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Effects of a Unilateral Tariff Liberalisation on Forestry Products and Trade in Australia: An Economic Analysis Using the GTAP Model

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1. Introduction

Australia has 147.4 million hectares of native forest areas which includes 48.4 million hectares of closed forest and open forest (Bureau of Rural Sciences [BRS], 2010). Some 103 million hectares of native forest areas are either privately owned or leasehold while the balance is multiple use forest (9.4 million hectares), conservation reserves (22.4 million hectares) or other categories of public ownership (12.4 million hectares).

Negotiations on trade liberalisation and bilateral agreements between countries and regions suggest that further tariff reductions are inevitable. With the current trade negotiations under the Doha round, the global forestry sector as well as Australia's could be affected by the outcomes of the negotiations. Moreover, the increasing recognition of the importance of the forestry sector in terms of addressing climate change issues suggests that any policy affecting this sector can be significant in terms of its economic as well as environmental impact. Forest conservation and carbon emissions are two issues linked to a possible carbon trading scheme in Australia.

The chapter attempts to verify the findings of previous studies (Gan & Ganguli, 2003; Liu et al., 2005; Sedjo & Simpson, 1999). These 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 & Simpson, 1999). At present, the paper does not explicitly model land use or carbon sequestration. Sohngen et al. (2008) highlight the challenges to computable general equilibrium (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. Unlike previous studies, this paper highlights the Australian forestry industry as well as the emerging regions in forestry trade such as the Russian Federation and sub-Saharan Africa.

The chapter aims to examine the economic and potential environmental effects of tariff liberalisation on forest products and merchandise trade in Australia using the global trade analysis project (GTAP) general equilibrium modelling framework. The chapter is organised as follows: Section 2 provides recent developments in trade of Australian forestry products.

It also highlights Australia's trading partners and the leading countries in merchandise trade. Section 3 describes the theoretical framework employed in this study. Section 4 discusses the model simulations while Section 5 summarises the results.

2. Background

Australia is a net importer of traditional forest products. Australia does not have significant forest trade relationship with the US. However, the US economy is a major consumer of forest products internationally. In terms of forest products, Australia's main exports are woodchips and sawnwood and it mainly imports wood-based panel and paper and paperboard. Japan and China are the main destination of exports, where Japan is the biggest market for Australian woodchips (broadleaf and conifer) and China is the biggest market for recovered paper. It is anticipated, however, that China will be Australia's biggest market for forest products in the next few years.

Table 1 shows the top exporting and importing countries of world merchandise. Interestingly, the top four exporters are also the top importers of world merchandise. Moreover, nine countries dominate world merchandise trade. Interestingly, the Russian federation is amongst the top exporters of world merchandise. It is ranked third behind the United States and Canada and ahead of Brazil and China in terms of industrial roundwood production (Food and Agriculture Organization [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 amongst the top five exporting and consuming countries for industrial roundwood, wood-based panels and sawnwood.

Exporters	Value (Bn \$)	Share	Importers	Value (Bn \$)	Share
Germany	1461.9	9.1	United States	2169.5	13.2
China	1428.3	8.9	Germany	1203.8	7.3
United States	1287.4	8.0	China	1132.5	6.9
Japan	782.0	4.9	Japan	762.6	4.6
Netherlands	633.0	3.9	France	705.6	4.3
France	605.4	3.8	United Kingdom	632.0	3.8
Italy	538.0	3.3	Netherlands	573.2	3.5
Belgium	475.6	3.0	Italy	554.9	3.4
Russian Fed	471.6	2.9	Belgium	469.5	2.9
United Kingdom	458.6	2.9	Korea, Republic of	435.3	2.7

Source: International Trade Statistics, WTO (2009)

Table 1. Leading Exporters and Importers in World Merchandise Trade, 2008

Table 2 shows the direction of trade for Australia. This suggests that Australia has a strong trade relationship with Asia than any other region in the world. Although Australia does not have significant forest trade relationship with the US, it is still one of its major markets in terms of the direction of trade.

Australia imported \$3.8 billion worth of forest products in 2000-2001 (Australian Bureau of Agricultural and Resource Economics [ABARE], 2001). In 2002, Australia had a trade deficit

in wood products of \$1.7 billion (National Association of Forest Industries [NAFI] briefings 2010). The World Trade Organization calculates the average final bound duties and MFN applied duties for wood, paper, etc. in Australia for 2008-2009 at 7 per cent and 3.4 per cent, respectively.

Exports	Millions, US\$	Imports	Millions, US\$
Japan	41515	China, People's Republic of	32804
China, People's Republic of	28282	United States	25311
Korea, Republic of	14969	Japan	19120
United States	10249	Singapore	14977
New Zealand	8005	Germany	10701
India	10999	United Kingdom	8431
United Kingdom	7324	Malaysia	8788
Singapore	5536	Thailand	9367
Thailand	4516	New Zealand	7366
Indonesia	3839	Korea, Republic of	6276

Source: Asian Development Bank (www.abd.org/Statistics)

Table 2. Australia's Direction of Trade, 2008

According to the Department of Agriculture, Fisheries and Forestry (DAFF), Australia has traditionally carried a deficit in the trade of its forest and wood products. From 1997 to 2007, in terms of volume, Australian forest product exports increased by 74 per cent while its imports increased by 37 per cent (ABARE, 2009). In contrast, from 1999 to 2009, exports increased by 41 per cent while its imports increased by only 11 per cent (ABARE, 2011).

In terms of value, total exports of wood products in 2009-10 were \$2.26 billion while imports were \$4.2 billion. This constitutes a trade deficit of \$1.9 billion. In 2008-2009, mainly due to the financial crisis, forest product exports decreased by 5.2 per cent and imports increased by 1.1 per cent (ABARE, 2009). Most of this deficit is in paper products as they account for around half (\$2.2 billion) of Australia's imports in 2008-09 (DAFF, 2010).

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. If tariff levels continue to decline then global merchandise trade liberalisation would boost Australia's agricultural exports by an estimated US\$9 billion (in 2006 dollars) in 2020 (ABARE, 2007).

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.

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).

3. 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 study 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 study, the regions are aggregated to 25 regions selected to emphasise global trade on forestry products. There are 13 sectors (commodities) 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 Table 1A (see appendix). 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. Both short-run and long-run closures are implemented, where capital is fixed in the

former and mobile in the latter. Tariffs are removed for the 16 regions which are considered dominant in the global forestry trade as shown in Table 3.

Regions
Australia
New Zealand
China
Japan
Korea
Indonesia
Malaysia
Thailand
USA
Rest of N America
Latin America
Germany
United Kingdom
EU_25 ¹
Sub-Saharan Africa ²
Russia

Table 3. Tariffs are removed for 16 out of 25 regions

The GTAP model requires a large data base (like any macroeconomic model) to reflect the underlying economic structure and dependency between regions. It provides a global/macroeconomic framework on inter-linkages between and amongst regions. The results from CGE analyses should be taken with caution and should not be relied on as the sole source of information (Siriwardana & Yang 2007, p. 26). Hence, specific country effects and microeconomic implications have to be tested using single-country CGE modelling. Nevertheless, a global model such as GTAP can provide useful insights to potential distribution effects of tariff liberalisation policies.

4. Results

On the macroeconomic level, the effects of a global trade liberalisation within the global forestry sector are minimal. The short-run and long-run effects for most regions are similar as shown in Table 4. Thailand, Sub-Saharan Africa and Russia would experience a reduction in their terms of trade relative to the other regions in the model between -0.07 per cent and -0.14 per cent. However, these countries together with Malaysia would experience an increase in their real gross domestic products (GDP) relative to the rest of regions between 0.06 per cent and 0.55per cent. The gains in economic growth are higher in the long-run than in the short-run for Thailand, Sub-Saharan Africa and Russia. In terms of welfare, some regions benefit more in the short-run than in the long-run and vice versa. In the short-run,

¹ Excluding Germany and the United Kingdom (see appendix, Table 2A).

² For the list of countries included in this region refer to appendix, Table 2A.

amongst the countries, China and Japan would experience the most gains at around US\$ 400 million. China, Thailand, Russia and collectively, Latin America, Sub-Saharan Africa and the EU_25 would gain more in the long-run at US\$ 445 million, US\$ 415 million, US\$ 1.35 billion, US\$ 722 million, US\$ 594 million and US\$ 1.03 billion, respectively. Australia is only slightly affected with modest increase in welfare.

Under Doha with the possible liberalisation of forestry tariffs, Australia can benefit since its major exports are agricultural goods which include forestry products. Table 5 shows changes in the Australian output and consumption of forest products compared to the other major traders of forest products as well as major traders of world merchandise in general. Forest products are classified into three groups such as forestry³, lumber and wood products and pulp and paper products. Australian output of forest products is predicted to decline whereas the opposite is true for the consumption of forest products.

Amongst its major trading partners of agricultural products, Japan's output of forestry and lumber and wood products would decline by -0.42 per cent and -0.72 per cent, respectively but the output of pulp and paper as well as the consumption of forest products would increase by 0.19 per cent, 0.14 per cent, 0.97 per cent and 0.04 per cent. China would benefit both in the production and consumption of forest products with the exception of pulp and paper production which would decline by -1.45 per cent. In contrast, the United States of America would experience a slight reduction in the production of forestry and lumber and wood products and a slight increase in the consumption of forest products. Indonesia would increase its production of forestry output by 2.06 per cent, lumber and wood products by 3.97 per cent and pulp and paper output by 1.69 per cent.

The European Union is also a major market for Australian agricultural products. At the moment, there are 27 countries included in the EU market. In the model simulation, the 25 EU countries are grouped into one region (i.e. EU_25) with Germany and the United Kingdom treated as separate regions. Germany would experience an increase in outputs for lumber and wood products and pulp and paper products by 0.62 per cent and 0.40 per cent, respectively while the UK would experience a reduction in the output as well as the consumption of its forestry products and the opposite for pulp and paper products. Collectively, the output of forest products in EU_25 would increase between 0.19 per cent and 0.58 per cent.

Table 6 shows the changes in Australia's market prices of forest products. Australia's domestic price of forest products would decline more than the world prices of forestry, lumber and wood and pulp and paper products by -0.36 per cent, -0.47 per cent and -0.22 per cent. Amongst its top trading partners in agricultural products, only Indonesia would experience a relatively substantial increase in the market price of forestry products at 1.05 per cent and a reduction of -0.52 per cent in the market price of pulp and paper products although China's market price for pulp and paper products are reduced by -0.32 per cent.

Russia, Latin America and Sub-Saharan Africa would experience the most reduction in the market price of forestry products between -0.54 per cent and -1.13 per cent while

³ The Food and Agriculture Organization classifies forest products into eight categories: wood fuel, industrial roundwood, sawnwood, wood-based panel, wood pulp, other fiber pulp, recovered paper and paper and paperboard. GTAP has three commodities that correspond to FAO's classification: forestry, wood products and paper products.

Malaysia and Taiwan⁴ would experience the biggest increase in the market price of forestry products at 1.06 per cent and 3.24 per cent respectively. Korea would experience a reduction in the market price of lumber and wood products at -1.25 per cent while Thailand would experience the most reduction in the market price of pulp and paper products at almost -5 per cent. New Zealand and the rest of North of America (which includes Canada) would experience a similar reduction in the market prices of their forest products.

Region	Terms of Trade (% Δ)		Real GDP (% Δ)		Welfare (\$US mn)	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
Australia	-0.04	-0.05	0.02	0.02	98.72	47.63
New Zealand	-0.05	-0.05	0.00	0.00	-10.39	-14.64
RO Oceania	-0.01	-0.02	-0.01	-0.03	-2.05	-6.21
China	-0.02	-0.02	0.04	0.04	458.24	445.09
Japan	0.01	0.02	0.01	0.00	407.69	241.88
Korea	0.01	0.02	0.04	0.03	261.65	208.30
Taiwan	0.03	0.05	0.05	0.01	214.90	104.42
RO East Asia	0.05	0.05	0.04	0.05	141.38	141.40
Indonesia	0.07	0.06	0.07	0.04	228.70	125.60
Malaysia	0.01	0.02	0.25	0.27	304.24	267.53
Singapore	0.02	0.02	0.04	0.05	64.51	70.87
Thailand	-0.09	-0.14	0.15	0.55	151.16	415.31
RO SEAsia	0.01	0.01	0.00	0.01	11.47	13.32
India	0.01	0.03	0.00	0.01	32.97	68.94
RO South Asia	0.00	0.01	0.00	0.00	5.31	9.43
USA	0.00	0.01	0.00	0.00	239.13	231.13
RO N America	-0.02	-0.03	0.00	0.01	-69.28	-81.86
Latin America	-0.07	-0.07	0.04	0.08	377.96	722.18
Germany	0.01	0.01	0.01	0.01	251.46	319.82
United Kingdom	0.01	0.01	0.01	0.00	288.48	87.77
EU_25	0.01	0.02	0.01	0.01	1141.94	1033.97
M East and N Africa	0.03	-0.01	0.01	-0.03	155.07	-274.70
Sub-Saharan Africa	-0.09	-0.12	0.06	0.19	168.21	593.76
Russia	-0.07	-0.11	0.06	0.28	362.92	1351.70
Rest of World	0.01	0.00	0.00	-0.02	-5.25	-198.26

Table 4. Effects of tariff liberalisation on terms of trade, real GDP and welfare

Table 7 shows the percentage changes in the value of forest products trade. In terms of forestry products exports, Korea and Taiwan would experience the highest increase at 14.64 per cent and 19.43 per cent, respectively while Indonesia and Russia would experience a similar increase in their imports of forestry products by 10.5 per cent and 9.65 per cent respectively. Latin America and Sub-Saharan Africa would experience the highest increase in forestry products imports by 15.08 per cent and 20.46 per cent respectively.

⁴ It is interesting that Taiwan consistently shows up to have significant changes in its forestry sector. It might be worth while investigating why a country so small would experience relatively bigger changes in its production of forest products.

Region	Forestry		Lumber and Wood Products		Pulp and Paper	
	Output	Consumption	Output	Consumption	Output	Consumption
Australia	-0.59	0.22	-2.82	1.78	-0.71	0.43
New Zealand	-0.32	0.08	-1.29	1.34	-1.17	0.08
RO Oceania	-0.61	0.03	-1.34	-0.01	-0.15	-0.02
China	0.13	0.01	1.23	0.07	-1.45	0.23
Japan	-0.42	0.14	-0.72	0.97	0.19	0.04
Korea	-0.74	0.31	0.09	2.94	0.86	0.25
Taiwan	6.39	-0.36	5.18	0.08	2.44	0.10
RO East Asia	0.11	0.11	0.23	0.14	4.12	0.14
Indonesia	2.06	-0.16	3.97	0.11	1.69	0.23
Malaysia	2.88	-0.11	6.37	3.76	-0.23	1.59
Singapore	1.53	-0.30	2.29	0.14	1.08	0.18
Thailand	-0.50	0.45	-2.25	1.77	3.40	4.09
RO SEAsia	-0.07	0.01	-1.09	0.02	0.16	0.05
India	0.21	0.00	0.24	0.01	0.51	0.02
RO South Asia	0.03	0.00	0.07	0.01	-0.09	0.03
USA	-0.16	0.03	-0.30	0.14	0.04	0.01
RO N America	-0.53	0.12	-0.73	0.30	-0.24	0.11
Latin America	-0.75	0.25	-1.95	0.67	-2.47	0.73
Germany	0.09	-0.01	0.62	0.09	0.40	0.02
United Kingdom	-0.06	-0.01	-0.01	0.19	0.07	0.01
EU_25	0.19	-0.01	0.58	0.07	0.37	0.04
M East and N Africa	0.15	-0.06	0.48	-0.03	0.25	-0.02
Sub-Saharan Africa	-0.43	0.26	-8.99	0.96	-5.81	1.15
Russia	-1.17	0.84	-11.04	2.92	-3.99	1.20
Rest of World	-0.28	0.02	-0.57	-0.01	-0.12	0.01

Table 5. Percentage changes of Australian output and consumption of forest products

Japan and Korea would increase their exports of lumber and wood products by 30.16 per cent and 40.32 per cent while China, Taiwan, Indonesia, Malaysia, Latin America and the Middle East and North African countries would also increase their exports of lumber and wood products between 5 per cent and 8 per cent. In terms of imports of lumber and wood products, Latin America, Sub-Saharan Africa and Russia would experience an increase between 30 per cent and 37 per cent while China, Indonesia, Malaysia and Thailand would

experience an increase of between 15.06 per cent and 17.94 per cent. Australia, New Zealand and Korea would experience a modest increase in their imports of lumber and wood between 7 per cent and 10 per cent. Thailand's export of pulp and paper products would increase by 33.55 per cent while East Asia (excluding Japan, Korea and Taiwan), Taiwan, Malaysia and India would increase their export of pulp and paper products between 10 per cent and 17 per cent. Japan and Korea would also experience an increase in their export of pulp and paper products by 7.51 per cent and 9.62 per cent, respectively while New Zealand would experience a decline of around -4.57 per cent. In terms of import of pulp and paper products, Thailand's imports would increase the most by 20.09 per cent. Russia, Latin America and Sub-Saharan Africa would increase their imports of pulp and paper products by 11.86 per cent, 14.75 per cent and 16.79 per cent, respectively. Australia, China, Korea, Indonesia and Malaysia would also increase their imports of pulp and paper between by 4 per cent and 10 per cent.

Region	Forestry	Lumber and Wood Products	Pulp and Paper
World Price	-0.04	-0.11	-0.09
Australia	-0.36	-0.47	-0.22
New Zealand	-0.22	-0.20	-0.13
RO Oceania	-0.23	-0.09	-0.06
China	0.07	-0.17	-0.32
Japan	-0.16	-0.14	-0.04
Korea	-0.26	-1.25	-0.20
Taiwan	3.24	0.03	0.00
RO East Asia	0.14	0.02	0.02
Indonesia	1.05	0.16	-0.52
Malaysia	1.06	-0.26	-1.28
Singapore	0.58	-0.03	-0.06
Thailand	-0.38	-0.49	-4.99
RO SEAsia	-0.03	-0.01	-0.14
India	0.11	0.04	0.00
RO South Asia	0.01	-0.03	-0.04
USA	-0.05	-0.05	-0.02
RO N America	-0.24	-0.24	-0.10
Latin America	-0.54	-0.57	-0.49
Germany	0.10	-0.01	0.01
United Kingdom	0.06	-0.08	0.00
EU_25	0.10	-0.02	0.00
M East and N Africa	0.10	-0.02	-0.03
Sub-Saharan Africa	-0.64	-0.97	-0.72
Russia	-0.75	-0.21	-1.13
Rest of World	-0.06	-0.02	-0.02

Table 6. Percentage changes in domestic and world market prices of forest products

Region	Forestry		Lumber and Wood Products		Pulp and Paper	
	Exports	Imports	Exports	Imports	Exports	Imports
Australia	2.78	-0.34	1.84	7.61	3.27	6.35
New Zealand	1.03	-0.29	0.13	10.35	-4.57	1.20
RO Oceania	-0.52	-0.33	-4.79	-0.17	-0.30	0.26
China	4.63	1.98	5.70	16.04	5.55	9.79
Japan	7.51	-0.32	30.16	2.76	7.51	0.78
Korea	14.64	1.17	40.32	9.83	9.62	4.85
Taiwan	19.43	3.74	7.33	2.55	17.00	1.99
RO East Asia	0.52	0.61	3.61	0.52	15.55	1.36
Indonesia	7.67	9.65	6.36	17.94	5.18	5.36
Malaysia	-4.71	3.01	8.41	15.06	11.90	5.86
Singapore	1.54	0.04	3.11	0.57	3.32	1.13
Thailand	6.13	-0.61	1.91	17.58	33.55	20.09
RO SEAsia	1.24	-1.62	-1.38	0.07	4.77	0.64
India	9.57	0.13	3.20	0.87	10.03	0.56
RO South Asia	1.17	-0.16	1.95	0.29	2.54	0.29
USA	0.38	0.34	-0.22	1.10	0.88	0.33
RO N America	0.93	0.31	0.13	3.83	-0.35	0.79
Latin America	4.38	15.08	5.42	29.89	1.85	14.75
Germany	-0.46	1.42	2.22	0.60	1.74	0.22
United Kingdom	0.72	0.46	3.51	0.49	0.85	0.13
EU_25	-0.18	1.04	1.87	0.84	1.66	0.43
M East and N Africa	2.78	0.45	6.53	0.18	2.75	0.20
Sub-Saharan Africa	4.66	20.46	0.51	37.10	-0.20	16.79
Russia	2.56	10.50	2.69	30.78	5.19	11.86
Rest of World	-0.30	0.07	-2.29	-0.08	-0.21	0.14

Table 7. Percentage changes in the value of forest products trade

5. Summary and conclusion

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 study analyses the effects of trade liberalisation on forestry products in Australia, 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 25 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 study 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 North America (excluding the United States). In the long-run, national welfare in China, Thailand, Latin America and Russia would increase between \$US445 million and \$US1.35 billion. Collectively, EU_25 and Sub-Saharan Africa would experience the highest increase in welfare in the long-run by \$US1.03 billion and \$US594 million, respectively. It seems that Asian countries, Latin America, Russia, the EU as well as Sub-Saharan Africa would gain the most with a tariff reduction on forest products namely forestry, wood and paper products.

As a caveat, the study does not explicitly model land use or carbon sequestration. It also cannot capture the full benefits of sustainability issues in forestry such as rotation periods and forest cover. However, there are recent attempts in the literature to address this short-coming (Sohnngen et al., 2008). It is apparent that forestry and hence the forestry sector generally can have environmental benefits such as biodiversity, low salinity, low soil erosion, etc. The incorporation of all non-monetary benefits requires a substantially rich environmental data set and modelling methodologies. The specific costs and benefits of localised industries and/or regions should be explored further via case studies to ensure success of any policy attempting to balance economic and sustainable issues.

6. Appendices

No.	Sector	Commodities
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

Table 1. A. Sectoral aggregation

EU 25	Sub-Saharan Africa
Austria	Nigeria
Belgium	Senegal
Cyprus	Rest of Western Africa
Czech Republic	Central Africa
Denmark	South Central Africa
Estonia	Ethiopia
Finland	Madagascar
France	Malawi
Greece	Mauritius
Hungary	Mozambique
Ireland	Tanzania
Italy	Uganda
Latvia	Zambia
Lithuania	Zimbabwe
Luxembourg	Rest of Eastern Africa
Malta	Botswana
Netherlands	South Africa
Poland	Rest of South African Customs
Portugal	
Slovakia	
Slovenia	
Spain	
Sweden	
Bulgaria	
Romania	

Table 2. A. Region Composition

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This book is dedicated to global perspectives on sustainable forest management. It focuses on a need to move away from purely protective management of forests to innovative approaches for multiple use and management of forest resources. The book is divided into two sections; the first section, with thirteen chapters deals with the forest management aspects while the second section, with five chapters is dedicated to forest utilization. This book will fill the existing gaps in the knowledge about emerging perspectives on sustainable forest management. It will be an interesting and helpful resource to managers, specialists and students in the field of forestry and natural resources management.

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