the model in more detail.

market size, either nationally or globally (see Francois and Nelson, 2002 for details). A similar approach was followed in the *ex-ante* literature on the Uruguay Round (see, for example, Harrison *et al.*, 1997 and Francois *et al.*, 1993).

Since so much of international trade is in intermediate goods, our CGE model – in line with virtually all others – includes detailed input-output linkages among industries (based on regional and national input-output tables). These explicitly link industries in a value added chain from primary goods, over continuously higher stages of intermediate processing, to the final assembling of goods and services for consumption. This is important since liberalization of imported intermediate goods can feed through to the competitiveness of final goods sectors that employ the intermediates. Note that the inter-sectoral linkages can be direct, like the input of steel in the production of transport equipment, and indirect, via intermediate use in other sectors (steel used in transport equipment which is then used in transport services).

Given the increasing returns and agglomeration forces in the model, the *laissez faire* outcome is not optimal for any individual nation. In particular, nations may gain if trade policy changes expand sectors where the agglomeration scale economies are particularly strong. Likewise, a liberalization that shrinks such sectors will, all else equal, cause a reduction in the nation's output.

The most important aspects of the model can be summarized as follows: (1) it covers all world trade and production; (2) it allows for scale economies and imperfect competition; (3) it includes intermediate linkages between sectors. The inclusion of scale economies and imperfect competition implies agglomeration effects like those emphasized in the recent economic geography literature.

3.1. Detailed theoretical structure

We turn next to the basic theoretical features of the model. In all regions there is a single representative, composite household in each region, with expenditures allocated over personal consumption and savings (future consumption) and over government expenditures. The composite household owns endowments of the factors of production and receives income by selling them to firms. It also receives income from tariff revenue and rents accruing from import/export quota licences (when applicable). Part of the income is distributed as subsidy payments to some sectors, primarily in agriculture.

On the production side, in all sectors, firms employ domestic production factors (capital, labour and land) and intermediate inputs from domestic and foreign sources to produce outputs in the most cost-efficient way that technology allows. Perfect competition is assumed in the agricultural sectors as indicated in Table A1 of the Appendix (notice that the processed food products sector is characterized by increasing returns to scale). In these sectors, products from different regions are assumed to be imperfect substitutes in accordance with the so-called 'Armington' assumption. Production under imperfect competition is discussed below.

Prices on goods and factors adjust until all markets are simultaneously in (general) equilibrium. This means that we solve for equilibriums in which all markets clear. While we model changes in gross trade flows, we do not model changes in net international capital flows. Rather our capital market closure involves fixed net capital inflows and outflows. This does not preclude changes in gross capital flows (see Hertel *et al.*, 1997 for a discussion of macroeconomic closure; our approach facilitates welfare analysis). To summarize, factor markets are competitive, and labour and capital are mobile between sectors but *not* between regions. All primary factors, labour, land and capital are fully employed within each region.

We model manufacturing and services as involving imperfect competition. The approach followed involves monopolistic competition. This is discussed in detail in the Appendix. Monopolistic competition involves scale economies that are *internal* to each firm, depending on its own production level. In particular, based on estimates of price-cost mark-ups, we model the sector as being characterized by Chamberlinian large-group monopolistic competition. An important property of the monopolistic competition model is that increased specialization at intermediate stages of production yields returns due to specialization, where the sector as a whole becomes more productive the broader the range of specialized inputs. These gains spill over through two-way trade in specialized intermediate goods. With these spillovers, trade liberalization can lead to global scale effects related to specialization. With international scale economies, regional welfare effects depend on a mix of efficiency effects, global scale effects, and terms-of-trade effects. Similar gains follow from consumer goods. Recent testing of CGE models against historic data work indicates that this approach works 'best' vis-à-vis Armington models, when tracked against actual trade patterns (see Fox, 1999, who uses the US-Canada FTA as a natural experiment for specification testing with the Michigan Model). Key parameters, such as trade substitution elasticities and mark-ups, are reported in Table A1 of the Appendix.

3.2. Model data and the benchmark

As always with such simulation studies, we must calibrate the model to a baseline set of prices, output and consumption values and trade flows. The data we use to this end comes from a number of sources. Data on production and trade are based on national social accounting data linked through trade flows (see Reinert and Roland-Holst, 1997). These social accounting data are drawn directly from a worldwide collaboration on CGE modelling known as the Global Trade Analysis Project (GTAP). Specifically, we use dataset version 6.4 (Dimaranan and McDougall, 2002). The GTAP version 6 dataset is benchmarked to 2001, and includes detailed national input-output, trade, and final demand structures. The basic social accounting and trade data are supplemented with trade policy data, including additional data on tariffs and non-tariff barriers.

The data on tariffs are taken from the WTO's integrated database, with supplemental information from the World Bank's recent assessment of detailed pre- and

post-Uruguay Round tariff schedules and from the UNCTAD/World Bank WITS (World Integrated Trade Solution) dataset. The mapping of these protection data to bilateral trade data has been a joint effort by the Centre d'études Prospectives et d'information Internationales (CEPII) and the International Trade Center (WTO/ITC). This database is used to convert tariffs applying to trade in products measured at a very disaggregate level (HS6) into their *ad valorem* equivalent. The underlying import protection measures include *ad valorem* tariffs, specific tariffs, quota, tariff rate quota regimes, and anti-dumping duties. An important feature of the dataset is the inclusion of existing trade preferences. See Bouët *et al.* (2004a) for a comprehensive documentation.

All of this tariff information has been mapped to GTAP model sectors. Services trade barriers are based on the gravity model estimates described in Francois *et al.* (2003).

3.2.1. Updating reality. Although our benchmark data is from 2001 (this is the best available given the inclusion of developing nations), a number of very important changes have marked the world trading system since then. In order to have a good idea on what the Doha Round might do, we need to update our 2001 benchmark for the key events, namely the accession of China to the WTO, the phase out of the worldwide bilateral quota scheme for textile and clothing (known as the ATC in WTO circles), and the 2004 enlargement of the EU to 25 members. We also include EU reforms that were part of the so-called Agenda 2000 plan (see Meijl and Tongeren, 2002). To accomplish this, before conducting any policy experiments we first run a 'pre-experiment' in which we do the following:

- implement the rest of the Uruguay Round tariff commitments;
- implement the ATC (agreement on textiles and clothing), phasing-out quotas;
- implement China's accession to the WTO;
- implement Agenda 2000; and
- implement the EU enlargement.

Our ATC quota elimination in the benchmark is only partial. In December 2004, China announced that it would place export taxes in place once quotas were removed. This is meant to forestall antidumping and safeguard actions by the United States, European Union and Canada when quotas are eliminated. In addition, China was forced to allow special safeguards for this sector as part of its accession agreement. As such, we consider it realistic to implement only a partial liberalization of textiles and clothing restrictions (50% of estimated export tax equivalents) as part of the benchmark experiment. Either China, or its partners, will take actions to avoid full liberalization. Given all the benchmark adjustments, the dataset we work with for our actual experiments is a representation of a notional world economy (with values in 2001 dollars) where we have already realized many of the trade policy reforms programmed for the next few years.

The social accounting data have been aggregated to 17 sectors and 16 regions. The sectors and regions for the 17 × 16 aggregation of the data are given in Table 5.

Table 5. Scenario definitions

Instruments:	Scenarios: Global Trade Round	OECD-based Trade Round
Import tariffs in agriculture and manufacturing	50% reduction	50% reduction for OECD
Estimated border measures in services	50% reduction	50% reduction for OECD
Export subsidies	50% reduction	50% reduction for OECD
Domestic agricultural support in OECD countries	50% reduction	50% reduction for OECD
Trade facilitation	1.5% of value of trade	1.5% of value of OECD import trade

Details on export shares, production shares, and self-sufficiency ratios (output-to-consumption ratios) are shown in Tables A4, A5 and A6 in the Appendix. These provide a rough sense of the importance of various sectors across our sample of countries in terms of production and trade in the benchmark equilibrium.

3.3. Market access scenarios

While the Doha Round has so far had a stop and go history, WTO members have agreed, as of late 2004, to target the elimination of export subsidies in agriculture, reductions in border protection and domestic subsidies in agriculture, reductions in manufactured goods tariffs, services liberalization, and trade facilitation. These market access issues are in addition to other issues, like investment measures, intellectual property, and a range of other issues that extend well beyond the traditional areas of market access, but for which prospects for progress are not as clear or positive.

3.3.1. Choices to be made in market access talks. Our interest here is in the market access component of the Doha Round negotiations. So far, even with the most recent announcements, we have little more than an agreement to continue with market access negotiations already agreed to in 2001 in the Doha declaration. Basic issues of definition remain, including the extent to which developing countries will actually liberalize as part of the process, and the extent to which OECD countries will actually eliminate export subsidies. To bring these elements together, we define two sets of scenarios, summarized in Table 5.

The first scenario is a partial liberalization scenario implemented globally. This is the optimistic (some might call it 'naïve') scenario. In the 'Global Trade Round' scenario, all trade protection instruments are reduced globally by 50%, as is domestic support for agriculture in the OECD. Specifically, this involves a 50% reduction in agricultural and industrial tariffs and export subsidies, a 50% reduction in OECD domestic support for agriculture, a 50% reduction in the tariff-equivalent of services barriers, and a partial reduction in trading costs, related to trade facilitation measures.

Table 6. Sectors and regions

Regions		Sectors	
Europe		*Primary agriculture*	
NLD	Netherlands	CERE*	Cereals
FRA	France	HORT*	Horticulture and other crops
DEU	Germany	SUGA*	Sugar, plants and processed
REU15	Rest of EU 15	INTLIV*	Intensive livestock & products
EU10	Recent EU accession countries	CATLE*	Cattle and beef products
Africa and Middle East		DAIRY*	Milk and dairy
MED	Mediterranean and Middle East	OAGR*	Other agriculture
SAF	South Africa	*Manufactured and processed foods*	
SSA	Sub-Saharan Africa	PROCF	Processed food products
Americas		TEXT	Textiles, leather and clothing
NAM	North America	EXTR	Extraction industries
SAM	South America	CHEM	Petro and chemicals
Asia and Pacific		MELE	Metal and electrotechnical industry
CHINA	China	OIND	Other industries
INDIA	India	*Services*	
HINCAS	High income Asia	TRAD	Trade services
OASPAC	Other Asia-Pacific	TRAN	Transport services
AUSNZ	Australia and New Zealand	BSVC	Business, financial and communications services
Rest of World		OSVC	Other private and public services

Note: * denotes a competitive sector in all applications.

Services liberalization involves a 50% or a full reduction in the barriers shown in Table 3. The second experiment is our pessimistic (or perhaps just realistic) scenario. In this experiment, developing countries are able to opt out of any actual liberalization. This is quite likely, given the combination of binding overhang as discussed above, and the pressure for flexibility for all developing countries and special and differential treatment (S&D) exemptions for the least developed countries in the market access talks. S&D implies lower targets for tariff reductions for developing countries. Combined with binding overhang, we may then expect little or no need to actually cut tariffs.

Both experiments are decomposed, both in terms of sectors and instruments, and also in terms of country grouping. For the decomposition by negotiation component (agriculture, services, goods, trade facilitation), we use a decomposition algorithm for non-linear policy experiments outlined in Harrison *et al.* (2000). Because of the decomposition method used, the reader can roughly pick and choose, combining the results of hybrid experiments involving elements from different experiments, for a rough sense of possible effects.

4. RESULTS

We now turn to the results of the experiments outlined above. The trade liberalization scenarios discussed earlier have their immediate impact on trade flows. It is from there that a further chain of economic interactions leads to shifts in production, national income and employment. We start with trade effects, and then follow these with a discussion of output and national income effects.

4.1. Trade effects

Table 7 presents the estimated changes in bilateral trade flows for three regional groupings. We focus first on our Global Trade Round scenario, wherein all countries actually engage in liberalization. Under this scenario, global trade expands by 11%. Because increased exports also imply increased opportunity costs, trade growth far exceeds the income effects discussed below and shown in Tables 8 and 9.

The lowering of external trade barriers by the EU25 will inevitably lead to the erosion of the intra-EU trade preferences, and suppliers with lower costs are therefore able to enter EU markets on a more even basis. Reflecting this effect, Table 7 shows a −2% decline in intra-EU25 trade. Because no positive growth can really be expected from intra-EU trade, European exports only expand through penetration into third markets. Exports to developing countries grow fastest, mainly driven by processed food exports, while growth of exports to other developed economies is mainly driven by trade in manufacturing goods.

Suppliers from developing countries, who expand their exports to the EU by 16%, realize the most impressive growth in market share on European markets. Developing countries obtain the highest overall growth in exports (21%). They are simulated to expand exports to all destinations, but the greatest surge is observed in trade among developing countries themselves. The lower-left part of Table 7 separates agricultural trade from the aggregate. By comparing these numbers with those for all commodities we see that developing country exports are mainly driven by agricultural exports, with the exception of exports to other OECD countries, which sees smaller expansion in agricultural exports than in overall exports from developing countries. This is to a large extent due to the fact that the 'Other OECD' grouping comprises Australia and New Zealand, who are themselves important agricultural exporters.

Turning to the right panel of Table 7 we see that an OECD based round, with developing countries not participating in reform, reduces trade growth for this group of countries substantially. We offer two observations based on the results in Table 7. First, intra-developing country South-South trade shrinks relative to the base. This points to yet more trade diversion effects in the face of OECD countries lowering their trade barriers while non-OECD barriers remain in place.[5] Second, developing

[5] We refer to further trade diversion because the existing pattern of global trade barriers already diverts trade away from South-South exchange and toward North-South exchange because basically it is the North's trade barriers that have come down relative to post-1947 highs during successive rounds of GATT negotiations.

Table 7. Bilateral trade, percentage change value in bilateral import volumes

To → From↓	Global Trade Round				OECD-based Trade Round			
	EU25	Developing countries	Other OECD	Total	EU25	Developing countries	Other OECD	Total
	All commodities				All commodities			
EU25	–2	17	10	4	–1	7	11	3
Developing countries	16	26	21	21	7	–2	8	5
Other OECD	12	22	6	12	11	9	7	8
Total	4	22	11	11	3	5	8	5
To → From↓	EU25	Developing countries	Other OECD	Total	EU25	Developing countries	Other OECD	Total
	Agriculture and Food				Agriculture and Food			
EU25	–1	31	24	6	–1	3	12	1
Developing countries	25	44	24	32	17	5	16	12
Other OECD	31	36	25	29	27	14	22	21
Total	8	39	24	21	6	8	18	10

Source: Calculations from the authors' simulation model.

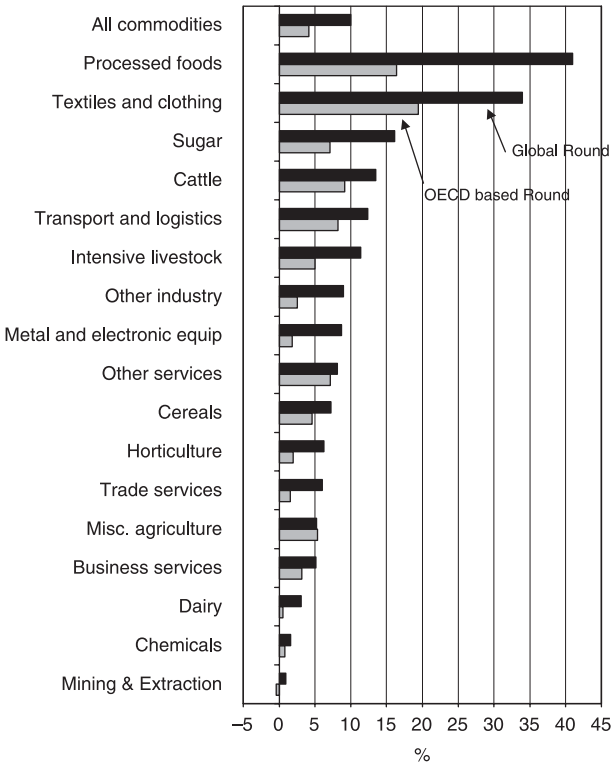

Figure 1. Change in global trade volume by commodity (%)

Source: Calculations from the authors' simulation model.

country exports to developed economies expand at a slower pace, including agricultural exports. This is because failure to engage in own reforms precludes specialization gains and insufficient resources are freed to allow expansion in export-oriented industries. The slower export growth implies that insufficient foreign exchange is earned to finance an expansion in imports.[6]

We contrast the global and OECD-based trade rounds in Figure 1. From the figure, a global trade round yields high export growth in those commodities that still have high rates of border protection. Processed foods (41%), textiles and clothing (34%), and sugar (16%) stand out.

An interesting case is textiles and clothing. Recall that our experiment assumes that the current quota regime, called the Agreement on Textiles and Clothing or ATC, is already phased out (with partial phase-out for China), and the trade liberalization experiment subsequently lowers the remaining import tariffs on textiles and clothing. This greatly boosts exports from some developing countries, especially from China and India, both of whom see a rough doubling of their textiles and clothing exports.

[6] A technical term in trade theory, Lerner symmetry, is relevant here. Import barriers also end up, in the end, suppressing exports. This is very evident in the pattern of developing country exports. Lerner symmetry works.

Table 8. Percentage change in the quantity of output: Global Trade Round

	EU25	Developing countries	Other OECD
Food	−0.6	0.7	−0.2
Cereals	−4.4	0.8	−2.3
Cattle	−8.8	3.8	−0.6
Manufacturing	−0.9	−0.4	−0.6
Textiles	−12.1	21.1	−32.8
Metal and electronic equip	−0.8	−8.9	2.2
Services	0.4	−0.1	0.1
Transport and logistics	3.0	1.5	−0.9
Business services	0.1	−2.2	0.2

Source: Calculations from the authors' simulation model.

Some sub-Saharan African countries currently enjoy trade preferences in textiles on the EU market, while some Central American countries have preferential agreements with the USA. These preferences are eroded in the process of multilateral lowering of import barriers, and consequently other developing country exporters are crowded out by supplies from China and India. At the same time, as China shifts into textiles and clothing, it pulls back from other export markets (like metal and electronic equipment), yielding opportunities for these same countries in other sectors. Manufacturing products see relatively less impressive trade expansion, which reflects the already low trade barriers in OECD countries. Services trade expansion is significant, especially in transport and logistics, which expands by 12% in the wake of global trade creation. As expected, a limited OECD-based round would limit the expansion of goods trade. Non-participation by developing countries leads to less North-South exports, and more importantly, reduces the scope for South-South trade, as indicated above in Table 7.

4.2. Output effects

We next turn from trade effects to output. Table 8 highlights estimated changes in output, measured as percentage changes. These output developments are jointly linked to trade developments and to the underlying importance of international trade in total sales. Only where a relatively large share of domestic production is exported does export growth correspond to a comparable growth in production.

Overall the changes in production are limited and much smaller than the changes in trade because only a small share of production is actually traded internationally. Furthermore, in general, underlying specialization patterns in the base data are reinforced by trade liberalization. Large exporters often expand production while importers decrease production. The general picture is that food production increases in developing countries (especially South America and South Africa) and decreases in the EU25 and other OECD countries. For services the picture is the opposite.

Services grow in the EU25 and (slightly) in other OECD countries. For manufacturing the growth is slightly negative in the three regional aggregates in Table 8 as resources are pulled into services, though this masks the underlying variation across individual countries. Some of our model regions strongly expand in certain products, while others decline.

As can be expected from reducing the initial high protection on agricultural products, output development for food is negative for the EU25. Cereals and livestock products (especially beef) experience the strongest contraction. Rice production declines with almost 20% in the highly protected high income Asia countries (Korea, Japan). Exporters such as South America and Australia-New Zealand increase their cereals production and their livestock output.

We also find that textile and clothing production becomes even more concentrated in China and India, both of which already have a strong revealed comparative advantage in these sectors. Production in the EU decreases due to increased import competition, and this affects the net exporting textile producers in the Central and East European Countries (CEEC), whose production declines by 36%. We have to realize, however, that the enlargement impact is already part of the baseline. During the enlargement process textile production in CEEC countries expanded rapidly, driven by increased exports to the EU15 countries. The new WTO round erodes the preferences associated with EU membership, therefore offsetting the process. A similar observation can be made for textile and clothing imports from Turkey, which currently enjoys preferential access to EU markets. This access is also offset by the new set of multilateral tariff reductions.

The metal and electronic equipment sector strongly expands in the Other Asia Pacific region, and we see some expansion in this sector in Africa as well. In part, this is in response to new opportunities as China withdraws resources from this sector to focus them instead on textiles and clothing. This result appears to be somewhat at variance with currently observed expansion of Chinese light manufacturing, and highlights how much the current pattern of Chinese industrial development has been driven by the uneven pattern of industrial trade barriers in the OECD.

For other manufacturing sectors and services, we find rather limited production effects. Small production effects are observed for trade services, business services and other services. Although these sectors obtain a positive growth in their exports, this does not significantly influence their production because these services are still predominantly operating at the national level. Their exports and imports form a relatively small share of production. (Note from Table A2 in the Appendix that the self-sufficiency indicator equals about 1 for all services sectors). An exception is transport and logistics, where we observe notable production increases due to increased trade volumes. The transport and logistics sector facilitates the shipment and distribution of larger trade volumes. Production expands especially in the Netherlands. Overall, even slight increases in services production can map to much larger reductions in manufacturing production. This is because the service sectors typically account for

60–70% of value added across the OECD. As such, and as reflected in Table 8, a 0.1% increase in resources devoted to service sector production corresponds to a 0.6% shift of resources out of manufacturing.

4.3. National income effects

Next, we turn to changes in real national income.[7] These effects follow from changes in trade and production, shifting terms of trade, and a mix of efficiency and scale effects. Under the global scenario we obtain an additional income of 0.5% of global GDP (US$158 billion). This is shown in Table 9. The highest gains relative to their income levels are observed in developing countries, with the important exception of China (to be discussed below).

National income effects are driven by three mechanisms.

- Improved allocative efficiency is obtained if lower protection causes resources to move to more productive uses. Typically, lower tariff rates will imply the reduction of deadweight losses, and this is beneficial for those economies engaging in own reforms.
- Terms of trade effects are not necessarily positive under the liberalization scenarios, but the fact that many nations liberalize simultaneously helps to offset adverse effects. The movement of export prices relative to import prices may be unfavourable for net importers of products that will see rising world prices, such as sub-Saharan African net food importers. In addition, our formulation of import demand implies that terms of trade may be declining for a country that witnesses a surge of exports in its dominant export product.
- Pro-competitive effects are related to increasing returns and expanded product varieties. The scope of the relevant market for individual firms is limited in the base situation by protective policies. Once those trade barriers are reduced, some firms are able to expand their markets, while consumers gain better access to foreign varieties of goods. At the same time, as industries expand in some regions and capture an increasing share of the global market, the same industries in other countries may shrink in the face of the increased efficiency of the sectors of competitors. This effect reinforces global specialization patterns and can lead to pronounced geographical specialization of activities.

Improved allocative efficiency contributes roughly half of the total gains in all regions. In OECD countries with highly protected agriculture, these efficiency gains stem mainly from reducing support to this sector. In Asian developing countries and

[7] National income effects are defined as Hicksian equivalent variation, which is the amount of income needed, at current prices, to yield the same change in national welfare that would follow from implementation of the new policies that make up our two experiments.

Table 9. Decomposition of income changes by effects

	Total		Global trade round			OECD based round		
Annual gain as % of base GDP	Global trade round	OECD based round	Allocative effects	Terms of trade effects	Variety and scale effects	Allocative effects	Terms of trade effects	Variety and scale effects
Europe								
Netherlands	1.3	0.9	0.8	0.2	0.3	0.7	–0.2	0.4
France	0.6	0.5	0.1	0.0	0.5	0.0	–0.1	0.5
Germany	0.6	0.5	0.2	0.1	0.4	0.1	0.0	0.4
Rest of EU 15	0.5	0.4	0.2	0.1	0.2	0.2	0.0	0.3
EU10	0.5	0.4	0.2	0.2	0.2	0.1	–0.1	0.3
Africa and Middle East								
Mediterranean	0.7	0.1	0.5	–0.2	0.4	0.0	0.1	0.0
South Africa	1.6	0.3	0.6	–0.1	1.2	0.1	0.3	–0.1
Sub-Saharan Africa	1.0	0.1	1.0	–0.9	0.8	0.0	0.1	0.0
Americas								
North America	0.2	0.2	0.1	–0.1	0.3	0.1	–0.1	0.3
South America	0.3	0.2	0.3	–0.2	0.2	0.1	0.2	–0.1
Asia and Pacific								
China	–0.8	–0.1	0.7	0.2	–1.6	0.2	0.4	–0.7
India	1.9	0.2	1.7	–0.6	0.8	0.1	0.1	–0.1
High Income Asia	0.8	0.6	0.3	0.2	0.4	0.3	–0.1	0.4
Other Asia-Pacific	3.2	–0.2	0.9	–0.1	2.4	–0.2	1.2	–1.3
Australia-NZ	0.8	0.6	0.3	0.3	0.2	0.2	0.1	0.3
Rest of World	0.6	0.1	0.7	–0.2	0.2	0.0	0.2	–0.1
World total	0.5	0.3	0.3	0.0	0.3	0.1	0.0	0.2

Source: Calculations from the authors' simulation model.

South Africa, we see expansion in manufacturing and services and some movements of factors out of agriculture, which is reinforced by pro-competitive gains driven by increasing returns to scale in these sectors. In Latin America, the improved opportunities for agricultural exports to OECD countries contribute the lion's share to the allocative gains. Consequently, in Latin America and Australia and New Zealand the pro-competitive welfare effects are less pronounced. Resources are instead tied up in constant-returns to agricultural sectors.

Negative terms of trade effects are observed for net importers of products where we see rising world prices. This includes, for example, net-food importers in Sub-Saharan Africa. In addition, sharply increasing exports can also drive down terms of trade if the exporter has a significant world market share. Outstanding examples in the current context are China and India, which see dropping export prices in the face of their dramatically increasing textile and clothing exports after phasing out of the remaining textiles quotas in the baseline and after further reduction of remaining import barriers in our experiments. Similarly, a significant expansion of Latin American agricultural production and exports drives global agricultural prices down. Another example is our region 'Other Asia Pacific' which drives down its own terms of trade through rapidly increasing exports of consumer electronics.

4.3.1. China's projected losses. While terms of trade effects matter, the dominant force behind income changes for China is reallocation of resources in a second-best situation. As mentioned above, our simulation model allows for agglomeration economies, so shifting resources from one sector to another may lower the productivity of a nation's productive factors, if the expanding sector is marked by lower agglomeration economies than the contracting sector. In the case of China, the combination of rich-nation tariff liberalization in textiles and clothing, combined with China's own liberalization of tariffs on other manufactured goods (sectors where China is a net importer) results in an important increase in Chinese textile and clothing production. The expansion in this sector comes at the expense of a contraction in another sector. In particular, the simulation results point to a dramatic reallocation of resources away from metals, machinery and electrical equipment like computers, consumer electronics, and machine tools (the MELE sector), with sector activity contracting 30%, and into the textiles and clothing sectors (the TEXT sector), with activity expanding by over 50% in the global trade round scenario.

Note that this is the result of both a push and a pull. It is driven both by tariff reductions in export markets, which pulls Chinese textiles and clothing production through China's exports, and also by tariff reductions in China, which place pressure on China's production in the contracting sectors. Reductions in textile and clothing tariffs in primary export markets, which are relatively high, are especially important here. On net, the result yields significant agglomeration-based income gains in the textile and clothing sector and a corresponding income loss focused on the contraction in the metals, electrical and technical manufacturing sector. From Table A1 in

the Appendix, we have higher scale/variety effects in the MELE sector than the TEXT sector, while from Table A4 the MELE sector is itself larger than the TEXT sector in the baseline. In income terms, 87.6% of our income effects under the global trade round scenario for China are explained by the net of these agglomeration effects across all sectors. (Of course, if textiles and clothing remain sensitive sectors that are subject to lesser tariff cuts, these effects will vary.)

4.4. Comparison between global and OECD-based scenarios

What do our results tell us about a likely OECD-based round as opposed to a true round of global liberalization? Globally, income gains fall from 0.5% of world GDP to 0.3% of world GDP (US$82 billion). The difference corresponds mostly to reductions in developing country benefits. The non-participants (i.e. developing countries) forgo collectively US$30 billion annually, with the biggest loss relative to GDP in the poor regions of sub-Saharan Africa and 'Other Asia Pacific'. Allocative effects and pro-competitive effects are basically the same for countries that engage in reform, and are lower for those who do not reform their own policies.

Since we have no own-liberalization by developing countries in the OECD scenario, terms of trade effects are more favourable for developing countries in the OECD-based scenario. Agricultural prices rise less sharply if all countries participate and prices for manufactures actually decline slightly in the broad scenario (following reallocation of manufactures due to increasing returns to scale). Manufacturing prices rise (or decline less sharply) in the OECD-only scenario. Since most developing countries are net importers of manufactures and tend to export food and agricultural products, their terms of trade improve in the OECD-based scenario. In the OECD-only scenario their real exchange rate (factor prices relative to world factor price index) improves, making their exports more expensive.

Table 10 provides an alternative breakdown of results, this time by the sector components of our policy experiments. This provides a different view of the sources of gains and losses across developed and developing countries. The highlights are:

- Trade facilitation is important for both developed and developing countries, while manufacturing tariffs in developing countries are very important for developing countries themselves, though relatively less so for the OECD.
- Apart from China, there is a strong mutual interest among developing countries for developing country liberalization in all manufacturing sectors, especially if accompanied by trade facilitation measures. China's interest appears to cover all sectors apart from textiles and clothing.
- Services are important for the OECD. This is primarily an intra-OECD issue. Most of the OECD's potential gains can be realized by a focus on OECD-based liberalization. We do not identify any substantial or real benefit for the OECD from pressing developing countries for better access in this area.

Table 10. Decomposition of income effects by Doha Round component (% of base GDP)

	Total		Global trade round				Likely (OECD-based) trade round			
	Global	OECD	Agriculture	Manufactures Tariffs	Services	Trade Facilitation	Agriculture	Manufactures Tariffs	Services	Trade Facilitation
Rich nations										
Netherlands	1.3	0.9	0.4	0.2	0.3	0.4	0.3	0.0	0.3	0.3
France	0.6	0.5	0.2	0.1	0.1	0.2	0.2	0.0	0.1	0.1
Germany	0.6	0.5	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1
Rest of EU 15	0.5	0.4	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1
EU10	0.5	0.4	0.2	0.1	0.1	0.2	0.2	0.0	0.1	0.1
North America	0.2	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1
Australia-NZ	0.8	0.6	0.1	0.2	0.2	0.4	0.1	0.0	0.2	0.3
Africa, Middle East and South America										
Mediterranean	0.7	0.1	0.0	0.1	0.1	0.5	–0.1	0.1	0.0	0.1
South Africa	1.6	0.3	0.0	0.5	0.4	0.6	0.0	0.1	0.2	0.1
Sub-Saharan Africa	1.0	0.1	0.6	–0.4	–0.3	1.0	0.0	0.0	0.1	0.0
South America	0.3	0.2	0.0	–0.1	0.1	0.3	0.0	0.1	0.0	0.1
Asia and Pacific										
China	–0.8	–0.1	0.0	–1.1	0.1	0.2	0.0	–0.1	0.0	0.0
India	1.9	0.2	1.1	–0.1	0.5	0.3	0.0	0.1	0.0	0.1
High Income Asia	0.8	0.6	0.2	0.3	0.0	0.3	0.2	0.1	0.0	0.2
Other Asia-Pacific	3.2	–0.2	0.1	0.8	0.0	2.3	0.0	–0.6	0.0	0.4
Rest of World and World Totals										
Rest of World	0.6	0.1	–0.4	0.3	0.2	0.5	–0.1	0.1	0.1	0.1
World income total	0.5	0.3	0.1	0.1	0.1	0.2	0.1	0.0	0.1	0.1
Memo: Change in world export volume total	10.1	4.7	1.1	5.1	1.2	2.7	0.5	1.7	1.0	1.5

Source: Calculations from the authors' simulation model.

- Agricultural liberalization in the OECD really is an intra-OECD issue as well. The OECD gains in this area follow from own-liberalization, and in fact it is Europe that gains from a rationalization of its own policies (something it seems unable to do without external pressure through its WTO partners). Agriculture emerges as primarily an issue of benefiting from own-liberalization. Hence, Africa and India, along with Europe, would benefit from rationalization of policies at home in agriculture, while the export-related income benefits in agriculture are not the dominant aspect of the overall impact of negotiations for any of the regions modelled.

5. CONCLUSIONS

In this paper we explore the possible economic effects of the new WTO Doha Round of trade negotiations for major developed and developing regions. Our modelling exercise includes market structure (pro-competitive) effects, and it stresses a policy benchmark including China's accession to the WTO, the phase-out of textile and clothing quotas, recent reforms to the CAP, and the recent enlargement of the EU. The analysis focuses on market access and agricultural support. We cover the areas of agricultural liberalization, liberalization in industrial tariffs, liberalization in services trade, and trade facilitation measures.

We argue that the modalities for tariff reduction are going to be at least as important as size of cuts. For example, in agriculture cuts in bound rates greater than 50% are required to effectively reduce applied rates in a country like Brazil. In view of the potential impact, trade facilitation and liberalization in services may also need a higher valuation vis-à-vis agriculture in the current round of negotiations.

For agricultural liberalization on the other hand, we find quite mixed results. Given the current protection landscape, OECD countries are expected to achieve allocative efficiency gains if they engage in own agricultural liberalization. Reduction of domestic support in OECD countries is certainly not unequivocally beneficial for all developing countries. On the contrary, those developing countries that are depending on food imports, and which do not have the resource base to develop their food sectors, will not benefit from the higher prices brought about by liberalization in industrial countries. In addition, for some primary exporters, the addition of agglomeration effects in non-primary sectors can offset direct benefits of improved market access for primary commodities, which highlights the importance of a long-term structural view on the effects of trade liberalization. Even for countries with a strong natural resource base, such as the CAIRNS group, it is not necessarily the case that expansion of primary exports is the primary source of overall gains in such an exercise.

Finally, a key finding is the importance of effective participation by developing countries in the negotiations, especially in manufacturing and trade facilitation. South-South trade liberalization is key to the 'development' part of the Doha Development

Agenda. This is downplayed in the current negotiations by all WTO-partners, however, with an emphasis instead on exemptions for developing countries (called Special and Differential treatment).

Given the structure of the negotiations though, and the rules governing developing country participation, we do not realistically expect much movement in this respect. If we take binding overhang, sensitive and special products, and AMS ceilings into account in our scenario, the global gains would be even more limited than our OECD-based scenario indicates. Very significant reductions of bound rates in developing countries (and in some instances also in developed countries) are required to reduce applied rates. In agriculture, the most contentious bone in the negotiations, some progress has been made in the area of export competition. Our findings indicate, however, that this is a relatively less important pillar. Also domestic support to agriculture is not effectively constrained by AMS ceilings, and these ceilings would have to be lowered very much in order to make a difference. Likewise, reduction of domestic support by OECD countries does not yield major gains to developing countries. On net therefore, we expect little impact on developing countries in this 'development' round, and little real progress in agriculture whatever happens with respect to developing countries.

Discussion

Simon J. Evenett

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This is a useful, informative and readable paper about the consequences of different potential outcomes of the Doha Round of multilateral trade negotiations. The authors compute the trade, income, and welfare effects of a round that includes the liberalization of agriculture, manufacturing, services and trade facilitation, and considers the implications of a round that requires liberalization first by the OECD nations and then by all WTO members. The latter distinction is significant as they find that (with the exception of China) most of the gains to developing countries accrue from liberalization by other developing countries. The pro-developmental impact, then, of a Doha Round that involves no reform by developing countries is tiny.

To assess this paper properly a little background on the Doha Round is needed. This round was launched with much fanfare in Doha, Qatar in 2001 and WTO members committed to giving this multilateral trade round a development focus. Initially, some very sizeable gains from a possible future Doha Round agreement were reported. For example, annual gains over $500 billion for developing countries were possible, according to World Bank's *Global Economic Prospects 2002*, an amount equivalent to just under 5% of the total national income of the low- and middle-income countries. Since then expectations about the likely outcome of the Doha Round have

been scaled back significantly. The Cancun Ministerial collapsed amid mutual recriminations and much of 2004 was spent getting the Doha Round back on track. Two developments, that should be borne in mind when interpreting this paper, were key. First, a letter sent by the European Commissioners for trade and for agricultural affairs proposed that the least developed countries and 'other weak or vulnerable developing countries' should not, in the context of the Doha Round, open up their markets further. The second development in 2004 was the agreement of the so-called July Package by the WTO's General Council that clarified a number of modalities for the negotiations, in particular those relating to agriculture. Little progress was made at that time in establishing clear modalities in the negotiations on non-agricultural market access, services and trade facilitation matters.

In light of the above developments, a number of comments are in order. First, even if developing countries liberalize in this round then, according to this paper, the estimated annual income gains for the world are $158 billion (in 2001 prices). If the developing countries get the 'Round for Free', then the total worldwide gain from the Doha Round is estimated to be $82 billion. It would seem that, in three short years, the Doha Round's likely impact has shrunk from an elephant to a mouse. If Francois *et al.*'s estimates are correct, I suspect that the Doha Round's enduring legacy will not be its economic impact but rather the norms established from the obligations and treatment of different types of WTO members.

The second observation is that this paper does not exactly capture the proposed modalities for developing countries in the Doha Round. The 'Round for Free' proposal was not extended to all developing countries, but to a subset of them. It is unfortunate, therefore, that this paper does not compute the welfare effects of a round that required liberalization from both the OECD nations and the big emerging markets (who were not offered the 'Round for Free'). Thus, the OECD-only reform scenario reported in the paper will probably understate the likely benefits of a successfully concluded Doha Round. Working in the opposite direction, however, is the paper's assumption on the likely size of tariff cuts to be agreed in the Doha Round. Arguably the size of the average tariff cut (50%) assumed is too large. I checked John Jackson's opus (*The World Trading System*) and on page 74 I found that the average tariff cut of every prior trade round lies between 34 and 38% (a fairly narrow range!). I would have preferred the authors to have considered an average tariff cut closer to 35%.

Finally, I turn to the broader, more systemic implications of the authors' main finding – that the OECD countries have little to gain from non-OECD nations' trade liberalization in the Doha Round. If this is true, then the authors might have reflected more on the implications of this finding for the current rules under which the WTO operates. Those rules require unanimity of the entire WTO membership to conclude a multilateral trade round which, on the terms considered in this paper, essentially benefits only a subset of that membership without harming the rest. This creates an incentive for opportunistic behaviour on the part of the non-benefiting WTO members. The latter may demand transfers (perhaps in the form of greater technical

assistance and capacity building) in return for supporting the conclusion of the Round. Delay could be created by long squabbles over process-related matters and over debates on amorphous terms (such as Special and Differential Treatment). This opportunism can only go so far as the benefiting subset of the WTO could always conclude agreements among themselves outside of the WTO (preferential agreements, regionalism). Any resemblance between this scenario and the ongoing Doha Round is, as the beginning of many films note, purely coincidental. However, in this scenario the room for miscalculation is ample while the overall benefits are meagre, circumstances that do not augur well for conclusion of any negotiation.

Panel discussion

In his discussion, Jaume Ventura's noted surprise that the effect of agriculture liberalization was so small and that of trade facilitation so large. The authors responded by pointing out that the emphasis on agriculture is largely politically motivated. Because of existing concessions and privileges for developing countries, they will not see much gain from liberalization of agriculture. With the exception of sugar, the remaining trade barriers are primarily in sectors, such as wheat or beef, in which sub-Saharan countries are unlikely to specialize and represent OECD countries protecting against one another.

The authors responded to Simon Evenett's comment that 50% was not the most likely level of liberalization by explaining that they were not really trying to predict the level of liberalization but were rather looking for what might happen were the world to undertake some level of serious liberalization and 50% was between all and nothing.

The low level of gains estimated, relative to what has been reported elsewhere, generated a good bit of discussion. Mary Amiti wondered why, if such large tariffs reductions generated such small gains, policy makers in developed or developing countries would bother. She asked if the authors thought that there might be bigger gains and if so, what factors that would have driven them had been left out of this analysis. Philippe Martin agreed with Amiti and pointed out that CGE models have a long history of underestimating gains from trade liberalizations. He asked what the professional had learned from these past underestimations and how the authors' analysis might be changed to avoid the same problems.

The authors pointed out that the low predicted gains were consistent with other estimates. The highest number which had been reported, of 500 billion, is a World Bank estimate that includes technological spillovers and productivity gains from increasing exports which were deliberately left out of this analysis due to the lack of a good empirical grasp of them.

Philippe Martin also asked how intermediate goods are treated. He noted that the elasticity of trade to tariffs has increased over time with the increase in global production

networks and that there may thus be a big non-linear effect that cannot be picked up with this model. He highlighted another potential non-linear effect that might occur when a country which initially produces none of a good, becomes a producer after liberalization. He thinks that this might be the case for Africa for some agricultural products.

Both Mary Amiti and Christian Gollier were concerned about the authors' presentation of the special and differential (S&D) treatment of developing countries as an unreservedly negative feature of trade rules. Mary Amiti pointed out that S&D treatment may take the form of either permitting delayed reforms or of requiring no reforms, and that the consequences of the two were very different. Delayed reforms may be a good thing where other institutional changes are necessary first. Christian Gollier agreed and wondered whether S&D treatment might also be good from an infant industry perspective.

Christian Gollier also asked about the dynamics of the model and specifically how the costs of transition (for example the transfer of employment from one sector to another) are treated.

The authors responded that the model focuses on steady states and thus could not deal with transitional effects. In particular, the issue of transitional unemployment never arises since the model takes labour market clearing as an equilibrium condition.

APPENDIX: SPECIFYING MONOPOLISTIC COMPETITION, VARIETY, AND AGGLOMERATION

Formally, within a region r, we assume that demand for differentiated intermediate products belonging to sector j can be derived from the following CES function, which is indexed over firms or varieties instead of over regions. We have:

$$q_{j,r} = \left[\sum_{i=1}^{n} \gamma_{j,i,r} X_{j,i,r}^{\Gamma_j} \right]^{1/\Gamma_j} \tag{1}$$

where $\gamma_{j,i,r}$ is the demand share preference parameter, $X_{j,i,r}$ is demand for variety i of product j in region r, and $\sigma_j = 1/(1 - \Gamma_j)$ is the elasticity of substitution between any two varieties of the good. Note that we can interpret q as the output of a constant returns assembly process, where the resulting composite product enters consumption and/or production. Equation (1) could therefore be interpreted as representing an assembly function embedded in the production technology of firms that use intermediates in production of final goods, and alternatively as representing a CES aggregator implicit in consumer utility functions. In the literature, and in our model, both cases are specified with the same functional form. While we have technically dropped the Armington assumption when we allow firms to differentiate products, the vector of γ parameters still provides a partial geographic anchor for production (Francois and Roland-Holst, 1997; Francois, 1998).

Globally, firms in different regions compete directly. These firms are assumed to exhibit monopolistically competitive behaviour. This means that individual firms produce unique varieties of good or service j, and hence are monopolists within their chosen market niche. Given the demand for variety, reflected in Equation (8), the demand for each variety is less than perfectly elastic. However, while firms are thus able to price as monopolists, free entry (at least in the long run) drives their economic profits to zero, so that pricing is at average cost. The joint assumptions of average cost pricing and monopoly pricing, under Bertrand behaviour, imply the following conditions for each firm f_i in region i:

$$\varsigma_{j,f_i} = \sum_{r=1}^{R} \frac{X_{j,f_i,r}}{X_{j,f_i}} \left(\sum_{k=1}^{n} \left(\frac{\alpha_{j,k,r}}{\alpha_{j,f_i,r}} \right)^{\sigma_j} \left(\frac{P_{j,k,r}}{P_{j,f,r}} \right)^{1-\sigma_j} \right)^{-1} \tag{2}$$

$$P_{f,i} = AC_{f,i} \tag{3}$$

The elasticity of demand for each firm f_i will be defined by the following conditions.

$$\varepsilon_{j,f,i} = \sigma_j + (1 - \sigma_j)\zeta_{j,f,i} \tag{4}$$

$$\frac{P_{f,i}MC_{f,i}}{P_{f,i}} = \frac{1}{\varepsilon_{f,i}} \tag{5}$$

In a fully symmetric equilibrium, we would have $\zeta = n - 1$. However, the calibrated model includes CES weights γ, in each regional CES aggregation function, that will vary for firms from different regions. Under these conditions, ζ is a quantity weighted measure of market share. To close the system for regional production, we index total resource costs for sector j in region i by the resource index $\mathcal{Z}$. Full employment of resources hired by firms in the sector j in region i then implies the following condition.

$$\mathcal{Z}_{j,i} = \sum_{f=1}^{n_i} TC_{j,i,f} \tag{6}$$

Cost functions for individual firms are defined as follows:

$$C(x_{j,i}) = (a_{j,i} + b_{j,i}x_{j,i})P_{z_{j,i}} \tag{7}$$

This specification of monopolistic competition is implemented under the 'large group' assumption, which means that firms treat the variable n as 'large', so that the perceived elasticity of demand equals the elasticity of substitution. In calibration, benchmark quantities are set to unity. The relevant set of equations then collapses to the following:

$$q_{j,r} = \left[\sum_{i=1}^{R} \bar{\gamma}_{j,i,r} \; \bar{x}_{j,i,r}^{\Gamma_j} \right]^{\frac{1}{\Gamma_j}} \tag{8}$$

$$\bar{\gamma}_{j,i,r} = \alpha_{j,i,r} n_{j,i,0}^{1-\Gamma_j} \tag{9}$$

Table A1. Model parameter values

	A	B	C	D = (B − 1)/B	E = 1/D	F = D/(1 − D)
	Trade substitution elasticities (regional differentiation)	Average mark-up levels	Elasticity of substitution in value added	Implied CDRs	Trade substitution elasticity (firm differentiation)	Variety-scaled output scale elasticity (firm differentiation)
CERE	5.61	1.00	0.25	0.00	5.61	0.00
HORT	4.92	1.00	0.25	0.00	4.92	0.00
SUGA	5.40	1.00	0.64	0.00	5.40	0.00
INTLIV	4.49	1.00	0.55	0.00	4.49	0.00
CATLE	6.93	1.00	0.57	0.00	6.93	0.00
DAIRY	7.30	1.00	0.65	0.00	7.30	0.00
OAGR	5.01	1.00	0.20	0.00	5.01	0.00
PROCF	4.34	1.13	1.12	0.11	8.98	0.13
TEXT	7.59	1.13	1.26	0.11	8.91	0.13
EXTR	12.38	1.18	0.20	0.15	6.64	0.18
CHEM	6.06	1.20	1.26	0.17	6.01	0.20
MELE	7.77	1.21	1.26	0.17	5.72	0.21
OIND	6.58	1.20	1.26	0.17	5.95	0.20
TRAD	3.80	1.27	1.68	0.21	4.67	0.27
TRAN	3.80	1.27	1.68	0.21	4.67	0.27
BSVC	3.80	1.27	1.26	0.21	4.67	0.27
OSVC	3.99	1.27	1.29	0.21	4.67	0.27

Source: Column A is from Hertel *et al.* (2003), which have also now been incorporated into the GTAP6 database, based on gravity estimates of trade substitution elasticities. Column C is directly from the GTAP6 database. Columns B, D, E, and F are from author estimates (see Francois *et al.*, 2003).

Table A2. Sector abbreviations

Abbreviation	Sector
CERE	Cereals
HORT	Horticulture and other crops
SUGA	Sugar, plants and processed
INTLIV	Intensive livestock and products
CATLE	Cattle and beef products
DAIRY	Milk and dairy
OAGR	Other agriculture
PROCF	Processed food products
TEXT	Textiles, leather and clothing
EXTR	Extraction industries
CHEM	Petro and chemicals
MELE	Metal and electrotechnical industry
OIND	Other industries
TRAD	Trade services
TRAN	Transport services
BSVC	Business, financial and communication services
OSVC	Other private and public services

Table A3. Applied manufactures tariffs before and after a 50% cut in average tariff bindings

	Post-UR and ITA tariffs				Effect of cut in bindings on applied tariffs				
	Simple average	Standard deviation	Maximum tariff	Binding overhang	Simple average	Standard deviation	Maximum tariff	Binding overhang	Percent reduction in average
European Union	3.7	3.6	17	0	1.9	1.4	5	0	–47.7
Japan	2.3	3.4	30.9	0	1.2	1.4	5.6	0	–48.5
United States	3.2	4.3	37.5	0	1.7	1.6	6.1	0	–48.3
Brazil	15.9	6	35	14.9	13.5	4.2	16.7	1.9	–15.4
India	19.2	16.5	40	3.9	11.3	9.2	30.5	0.3	–41.3
Thailand	10.5	10.8	80	7.8	7.2	6.1	20.7	2	–31.6

Source: Francois and Martin (2003).

Table A4. Self-sufficiency or domestic share in total use (baseline)

	Netherlands	France	Germany	Rest of EU15	EU10	Mediterranean	North America	South America
Cereals	0.20	2.00	1.00	0.72	1.05	0.80	1.17	1.15
Horticulture	1.34	0.87	0.52	0.88	0.75	0.99	0.94	1.17
Sugar	0.89	1.12	1.04	0.87	1.03	0.97	0.95	1.19
Intensive livestock	1.49	1.16	0.95	1.00	0.99	0.91	1.00	1.03
Cattle	1.06	0.98	1.03	0.93	1.12	0.91	1.00	1.03
Dairy	1.24	1.12	1.05	0.99	1.17	0.89	0.98	0.98
Other agriculture	0.81	0.91	0.93	0.91	1.01	1.00	1.04	1.04
Processed foods	1.40	0.96	1.04	0.98	0.65	0.86	0.99	1.09
Textiles and clothing	0.51	0.55	0.55	0.81	0.78	0.85	0.67	0.97
Extraction	0.23	0.18	0.28	0.46	0.58	2.53	0.83	1.36
Chemicals	1.21	1.07	1.11	1.03	0.79	1.01	0.97	0.88
Metal and electronic equipment	0.90	1.01	1.20	0.96	1.07	0.55	0.94	0.82
Other industry	0.92	0.96	0.99	1.03	0.97	0.90	0.94	0.97
Trade	1.01	1.01	0.97	1.01	1.00	1.00	1.00	0.99
Transport and logistics	1.85	1.08	1.01	1.17	1.25	1.19	1.03	1.06
Business services	0.99	1.01	0.98	1.02	0.97	0.97	1.00	0.98
Other services	1.01	1.02	0.99	1.00	1.00	0.97	1.01	0.99

	China	India	High Income Asia	Other Asia-Pacific	Australia-NZ	South Africa	Sub-Saharan Africa	Rest of World
Cereals	0.94	1.02	0.64	0.89	2.10	1.09	0.93	1.00
Horticulture	1.00	1.01	0.86	1.10	1.29	1.60	1.32	0.92
Sugar	0.81	1.02	0.73	0.97	1.33	1.48	1.01	0.86
Intensive livestock	0.99	0.98	0.90	0.99	1.19	1.08	0.93	0.96
Cattle	0.95	1.06	0.79	0.92	1.79	1.00	0.99	0.94
Dairy	0.87	1.00	0.92	0.75	1.46	1.00	0.69	0.99
Other agriculture	0.95	0.92	0.84	0.96	1.72	1.10	1.17	1.18
Processed foods	0.99	0.98	0.90	1.12	1.05	1.00	0.89	0.99
Textiles and clothing	1.37	1.47	0.91	1.82	0.56	0.83	0.61	0.82
Extraction	0.96	0.69	0.15	1.02	1.52	1.25	3.33	1.36
Chemicals	0.90	0.91	1.02	0.87	0.82	0.94	0.61	1.04
Metal and electronic equip	0.90	0.88	1.19	0.84	0.77	1.07	0.37	0.98
Other industry	1.12	0.99	0.96	1.13	0.90	1.15	1.01	0.94
Trade	1.08	1.00	0.99	0.98	1.00	1.00	0.96	0.98
Transport and logistics	1.03	1.03	1.04	1.25	1.08	1.08	1.09	1.19
Business services	1.00	0.99	0.99	1.02	0.99	0.98	0.92	0.98
Other services	0.99	1.00	0.99	0.99	1.00	1.00	0.98	1.00

Source: See text.

Table A5. Export shares (percentage of national exports in baseline)

	Netherlands	France	Germany	Rest of EU15	EU10	Mediterranean	North America	South America
Cereals	0.24	1.11	0.29	0.15	0.45	0.16	1.51	4.06
Horticulture	4.00	0.82	0.32	1.09	0.48	1.71	1.00	5.79
Sugar	0.06	0.13	0.04	0.03	0.08	0.05	0.04	1.28
Intensive livestock	4.30	3.05	1.14	2.01	1.67	0.67	1.30	2.12
Cattle	0.48	0.39	0.22	0.25	0.46	0.15	0.58	0.92
Dairy	1.62	1.16	0.71	0.58	0.97	0.17	0.09	0.31
Other agriculture	0.10	0.25	0.10	0.24	0.39	0.34	0.37	0.50
Processed foods	5.41	1.86	1.91	2.25	2.08	1.33	1.69	7.80
Textiles and clothing	2.12	2.65	2.43	4.78	5.05	6.77	2.21	6.74
Extraction	0.18	0.19	0.26	1.06	1.56	35.55	2.70	11.51
Chemicals	17.94	14.64	13.20	14.01	8.19	13.43	9.73	10.14
Metal and electronic equip	34.96	43.01	59.08	39.70	53.92	12.74	48.68	23.19
Other industry	5.68	6.56	7.10	10.35	9.70	5.87	7.84	7.01
Trade	2.80	2.75	1.89	3.21	1.43	1.98	1.56	1.98
Transport and logistics	6.18	6.86	2.88	6.29	4.57	6.86	5.71	7.59
Business services	7.89	7.12	5.31	10.00	4.61	8.15	7.90	5.49
Other services	6.04	7.47	3.13	4.00	4.39	4.09	7.10	3.56
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	China	India	High Income Asia	Other Asia-Pacifi	Australia-NZ	South Africa	Sub-Saharan Africa	Rest of World
Cereals	0.29	1.60	0.12	0.13	2.70	0.64	0.63	0.58
Horticulture	0.73	3.55	0.12	1.92	1.98	3.55	10.47	0.38
Sugar	0.01	0.43	0.00	0.17	0.76	1.15	0.66	0.02
Intensive livestock	0.84	0.39	0.21	1.03	3.16	2.10	0.77	0.89
Cattle	0.02	0.51	0.01	0.04	6.16	0.46	0.28	0.18
Dairy	0.01	0.14	0.01	0.08	4.48	0.23	0.07	0.32
Other agriculture	0.20	0.37	0.06	0.61	4.40	0.63	4.31	1.32
Processed foods	1.25	4.92	0.58	4.09	3.07	2.69	4.40	2.50
Textiles and clothing	32.93	29.80	4.88	20.51	1.31	2.69	3.14	3.32
Extraction	1.07	2.16	0.04	3.88	13.85	10.40	35.74	18.44
Chemicals	5.40	11.27	9.93	8.65	5.68	7.17	2.74	15.12
Metal and electronic equip	29.03	14.86	66.66	33.58	22.69	43.20	10.80	33.64
Other industry	13.39	14.95	4.11	6.62	4.97	11.22	10.02	6.94
Trade	10.86	2.25	1.43	2.59	3.22	2.05	1.38	1.11
Transport and logistics	1.82	4.89	4.92	4.76	10.20	6.10	6.28	5.84
Business services	1.26	6.72	3.71	9.51	6.00	3.15	5.05	5.11
Other services	0.91	1.18	3.21	1.83	5.37	2.57	3.27	4.31
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A6. Output shares (percent of total national output in baseline)

	Netherlands	France	Germany	Rest of EU15	EU10	Mediterranean	North America	South America
Cereals	0.09	0.31	0.19	0.18	0.67	1.91	0.52	1.69
Horticulture	1.31	0.87	0.36	0.67	0.77	3.10	0.45	3.17
Sugar	0.10	0.16	0.11	0.16	0.43	1.00	0.10	0.75
Intensive livestock	2.23	1.92	1.82	2.04	4.54	2.26	1.61	3.04
Cattle	0.32	0.67	0.32	0.67	0.87	1.04	0.87	1.91
Dairy	1.34	1.19	0.96	0.98	1.50	1.38	0.61	2.04
Other agriculture	0.07	0.22	0.22	0.51	0.60	1.32	0.24	0.73
Processed foods	2.70	1.93	1.90	2.35	2.31	2.22	1.83	5.10
Textiles and clothing	0.75	0.93	1.02	1.88	2.38	3.07	1.34	4.45
Extraction	0.35	0.15	0.23	0.45	1.35	9.56	0.93	2.59
Chemicals	6.55	5.89	6.03	5.78	5.60	7.13	4.97	7.18
Metal and electronic equip	13.25	16.12	20.94	14.19	22.70	6.78	13.64	11.70
Other industry	5.16	5.83	5.53	6.76	6.58	5.61	4.70	5.15
Trade	10.51	8.19	9.09	12.57	10.10	10.09	13.27	7.67
Transport and logistics	5.89	4.98	3.67	6.00	6.03	7.17	4.21	5.21
Business services	19.11	16.63	12.16	17.32	12.46	8.19	20.08	12.29
Other services	30.25	34.01	35.43	27.49	21.10	28.17	30.65	25.32
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	China	India	High Income Asia	Other Asia-Pacific	Australia-NZ	South Africa	Sub-Saharan Africa	Rest of World
Cereals	1.38	5.31	0.35	2.14	0.64	0.60	3.77	2.05
Horticulture	3.68	4.91	0.63	2.72	0.77	1.32	6.21	2.54
Sugar	0.05	1.61	0.08	0.65	0.34	0.47	1.71	0.61
Intensive livestock	4.59	1.86	1.45	3.24	1.77	2.56	6.04	4.54
Cattle	0.36	0.56	0.26	0.50	1.75	2.05	2.56	1.12
Dairy	0.14	3.20	0.31	0.43	1.72	0.59	0.49	2.22
Other agriculture	1.72	2.25	0.33	2.09	1.32	0.76	4.82	0.88
Processed foods	3.00	3.87	2.41	4.90	1.88	3.25	5.84	3.29
Textiles and clothing	10.63	5.69	1.61	10.76	0.86	2.09	2.18	2.66
Extraction	2.59	1.39	0.16	2.48	3.73	5.77	7.99	5.95
Chemicals	7.35	7.52	5.69	6.64	3.85	7.57	3.88	6.86
Metal and electronic equip	18.84	12.14	19.96	15.18	8.76	15.73	3.71	13.79
Other industry	9.40	4.29	4.46	5.55	4.45	6.02	6.98	6.95
Trade	9.14	9.74	11.95	8.64	14.14	12.20	8.52	6.74
Transport and logistics	4.92	7.96	5.27	6.12	6.50	5.82	6.14	6.53
Business services	4.51	5.70	13.58	9.27	18.23	9.08	9.19	10.11
Other services	17.71	22.00	31.51	18.68	29.30	24.13	19.98	23.14
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: See text.

$$\bar{x}_{j,i,r} = \left(\frac{n_{j,i}}{n_{j,i,0}} \right)^{(1-\Gamma_j)/\Gamma_j} X_{j,i,r} \tag{10}$$

$$\bar{x}_{j,i} = \left(\frac{z_{j,i,1}}{z_{j,i,0}} \right)^{(1-\rho_j)/\rho_j} X_{j,i} \tag{11}$$

In Equations (8) and (9), n_0 denotes the number of firms in the benchmark. We can rewrite Equation (1) in terms of consumption of the variety-scaled good defined by Equations (9) and (10). This yields (7). Through calibration, the initial CES weights then include the valuation of variety. As a result, the reduced form exhibits external scale effects, determined by changes in variety based on firm entry and exit, and determined by the substitution and scale elasticities. Equation (10) shows how variety effects translate into agglomeration effects.

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