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***Effects of global trade liberalisation on forestry products and forest sustainability using the GTAP model***

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**Abstract**

The paper analyses the effects of trade liberalization amongst the leading exporters and importers of forest products, in particular, as well as global merchandise, in general. The study utilises the Global Trade Analysis Project (GTAP) model and its database, version 7. Given that forest products only comprise a small proportion of world merchandise trade, it is expected that trade liberalisation would cause small changes in terms of trade, real GDP, production, consumption and prices of forest products in most countries. In the short-run, national welfare in China and Japan would increase substantially by more than $US400 million while the opposite is true for the United States. In the long-run, national welfare in China, Mexico and Thailand would increase between $US230 million and $US295 million. Food production in Australia, Chile and New Zealand would increase slightly but significantly compared to other countries/regions. Similarly, food consumption in Malaysia and Thailand would increase by about 0.10 per cent.

Keywords: forest sector, international trade, computable general equilibrium model, trade liberalisation, food production

## I. Introduction

Reduction in carbon emission is one of the important issues facing the world today. This issue poses a great opportunity to learn from the economic processes and outcomes of the last 20 years and the significance of returning to carbon emissions at the 1990 levels. The Kyoto Protocol of 1997, and its possible successor, the G20 meeting held in December 2009 in Copenhagen now formalised as the Copenhagen Accord, have the world divided as to which direction, it would take collectively. The increasing popularity of carbon emission trading and the possibility of buying carbon credits from developing countries that have much land to be given up for forest plantation for the purposes of carbon sequestration provides an opportunity. In particular, the Copenhagen Accord has setup a forestry deal which is hoped to assist in reducing deforestation in return for cash. More importantly, the possible effects on the size and composition of international trade on forestry products of carbon emission reduction would be interesting.

The paper analyses the trade patterns amongst the leading exporters and importers of world merchandise in 2008 as well as amongst the main exporters and consumers of forestry products. In particular, the paper attempts to examine the effects of trade liberalisation on forestry products (i.e. forestry, wood products and paper products) as classified in the Global Trade Analysis Project (GTAP) model. It also examines the effect on food production and food consumption of reduced tariff on forest products.

Competing land uses have implications for forest sustainability. The increase in trade volume of forest products due to a more liberalised trading regime may increase deforestation. Without proper forest management, the conversion of forestlands to agricultural lands becomes easier because of greater accessibility created by logging activities. Hence, trade liberalisation may lead to higher food production and might also affect food prices. The interaction between higher incomes, increasing population, poverty and food security has been pointed out in the literature (Anderson 2003; von Braun 2007) and could have important implications in the management of forest resources.

The paper attempts to verify the findings of Liu, et al. (2005) and Sedjo and Simpson (1999). Both studies suggest that further reductions in tariffs on forest products are likely to generate only very modest increases in worldwide trade and production. Moreover, the increased harvest pressures on forests due to tariff reduction should be small (Sedjo and Simpson 1999). At present, the paper does not explicitly model land use or carbon sequestration. Sohngen et al. (2008) highlight the challenges to CGE modellers in capturing the full range of potential inter-relationships of the forestry sector to the rest of the economy such as land use changes, carbon sequestration and climate policy.

The succeeding discussion provides an overview of the recent developments on forestry trade, the GTAP model and database used as well as some preliminary macroeconomic and sectoral results.

## II. Background

Lower tariffs have arguably been accepted as beneficial to society's economic well-being. Tariff levels have come a long way since the General Agreement on Tariffs and Trade (GATT). However, protectionism especially on local employment from developed countries is resurfacing due to the financial crisis of 2008-2009.

The Doha round of trade negotiations is considered to provide a major opportunity for developing countries. This trade negotiation started in November 2001 and emphasises on tariffs, non-tariff measures, agriculture, labour standards, environment, competition, investment, transparency and patents. As part of the series of negotiations since 2001 in Hong Kong after four years, trade ministers representing most of the world's governments reached a deal that sets a deadline for eliminating subsidies of agricultural exports by 2013. The effect of the Doha round on forest product's trade is of practical importance for this study. Unfortunately, the current negotiations on trade collapsed in July 29, 2009. Informal negotiations are taking place in nine key sectors based on what has been dubbed 'the crucial mass' approach – where a certain number of countries representing a certain percentage of world production in a sector are required to participate in order to create a sectoral initiative (Smaller 2005). These sectors

include electronics, bicycles and sporting goods, chemicals, fish, footwear, forest products, gems and jewellery, pharmaceuticals and medical devices, and raw materials. The possible increase in forest products trade due to lower tariffs can have a significant effect on deforestation and as a consequence carbon trading.

There are many countries who have been involved in the international trade of forest products. Table 1 shows the major trading countries in forest products. The Food and Agriculture Organization (FAO) combines forestry trade data for China, Hong Kong and Taiwan and reports separate forestry trade data for North and South Korea. Hence, in Table 1 Taiwan's trade data is not reported unlike in Liu et al. (2005) and only South Korea's trade data is reported (excluding North Korea). The share of forestry products on total exports and total imports has slightly declined from 2001 to 2007. In 2007 and 2008, Russian Federation is ranked third behind the United States and Canada and ahead of Brazil and China in terms of industrial roundwood production (FAO 2009). The Russian Federation is also a major producer of wood-based panels behind China, the United States, Germany and Canada (FAO 2009). The region is also amongst the top five exporting and consuming countries for industrial roundwood, wood-based panels and sawnwood. In Africa, Ethiopia and the Democratic Republic of Congo are included in the five leading producers and consumers of wood fuel for 2007 and 2008 whereas Ukraine, France and Latvia are the top exporting countries of wood fuel. In Asia, China, India, Pakistan and Viet Nam are the top four producers of other fibre pulp. These countries are also the main consumers of other fibre pulp. The Philippines, once a major exporter of roundwood, now ranks fifth in other fibre pulp export.

**Table 1: Major Trading Countries of Forest Products, 2007**

| | Country | Import | Export | Share of country's total | |
|---|---|---|---|---|---|
| | | (1,000 US$) | (1,000 US$) | Imports (%) | Exports (%) |
| 1 | Argentina | 894,437 | 542,929 | 2.00 | 1.21 |
| 2 | Australia | 2,101,224 | 1,726,445 | 1.27 | 1.22 |
| 3 | Austria | 4,240,500 | 8,383,536 | 2.61 | 5.15 |
| 4 | Belgium | 6,064,356 | 5,793,381 | 1.47 | 1.34 |
| 5 | Brazil | 1,294,505 | 7,186,667 | 1.02 | 4.47 |
| 6 | Canada | 5,397,997 | 26,250,342 | 1.39 | 6.26 |
| 7 | Chile | 594,268 | 4,260,573 | 1.26 | 6.24 |
| 8 | China | 25,112,288 | 10,788,695 | 2.63 | 0.89 |
| 9 | Denmark | 2,239,667 | 477,807 | 2.25 | 0.46 |
| 10 | Finland | 2,405,910 | 15,895,730 | 2.95 | 17.72 |
| 11 | France | 11,536,098 | 8,615,128 | 1.88 | 1.56 |
| 12 | Germany | 18,232,321 | 20,995,879 | 1.72 | 1.58 |
| 13 | India | 2,456,089 | 277,967 | 1.13 | 0.19 |
| 14 | Indonesia | 1,597,188 | 6,572,861 | 1.73 | 5.57 |
| 15 | Italy | 12,028,893 | 5,521,357 | 2.38 | 1.12 |
| 16 | Japan | 12,335,273 | 2,898,991 | 1.99 | 0.41 |
| 17 | Korea | 4,998,428 | 2,006,502 | 1.40 | 0.54 |
| 18 | Malaysia | 1,808,139 | 4,033,622 | 1.23 | 2.29 |
| 19 | Mexico | 4,209,991 | 366,435 | 1.42 | 0.13 |
| 20 | Netherlands | 7,413,741 | 4,725,044 | 1.51 | 0.86 |
| 21 | New Zealand | 555,644 | 2,201,811 | 1.80 | 8.15 |
| 22 | Poland | 4,168,628 | 2,893,509 | 2.56 | 2.08 |
| 23 | Portugal | 1,549,686 | 2,518,864 | 1.98 | 4.89 |
| 24 | Spain | 7,262,850 | 4,596,972 | 1.95 | 1.91 |
| 25 | Sweden | 3,163,117 | 16,591,883 | 2.09 | 9.81 |
| 26 | Switzerland | 2,217,913 | 1,601,824 | 1.38 | 0.93 |
| 27 | Thailand | 1,811,976 | 1,592,104 | 1.29 | 1.04 |
| 28 | United Kingdom | 13,620,761 | 3,273,306 | 2.20 | 0.75 |
| 29 | USA | 28,805,606 | 20,899,163 | 1.43 | 1.80 |
| 30 | World | 232,245,868 | 228,075,855 | | |

Source: Online FAO Yearbook of Forest Products, 2007, Online WTO International Trade Statistics

**Table 2: Selected developing countries' import tariff rates (% ad valorem) on selected forest products, 2007**

| Forest Products | Brazil | China | India | Indonesia | Malaysia | Mexico | Thailand |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Wood, Paper, Etc. | | | | | | | |
| -Average Final Bound Duties | 28.4 | 5 | 36.6 | 39.4 | 19.4 | 34.1 | 24.4 |
| -Average MFN Applied Duties | 10.7 | 4.4 | 9.1 | 5 | 10.1 | 9.2 | 6.9 |

Source: World Trade Organisation online statistics

Table 2 shows the import tariffs in selected developing countries. There is a huge difference in the ad valorem import tariffs rates especially for India, Indonesia, Mexico and Thailand. China is the only country that has similar tariff rates for forest products between final bound and MFN applied duties.

Partial equilibrium models have been used in the past to analyse the effects of tariff reductions in the forest sector (Liu, et al. 2005). These models cannot generally include the interactions of different sectors in the economy with the forestry sector. Since forest products can be processed to have a higher value-adding within an economy's production as well as consumption, changes in forestry production (and consumption) due to tariff reduction can have significant impacts on the whole economy. Using a global CGE model, such as GTAP, the changes in one sector of the world economy say, countries with higher endowment of forest products or countries that rely heavily on forest products, can be predicted and analysed. Industries and/or countries that are affected in a positive or negative way can be identified. The GTAP model has also been used to analyse the effects of tariff liberalisation on the forest sectors of Brazil, the European Community and the United States (Coelho et al. 2006; Francois et al. 2003; Tsigas 2005).

## III. Theoretical Model and Data Specifications

The model used in the study is developed within the global trade analysis project (GTAP). The project is a global network of researchers and policy makers conducting

quantitative analysis of international policy issues. The standard GTAP model is a multi-region (i.e. 113 regions), multi-sector (i.e. 57 sectors), computable general equilibrium model, with perfect competition and constant returns to scale. Each region has a single representative household. The share of aggregate government expenditure in each region's income is held fixed. There is a global banking sector which intermediates between global savings and consumption. International trade and transport margins are treated explicitly and bilateral trade is handled via the Armington assumption. Full documentation of the theoretical structure of GTAP is available in Hertel (1997).

The paper uses GTAP database version 7. It contains complete bilateral trade information, transport and protection linkages among 113 regions for all 57 commodities for 2004. The database also includes energy data and OECD domestic support. In this paper, the regions are aggregated to 34 regions selected to emphasise global trade on forestry products. There are 13 sectors selected to place emphasis on the forest sector and the other sectors in the economy that depend on it (i.e. forestry, wood products and paper products) and they are summarised in Appendix 1A. The regions are selected and grouped to identify the main players in forestry trade. Regions like Russian Federation and Sub-Saharan Africa are included in contrast to Liu, et al. (2005) to highlight the relative importance and contribution of these countries. There are five factors of production: land, unskilled labour, skilled labour, capital and natural resources, where labour and capital are assumed mobile. There is no change in the parameters used within the standard GTAP data base.

In order to compare with previous studies (Buongiorno et al. 2003; Liu et al. 2005; Zhu et al. 2001), Tariffs are removed for the following 25 countries: Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Finland, France, Germany, Indonesia, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, New Zealand, Portugal, Spain, Sweden, Thailand, United Kingdom, and United States. For the remaining nine regions/countries, it is assumed that there would be no change in tariffs. Both short-run and long-run closures are implemented, where capital is fixed in the former and mobile in the latter.

## IV. Results

*Macroeconomics results*

Table 3 summarises the short-run and long-run effects of tariff liberalisation in the forest products sectors on changes in the terms of trade, real gross domestic product (GDP) and national welfare. For the 34 regions, short-run and long-run effects on the terms of trade are similar. Moreover, the results for GDP, exports and imports are all similar except for Malaysia and Thailand. Around less than a third of the regions would have a negative effect on the terms of trade and majority of the regions would experience positive or no effect on GDP.

In the short run, the reduction in the terms of trade ranges from -0.09 per cent and -0.01 per cent with Australia, New Zealand, Chile and Thailand slightly worse off as well in the long-run. Moreover, a third of the regions would experience higher exports as well as imports, where Australia, Brazil, China, Indonesia, Malaysia and Thailand would gain the most. The increase in exports ranges between 0.22 per cent and 0.49 per cent in the short-run and between 0.22 per cent and 0.79 per cent in the long-run. Similarly, the increase in imports ranges between 0.24 per cent and 0.47 per cent in the short-run and between 0.24 per cent and 0.77 per cent in the long-run.

National welfare which is measured by equivalent variation (Varian 1992) would increase substantially in China, Japan and Malaysia by 438, 425 and 301 million US dollars, respectively in the short-run, while the United States would experience a reduction in welfare by about 396 million US dollars. In the long-run, China, Mexico and Thailand would increase welfare by more than 200 million US dollars.

National welfare in some countries would increase more in the short-run than in the long-run and vice versa whereas for Sub-Saharan Africa, Russia, Argentina, Chile, Denmark, Finland, Sweden, Austria, Germany, Italy, Poland, Portugal, Spain, Switzerland, India, Hong Kong and New Zealand the changes (either positive or negative) are roughly the same between short-run and long-run. Canada and the United States would suffer relatively more in the short-run compared to the long-run however, to a lesser extent with a reduction of national welfare at around US$109.29 million and US$76.68 million.

***Insert Table 3 about here***

*Sectoral results*

Due to the similarity of the results between short-run and long-run, the succeeding discussion will focus on the long-run effects only. The effects of tariff liberalisation on production are shown in Table 4. The changes in the forestry sector's production would be between -1.41 per cent in Chile and 6.48 per cent in Taiwan. For wood products, Brazil (2.36%), Indonesia (3.66%), Malaysia (5.81%) and Taiwan (4.16%) would have the highest growth, while Australia (-2.87%), Chile (-2.65%), New Zealand (-1.34%) and Thailand (-2.82%) would have the highest decline. Hong Kong, Taiwan and Thailand would increase their paper production between 2 and 5 per cent while Brazil, Chile, China and New Zealand would suffer from trade liberalisation by more than 1 per cent.

***Insert Table 4 about here***

Table 5 shows the effects of eliminating forest products tariffs on consumption. The consumption of forest products would increase in the majority of regions except for India, Indonesia, Malaysia and Taiwan with tariff reduction. Australia, Korea, Malaysia, New Zealand and Thailand would increase their consumption of wood products between 1.33 per cent and 3.63 per cent. Thailand's consumption of paper products would increase the most by 3.98 per cent compared to the other 33 regions.

***Insert Table 5 about here***

The simulation results on exports and imports are more substantial than the results on production and consumption as shown in Tables 6 and 7. The exports of forest products from Korea and Taiwan would increase significantly by about 15.21 per cent and 19.84 per cent, respectively with most of the gains would occur in Asia and South America (Table 6). Exports of wood products from Japan and Korea would increase significantly by about 29.2 per cent and 34.08 per cent, respectively while paper products exports from Hong Kong, Malaysia, Taiwan and Thailand would increase between 11.43 per cent and 33.31 per cent.

***Insert Tables 6 and 7 about here***

Table 7 shows the effects of tariff reductions on imports. Brazil, Indonesia and Mexico would increase their imports of forest products the most at around 10 per cent. Brazil would significantly increase its imports of wood products by about 45.34 per cent. Australia, China, Indonesia, Korea, Malaysia, New Zealand and Thailand would also increase their imports of wood products between 7.52 per cent and 17.6 per cent. Brazil and Thailand would increase their imports of paper products by 25.6 per cent and 19.87 per cent, respectively.

Table 8 shows the effects of tariff liberalisation on prices. The prices of forest products in the majority of the regions (19 out of 34) would decrease. Theoretically, it is expected that prices decrease with the expansion of trade under the tariff cut. However, forest product prices in Indonesia, Malaysia and Taiwan would increase by 0.92 per cent, 1.20 per cent and 3.34 per cent, respectively. Prices of wood products' decline (or no change) in all regions except for Finland, Hong Kong, India, Indonesia and Taiwan. Similar results are projected for paper products prices with Thailand gaining the most with price reduction on paper products by about 5 per cent.

***Insert Table 8 about here***

Table 9 summarises the long-run results for food (i.e. agriculture sector) production and consumption. Food production would increase more in Australia, Canada, Chile and New Zealand, relative to Argentina, Brazil, Mexico, Thailand and the United States while Finland and Malaysia would experience a decline. Moreover, Malaysia and Thailand would increase their food consumption relatively higher than Finland, Hong Kong and Indonesia while Chile and New Zealand would experience a reduction.

***Insert Table 9 about here***

## V. Summary

The interaction between economic activity and the environment are increasingly being recognised not only locally but internationally. Globalisation and the relevance of international trade suggest that increasing cooperation amongst countries is required. Trade liberalisation and climate change are issues that will continue to be in the political agenda for the next few years. With forestry included in the DOHA round of trade negotiations, the sector's effects on the domestic economy as well as its importance in managing climate change could reveal important policy implications.

The paper analyses the effects of trade liberalization amongst the leading exporters and importers of forest products, in particular, as well as global merchandise, in general. The study utilises the Global Trade Analysis Project (GTAP) model and its database, version 7 with 2004 data. There are 34 regions aggregated to emphasise global trade on forestry products and 13 sectors to emphasise the forest sector and the other sectors in the economy that depend on it. There are five factors of production namely, unskilled and skilled labour, capital, land and natural resources. There is no change in the parameters used within the standard GTAP data base. The paper has not incorporated the role of the forestry sector in carbon sequestration.

Given that forest products only comprise a small proportion of world merchandise trade, it is expected that trade liberalisation would cause small changes in terms of trade, real GDP, production, consumption and prices of forest products in most countries. In the short-run, national welfare in China and Japan would increase substantially by more than $US400 million while the opposite is true for the United States. In the long-run, national welfare in China, Mexico and Thailand would increase between $US230 million and $US295 million. It seems that Asian countries will gain the most with a tariff reduction on forest products namely forestry, wood and paper products while the United States and Canada would experience a reduction in national welfare.

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**Table 3: Effects of tariff liberalisation on terms of trade, real GDP and welfare**

| Country | Terms of Trade (% change) | | Real GDP (% change) | | Welfare ($US million) | | Exports (% change) | | Imports (% change) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Short-run | Long-run | Short-run | Long-run | Short-run | Long-run | Short-run | Long-run | Short-run | Long-run |
| Africa (Sub-Saharan) | 0.01 | 0.01 | 0.00 | 0.00 | -2.73 | 1.47 | -0.01 | -0.01 | 0.00 | 0.00 |
| Argentina | 0.00 | -0.01 | -0.01 | -0.01 | -15.91 | -12.06 | -0.01 | -0.01 | -0.02 | -0.02 |
| Australia | -0.04 | -0.04 | 0.02 | 0.01 | 105.53 | 20.60 | 0.31 | 0.31 | 0.24 | 0.24 |
| Austria | 0.00 | 0.00 | 0.01 | 0.00 | 24.65 | 18.84 | 0.01 | 0.01 | 0.02 | 0.02 |
| Belgium | 0.00 | 0.00 | 0.02 | 0.01 | 65.04 | 30.65 | 0.02 | 0.02 | 0.02 | 0.02 |
| Brazil | -0.02 | -0.01 | 0.04 | 0.03 | 220.38 | 129.02 | 0.33 | 0.33 | 0.44 | 0.44 |
| Canada | -0.03 | -0.03 | -0.02 | 0.00 | -252.97 | -109.29 | 0.04 | 0.05 | 0.01 | 0.02 |
| Chile | -0.06 | -0.06 | -0.03 | -0.02 | -38.94 | -36.00 | 0.07 | 0.07 | 0.01 | 0.00 |
| China | -0.02 | -0.02 | 0.03 | 0.03 | 438.53 | 232.57 | 0.26 | 0.26 | 0.27 | 0.27 |
| Denmark | 0.00 | 0.00 | 0.00 | 0.00 | 9.73 | 6.75 | 0.01 | 0.01 | 0.01 | 0.01 |
| Finland | 0.03 | 0.02 | 0.01 | 0.01 | 42.65 | 40.69 | 0.00 | 0.01 | 0.03 | 0.04 |
| France | 0.00 | 0.00 | 0.00 | 0.00 | 105.03 | 41.90 | 0.01 | 0.01 | 0.01 | 0.01 |
| Germany | 0.00 | 0.00 | 0.00 | 0.00 | 138.28 | 126.33 | 0.01 | 0.01 | 0.02 | 0.02 |
| Hong Kong | 0.05 | 0.04 | 0.04 | 0.05 | 128.52 | 119.52 | 0.05 | 0.06 | 0.12 | 0.13 |
| India | 0.00 | 0.00 | 0.00 | 0.00 | -2.55 | -5.25 | 0.01 | 0.01 | 0.01 | 0.01 |
| Indonesia | 0.05 | 0.05 | 0.06 | 0.06 | 204.09 | 179.12 | 0.22 | 0.23 | 0.31 | 0.32 |
| Italy | 0.00 | 0.00 | 0.00 | 0.00 | 28.60 | 34.86 | 0.01 | 0.01 | 0.01 | 0.01 |
| Japan | 0.01 | 0.01 | 0.01 | 0.00 | 425.25 | 186.20 | 0.07 | 0.07 | 0.10 | 0.10 |
| Korea | 0.00 | 0.00 | 0.04 | 0.03 | 255.34 | 162.68 | 0.13 | 0.12 | 0.15 | 0.15 |
| Malaysia | 0.01 | 0.02 | 0.25 | 0.16 | 301.18 | 174.81 | 0.29 | 0.22 | 0.43 | 0.34 |
| Mexico | -0.02 | -0.01 | 0.03 | 0.05 | 186.33 | 250.87 | 0.11 | 0.13 | 0.09 | 0.11 |
| Netherlands | 0.00 | 0.00 | 0.01 | 0.00 | 42.72 | 28.67 | 0.01 | 0.01 | 0.02 | 0.02 |
| New Zealand | -0.05 | -0.05 | 0.00 | -0.01 | -9.37 | -18.42 | 0.18 | 0.17 | 0.13 | 0.12 |
| Poland | 0.00 | 0.00 | 0.00 | 0.00 | -6.03 | -4.67 | 0.00 | 0.00 | -0.01 | 0.00 |
| Portugal | -0.01 | -0.01 | 0.00 | 0.00 | -11.78 | -5.24 | 0.00 | 0.00 | -0.01 | -0.01 |
| Russia | 0.01 | 0.01 | 0.00 | 0.00 | 25.85 | 24.46 | 0.00 | 0.00 | 0.01 | 0.01 |
| Spain | 0.00 | 0.00 | 0.00 | 0.00 | 33.54 | 22.69 | 0.01 | 0.01 | 0.01 | 0.01 |
| Sweden | 0.01 | 0.00 | 0.00 | 0.00 | 14.57 | 12.09 | 0.01 | 0.01 | 0.01 | 0.02 |
| Switzerland | 0.00 | 0.00 | 0.00 | 0.00 | 12.07 | 8.53 | 0.00 | 0.00 | 0.00 | 0.00 |
| Taiwan | 0.03 | 0.03 | 0.05 | 0.01 | 198.79 | 80.19 | 0.02 | -0.01 | 0.06 | 0.03 |
| Thailand | -0.09 | -0.14 | 0.15 | 0.43 | 148.26 | 295.74 | 0.49 | 0.79 | 0.47 | 0.77 |
| United Kingdom | 0.00 | 0.00 | 0.01 | 0.00 | 160.08 | 65.10 | 0.02 | 0.02 | 0.02 | 0.02 |
| USA | -0.01 | 0.00 | 0.00 | 0.00 | -396.80 | -76.68 | 0.03 | 0.03 | 0.02 | 0.02 |
| Rest of the World | 0.01 | 0.01 | 0.00 | 0.00 | 189.92 | 189.94 | 0.00 | 0.00 | 0.01 | 0.01 |

| **Table 4: Effects of tariff liberalisation on production (% change)** | | | |
|---|---|---|---|
| Country | Forestry | Wood Products | Paper Products |
| Africa | 0.00 | -0.43 | -0.28 |
| Argentina | -0.39 | -0.74 | -0.64 |
| Australia | -0.61 | -2.87 | -0.70 |
| Austria | 0.03 | -0.02 | 0.32 |
| Belgium | -0.07 | 0.33 | 0.27 |
| Brazil | 0.07 | 2.36 | -1.25 |
| Canada | -0.58 | -0.85 | -0.30 |
| Chile | -1.41 | -2.65 | -1.27 |
| China | 0.13 | 0.96 | -1.53 |
| Denmark | -0.07 | -0.18 | 0.07 |
| Finland | 0.09 | -0.01 | 0.35 |
| France | 0.00 | -0.03 | 0.15 |
| Germany | 0.05 | 0.30 | 0.15 |
| Hong Kong | 0.46 | 0.03 | 4.52 |
| India | 0.18 | 0.01 | 0.03 |
| Indonesia | 1.92 | 3.66 | 1.03 |
| Italy | 0.04 | 0.13 | 0.10 |
| Japan | -0.33 | -0.71 | 0.19 |
| Korea | -0.74 | -0.68 | 0.75 |
| Malaysia | 2.51 | 5.81 | -0.34 |
| Mexico | -0.45 | -0.24 | -0.10 |
| Netherlands | -0.33 | -0.22 | 0.04 |
| New Zealand | -0.29 | -1.34 | -1.17 |
| Poland | -0.07 | -0.18 | 0.05 |
| Portugal | -0.12 | -0.49 | 0.00 |
| Russia | -0.07 | 0.40 | -0.41 |
| Spain | 0.01 | 0.00 | 0.11 |
| Sweden | -0.04 | -0.19 | 0.24 |
| Switzerland | 0.05 | 0.08 | 0.21 |
| Taiwan | 6.48 | 4.16 | 2.40 |
| Thailand | -0.80 | -2.82 | 3.26 |
| United Kingdom | -0.06 | -0.37 | 0.01 |
| USA | -0.26 | -0.46 | -0.06 |
| Rest of the World | -0.01 | -0.22 | 0.03 |

| **Table 5: Effects of tariff liberalisation on consumption (% change)** | | | |
|---|---|---|---|
| Country | Forestry | Wood Products | Paper Products |
| Africa | 0.00 | 0.00 | 0.01 |
| Argentina | 0.06 | 0.00 | 0.00 |
| Australia | 0.19 | 1.77 | 0.42 |
| Austria | 0.00 | 0.03 | 0.01 |
| Belgium | 0.06 | 0.16 | 0.04 |
| Brazil | 0.03 | 0.32 | 0.53 |
| Canada | 0.17 | 0.53 | -0.01 |
| Chile | 0.33 | 0.21 | 0.07 |
| China | -0.01 | 0.05 | 0.21 |
| Denmark | 0.03 | 0.09 | 0.00 |
| Finland | 0.00 | 0.08 | 0.03 |
| France | 0.01 | 0.05 | 0.00 |
| Germany | 0.02 | 0.07 | 0.01 |
| Hong Kong | 0.06 | 0.12 | 0.14 |
| India | -0.02 | 0.00 | 0.00 |
| Indonesia | -0.11 | 0.13 | 0.25 |
| Italy | 0.00 | 0.03 | 0.01 |
| Japan | 0.11 | 0.94 | 0.04 |
| Korea | 0.31 | 2.92 | 0.23 |
| Malaysia | -0.24 | 3.63 | 1.50 |
| Mexico | 0.17 | 0.51 | 0.26 |
| Netherlands | 0.47 | 0.08 | 0.01 |
| New Zealand | 0.07 | 1.33 | 0.07 |
| Poland | 0.01 | 0.00 | 0.00 |
| Portugal | 0.01 | 0.03 | 0.00 |
| Russia | 0.01 | 0.01 | 0.01 |
| Spain | 0.01 | 0.04 | 0.00 |
| Sweden | 0.02 | 0.03 | 0.01 |
| Switzerland | -0.01 | 0.01 | 0.01 |
| Taiwan | -0.44 | 0.06 | 0.08 |
| Thailand | 0.33 | 1.66 | 3.98 |
| United Kingdom | 0.04 | 0.17 | 0.01 |
| USA | 0.08 | 0.13 | 0.01 |
| Rest of the World | 0.01 | 0.01 | 0.02 |

| Table 6: Effects of tariff liberalisation on exports (% change) | | | |
|---|---|---|---|
| Country | Forestry | Wood Products | Paper Products |
| Africa | 0.32 | -1.04 | -1.40 |
| Argentina | 4.61 | -3.12 | -4.42 |
| Australia | 2.75 | 1.45 | 3.45 |
| Austria | 0.12 | 0.03 | 0.86 |
| Belgium | -0.34 | 1.41 | 0.64 |
| Brazil | 0.71 | 7.15 | 1.27 |
| Canada | 1.04 | -0.55 | -0.71 |
| Chile | 5.92 | -3.26 | -2.11 |
| China | 3.69 | 5.07 | 4.29 |
| Denmark | -0.23 | -0.04 | 0.48 |
| Finland | -0.43 | 0.09 | 0.63 |
| France | 0.16 | 0.42 | 0.99 |
| Germany | 0.02 | 1.23 | 0.67 |
| Hong Kong | 3.10 | 1.35 | 15.20 |
| India | 8.55 | 0.40 | 1.13 |
| Indonesia | 8.47 | 5.92 | 3.74 |
| Italy | 0.51 | 0.47 | 0.71 |
| Japan | 7.28 | 29.20 | 7.46 |
| Korea | 15.21 | 34.08 | 8.82 |
| Malaysia | -4.68 | 7.80 | 11.43 |
| Mexico | 0.31 | 1.34 | 1.44 |
| Netherlands | 0.59 | -0.33 | 0.28 |
| New Zealand | 1.22 | 0.02 | -4.58 |
| Poland | 0.12 | -0.25 | 0.27 |
| Portugal | 2.12 | -0.78 | -0.01 |
| Russia | -0.06 | 1.05 | -1.25 |
| Spain | 0.11 | 0.61 | 0.77 |
| Sweden | 0.06 | -0.29 | 0.52 |
| Switzerland | 0.14 | 0.68 | 0.45 |
| Taiwan | 19.84 | 5.91 | 16.62 |
| Thailand | 6.20 | 1.10 | 33.31 |
| United Kingdom | 1.36 | 0.73 | 0.19 |
| USA | 0.31 | -4.36 | -0.56 |
| Rest of the World | 0.38 | -0.55 | 0.58 |

| **Table 7: Effects of tariff liberalisation on imports (% change)** | | | |
|---|---|---|---|
| Country | Forestry | Wood Products | Paper Products |
| Africa | -0.11 | 0.00 | 0.08 |
| Argentina | -0.58 | -0.28 | 0.11 |
| Australia | -0.34 | 7.52 | 6.30 |
| Austria | 0.08 | 0.12 | 0.10 |
| Belgium | 0.33 | 0.60 | 0.19 |
| Brazil | 12.89 | 45.34 | 25.60 |
| Canada | -1.08 | 1.96 | -0.11 |
| Chile | -0.40 | 3.18 | 1.01 |
| China | 1.00 | 15.86 | 9.61 |
| Denmark | -0.02 | 0.29 | 0.03 |
| Finland | 0.47 | 0.69 | 0.28 |
| France | 0.12 | 0.26 | 0.08 |
| Germany | 0.86 | 0.42 | 0.10 |
| Hong Kong | 0.19 | 0.39 | 1.35 |
| India | -0.36 | 0.22 | 0.18 |
| Indonesia | 9.06 | 17.60 | 4.69 |
| Italy | 0.09 | 0.42 | 0.13 |
| Japan | -0.59 | 2.69 | 0.72 |
| Korea | 0.44 | 9.60 | 4.65 |
| Malaysia | 3.27 | 14.76 | 5.76 |
| Mexico | 12.12 | 3.34 | 1.20 |
| Netherlands | 0.72 | 0.32 | 0.11 |
| New Zealand | -0.39 | 10.33 | 1.17 |
| Poland | -0.17 | -0.04 | 0.01 |
| Portugal | -0.13 | 0.14 | 0.00 |
| Russia | -0.12 | 0.05 | -0.07 |
| Spain | 0.16 | 0.34 | 0.08 |
| Sweden | -0.03 | 0.24 | 0.09 |
| Switzerland | 0.08 | 0.06 | 0.03 |
| Taiwan | 3.11 | 2.06 | 1.87 |
| Thailand | -1.17 | 17.26 | 19.87 |
| United Kingdom | 0.12 | 0.37 | 0.07 |
| USA | 0.18 | 0.96 | 0.20 |
| Rest of the World | -0.25 | 0.03 | 0.17 |

| **Table 8: Effects of tariff liberalisation on prices (% change)** | | | |
|---|---|---|---|
| Country | Forestry | Wood Products | Paper Products |
| Africa | -0.01 | -0.01 | -0.01 |
| Argentina | -0.21 | -0.05 | -0.03 |
| Australia | -0.32 | -0.47 | -0.23 |
| Austria | 0.02 | 0.00 | 0.01 |
| Belgium | -0.03 | -0.07 | -0.01 |
| Brazil | 0.03 | -0.14 | -0.35 |
| Canada | -0.31 | -0.19 | -0.06 |
| Chile | -1.01 | -0.29 | -0.17 |
| China | 0.07 | -0.17 | -0.32 |
| Denmark | -0.03 | -0.02 | 0.00 |
| Finland | 0.07 | 0.03 | 0.03 |
| France | 0.00 | -0.01 | 0.00 |
| Germany | 0.02 | -0.01 | 0.00 |
| Hong Kong | 0.25 | 0.03 | 0.03 |
| India | 0.08 | 0.02 | 0.00 |
| Indonesia | 0.92 | 0.13 | -0.52 |
| Italy | 0.02 | -0.04 | 0.00 |
| Japan | -0.14 | -0.13 | -0.03 |
| Korea | -0.29 | -1.23 | -0.20 |
| Malaysia | 1.20 | -0.21 | -1.29 |
| Mexico | -0.24 | -0.52 | -0.29 |
| Netherlands | -0.13 | -0.04 | 0.00 |
| New Zealand | -0.22 | -0.20 | -0.13 |
| Poland | -0.04 | 0.00 | 0.00 |
| Portugal | -0.05 | -0.03 | -0.01 |
| Russia | -0.02 | 0.00 | 0.00 |
| Spain | 0.01 | -0.02 | 0.00 |
| Sweden | -0.01 | 0.00 | 0.01 |
| Switzerland | 0.02 | 0.00 | 0.00 |
| Taiwan | 3.34 | 0.04 | 0.00 |
| Thailand | -0.34 | -0.50 | -4.99 |
| United Kingdom | -0.03 | -0.07 | 0.00 |
| USA | -0.12 | -0.05 | -0.02 |
| Rest of the World | 0.00 | 0.00 | -0.01 |

| Table 9: Food Production and Consumption (% change) | | |
|---|---|---|
| | Production | Consumption |
| Africa (Sub-Saharan) | 0.01 | 0.00 |
| Argentina | 0.03 | -0.01 |
| Australia | 0.10 | -0.01 |
| Austria | -0.01 | 0.00 |
| Belgium | -0.01 | 0.01 |
| Brazil | 0.04 | 0.01 |
| Canada | 0.08 | -0.02 |
| Chile | 0.12 | -0.04 |
| China | 0.01 | 0.00 |
| Denmark | 0.00 | 0.00 |
| Finland | -0.04 | 0.02 |
| France | -0.01 | 0.00 |
| Germany | -0.01 | 0.00 |
| Hong Kong | -0.02 | 0.05 |
| India | 0.00 | 0.00 |
| Indonesia | -0.04 | 0.05 |
| Italy | 0.00 | 0.00 |
| Japan | 0.00 | 0.00 |
| Korea | 0.00 | 0.01 |
| Malaysia | -0.06 | 0.14 |
| Mexico | 0.03 | 0.01 |
| Netherlands | -0.01 | 0.00 |
| New Zealand | 0.16 | -0.03 |
| Poland | 0.00 | 0.00 |
| Portugal | 0.01 | 0.00 |
| Russia | 0.00 | 0.00 |
| Spain | -0.01 | 0.00 |
| Sweden | -0.01 | 0.00 |
| Switzerland | 0.00 | 0.00 |
| Taiwan | -0.03 | 0.01 |
| Thailand | 0.03 | 0.10 |
| United Kingdom | 0.00 | 0.00 |
| USA | 0.02 | 0.00 |
| Rest of the World | 0.00 | 0.00 |

Appendix

Table 1A: Sectoral aggregation

| | | |
|---|---|---|
| 1 | Agriculture | Paddy rice, Wheat, Cereal grains nec, Vegetables, fruit and nuts, Oil seeds, Sugar cane and sugar beet, Plant-based fibers, Crop nec, Cattle, sheep, goats and horses, Animal products nec, Raw milk, Wool and silk-worm cocoons, Meat, Meat products, Processed rice |
| 2 | Forestry | Forestry |
| 3 | Fishing | Fishing |
| 4 | Mining and Extraction | Coal, Oil, Gas, Minerals nec |
| 5 | Manufacturing | Vegetable oil and fat, Dairy products, Sugar, Food products nec, Beverages and tobacco products, Textiles, Wearing apparel, Leather products, Petroleum and coal products, Chemical, rubber and plastic products, Mineral products, Ferrous metal, Metals nec and Metals products, Motor vehicles and parts, Transport equipment nec, Electronic equipment, Machinery and equipment nec, Manufactures nec |
| 6 | Wood Products | Wood Products |
| 7 | Paper products | Paper products and publishing |
| 8 | Construction | Construction |
| 9 | Public Service | Electricity, Gas manufacture and distribution, Water |
| 10 | Trade | Trade |
| 11 | Sea Transport | Sea Transport |
| 12 | Air Transport | Air Transport |
| 13 | Other Services | Transport nec, Communication, Financial services, Insurance, Business services, Recreation and other services, Public Admin, Defence, Health, Education and Dwellings |