An Analysis of the Impact of Changes in Provincial and International Softwood Lumber Supply and Trade Flows on British Columbia

Working Paper 96.01

by

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November, 1996

Funding Support

This project was funded by the Canadian Forest Service, the Socio-Economic Analysis Program of the Canada-British Columbia Partnership Agreement on Forest Resource Development: FRDA II and the Forest Economics and Policy Analysis Research Unit (FEPA) at UBC.

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Executive Summary

Softwood lumber exports remain a mainstay in the British Columbia (BC) forest products industry. In recent years BC softwood lumber exports have averaged about $7.5 billion dollars. Indeed, almost one-third of global softwood lumber exports originate in BC. However, reduced access to standing timber stocks and recently legislated forest management practices are expected to provide significant challenges to BC lumber producers. The future of BC forestry is inherently dependent on the forest management plans and harvesting strategies implemented by the provincial government and the forest companies. This study is an effort to examine the implications of these challenges in terms of the impacts on the BC economy and on softwood lumber trade flows.

In this study, a partial spatial equilibrium model is developed to analyze changes in global softwood lumber trade. This model, the Global Softwood Lumber Trade Model (SLM), is a one-commodity model which is based on work by Adams and Haynes (1980) and Cardellichio *et al.* (1989). Trade flows from 15 different regions are analyzed using elasticity estimates and production, trade and price data. Unlike earlier models, SLM focuses on the British Columbia forest sector and how changes in BC government policy (i.e., reductions in the AAC, reforestation and silviculture investments), and the forest policies in other competing regions, impact trade flows and prices, and the economic well-being of BC residents. The model establishes a base case of expected future conditions from which a variety of different scenarios are developed and compared. Prices, production, consumption and trade flows are calculated over a 38-year time horizon to 2025.

A “base case” scenario is developed using a set of explicit assumptions regarding future lumber supply and demand conditions. This base case is not deemed the most likely scenario. Instead the base case is held to be the most likely scenario of future lumber trade flow in given existing conditions. Once the base case conditions are determined, the model is used to compare alternative scenarios driven by redefined supply conditions. The different scenarios examined in this study include:

- a short-term reduction in the BC annual allowable cut, followed by an increase in AAC over time as a result of silvicultural investment;
- a permanent reduction in provincial AAC over the 38-year period of the study; and
- an increase in supply from a new source (the expected expansion in lumber production by Chile and New Zealand is included in the base scenario) represented by expanded Russian lumber production.

The findings for the different scenarios include the following.

Short-run reduction in AAC, followed by a return to 1992 output levels

The findings confirm the significance of BC in global softwood lumber trade. Changes in BC production affect global prices and trade. A short-term reduction in BC's AAC causes an increase in prices due to the inability of producers in other regions to offset the reduced BC supply, at least in the short run. BC diverts exports away from the US North region, but continues to supply the Canadian, Japanese and the US West markets. Then, as BC production expands back to 1992 harvest volumes in response to an allowable cut effect through silvicultural investment comes into play, an excess supply of lumber comes onto the market, causing real world prices to decline.

In the short run, higher global lumber prices cost consumers (this is measured by consumer surplus) and lumber producers gain (this is measured by producer surplus). In addition, the value of standing timber inventories increases and returns to timber owners also increases in all regions due to the higher lumber prices. In BC the bulk of the gains to standing timber accrue to the public sector as the owner of the forest land. In the long term, increased production in BC results in lower prices and a reduction in financial returns to BC residents; BC consumers are better off due to lower prices, but producers and forest land owners are worse off.

Permanent reduction in AAC

In the case of a permanent reduction in AAC (specified as the 38 year period for this study), the reduction causes lumber prices to increase world-wide since other producers cannot quickly respond to the reduction in global supply, as was the case for a short-run reduction in AAC. Importers of BC lumber increase domestic production in response to higher global prices. Japanese imports from BC decline over time and are replaced by the increased production from the US South. The bulk of BC exports flow east to central Canada and south to the US West.

Even though BC experiences an AAC reduction, the study indicates that most producers will be better-off as a result. The net income effect on BC is positive due to the increase in producer gains driven by higher prices; in contrast, consumers in most regions, especially Japan, will face higher lumber prices. However, this result holds only if substitute building materials and new technology do not impact prices negatively.

The sustainability of higher lumber prices will be directly determined by the ability of substitute products such as steel studs, engineered building products (which often use less wood volume and lower grades), non-wood siding, etc. to compete on price, quality and service terms. Another aspect of price which contribute to demand response is price volatility. Frequent or large variations in product price serve to encourage substitution. It is expected that the price response among consumers to these signals can be rapid and large. In addition, the transition to alternate products can be very demanding to reverse.

Expansion of production in Russia: Example of a newly-emerging supplier

An increase in supply from Russia causes world prices to fall in response to the introduction of new softwood lumber on the market. Western Europe decreases production in response to an increase in Russian softwood lumber supply. BC decreases its production and diverts trade away from the US West in favour of Japan, Interior Canada and the US North.

By the year 2025, global economic performance will improve in response to an increased supply of Russian lumber. Consumers are net winners due to lower prices, while producers are net losers. Scandinavia, in particular, experiences a dramatic decline in producer well-being because its export markets are challenged by Russian supply. BC is relatively unaffected by the increase in production.

Overall, the results indicate that changes in BC production cause an increase in the world average price until production in other regions responds to this shortage. As BC experiences a decline in production, exports to the United States are replaced by increased production in the US South (the southern yellow pine plantations). However, BC continues to increase its exports to Japan and central Canada as demand for softwood lumber grows over time.

Economic impact results from SLM projections indicate that, in the long term, a permanent reduction in AAC leads to greater economic gains for BC than does a temporary reduction in AAC that is followed by increased production through investments in reforestation and enhanced silviculture (e.g., through the Forest Renewal Plan) which lead to an allowable cut effect that permits greater future harvests. The results of the analysis suggest that a BC strategy of silvicultural investment for an increased timber objective needs to be carefully considered. An examination of the return on such investments, both in timber and non-timber terms, will serve to ensure an improved targeting of the increasingly limited investment funds. In addition, the gains from such investments will be complemented by greater efforts in developing and cultivating new markets, remaining flexible so that lumber can easily be switched from one market to another, and by using BC's ability to impact world prices. It is in this regard that forest policy can benefit from a renewed examination.

An Analysis Of The Impact Of Changes In Provincial And International Softwood Lumber Supply And Trade Flows On British Columbia

1. Introduction

BC is experiencing a reduction in the supply of merchantable timber as a result of a review of timber supply estimations, a policy commitment to achieve 12 percent of the land base in preservation status and new forest management regulations which include smaller clear-cuts and more environmentally-sensitive logging practices. In addition, projections of harvest levels indicate a fall-down period in coming years as the transition to second-growth stands proceeds. These factors have combined to product an estimated reduction in the annual allowable cut (AAC) of 20 to 25 percent from current levels (Ministry of Forest 1994; Smyth 1994), which will cause serious problems for the BC forest industry with its current capital-intensive structure. Reduced employment, mill closures and increased production costs are only among the expected consequences of the reduction in harvest levels.

What might be the longer term effects of this combination of policy changes? Would investments in silviculture, such as those implemented under the Forest Renewal Plan, yield an increase in the sector activity adequate to offset the longer-term economic impact on BC? One objective of this study was to examine these questions..

BC's competitive advantage in forestry is a result, to a large degree, of its endowment of mature timber. World softwood lumber supply is increasing, but there are wide variations in regional production. Emerging regions and other alternative sources are threatening BC's market share. The US South, New Zealand and Chile are producing softwood lumber with rotation periods many times shorter than those in BC. Russia is another producer that has enormous potential to supply softwood lumber.

Nonetheless, BC continues to dominate the international softwood lumber market. In 1991 BC accounted for almost one-third of all softwood lumber exports and one-tenth of global production (COFI 1993). However, declining domestic supply, rising wood costs and deflated international prices have created uncertainty about the future direction of the BC forest industry. Recent provincial legislation suggests that AAC will be reduced at the same time that stumpage costs are increased. BC firms object to higher stumpage costs, arguing that they are unable to compete in times of depressed prices (Hamilton 1995). The forest industry is being forced, however, to alter its focus as these issues, as well as pressure from special interest groups, both domestic and international, create an uncertain environment for the marketing of BC wood products.

As timber demand rises, traditional timber production and consumption patterns are modified. Production changes include the utilization of marginal species and smaller trees, investments in plantation forests, including on agricultural land, and biotechnological investments in enhancing tree growth (i.e., expansion of the intensive margin); and the use of marginal forest areas and removal of remaining trees from agricultural land (i.e., expansion of the extensive margin). Plantation forests have become common-place in regions such as Australia, New Zealand, the US South and parts of South America. As these plantations mature and become areas of reliable timber supply, consumers of BC lumber may look to these alternative suppliers.

The US has invested in plantation forests for over half a century and, in regions such as the US South, second- and third-growth timber is being harvested. Other countries such as New Zealand, Chile, Australia and Brazil are investing in plantations with high yield/short rotation species that are expected to have an impact on world supply in the near future, while the former USSR is an area with abundant timber resources that should not be neglected. While BC lumber may have a quality advantage over that from other regions, direct comparisons on that score are not always possible as a result of new technologies and the different uses for lumber. Further, there are no good data to indicate that lumber from BC commands a price premium. New Zealand radiata pine, for example, has become a substitute for ponderosa pine and other US species during periods of high lumber prices (Apthorp 1994).

Due to a large standing inventory of timber, low rates of growth and the uncertainty of property rights there has been little investment in BC in replanting and intensive silviculture, at least until recently. Analysis has produced results that suggest, as a financial investment, silviculture expenditures are not attractive in many BC regions (Benson 1988; Thompson *et al.* 1990). As illustrated in Figure 1, BC growth rates (i.e., mean annual increments) are one-fifth of those in the southern hemisphere rapid growth plantations, making forest management plans even more important over the long run. However, BC needs to pursue a forest management plan whereby the forest resources are used in a manner that maximizes provincial welfare, not simply harvested timber volume. This multiple-objective model is increasingly reflected in BC's policy structure.

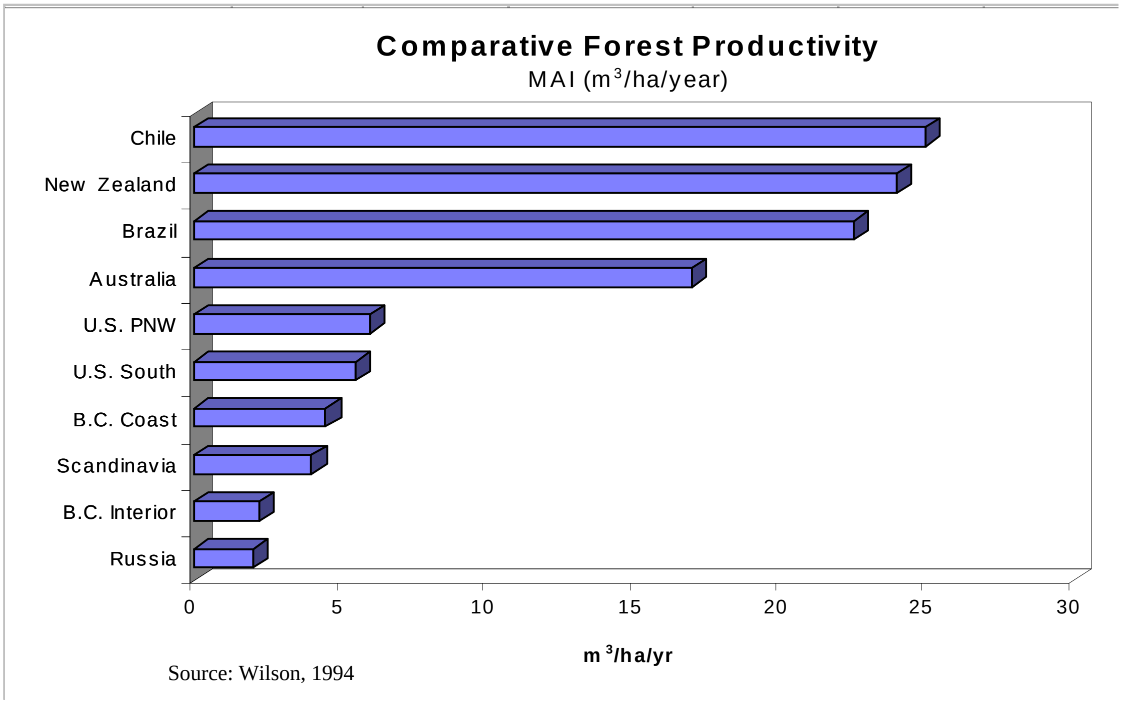

Figure 1

The 60-100 year rotation length of BC forests creates uncertainty regarding silvicultural investment and harvesting patterns. Since future demand for lumber is uncertain, the type and size of silvicultural investments are considerations for the BC forest industry. Currently timber is harvested for lumber, and the residual is used for pulp and paper. An option exists for more regions to grow timber exclusively for pulp and paper, thus altering current investment decisions. However, the future of BC lumber remains promising, although factors such as technical change and increased competition from emerging regions could affect market demand for BC lumber. As technology develops, fibre could substitute for sawn timber and cause a decline in demand for BC's construction material.

The BC forest industry structure is dominated by commodity-grade manufacturing with an export concentration in three main markets. Secondary manufacturing has grown in significance in the 1990's but it remains a relatively small component of the total industry. Indeed, the bulk of the product mix in secondary manufacturing, measured in both employment and sales terms, is in remanufactured products like cutting for clear wood and finger-jointing. The forest industry also invests little in market research .. a characteristic to much of Canadian industry. Exports of lumber outside Canada account for over 75% of total volume produced. The US imports about 58% of total production (COFI 1993). Other major markets for BC lumber are Canada (20%), Japan (14%), and the UK (3%). See Figure 2.

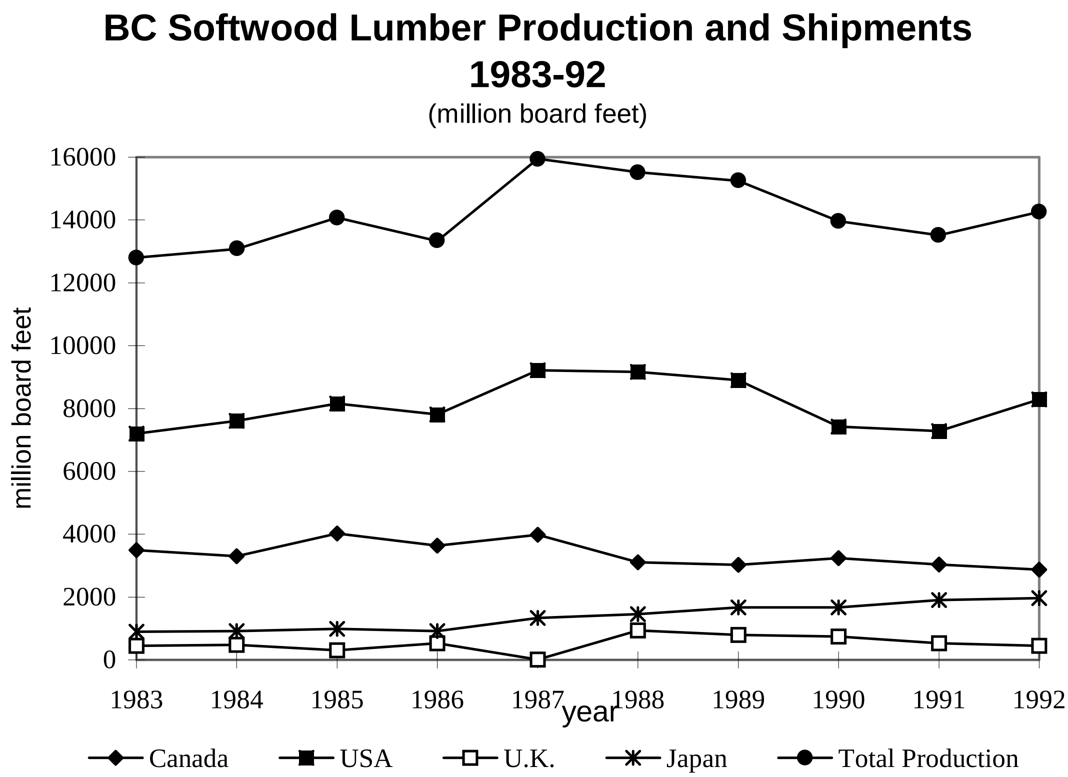

Figure 2

Demand patterns in the US and Japan differ considerably. The US is the world's largest producer and consumer of softwood lumber, whereas Japan imports most of its lumber leaving its domestic forest lands relatively untouched. Both of these markets have strong currencies compared to the Canadian dollar, thereby making BC wood products more attractive.

The US accounts for approximately 25% of world production, of which less than 10% is exported. Until the late 1980s, the US West dominated US lumber production, but recent concern about the endangered spotted owl has resulted in harvest reductions, allowing the US South to increase its market share of US lumber production by over 10%. US South production is expected to grow to over 50% of US lumber market share by the year 2000 (Widman 1994). Although the US is the largest producer, it is also the largest importer and consumer. In 1992, over 19.6 million m^3 of BC lumber was sent to the US (COFI 1993). Dependency on the US market could cause BC exporters to scramble to find alternative markets as plantations from the US South become more competitive in terms of output volume (Smyth 1994).

The Japanese market has traditionally demanded “non-SPF”, large-dimension, appearance grade timber from BC. BC old-growth possesses qualities that are well-suited for Japanese construction meeting both structural and decorative demands. The 1995 Kobe earthquake provided a clear demonstration of the relative structural properties of the traditional post and beam versus the platform frame (i.e., 2 X 4) construction styles. Houses of Vancouver Village in Kobe, built using the platform frame style, were relatively undamaged compared to traditional post and beam housing (Column One 1995). Exports to Japan have more than doubled over the past ten years and trade is favorable between the two regions due to location.

Although BC’s sawtimber exports to Japan has increased considerably the cost advantages in Chile, Brazil and New Zealand could change the demand for ‘performance’ grade lumber. In addition, both Sweden and Finland have annual timber increment that is currently not being harvested and have initiated log and lumber exports to Japan. The Russian timber stock, which remains poorly defined, could provide a further source of considerable competition should the stock prove to be there, the necessary infrastructure be put in place, and perhaps most importantly, the lack of common law (contract process) be resolved.

Global supply of softwood lumber is increasing over time due to increased harvests and developments in technology. It is also changing. As resources become less abundant and demand conditions change, countries that were net exporters could become importers. In this study, we focus on softwood lumber as hardwoods do not yet appear to be an adequate substitute for softwoods. We examine the effects of forest policies and increased global supply on international trade flows. A partial equilibrium trade model for a single commodity is developed, and is referred to as the Global Softwood Lumber Trade Model (SLM) The model was developed at, and is available from, the Forest Economics and Policy Analysis (FEPA) Research Unit at the University of British Columbia. The model is based on work by Adams and Haynes (1980) and Cardellichio *et al.* (1990). Unlike earlier models, SLM focuses on BC and is used to predict how different regions react to different supply and demand conditions. The model predicts changes in softwood lumber trade, production, consumption and prices for seven demand regions and eight supply regions over a 38-year period from 1987 to 2025. The base case scenario, which is derived from explicit assumptions about future supply and demand conditions, yields projections regarding future market conditions. The following counterfactual scenarios are compared with the base case scenario:

1. a short-term reduction in provincial AAC, followed by an increase in AAC over time attributed to recent reforestation and current investments in silviculture;
2. a reduction in provincial AAC with no increase in AAC over time; and
3. an increase in supplies from Russian sources.

Projections from SLM are indicative of long-run equilibrium conditions in global forest markets. SLM can be used as a tool in developing public policy scenarios and in the making of rational investment decisions—both private and public. The provincial government's introduction of new policies in forest management is of particular interest because it affects investment decisions, land use and costs of production. By modeling different policy scenarios, projections of future trade flows are generated and different scenarios are compared, as are impacts on provincial well being.

The study is organized as follows. In the next section, partial equilibrium trade models are discussed and existing models employed in forestry are reviewed. In section 3, the SLM is described, while the results of the base scenario and three counterfactuals are provided in section 4. The conclusions follow in section 5.

2. Spatial Equilibrium Modeling: A Review

Research in spatial models has progressed a great deal since the early 1960s. Inter-regional trade is increasing as restrictions such as tariff and non-tariff barriers, embargoes, most favoured nation (MFN) status and technological constraints are overcome. As a result, free-trade agreements and regional trading blocks are being formed, thus creating a demand for research in spatially optimal trade conditions. Policies, economic development and different business strategies require analysis using international trade models. The development of spatial models has come primarily from agriculture and general economics research; the forest sector did not venture into this area until the early 1970s. Spatial models can be classified as indicated in the following paragraphs.

Two-Region, Nonspatial Models

The two-region, nonspatial model divides the market into two geographical regions: the target region and the rest of the world (ROW). The target region is either a net importer or exporter and has either an excess demand or supply curve. If it is a small player in the world market, it is deemed a "small country" and has no influence on world price. If it has a significant amount of market share, it is deemed a "large country," price is endogenous, and its production decisions affect trade prices and quantities.

Two-region, nonspatial models are the most aggregate of all trade models, but have been used very little in the forest sector. Its primary advantage is its ability to focus on a specific country or region. It is useful when only crude approximations are needed; the disadvantage is its high level of aggregation. The ROW category groups all bilateral trade together, thereby making supply and demand elasticities unreliable. Also, the decision of whether the region is a "small country" or "large country" is arbitrary and can lead to problems in model estimation.

Multi-region, Nonspatial Price Equilibrium Models

The multi-region, nonspatial price equilibrium model calculates quantities traded by each region, but it does not calculate trade flows among regions. Excess demand and excess supply are used to calculate a global equilibrium price that has been adjusted to include the transport costs between each region.

Since this model cannot identify bilateral trade flows, it cannot be used to predict specific bilateral trade restrictions. It does, however, effectively model tariff or quota restrictions imposed on all regions by a single region. The primary disadvantage of this model is the assumption of a single global equilibrium price.

Spatial Equilibrium Models

The spatial equilibrium (SE) model calculates prices, quantities and bilateral trade flows endogenously. Transportation costs are used to quantify the spatial location of trading partners. When transportation costs are minimized, optimal trade conditions prevail. A partial SE model is one that only considers one commodity while assuming all other factors constant.

The SE model is a desirable modeling technique when long-term analysis is required. Over time a market moves toward competitive equilibrium and trade routes maximizing individual welfare are developed. Thus, trade relationships that do not exist may very well develop over the long term. The SE model is able to predict these new trade patterns. Adams and Haynes (1987) discuss the advantages of using the SE model and note that "...numerous geographic regions are readily accommodated...with little additional solution cost or increase in model complexity. This stands in distinct contrast to any other general modeling approaches." Also, the SE model provides the flexibility to perform changing policy simulations by simply altering the objective function or constraints to imitate the proposed policy. The limitations of the SE model focus on the assumptions implicit in the model. These assumptions include perfect competition, homogeneous products and per unit transportation costs. The SE model is the model-type used in this study.

Trade Flow and Market Share Models

Trade flow and market share models explain bilateral trade flows between specific regions for specific relationships. This contrasts with the SE model where trade flows between all regions are determined. The trade flow and market share models attempt to explain differences in import demand characteristics depending on the region and the product. For each region and commodity, a market share relationship exists; it is a function of relative import prices and substitutes, and other derived demand shifters such as output price, economic indicators and end-use activity measures (Adams and Haynes 1987). Cardellichio and Veltkamp (1981) use this form of model to explain imports and inter-regional shipments in the softwood lumber and plywood markets. A market share relation is developed for each region to explain each supplier's preference to supply less distant markets.

Another form of this model uses explicit supply and demand equations for each bilateral trade flow. For each region, a solution of equilibrium prices and flows is determined. Data requirements are extensive for these models, but trade flows are generally more accurate than in the SE model. Short-term projections are more accurate as the distributed lag of price and volume achieves the appropriate inertia properties. The major limitation of these models is their inability to model trade flows that did not exist historically. Also, the models become very large and data requirements are extensive when many producers and consumers are modeled.

Transportation models

The transportation model minimizes transportation costs of bilateral trade flows given the unit costs of shipments between each port (Koopmans 1948). This model is similar to the SE model where trade flows are transportation cost minimizing; however, the transportation model is less general than the SE model. Supply, demand and prices are determined outside the model and bilateral trade flows are approximated.

Forest Sector Models

There have been major developments and extensive undertakings in forest trade models recently. The SE model is used most frequently and viewed advantageous for modeling trade and long-term policy effects (Adams and Haynes 1987). Studies have become more complicated and the number of regions and products have become substantial in number (Cardellichio *et al*. 1989; Boyd, Doroodian and Abdul-Latif 1993; Kallio, Dykstra and Binkley 1987).

The first noteworthy forest market model was the Timber Assessment Market Model (TAMM) by Adams and Haynes (1980). TAMM is a SE market model. The methodology of TAMM is still the basis of numerous models, including most of the models discussed below and the current one. TAMM models nine supply regions and six demand regions in North America for two major forest sectors (final products and stumpage). The final products (including lumber) are modeled with their individual supply and demand curves linked to stumpage supply. Due to difficulties experienced in estimating the simple linear demand curve, the demand functions for lumber are derived using the national demand elasticity and regional demand quantities and prices.[1] Regional demand elasticities are derived by relating the national US lumber demand elasticity, -0.35, to the national/regional price ratio. This is based on the assumption that the national/regional elasticities ratio is equal to the price ratio. The basic form of the demand equations is:

$$D_{it} = \gamma_o - \gamma_1 P_{it}, \qquad (1)$$

where

D_{it} is the quantity demanded of lumber in region *i* in year *t*;
P_{it} is the delivered price of lumber in region *i* in year *t; and*
γ_o, γ_1 are the intercept and slope parameters, respectively.

Adams and Haynes (1980) refer to their regional elasticity derivation as the hybrid approach.

The product supply functions in TAMM are represented by a lagged supply term, average product price at the mill, "stump to car" transport price and an over-run factor. Lumber supply elasticities with respect to price range from 0.21 in the Western Pacific Northwest to 0.79 in the Southern US. The estimate for the supply elasticity of Canada is 0.47, with an export supply elasticity estimated at 0.89.

The output of TAMM consists of prices and quantities, harvest volumes and stumpage prices, and the distribution of shipments. The model is calibrated to 1978 values and achieves equilibrium for future time periods by solving for each year of the forecast. The model was validated by plotting actual values against predicted values for the ten-year period 1966 to 1976. The predicted values replicated actual values very closely, especially for lumber. US imports from Canada were overstated due to demand elasticities changing over time (Adams and Haynes 1980).

Numerous simulations were performed with TAMM, but the simulation of interest for the current study examined changes in exports when Canadian production costs increased over time. This scenario comes from the assumption that second-growth timber will take longer to mature, thus creating a fall-down in supply, forcing firms to log the extensive

[1] The expected size and signs of the coefficients in the demand functions are not intuitive. This phenomena was also found by Berck (1979) who had to use different price variables.

margin. TAMM estimates that an increase in production costs of \$6/MBF in 2010, \$11/MBF in 2020 and \$17/MBF in 2030 will cause a 14% decrease in Canadian timber production and 31% decrease in exports to the US. A similar analysis is performed in the current study, although the decrease in supply is due to provincial government policy.

The SE model developed by Boyd and Krutilla (1987) is conceptually related to TAMM with some improvements. Boyd and Krutilla (1987) analyze lumber trade between 34 supply regions and 39 demand regions in Canada and the United States. They pay particular attention to transportation costs, exchange rates and tariffs. Demand elasticities are derived indirectly from local construction activity and lumber prices. The construction component induces demand elasticities to vary across regions. The supply of US domestic lumber is assumed to be fairly inelastic since US government timber sales are not responsive to price. Excess supply cannot be more inelastic than domestic supply, so Canada's exports are able to vary with price. The authors use TAMM's estimate of Canada's export supply elasticity, finding that Canadian exporters can lose up to 7% of their pre-tariff welfare as a result of US trade restrictions (a 10% ad valorem tariff). If suppliers are more responsive to price changes (supply is more elastic), a tariff will be more effective in reducing exports. Changes in the foreign exchange market had little impact on the demand for Canadian lumber in Boyd and Krutilla's model.

Sedjo (1983) modeled the economic returns of different forest regions with an emphasis on the potential of plantation forests. His study is of interest because it establishes long-term supply potentials of plantations. Sedjo (1983) found that plantations of South America and the US South generate higher net present values (NPVs) than temperate-climate wood-producing areas. Temperate regions experience negative NPV for scenarios with high discount rates, high production costs and high transportation costs. A comparative advantage is found in areas with high-yield, short rotation plantations. The implications of these findings suggest that BC's forest industry could come under pressure once its comparative advantage (in absolute volume of timber) is reduced as a result of harvesting its stock of mature timber.

The International Institute for Applied Systems Analysis (IIASA) developed the Global Trade Model (GTM) (Kallio, Dykstra and Binkley 1987). The IIASA GTM uses a SE model to represent the global forest sector and international trade in forest products. The model estimates production, consumption, trade and prices of 16 forest products. It also projects values for the year 2030 given a variety of assumed structural changes. These scenarios include changes in global economic growth, changes in the strength of currency exchange rates, trade liberalization, increased supply from the USSR region, and environmental effects from acid rain and global warming. The basic model is a partial market equilibrium economic model with linear constraints and a non-linear objective function. The model links the components of each region's forest sectors to address the complexity of the forest industry. Timber supply, processing, demand and trade are all linked to their respective markets. There are 10 iterations of the model in a 50-year forecast where equilibrium for any time period is dependent on the previous time period. The model does not make future time periods endogenous (i.e., it is not a dynamic model).

The results of the IIASA GTM indicate trends in the forest sector that are important to the current study. The model predicts that Canada's share of softwood lumber trade, mainly to Japan and the Rest of the World, will increase. The model also finds that there is not a significant increase in real prices of softwood lumber. However, when the model allows for increased supply from Russia, the results indicate that the main losers are Canada, the US, Southeast Asia, Brazil and Chile.

The fundamental limitation of IIASA GTM is its inability to address inter-temporal optimization; decisions in time *t+1* have no effect on decisions in time *t*. This causes a bias in the model that is also a problem in most other trade models. Another problem of GTM is the reliability of its database (Cardellichio and Adams 1987). Data are inconsistent and unreliable for some cases and replication is problematic. Despite its limitations, GTM provides an excellent framework for analysis of forest sector trade.

To address the aforementioned concern, Sedjo and Lyon (1991) developed an optimal control model–the Timber Supply Model (TSM)–that addresses the changing age and volume of forests and the changing state of the forest. Inter-temporal investment can be modeled to allow for optimal rotation length and optimal old-growth depletion. TSM uses a partial equilibrium approach by assuming that the forest sector is a price taker with respect to macroeconomic parameters such as interest rates, prices of intermediate goods and factor input prices. The model calculates global demand and each region's supply, but *it does not predict bilateral trade flows*. It is of interest for the current study because it investigates the draw down of inventories of old-growth stands and models the transition to second-growth and plantation timber. The TSM estimates that the global demand for timber will increase at 0.6% to 0.9% a year to the year 2035. These results are similar to the GTM-estimated annual growth rate of 1.2% to the year 2030. Sedjo and Lyon (1991) also predict that real prices of industrial roundwood will remain relatively constant over the estimated time horizon.

A revised TSM (Sedjo *et al.* 1994) incorporates the expected decline in harvest in BC and the US West. The authors demonstrate that average prices only increase about 5% over the original TSM results. Increased production from the US South, Scandinavia and emerging regions offset the reduction in supply in the Pacific Northwest. When demand is assumed much stronger, prices increase 30% over the base case, and regions such as Eastern Canada become an important alternative supply source. These results are consistent with

Messmer and Booth (1993) who found that Ontario harvest levels are sensitive to relatively minor changes in price.

Boyd, Doroodian and Adul-Latif (1993) attempt to quantify the consequences of reducing and eliminating lumber (pine and fir) tariff restrictions between Canada and the US, and the US and Mexico, as a result of the North American Free Trade Agreement. They analyze trade flows, prices and welfare effects of all three countries using a variation of the SE model developed by Boyd and Krutilla (1987). Since transportation costs act like a tariff in the model, they simulate the tariff rate by raising transportation costs. Own-price elasticities are estimates from Adams, Boyd and Angles (1992) and cross-price elasticities between fir and pine are derived indirectly by relating construction activity to the input amounts of pine, fir and capital. In order to keep shipments of fir out of pine producing regions, they impose exceedingly high transportation costs (US\$220/m^3). (This method is used in the current study to restrict trade between some regions.)

The results suggest that the removal of tariffs on lumber cause consumption to increase and lumber to be allocated more efficiently. British Columbia is expected to gain over US\$6 million dollars per year under the free trade scenario. The total gain in welfare from removal of tariffs is estimated at US\$35 million/year. Boyd, Doroodian and Adul-Latif (1993) conclude that the increase is relatively small compared to total industry revenues (about 2%), due in part to the lack of demand for lumber in Mexico. The insignificant size of the gains from trade liberalization is a common finding of studies modeling trade liberalization.

The most significant and most comprehensive forest trade model is the Global Trade Model (CGTM) developed by the Center for International Trade in Forest Products (CINTRAFOR) at the University of Washington (Cardellichio *et al.* 1989). This is a SE model that builds on IIASA GTM. The CGTM modifies GTM by covering less products (10 instead of 16) and substantially more regions (40 rather than 18). The CGTM reduces the number of products by combining all pulp and paper into one category and dropping fuelwood. It creates new categories to differentiate coniferous and non-coniferous products. As in GTM, CGTM is comprised of four components: timber supply, product supply, product demand, and trade. The demand and supply curves are determined endogenously for all but 16 regions where they are determined exogenously by the user. These exogenous regions are ones that have poor data, specialized products or little trade, and include the former USSR, Eastern Europe, Africa and all of South America except for Chile. The user must provide output and consumption levels for these regions.

As with GTM, CGTM maximizes an objective function to determine optimal global welfare. The demand function uses a non-linear form and, for some regions, elasticities from other studies. The supply curves are determined as in GTM. Also similar to the GTM, trade is banned between regions with negligible trade and regions that are not expected to trade in the future. CGTM estimates transportation costs as the gross difference between import and export prices. This causes transport costs and other transfer costs (tariff and non-tariff barriers) to be included in one value. Projections for coniferous softwood markets suggest that there will be a large increase in consumption in Western Europe, China and the US West. Production increases are projected to occur in Eastern Canada, the US South and the US North. Policy simulations with the CGTM are made through marginal increases rather than simulating extreme absolute changes since marginal policy changes are viewed as more realistic.

Perez-Garcia (1993) uses CGTM to study the global impacts of a reduction in softwood from North America. He reports considerable increases in log prices for all regions over the next 50 years and suggests price increases of 20% in the Pacific Northwest, 60% in the US South, 90% in Interior BC, and 20% in Chile. In the study, Perez-Garcia (1993) estimates two scenarios: a reduction of 33 million cubic meters from Western Canada and the US West, and an increase in log exports from Siberia (with the reduction in North American supply). Under the first scenario, the results indicate further price increases and substantial welfare losses to lumber consumers. Canadian consumers lose US$141 million and US consumers lose US$970 million. Lumber producers gain US$512 million in Canada and US$754 million in the US. Globally, lumber consumers lose about US$2.5 billion dollars annually. The second scenario does not change welfare conditions much for Canada and the US, but it does reduce global losses to only US$1.5 billion. High cost forest producers are the overall winners. The preservation of one hectare by a low cost producer is offset by the harvest of 1.12 to 1.61 hectares by high cost producers. The ratio is even higher if Siberia enters into the export market. The results clearly indicate that forest policies aimed at domestic environmental problems could have adverse global environmental implications.

The current study draws on the methodology, data and results of the papers reported above. Particular attention is given to the methodology of TAMM and CGTM. It is these models that the current study builds on by modifying scenarios, updating data and altering supply and demand specifications. The results of the above models are then compared to those of the current study.

3. The Global Softwood Lumber Trade Model

The trade model presented in this study is a spatial equilibrium (SE) model that optimizes welfare by estimating quantities traded, international prices and trade flows among regions. Under the assumptions of the SE model, countries with high costs of production or inadequate supplies look to world markets to satisfy domestic demand at lower prices. Likewise, regions supply world markets at higher than domestic prices, and regions continue to trade as long as prices, net of transportation and other transfer costs, differ from domestic prices. An iterative process is used to maximize welfare subject to certain constraints. A spatial price equilibrium is established when the demand price is equal to the sum of the supply price and transportation costs for all regions. Consumers re-arrange their consumption bundle in favour of cheaper suppliers until this equilibrium is reached. A SE model is used so bilateral trade flows can be observed. As more countries enter the world market, interactions become more complex and optimal trade flows become less obvious for each region.

The SE model assumes cost minimizing (profit maximizing) behavior by the consumer (producer). Therefore, by solving for a global maximum, regional welfare is maximized. Enke (1951) summarizes the one commodity model as follows:

> "There are three [or more] regions trading a homogeneous good. Each region constitutes a single and distinct market. The regions of each possible pair of regions are separated—but not isolated—by a transportation cost per physical unit which is independent of volume. There are no legal restrictions to limit the actions of profit-seeking traders in each region. For each region the functions which relate local price are known, and consequently the magnitude of the difference which will be exported or imported at each local price is also known. Given these trade functions and transportation costs, we wish to ascertain:
>
> 1) the net price in each region,
> 2) the quantity of exports or imports for each region,
> 3) which regions export, import, or do neither,
> 4) the aggregate trade in the commodity, [and]
> 5) the volume and direction of trade between each possible pair of regions."

The Two Region Case

To illustrate the concept of price equilibrium, the two region case is used. In Figure 3, trade occurs because equilibrium prices differ in the two regions. Without trade, price in Region A is P^A and the price in Region B is P^B. If a region's domestic price is greater or lower than the other region's price, net of transportation costs, it will engage in trade until an equilibrium is established. If a region cannot clear its market domestically, it becomes an exporter and its excess supply (ES) function is derived by laterally subtracting the demand curve from the supply curve at every price greater than the no-trade equilibrium in the domestic market. Likewise, the excess demand (ED) curve is derived from the importer's domestic market by laterally subtracting the supply curve from the demand curve at every price less than equilibrium in the domestic market. The ES and ED functions are more elastic than their respective functions in the domestic markets.

<Insert Figure 3 approximately here>

Under conditions of zero transportation costs, a price equilibrium occurs where the excess-supply and excess-demand curves intersect. Region A imports quantity Q^* from Region B and world price is equal to P^*. This is the solution of a nonspatial price equilibrium without transportation costs. The inclusion of transportation costs of *wz* per unit increases import prices, decreases export prices and reduces the amount traded. In this case Q^{**} ($< Q^*$) is traded and transport costs are equal to area *xywz* in Figure 3. When the area between the excess demand and excess supply curves is at a maximum, net of transportation costs, a spatial price equilibrium is calibrated. Samuelson (1952) termed this area (*Axz+Byw*) the net social payoff (*NSP*). He explains that this area is "artificial" in magnitude since the "Invisible Hand has led us to maximization, [and] we need not necessarily attach any social welfare significance to the result." The *NSP* is also equivalent to the sum of *aed* in Region A and *gkj* in Region B.

Constraints are imposed on the model in order to define a feasible solution space. The constraints form bounds on the solution to restrict the values of the flow parameters. The minimum constraints needed to calibrate the model include total exports equal total imports, total exports of a region are greater than or equal to the sum of all imports from that region, and the non-negativity of prices and quantities.

Multi-region Case

The two region case is adequate for describing the essence of the model, but it does not explain multi-lateral trade movements. By minimizing transportation costs between regions, a direction of trade matrix can be determined. The dual of this problem, maximizing *NSP*, yields the same results. A spatial price equilibrium is found when all regions have maximized their individual welfare.

The multi-region case considers n regions that supply and demand a given commodity. Each region is considered an independent market where quantity h_j is supplied at price p_j with a inverse supply function, $S_j(h_j)$, $j=1,...,n$. Quantity demanded, d_i, is explained by the inverse demand function, $D_i(d_i)$, $i=1,...,n$. It is assumed that $S_j(h_j)$ is a continuous monotone increasing function in h_j, $h_j \geq 0$, and that $D_i(d_i)$ is a continuous decreasing monotone function in d_i, $d_i \geq 0$. Let y_{ji} be the amount region j exports to import region i, and let c_{ji} be the price of that amount of bilateral trade per unit—the transportation costs from region *j* to region *i*. Equilibrium occurs when the following condition holds for all *i* and *j*:

$$S_j(h_j) + c_{ji} - D_i(d_i) = 0 \text{ if } y_{ji} > 0, \tag{2}$$

$$\geq 0 \text{ if } y_{ji} = 0. \tag{3}$$

The NSP is derived by maximizing the sum of the area under the excess demand curves less the sum of the area under the excess supply curves and transportation costs. Optimal trade flows are determined by simply solving the following optimization problem:

$$\max \sum_i \int_0^{q_i} D_i(q_i)dq - \sum_j \int_0^{y_j} S_j(y_j)dy - \sum_i \sum_j c_{ji} y_{ji} \tag{4}$$

subject to:

$$p_j, y_{ji}, y_j, q_i \geq 0 \ \forall \ i, j, \tag{5}$$

$$\sum_i q_i - \sum_j y_j = 0, \tag{6}$$

$$-q_i + \sum_j y_{ji} \geq 0, \tag{7}$$

$$y_j - \sum_i y_{ji} \geq 0, \tag{8}$$

where q_i is the quantity of imports of region *i*, and y_j is the quantity of exports from region *j*. The constraints form bounds on the optimal solution space. Constraint (5) ensures prices and quantities are positive. Constraint (6) ensures all markets clear. Constraint (7) ensures that what is supplied to region *i* is at least equal to what is consumed in region *i*. Constraint (8) ensures that the supply of region *j* is at least as big as what region *j* exports. The Kuhn-Tucker conditions are equivalent to the above constraints. Since the objective function is the sum of two concave functions and a linear function, it is therefore a concave function and the Kuhn-Tucker conditions are necessary and sufficient for equilibrium values q_i, y_j and t_{ij} (Florian and Los 1982). Inverse functions are used because the constraints to the problem are in terms of quantity. This framework provides the basis of the spatial equilibrium problem to be solved in this study.

The Structure of SLM

The object of this study is to develop a trade model that replicates current lumber trade and then use it to estimate future conditions given specific policy decisions. The one-commodity SE model is used here because of its ability to estimate trade flows and its explicit consideration of regional price differences through transportation costs. Only softwood lumber is modeled since it is of particular interest to the BC forest industry. The model is first calibrated to replicate trade flows from 1987 and then used to project trade to the year 2025. The model performs 6 iterations over a 38-year forecast period where equilibrium for each period is dependent on the supply and demand conditions of the previous period. Implicit assumptions are made regarding future market conditions for each time period. Initial projections are referred to as the "base case" with counterfactual policy scenarios analyzed relative to it.

A partial equilibrium model (versus a general equilibrium model) is used in this study under the assumption that changes in the softwood lumber industry do not disturb nonforestry sectors of the economy. This implies that the softwood lumber industry acts as a price taker with respect to changes in interest rates and factor inputs. Although the SE model may not produce predictions as accurate as other short-term models, it does provide information on long-term equilibrium and the competitive advantage of each region (Cardellichio *et al*. 1989; Adams and Haynes 1987). The model generates optimal trade patterns and predicts changes in the international demand for softwood lumber.

A total of 15 regions are considered. Each region is active in the international softwood lumber market as either an importer or an exporter. Using reported supply and demand elasticities, domestic markets are modeled and trade functions are derived for the international market. A region will be represented by either an excess-demand function (if it is an importer) or an excess-supply function (if it is an exporter). Transportation costs between regions are estimated and used to calibrate the spatial nature of international trade. By maximizing the area between the trade functions net of transportation costs and subject to a number of constraints, optimum trade flows are determined.

The model is set-up and estimated using the Microsoft Excel software package. Through an iterative approach, each region's optimal trade flow is calculated by optimizing global welfare. The Excel software package is used because of its availability and simplicity. It allows users to try different trade scenarios, perform sensitivity analysis or impose additional constraints with little difficulty. Also, since Excel permits programming with

Visual Basic, the model can be created as a stand alone executable file to be used with the Excel spreadsheet program.

The Regions

The model estimates 15 regions (see Table 1) that are active in the international trade in softwood lumber. Of these regions, 8 supply lumber to the international market and 7 are demanders of international lumber. In 1992, BC and Interior Canada accounted for over three-quarters of Canada's softwood lumber exports and one-third of world exports (National Forestry Database 1993). The US West and US South primarily supply the domestic US market, but also export some softwood lumber overseas. The Scandinavian countries of Sweden and Finland form the other primary exporting region; their export share is about 16% of total world exports. Chile and New Zealand are emerging supply regions with growing market shares and are of interest when estimating future trade flows. The remaining exporting regions are grouped together as ROW and account for only about 7% of the market share.

Table 1

Exporting Regions	Importing Regions
British Columbia	Central Canada[a]
Eastern Canada[b]	US West Interior[d]
US West Coast[c]	US South Atlantic[f]
US South Central[e]	US North[g]
Scandinavia[h]	W. Europe[i]
Chile	Japan
New Zealand	Rest of the World Imports (ROW)
Rest of the World Exports (ROW)	

Notes:

a) Alberta, Saskatchewan, Manitoba and Ontario.

b) Quebec and Atlantic provinces.

c) Washington and Oregon.

d) Montana, Idaho, Colorado, Nevada, Wyoming, Utah, Arizona, New Mexico and South Dakot

e) Kentuky, Alabama, Tennessee, Arkansas, Louisiana, Oklahoma and Texas.

f) Virginia, North Carolina, South Carolina, Florida and Georgia.

g) The Notheast and North Central US States.

h) Finland and Sweden.

i) All Western Block countries (excluding Finland and Sweden).

The demand for softwood lumber is dominated by the US, where almost two-fifths of all foreign exports are destined; the US imports almost all of this from Canada (FAO 1992). The US North is the largest demand region within the US, accounting for about one-third of the imports from all regions. Central Canada imports primarily from BC with some imports from different regions in the US. Western Europe imports about 32% and Japan accounts for about 8%. The remainder of the importers is included in ROW and competes for about 10% of the market.

Table 2

Total Quantity Produced

millions of cubic metres

	Actual			*Predicted*	
Export Regions	**1987**[*]	**1992**		**1987**	**1992**
British Columbia	37.6	33.4	a	36.9	34.5
Eastern Canada	15.0	11.9	a	14.8	14.5
US West Coast	31.2	24.2	b	29.7	28.1
US South Central	10.3	15.3	c	10.3	10.9
Scandinavia	18.7	18.8	d	18.6	19.3
Chile	2.3	2.6	d	2.7	2.4
New Zealand	1.8	2.5	d	2.2	2.0
ROW	76.8	*n.a.*		77.6	79.2

	Actual			*Predicted*	
Import Regions	**1987**[*]	**1992**		**1987**	**1992**
Interior Canada	9.4	9.3	a	9.3	9.1
US West Interior	10.3	9.4	b	10.1	9.5
US South Atlantic	10.3	13.5	c	10.1	11.0
US North	3.1	3.5	c	3.0	2.9
Western Europe	33.9	32.9	d	33.7	35.2
Japan	26.2	24.4	d	26.1	26.1
ROW	93.1	*n.a.*		94.1	96.0

Note: US South data are assumed from Cardellichio et al. (1989)
n.a. - not available
[*] Cardellichio et al. (1989)

There is an abundance of literature reporting domestic supply and demand elasticities for Canada and especially the US (see Gaston, Cohen and Prins 1994). Elasticities for other regions are less accessible and somewhat deceiving without their respective price/quantity ratio. This model uses elasticity estimates by Cardellichio *et al.* (1989) for all regions. Table 3 reports the own-price supply and demand elasticities for each region. These elasticities are comparable to the elasticities used by TAMM (Adams and Haynes 1980).

Table 3

Lumber Supply and Demand Elasticities

Region	**Own-price Elasticity of Supply**	**Own-price Elasticity of Demand**
British Columbia	1.0	-0.3
Central Canada	1.0	-0.3
Eastern Canada	1.0	-0.3
US West	1.0	-0.3
US South	1.0	-0.3
US North	1.4	-0.3
Scandinavia	1.0	-0.3
Western Europe	1.0	-0.3
Chile	2.8	-0.3
New Zealand	2.2	-0.45
Japan	0.9	-0.67
Rest of the World	1.0	-0.3

Source: Cardellichio *et al.* (1989)

Model Specification

In an ideal trade model, information on all market interactions would be included in each region's supply and demand equations. The development of a complete forest model is somewhat elusive due primarily to the lack of data. Also, by making the model more complex, the results may or may not improve over extended projection periods. This study relates prices to quantities using linear domestic supply and demand curves to estimate the international trade functions.

The model uses linear functions for a number of reasons. First, they are integrable and robust in determining an equilibrium. Second, elasticities are non-constant. As prices rise, price becomes more elastic and resembles market conditions more closely. Third, demand curves with constant elasticities less than $|1.0|$ indicate a negative marginal revenue and, therefore, cannot be profit maximizing; it is impossible for marginal revenue to intersect marginal cost since marginal revenue is continuously less than zero and marginal cost is continuously greater than zero. The use of linear functions for demand and supply curves eliminate these problems associated with using non-linear functions. However, as with the other trade models, the objective function remains non-linear.

Within the model's supply and demand curves, changes in exogenous variables are permitted through an intercept shifter. By shifting the intercepts on supply or demand, a uniform increase or decrease in quantity is assumed for all price/quantity pairs. A change in slope, or a rotation about the equilibrium, may or may not represent real world conditions more accurately, but do, however, pose a problem in solving for equilibrium values. The scenarios presented in this study are modeled using an intercept shifter since the changes in supply are assumed to cause uniform changes in price for all quantity/price ratios.

Consumption Function

For each region, the demand function explains the relationship between domestic prices and the level of consumption. The demand function is derived using prices, quantities and elasticities from existing literature. Elasticity estimates from Cardellichio *et al.* (1989) are used to evaluate domestic demand curves since this is also the source of price and quantity data.

Given that lumber is consumed primarily by the housing market, elements outside the forest sector can influence lumber demand. Interest rates, income growth, population and technology can shift demand over time. Due to incomplete data, these factors are not explicitly included in the demand function; however, they are included as an intercept shifter.

Given that a partial equilibrium is desired, the primary requirement for each region is that the demand function must depend on price. The final demand function for region i, $i=1,..,15$, and time period t is specified as follows:

$$Q_{it} = \alpha_{it} + \beta_i P_{it}^D, \quad (9)$$

where:

Q is lumber consumption in millions of cubic metres,
P is the real US price of lumber per cubic metre, and
α, β are the intercept and slope parameters, respectively.

Changes in demand from non-price effects are measured over time by making α endogenous. Each time period is dependent on the changes of previous time periods. Let α_i be defined as follows:

$$\alpha_{it} = \alpha_{i(t-1)} + \alpha_{i(t-1)}(n_i)(t-(t-1)) \quad (10)$$

where:

n_i is the global per annum increase in demand for softwood lumber,
t is the year of the current period, and
t-1 is the year of the previous period.

The inclusion of this effect allows the model to be used in estimating future trade flows by simulating changes in the nonforest sector of each region. It is obvious that, since n_i=0 in the base case, α_{it} equals $\alpha_{i(t-1)}$. It follows that as global demand increases, consumers will demand more at a given price, thereby shifting the intercept of the demand curve.

The demand equation must be in its inverted form to be used in the algorithm of the objective function. Therefore the estimated domestic demand equation used in the model is defined as:

$$P_{it} = -\frac{\alpha_{i(t-1)} + \alpha_{i(t-1)}(n_i)(t-(t-1))}{(\beta_i)} + \frac{1}{\beta_i} Q_{it}. \quad (11)$$

From above, it is assumed that the slope of the demand equation remains constant over time.

Production Function

Each domestic lumber supply function is defined as the relationship between the quantity produced and the price. Changes in the supply of lumber in domestic markets are felt in the international market. Domestic elasticities, prices and quantities are used to estimate the supply curve. As in demand elasticity estimates, there is a wide range in the values of supply elasticities. Long-run and short-run elasticities vary due to the ability to earn positive profits in the short run. Long-run elasticities are used because they resemble a competitive market more accurately.

The supply of lumber is dependent on numerous factors other than price. Technology will cause an increase in utilization rates in lumber as well as develop other sectors which may divert input materials away from lumber. Investment in enhanced silviculture and plantations cause an increase in future timber supplies. Supply is also dependent on government policy, which is currently evident in BC (Ministry of Forests 1994). These factors have not been explicitly estimated due to lack of data. Instead, they have been acknowledged in the supply function as intercept shifters for future periods. As with the demand equation, slope shifters may enhance results, however this should be addressed in a sensitivity analysis during further research. The final supply function for region *i*, *i=1,...,15*, for time period *t* is specified as:

$$Y_{it} = c_{it} + d_i P_{it}^S \qquad (12)$$

where:

Y is lumber supplied in million m^3

P^S is the real US price of lumber per m^3

c, d are the intercept and slope parameters, respectively.

Parameter c is made endogenous to measure the effect that changes in non-price factors have over time. Let c_i be defined as follows:

$$c_{it} = c_{i(t-1)} + c_{i(t-1)}((g_i + h_i)(t-(t-1))) \qquad (13)$$

where:

g_i is the rate of change in global supply due to technological developments,

h_i is the rate of change in regional supply due to increasing rates of harvests,

t is the year of the current period, and

$t-1$ is the year of the previous period.

Forecasts of future lumber supply can be made by allowing these variables to change with expected changes in technology and harvest rates. Supply changes are easier to predict in the short term since harvests from standing inventories can be projected over time. In the first period, c_{it} equals $c_{i(t-1)}$ since g_i and h_i equal zero. The supply equation must be inverted so it is a function of quantity. Therefore the estimated domestic supply equation used in the model is defined as:

$$P_{it}^{S} = -\frac{c_{i(t-1)} + c_{i(t-1)}((g_i - h_i)(t-(t-1)))}{d_i} + \frac{1}{d_i} Y_{it}\,. \qquad (14)$$

The domestic supply curve will shift according to regional supply conditions and policy decisions.

Trade Functions

Each region will be either a net importer, a net exporter or neither, depending on the domestic equilibrium price. The trade functions are generated by using each region's 1987 price and quantity data and estimating their respective excess demand or excess supply elasticity. If a region is a net exporter, the slope of the excess supply curve is derived from the elasticity of excess supply, the quantity traded and the domestic price. The intercept of the excess supply curve is equal to the equilibrium price in the domestic market. The excess demand curve is derived using this same method except substituting the excess supply elasticity with its excess demand elasticity. These equations are then used in the objective function to calculate optimal trade relations.

The slope of the trade functions remains constant over time since the slope of the domestic supply and demand curves do not change. Changes in domestic conditions are measured in the international market through changes in the market clearing price in each region. Thus, the intercepts of the excess supply and demand curves are altered. International trade conditions are dependent on domestic conditions and the relative size of the domestic markets. It is obvious that supply changes in BC will have a more dramatic effect on price than a small volume exporter such as Chile.

Transportation Costs

Transportation costs, used to quantify the relative distances between trading partners, play an important role in determining flows and direction of trade. Transport costs of commodities with low value-to-weight ratios, such as lumber, are even more important, especially when looking at a region's ability to compete with distant markets. BC's close proximity to the giant US market gives BC forest companies a geographic advantage over competing foreign producers. Foreign marginal producers cannot afford to trade due to their proximity to importing regions.

Transportation costs can be difficult to estimate due to highly variable freight rates. Costs vary between regions and over different distances, particularly with respect to port handling fees. Long-term contracts, energy costs, port facilities, backhaul availability, commodity and length of haul are all determinants of shipping costs and account for the highly unstable transport costs.

In SE models, transport costs are assumed to be independent of volume and a function only of distance. Sedjo (1983) uses the following function to estimate freight costs as a function of distance:

$$FR = 1.6(16 + 4D) \qquad (15)$$

where:

FR is the freight rate per thousand board feet (MBF); and
D is the distance in thousands of nautical miles.

Using the linear relationship (15) is problematic in representing the differences between import and export prices. Since the SE model assumes that transport costs are equal to the price difference between two regions, a strategy used by Cardellichio *et al.* (1989) is adopted and used to model transportation and other transfer costs in this study. The price equilibrium is defined as follows:

$$P_i = P_j + T_{ji} + C_{ji}, \qquad (16)$$

where :

P is the average product price,
T is the transportation cost,
C is the value adjustment or quality differential, and
i and *j* are the importing region and exporting regions, respectively.

The difference in price between regions, $T_{ji} + C_{ji}$, is referred to as the transfer costs. C_{ji} can be either positive or negative, depending on tariff and non-tariff barriers as well as the average quality of the lumber shipped compared to the average quality of the domestic market supply. Tariff rates on softwood lumber vary from region to region and, in the model, are included in the C_{ji} term.

This study uses transportation costs derived from the functional form presented by Sedjo (1983) to equal T_{ji}. When modeling changes in transport costs, C_{ji} is held constant and only T_{ji} is changed. Transportation costs and the value adjustments are detailed in Tables 4 and 5, respectively. Adjustments costs less than zero simply imply that the average value of the export is greater than the average value of lumber produced in the importing region. This does not affect the solution procedure.

Table 4

Transportation Costs
in 1980 US$/cubic metre

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW
British Columbia	$18.44	$11.93	$19.53	$18.98	$35.53	$22.51	$36.88
Eastern Canada	$10.85	$18.44	$13.56	$12.20	$19.53	$40.41	$38.78
US West Coast	$18.44	$10.85	$19.53	$18.98	$35.25	$22.51	$40.14
US South Central	$13.56	$19.53	$10.85	$13.56	$22.51	$37.15	$45.56
Scandinavia	$20.88	$35.80	$24.41	$23.86	$12.47	$38.51	$29.83
Chile	$26.58	$25.49	$20.88	$22.78	$31.73	$37.42	$34.17
New Zealand	$38.78	$28.47	$35.53	$36.61	$45.29	$24.41	$27.66
ROW	$38.78	$40.14	$45.56	$46.64	$20.34	$27.12	$10.85

Source: Sedjo and Lyons 1983

Table 5

Transportation Cost Value Differential
in 1980 US$/cubic metre

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW
British Columbia	$2.56	$31.07	$28.47	$39.02	$47.47	$109.49	$36.12
Eastern Canada	-$8.85	$5.56	$15.44	$26.80	$44.47	$72.59	$15.22
US West Coast	-$35.44	-$5.85	-$9.53	$1.02	$9.75	$71.49	-$5.14
US South Central	-$31.56	-$15.53	-$1.85	$5.44	$21.49	$55.85	-$11.56
Scandinavia	-$58.88	-$51.80	-$35.41	-$24.86	$11.53	$34.49	-$15.83
Chile	-$3.58	$19.51	$29.12	$37.22	$53.27	$96.58	$40.83
New Zealand	-$75.78	-$43.47	-$45.53	-$36.61	-$20.29	$49.59	-$12.66
ROW	-$70.78	-$50.14	-$50.56	-$41.64	$9.66	$51.88	$9.15

(Value differential =Import Price - Export Price - Transportation Costs)

General Assumptions

The assumptions of the SE model, as stated by Enke (1951), require further attention. The SE model assumes a perfectly competitive market where world consumption is equal to world production at any time period. Homogeneous goods, per unit transportation costs and free trade are simple rules that form the benchmark of the "normal" competitive model. Some problems arise, however, when this model is applied to real market conditions. Additional assumptions need to be imposed on the model in an attempt to create more representative conditions.

Homogeneity

The SE model assumes that each commodity is viewed by the consumer as a homogeneous good. This implies that all lumber is of the same quality and available to all consumers at a single price. This is an unrealistic assumption as there are often large differences in prices of lumber depending on the grade, size of lumber, method of processing and the species of log. Larger logs require less handling per cubic metre of output, produce more output per cubic metre and usually possess the desired characteristics of performance grade lumber (and therefore return higher profits). Some of these differences are captured in regional supply equations. Quality differences arise across species as well as within species. For example, performance grade lumber fetches higher prices than structural lumber. In the construction of the post and beam style Japanese housing, structural wood is visible and, therefore, clear lumber is desired. Culturally, the Japanese view knots and defects as structural weaknesses (Sedjo 1983, p 25).

Dealing with a commodity such as lumber is a difficult task when creating a forest model. Unlike pulp and paper, thousands of different products and qualities comprise the sawtimber commodity. When estimating supply and demand, each function must specify a particular region, time period and final product. Most models assume that sawtimber is a homogeneous product that is perfectly substitutable with timber from other regions and among species. Published data aggregate many heterogeneous lumber products together when evaluating lumber volumes, making no attempt to define quality differences.

To address the problem of homogeneity, Sedjo (1983) assumed that a representative basket of sawtimber is produced containing equal proportions of differing qualities for each region. He makes a distinction between coniferous and nonconiferous products by arbitrarily setting hardwood sawtimber prices 10% below those of softwood sawtimber. He also discounts plantation softwood by 10% to account for the higher percentage of lower quality lumber produced from this input. The CGTM makes no attempt to address the lumber quality problem and simply regards it as a limitation of the spatial equilibrium model (Cardellichio *et al.* 1989). The current study does not make reference to different qualities in lumber.

Competitive Market Assumption

In determining a spatial equilibrium, it is assumed that a competitive market exists across all regions. Neoclassical long-run conditions hold so that economic profits equal zero (i.e., normal profits prevail), supply equals demand and average total cost equals price. The SE model maximizes the objective function to yield an efficient allocation of goods within given constraints (Pareto optimality). Efficient allocations are chosen by a firm where profits are maximized for a given price. The model used in this study assumes competitive equilibrium and includes parameters in the demand and supply functions to account for exogenous circumstances.

Preferences

The heterogeneity of lumber makes it difficult to model changes in tastes. Consumption of high quality lumber may remain inflated even when lower quality lumber is available at a lower price. Flora, Anderson and McGuiness (1991) found that the offshore demand facing the US had a price elasticity of -1.95 for construction grade logs compared to a price elasticity of -0.80 for performance grade logs. This indicates that higher quality grades are more resilient to changes in prices and more likely to show inertia in trade. It is therefore believed that Canadian softwood lumber will continue to experience high demand even at higher prices (Wallace 1987). Since tastes are driven in part by price, over time tastes will change and demand for higher priced goods will decline. The model is unable to pick up this price-quality interaction directly; rather, it is assumed that each region's exports and imports consist of a representative sample of similar quality lumber.

Trade Inertia

It is a assumed that a trading agent will maximize profit by choosing the lowest cost and, therefore, the most profitable trade route available. This is not always the case due to trade inertia. Trade inertia is the extent to which historical patterns of trade prevail over time (Kornai 1987). Once one country has established a trading relationship with another, it is more likely to continue to trade with that country than to spend the time and money in developing other trade relationships. Many factors influence a nation to carry on a trading relationship even when relative price and cost differentials indicate otherwise. Trade between regions has been driven by numerous factors including culture, geographic location, political structure and accessibility. Other factors include availability of information, preferences, costs of changing to other markets and long-term contracts. Prohibitive trade barriers also affect the inertia of trade as do tariffs, non-tariff barriers, embargoes, cartels and lack of information. As international trade becomes more efficient, inertia will play a remote role. For homogeneous goods, inertia is less of a concern than with products that are more diverse in nature.

Cardellichio *et al.* (1989) chose not to place bounds on inertia due to the artificial effect that constraints have on the model. Constraints on inertia do not allow the model to estimate an equilibrium; rather, it forces the model to equate to some preconceived level of trade. The IIASA GTM accounts for inertia by placing upper and lower bounds on bilateral trade. By imposing these restrictions, the speed of adjustment is controlled. This approach is followed in this study.

Other Assumptions

Since the SE model is unable to predict bi-directional trade flows, it is necessary to make assumptions regarding the production and consumption characteristics of some regions. It is believed that valuable results can be obtained regarding regions that are both importers and exporters. The reason why a region imports lumber even though it already has an excess supply is uncertain, however it could be a function of quality, short-term inventory deficits or location. These factors cannot be modeled in a SE model. In an attempt to gain insight regarding these areas that both import and export, these regions are divided into separate trade areas and designated as either an importer or an exporter. The US South, US West and Canada (excluding BC) are divided into smaller trading blocks.

The US West is broken into two regions, the Interior and the Coast. The Interior region includes the US states of Montana, Idaho, Colorado, Nevada, Wyoming, Utah, Arizona, New Mexico, and South Dakota. This region produced approximately 11.6 million m^3 in 1987 and 7.9 million m^3 in 1992. The Coast region is made up of Washington and Oregon and produced 31.9 million m^3 in 1987 and 24.1 million m^3 in 1992 (Warren 1994). Due to the size of the Interior region and comparatively low production, it is assumed that this region is an importer (importing all of the 3.5 million m^3 destined to the Pacific Northwest (PNW)). The Coast region is assumed to be the export region because of its size and port facilities. Cardellichio *et al.* (1989) reported that 16.6 million m^3 of softwood lumber were shipped from the PNW in 1987.

The US South is another region that is divided into an import and an export region. The import region is the Atlantic region and the export region is the South-Central region. The US South Atlantic is assumed an importer due to its population base. Both regions produce similar amounts of softwood lumber and have similar production capacities, but the Atlantic region has less extensive inventories (Haynes, Adams and Mills 1995). The division of the South into these two groups is undesirable since the actual quantities that are imported and exported by each region are unclear. The US South reported imports of 9.9 million cubic metres and exports of 4.5 million m^3 in 1987 (Cardellichio *et al.* 1989). The creation of these two regions enables inter-state trade to be analyzed.

Interior Canada and Eastern Canada are the final regions that need clarification regarding regional assumptions. Interior Canada (the import region) is comprised of the Prairies and Ontario, and Eastern Canada (the export region) includes the Maritimes and Quebec. Although Interior Canada exports softwood lumber (primarily to the US), it is also assumed to be an importer since it is Canada’s largest consumer. Interior Canada produced

10.3 million m^3 in 1987 and 9.4 million m^3 in 1992.[2] The model assumes that Interior Canada imports all shipments destined to Canada. Eastern Canada is assumed an exporter due to its quantity of production. The province of Quebec is Canada's second largest producer, next to BC. It produces over 18% of total Canadian production and exports over half this amount to regions outside Canada. The remainder is either consumed within the province or shipped to Interior Canada. In SLM, it is assumed that Eastern Canada exports all of Canada's softwood lumber, net of BC's share.

Although not ideal, these assumptions enable one to use the model to predict regional trade flows. Assumptions about expected future supply conditions are detailed in Table 6 and discussed below.

Table 6.

Regional Assumptions of Future Supply Conditions

Region name	**1992-1996**	**1997-2001**	**2002-2006**	**2007-2025***
British Columbia - Base	-0.75	-2	-2	-1
British Columbia - Temporary cut	-10%	0	+1%	+1, +3
British Columbia - Permanent cut	-10%	0	-1%	-2, 0
Eastern Canada	+0.5	-0.5	-0.5	-0.5
US West	-4.75	-3	-0.5	0
US South Atlantic	+4	+5	+2	0
US South Central	+4	+5	+4	+2
Chile	+4	+4	+3	+3
New Zealand	+4	+4	+3	+3

*Only one number given if same assumptions hold for each five year period.
Source: Adopted from Haynes, Adams and Mills (1995) and authors' assumptions for BC

Validation

SLM must be tested to see if it simulates actual conditions. Of primary concern is the model's suitability in representing the scenarios for which it was developed. SLM is intended to measure, over time, the long-term effects of policy change by the BC provincial government. Without prior knowledge of the intended use of the model, validation is meaningless. Therefore, to test the model's ability to predict policy changes, SLM is put through a variety of tests.

[2] Consumption data is unclear since it is only reported as "apparent consumption" (i.e., consumption equals production less exports plus imports).

First, the model is validated through simulation. The base year is calibrated to 1987 values using existing data. The 'base case' scenario is evaluated and trade flows are simulated in the absence of any policy intervention or exogenous supply factors. Testing the model's ability to accurately project future trade flows is an excellent indicator of its prediction capabilities. When actual raw data are compared with predicted values the model should replicate production, consumption and direction of trade with some degree of accuracy. The current model predicts 1987 production values almost exactly (see Table 2). When 1992 values are compared, short-term market fluctuations cause projected values to diverge from actual values.

Second, future simulations of the model are performed and compared with research by industry, government and academia to determine their validity. It is the goal of the programmer to develop a model replicating future trade flows and it should be in agreement with expectations of future conditions. The current model performs well when compared to other studies (FAO 1991; Cardellichio *et al.* 1990).

A third method of model validation is to perform historical simulations. To perform historical simulations spanning the same time period as performed for the future is difficult and probably of little value. There has been a great deal of structural change in the forest industry over the past 40 years. Since these changes have not been made endogenous, the model is unable to account for these technical developments. Also, the model has been calibrated using the consumer and producer preferences of 1987. Current behaviour is probably more indicative of the future rather than historical market behaviour (Adams and Haynes 1980). Therefore, a model's ability to predict historical trade relationships may be of little value in determining future behaviour. Furthermore, inaccuracies may occur due to short-term estimations. SE models are able to predict long-term trade flow, but short-term fluctuations are extremely difficult, and often undesirable, to model. Due to the dependence of lumber demand on the housing market, the cyclical nature of the economy causes lumber demand to follow the peaks and valleys of the housing market. This causes instabilities and inconsistencies in short-term projections making these estimates questionable at best. The current trade model has not been tested for historical trade flows due to the above reasoning.

The final test of model validation is the model's response to policy changes. The basic test is to see if trade flows, prices and quantities move in the expected direction when alternative scenarios are proposed. For example, if a US tariff caused BC lumber import prices to rise by 10%, a decrease in BC lumber exports to the US should also take place. Further tests of policy include comparing the absolute and relative values of simulation results with actual, projected and intuitively reasonable values. Comparisons are also made with other projections from other models, forest-sector studies and/or industry estimates of what might happen.

4. Base Case and Policy Simulation Results

This section presents the results of the trade model simulations. SLM is calibrated to 1987 price and quantity values, with forecasts generated for the years 1992, 1997, 2002, 2007, 2012 and 2025. The first set of forecasts is referred to as the base case. The counterfactuals follow.

Base Case Simulation

The base case scenario for SLM projects future quantities, prices and bilateral trade flows using expected trends and fixed policy conditions. Projections are based on a basic set of assumptions believed to be most probable in future market conditions (Sedjo and Lyon 1990; FAO 1991; Haynes, Adams and Mills 1995). The base case scenario is not deemed the most likely scenario; rather, it is an indication of how future trade could unfold given present conditions. All scenarios are compared to the base case, which is used as a guideline to measure the impacts of a variety of changing market conditions and policy changes. By analysing how different scenarios cause trade to diverge from the base case, insight can be gained regarding the long-term behaviour of global lumber trade. The results may be interpreted and used to aid in policy decisions for industry development.

The base case is developed from 1987 equilibrium conditions from which assumptions are made about current market conditions. In order to calibrate SLM, some constraints were imposed on 1987 trade flows. Although it is optimal to use as few constraints as possible, it is often necessary to impose trade flow restrictions between some region as well as force trade between other regions. Although this does not yield a true competitive equilibrium, it does replicate real world conditions more closely. Real world conditions may or may not encourage trade due to tariff and non-tariff barriers, differing product qualities and long-term contracts. Over time, however, equilibrium conditions are expected to prevail.

From the 1987 equilibrium conditions, projections are then made for future time periods. Projections after 1987 are calibrated to equilibrium values with only the minimum constraints (as discussed earlier). Future projections are made in 5 year intervals until the year 2012 and then a final projection is made for the year 2025. Assumptions are made about future supply and demand conditions throughout the projection period. These assumptions are discussed below.

Base Case Assumptions

A set of basic conditions are assumed for all regions in the model. These assumptions are based on previous studies (Sedjo and Lyon 1990; FAO 1991; Haynes, Adams and Mills 1995), current conditions and historical trends. The assumptions are as follows.

1. World demand for lumber increases at an initial rate of 1.4% per year until 2002 and then 1.5% per year (FAO 1991);[3] this increase is due to population growth and the rise in global economic conditions.
2. Global lumber production increases at an initial rate of 0.5% per year (Sedjo and Lyon 1990); this increase is due to advancements in biotechnology, harvest, milling and distribution.
3. Exchange rates remain at 1987 values.
4. Relative transportation costs are constant (i.e., unchanged).

Using the above assumptions, the base case is generated for the different trade regions in the model. Assumptions (1) and (2) are determined for five-year intervals, using the production, consumption and price data of the previous period to determine intercept values for the current period. This process ensures non-linear changes in supply and demand (e.g., demand increases at an increasing rate due to the geometric growth in population). There is no increase in demand during the first period since historical data indicate a decline in demand during this period. It is assumed that there is a continual upward trend in the demand for softwood lumber throughout the remainder of the projection period. The only regional assumption on demand is one regarding the regions contained in the ROW. The ROW is assumed to demand less softwood lumber than the world average after the year 1992. Many regions within this group have wide access to domestic hardwood lumber supplies and it assumed that, as these supplies develop, regions within ROW will substitute softwood lumber with the hardwood variety. [4]

Assumption (2) is used to account for increased efficiency in production over time. This assumption does not include changes in regional supply due to plantations or reforestation, but does include increases in supply due to the exploitation of existing inventories. Assumptions regarding regional supply are discussed below.

Constant 1987 exchange rates are assumed throughout the model due to uncertainty in future money markets. It is unlikely that predictions of future money markets would yield better results than the status quo. Buongiorno, Chavas and Uusivuori (1988) determine that it is prices and not exchange rates that are responsible for long-run changes in imports of lumber.

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[3] Sedjo and Lyon (1990) and the BC Ministry of Forests (1994, p. 217) forecast softwood demand to increase at 1 percent per year.

[4] World hardwood consumption is predicted to grow faster than softwood consumption. Consumption is primarily from each producer’s domestic market (Waggener, Schreuder and Eastin 1990).

Transportation costs are also assumed constant. Under free trade conditions there is free movement of knowledge, capital and labour, thereby allowing each region equal access to the same technology. Any relative cost advantages will be equated over time.

Knowledge of future supply conditions in each region makes it necessary to include assumptions for certain regions in the development of the base case. Overall global lumber production will increase in the future; however, regional output varies depending on the region. Only assumptions on production are made for individual regions (except for ROW imports) since future production levels can be inferred from standing inventory. These assumptions are simplistic and their accuracy debatable, but the recognition of these conditions is important and their inclusion is necessary.

The base case follows the supply assumptions detailed in Table 6. Each supply change is in response to current inventory assessments and current harvesting technology. This allows assumptions to be made regarding the availability of future quantities of mature supply during any particular period. Most supply assumptions come from Sedjo and Lyon (1990) and Haynes, Adams and Mills (1995) who look at timber inventories in their respective studies. Assumptions regarding individual regions are discussed below.

British Columbia

BC continues to have a major share of global softwood lumber trade, accounting for almost one-third of total volume traded. Within this share the dependence on exports to the US creates a vulnerability to the US business cycles. In 1993, BC exported almost three-quarters of its international exports to the US and this trend is likely to continue. Increasing supplies in the US South (the southern yellow pine plantations), and other foreign supplies, will serve to offset reductions in BC production. US interest in sourcing timber imports from the Russian far east continue to percolate as means of addressing the displacement arising in the Pacific Northwest from the Option 9 decision. The supply impacts for BC exporters could be significant both in terms of the price effects and in terms of any exotic pest introductions due to phytosanitary deficiencies. Political directive and consumer signals with respect to environmental concerns may pressure US importers to choose suppliers whose imports can be "certified".

Assumptions imposed on the British Columbia export region include a gradual reduction in supply due to the provincial government's reduction of harvestable timber area (Ministry of Forests 1994). Although supplies are becoming more remote and less accessible, a one-time reduction is not assumed in the base case since there are still abundant supply areas to harvest. The base case assumes that the current AAC (71.6 million m^3) will continue into the future, with lumber production at levels approximately equal to current output (37 million m^3). Although such an assumption is probably unrealistic, it gives a basis to compare changes in trade caused by future declines in BC supply. Present day conditions are used as the base case to compare the effects of the predicted “fall-down” in lumber production.

Eastern Canada

Since Eastern Canada is not yet harvesting at its AAC, some production growth is allowed in the base case, but after the year 2002 production increases are modest. Although much of Eastern Canada is forested (about two-fifths of Canada’s inventory), the location of the timber is often in remote areas requiring long distance transport to processing facilities. The inaccessibility of certain regions make harvesting and reforestation difficult and costly. The base case assumes that supply remains relatively constant over time.

Pacific Northwest

The US West regions are assumed to undergo radical reductions in harvestable timber in the short-term. Declining stocks on private lands and the elimination of federal forest lands have caused a worsening of timber supply conditions. Until the late 1980s, timber from government forestland supplied about 13.9 million m^3 per year of timber to domestic sawmills. This ended in 1991 when a federal court injunction shut down most of the national forest program in Washington and Oregon to investigate the environmental impacts on the northern spotted owl. US President Bill Clinton’s proposed plan, referred to as Option 9, is forcing harvests from federal lands to be cut to one-quarter the 1985-1989 average (Smyth 1993). In SLM, it is assumed that there is a partial reduction in production from 1992 to 1997 and a further 15% reduction in the next time period. This reduction is in response to Option 9 and declining production from private land. This trend is predicted to stabilize due to growing inventories on private and state land, but not until 2010-2020 (Haynes, Adams and Mills 1995).

US South

The US South is expected to continue its intensive management and reforestation practices. Already the region has been able to increase production to modern day records, up 5,192 thousand cubic metres from 1990 to 1993. The region is anticipated to increase production by over 50% by the year 2000 (Haynes, Adams and Mills 1995). This trend is expected to continue in the Atlantic region until 2010 and until 2025 in the Central region, or until inventories and harvests start to decline on private lands. Increased demand and falling US supplies are already causing smaller-sized timber to be harvested in the US South. Higher chip prices make the harvest of small timber more profitable (Smyth 1993).[5] Also, as lumber prices rise, a shift from pulp and paper to lumber could occur.

The model acknowledges the abundant inventories of the US South by imposing a 4% annual increase during the 1992-1997 period and a 5% annual increase during the 1997-2002 period. After the year 2007, the US South Atlantic only experiences growth from technological developments.

Chile and New Zealand

The forest industries of Chile and New Zealand have highly developed plantations capable of producing high volume/short rotation timber. These resources are expected to continue to increase in the future. Although they are currently viewed as inferior in quality, this may not be the case in the future. Future harvests of Chile's plantation forests are estimated to increase by over 100 percent by the year 2005 (Cortes 1988). These projections are estimated from Chile's well stocked plantations. Inventory data indicate that 82 percent of the plantation forests are between 5 and 20 years old, with a 24-year rotation. The current model assumes a 4% annual increase in production from the year 1987 to 2002 and then a 3% increase thereafter. Similar assumption are made regarding New Zealand production. A majority of their 1.3 million ha plantation forest is less than twenty years old, with expected 25-year rotations. Exports are expected to continue to increase as well (Neilson and Smith 1993). It should be recognized that, although these regions are important in supplying the Pacific Rim, they are both only marginal suppliers in terms of volume.

Welfare Measures

To represent the overall well being of each region, consumer and producer surplus values are calculated. These measure, respectively, the area under the demand and supply curve for each importing and exporting region. The consumer and producer welfare measures are used to assess how changes in prices and quantities affect the over-all well being of a region's residents. For example, it is not obvious if a region's welfare increases if exports increase but price decreases. Increases in supply and demand will have diverse effects on the different regions depending on the slopes of the respective supply and demand curves of each region.

Consumer surplus (CS) is calculated by taking the area under the demand curve less the total cost of the amount consumed. Likewise the producer surplus (PS) is calculated by subtracting the area under the supply curve from total revenue. In Figure 3, before trade

[5] The move down from 20 centimetre chip-N-saw logs to 15 centimetre diameter in the US South has been required by more severe competition for timber, and higher stumpage and lumber prices (Smyth 1993).

occurs, the CS of the importing region A is equal to area faP^A. It is obvious from this figure that when the region begins trading and prices remain different across regions, CS will increase. Once an optimal trade relationship is established, CS is equal to area fdP^i, an increase of P^AadP^i. The PS of region A decreases from $0aP^A$ to $0eP^i$. The over-all welfare gain from trade is equal to area *aed*. Under different scenarios, each region will be better-off than in a non-trade case; however, it is of interest to this study to see how changes in supply and demand conditions affect regional welfare. Global welfare is calculated as the sum of regional consumer and producer surpluses.

Base Case Forecast

Figures 4 and 5 show the results of the base case projections for imports and exports. BC exports remain relatively flat, whereas those of the US South Central region experience large growth. Chile and New Zealand also experience significant increases in exports. The US North imports substantially more because of increased demand that is much larger than the increase in regional production. The US South Atlantic decline in imports is due to the increased harvest of its privately-owned forests. Production, consumption, trade and prices for the export and import regions are detailed in Tables 7 and 8, respectively. Table 9 reports the direction of trade results for the base case.

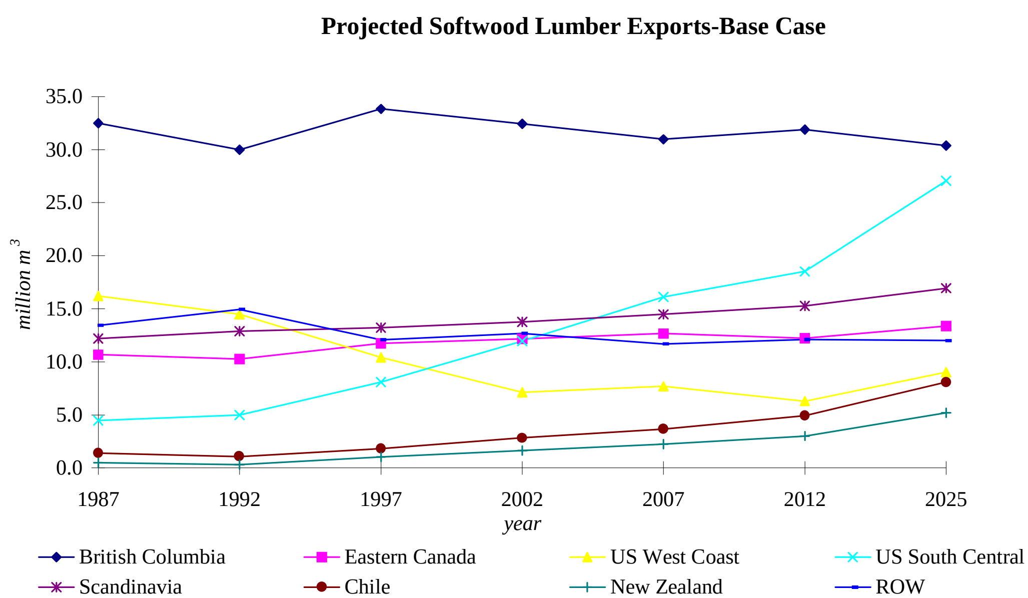

Figure 4

Projected Softwood Lumber Imports-Base Case

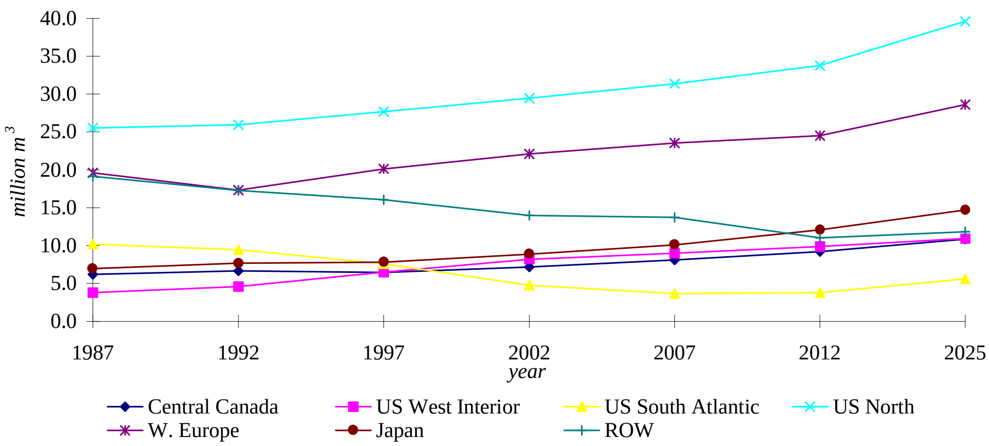

Figure 5

<Insert Tables 7, 8 & 9 approximately here>

Export Regions

The model predicts that, although BC production remains constant, exports do not decline substantially. The base case predicts that BC lumber destined to the US North, currently BC's primary destination, is displaced by exports from the US South Central region and Eastern Canada. Lower transportation costs and a secure supply source could be the reasons for a movement away from BC lumber. BC diverts this quantity to Japan, the US West Interior and Central Canada. As the US South inventories mature, the US market becomes less important to BC as exports headed south decline to less than 14.0 million m^3 per year. By the year 2025, BC exports over half of its total exports to Japan and Central Canada.

The US West experiences the largest decrease in exports because of the spotted owl controversy. Although the decline is substantial in the 1990s, the base case predicts that inventories and harvests from plantations will increase production to 1987 levels by the year 2025. Also, by 2025 Japan becomes the US West Coast's most important export destination. Increased demand for softwood is primarily due to an increasing population in Japan.

Eastern Canada increases production by almost a one-third over the 38-year span of the model. Technological advances and increased prices are responsible for this increase. Most of the increase continues to go to the US North region, replacing BC and the US West as suppliers. Total exports increase by approximately 3.0 million m^3.

Production levels in the US South Central are predicted to increase to levels of 35.8 million m^3 by the 2025,[6] most of which is either consumed in its domestic market or exported to the US North. The model predicts that the US South Atlantic waits until after 2012 to start importing from the US South Central. The US South Atlantic shuts BC out of this market in favour of the US South Central.

Scandinavia's increase in production is absorbed by Western Europe and also by the US North. Production levels increase by over 8 million m^3 to 24.8 million m^3 by the year 2012. (FAO (1991) predicts that production will be 25.4 million m^3 by 2010.) It appears that Scandinavia attempts to develop alternative export markets in the US because of increased competition from the ROW region.

Chile and New Zealand increase production by substantial amounts, although they do not make an impact on the world market. Most of the production from both regions is bound for their domestic markets or the ROW. Australia and Southeast Asia are the primary importers of the ROW group. Chile and New Zealand do enter the European market, but this seems unlikely given the distance between markets.

The ROW exporters play a more significant role over time. As demand increases, more supplies are exported to Western Europe. As Russia develops its infrastructure, it will play a more prominent role in lumber trade. Currently the east primarily exports logs to Southeast Asia and most of the lumber comes from the west.

Import Regions

The most substantial change in imports occurs in the US North where, as discussed above, the US South Central replaces a market currently dominated by BC and the US West Coast. The US North also increases its imports from the ROW. The remaining regions do not show any radical changes in trading partners.

Japan increases imports from both BC and the US West Coast over the 38-year span. It appears that there is a preference for US West Coast lumber over BC lumber; however, restricted production causes imports from the US West to fall. Alternative suppliers—Chile, New Zealand and ROW—begin to enter the Japanese market, and appear to be replacing BC and US West lumber to a small degree. Imports from BC decline in 2025 in response to

[6] Haynes, Adams and Mills (1995) projected that current inventories indicate that by the year 2030 production will reach 38.0 million m^3.

increased production in the US West and alternative sources, although BC still holds over 50 percent of the market share.

Western Europe increases imports from the ROW in response to increased domestic demand. Scandinavia remains its primary exporter, although its market share declines due to cheaper imports from the ROW. The US South Central region increases its exports to Western Europe over time. Exports from BC fall to zero in 1997 in response to a realignment of competitive position and non-tariff barriers, including regulations banning green lumber imports from North America.[7]

The US West Interior increases its imports to offset the decline in domestic production. BC continues to be supply a majority of the lumber demanded in this region. The US West Coast ships small quantities to the Interior despite higher prices in Japan. By 2025, total imports from BC approximately equal total production in the US West Interior.

Prices

Projections from the base case indicate an increase in real prices over time. Real price changes for the base case are detailed in Table 10. The projected softwood lumber price index is reported in Table 11. Over time, the real price of BC softwood lumber increases at an average rate of approximately 1.0 percent a year. Most of this price increase occurs in the 2012-2025 period (at 1.3% per year) when higher domestic demand restricts exports. The changes in price are consistent with Haynes (1990).

<Insert Table 10 & 11 approximately here>

Alternative Scenarios

The model's ability to represent alternative scenarios relies on each region's demand and supply curve specifications. Each alternative scenario is calculated by shifting the supply curve of a representative region and then calculated using the underlying assumptions of the base case. The sensitivity of the model to changes in the intercept rely on the slope of the domestic demand curve in the respective market. Although shifting the constant is not an ideal method to model changes in individual markets, changes in slope cause the model to calculate large fluctuations in trade and make results unrealistic.

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[7] The European Union placed a ban on green lumber from North America in 1993, based on concern about the pinewood nematode found in some BC softwood species. Lumber is required to be kiln dried prior to export to the EU (CORE 1994).

From the base case projections, a variety of alternative conditions are predicted for the future. The base case offers one future scenario, with results strongly influenced by the economic conditions of the base year and the assumptions implicit in the model. The model's ability to analyze alternative scenarios allows the examination of a variety of different future conditions affecting domestic supply and demand conditions. This section looks at some alternative futures.

The counterfactuals analyzed, along with a brief description of their importance, are as follows.

1. **Decrease in BC AAC.** A 25% reduction in BC's AAC is modelled by restricting production to 75% of the base case levels. The following two scenarios are examined:
    a) a **temporary,** one-time reduction in AAC for the period 1997-2007, with a slow increase in AAC thereafter as the Forest Renewal Plan increases future yields (perhaps via an allowable cut effect); and
    b) a **permanent** reduction in AAC.

2. **Increase in Supplies from Alternative Sources.** Russia is of particular interest due to its immense resource base. A one-time increase in Russian production is modelled in SLM as an increase in production from the ROW by 20%. It is important to note that the expected increase in production from Chile and New Zealand is already included in the base case scenario, so this increase in lumber output can be thought of as the result of a new supplier, namely, Russia.

Tables 7 and 8 summarise the production, consumption, trade and prices for the each alternative scenarios. All results are detailed by region and scenario. Direction of trade results are displayed in Tables 12 to 14. The "winners" and "losers" of each scenario are determined through changes in consumer and producer surplus values. These measurements are found in Table 15.

<Insert Table 12, 13, 14 & 15 approximately here>

Decrease in BC Production

It is well documented that a fall-down in timber supply is probable in BC due to the imbalance in age classes. A reduction in BC's AAC may aid in reducing the impact of the projected fall-down (Ministry of Forests 1994; Smyth 1994). Current harvesting levels cannot be sustained over the medium term. In response, the provincial government is developing a new forest management strategy and assessing each region's timber supplies. Since the timber supply reviews will not be completed before December 1996, it is predicted that a 25%

reduction in the current AAC will be needed. Other reductions in BC harvest result from the conversion of forestlands to parks[8] and slow regeneration on previously harvested areas.

Scenario 1(a) illustrates the market power that BC has on world lumber trade (see Table 12). The one-time reduction in 1997 causes global lumber prices to increase since other producers cannot adjust quickly to the drop in global supply. Price increases are felt by all import regions in response to a redistribution of lumber trade. BC diverts supplies away from the US North and continues to supply the Canadian, Japanese and US West markets. This deficit in the US North is filled by the US South Central region. As production in BC increases to 1987 output, prices fall below the base case levels. This response is due to the increase in global production under this scenario.

Scenario 1(b) projects the reduction in AAC with no recovery in harvests. Total exports never recover to the base case output as they did in the first scenario. Prices remain inflated in all regions and domestic production increases in regions that consume BC lumber. (Of course, this assumes that technical change in construction methods, which could lead to greater substitution of non-wood for wood products, is not induced to any greater extent than currently as a result of a rise in prices.) Exports to Japan decline over time and are replaced by the recovering US West Coast production (Table 13). BC continues to export to Japan, although the absolute quantities are declining over time. Exports from BC to the US West and the Interior Canada remain relatively constant.

Figure 6 and 7 illustrate the changes in market share for the base case and the alternative scenarios. With a decrease in AAC, it is evident that BC market share declines. Most notable is the increase in market share of the US South.

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[8] The Commission on Resources and Environment (CORE) recently completed a detailed land-use plan for BC. A wide variety of interest groups were invited to present their land use demands. Among other decisions, the Vancouver Land Use Plan added 480,000 hectares to the park system (CORE 1994).

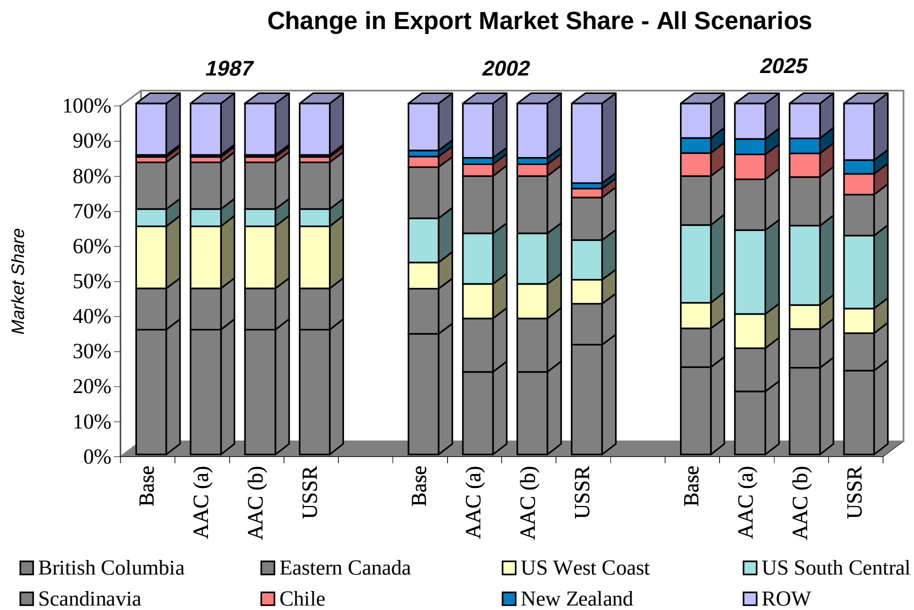

Figure 6

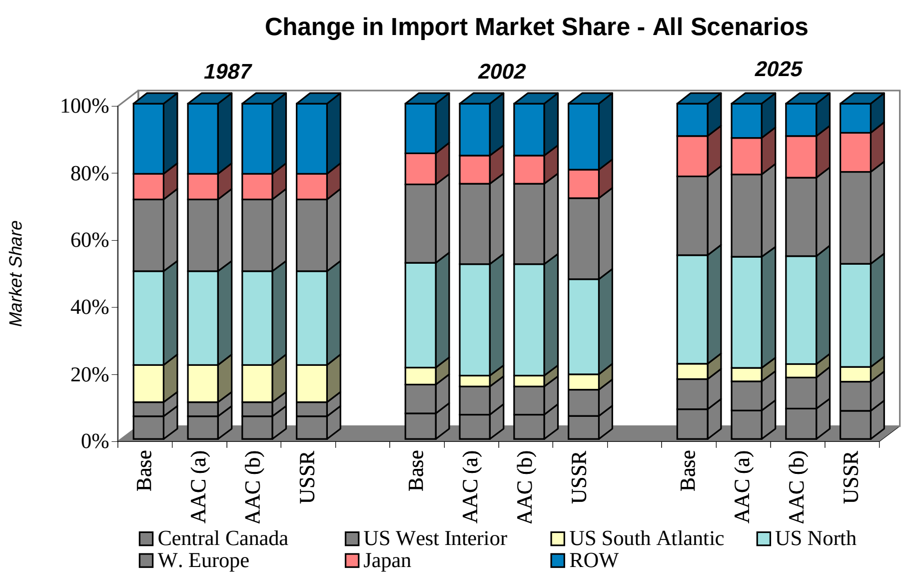

Figure 7

Welfare Changes

Although production decreases in BC, the province experiences a net increase in welfare in the short run (Table 15). In scenario 1(a) higher prices cause consumer surplus to decline, however producers are better-off through inflated revenues from higher global prices and a reallocation of exports. In the long run, BC producers are worse off. Increased global demand and higher prices have stimulated competition and technological advancements in lumber production. When BC increases production, due to the allowable cut effect (ACE) from increased investment in reforestation and other silviculture, world prices decline. Japan's producers feel the effect of lower BC prices through a reduction in demand from their domestic market—imports from BC increase above the base case levels. Lower BC prices also affect the US West producers. Over time, consumers in Central Canada, BC, Japan and the US West gain from the reduction in AAC. Increased imports from BC cause the rise in CS.

The biggest loser from the AAC reduction is the consumer in the US South Atlantic and the US North. Both regions experience a net loss in consumer welfare of approximately US$176.7 and US$128.4 million, respectively. This is primarily a result of higher prices in their domestic markets and in Eastern Canada.

Scenario 1(b) indicates that most producers will be better-off under a scenario of reduced BC production (see Table 15). So, even though BC experiences a drastic decline in production, the net welfare of the province increases. The reduction in BC's AAC has a similar effect on other exporting regions. Higher prices and a redistribution of exports effectively increase producer surplus in all regions, except for Chile and New Zealand in 2025. Lumber producers in importing countries also gain from the reduction in BC production through higher demand for domestic lumber (due to higher import prices). Over-all, however, regional welfare in the importing regions decline; higher prices effectively reduce consumer surplus. Japan experiences the greatest reduction in consumer surplus (US$534 million) because of its dependence on BC lumber.

Increased Production in Russia

Over time new supply regions develop and compete with existing export countries. It is reported that the former USSR has a forest area of over 800 million ha of which 52% of the world's coniferous forests are located (Neilson 1994). Growth rates are very low (0.5-1.5 m^3 per ha per year) and quality is often inadequate for harvest. However, the absolute size of the resource creates an alternative source to many regions. In 1983, Japanese log imports totalled 6.4 million m^3, but has since fallen to about half that level due to political, social and physical access to the resource. This simply emphasises the instability and unpredictability of this region. Inadequate infrastructure and political turmoil have slowed growth in this region.

In the base case, Russia is grouped within the ROW exporters. This scenario assumes that ROW production increases by over 50% (40 million m^3) from 1992-2025 (see Table 14). As expected, world prices are projected to fall and global production and exports increase. Western Europe decreases its domestic production in favour of cheaper imports from the ROW. BC reduces its total production in response to lower prices and diverts trade away from the US West Interior in favour of Japan, Interior Canada and the US North.

Figure 6 illustrates the changes in market share when exports increase from the former USSR. Again, BC market share declines, but BC does capture more of Japan's market for softwood lumber.

Welfare Changes

By the year 2025, an increase in output from Russia causes world welfare to increase. The most significant beneficiary is Western Europe. As outlined in Table 15, CS increases by over US$1.3 billion at the expense of a reduction of US$500 million in PS. All other consumers (except for the Rest of the World importers and small losses in Canada) gain from lower prices brought on by the increased production. Producers are net losers due to lower prices. Scandinavia is the worst off since its exports are replaced by Russia. BC is relatively unaffected by the increase in production, but the redistribution of trade does positively affect BC producers.

6. Conclusions

The base case simulation developed using the global softwood lumber trade model produces an estimate that global softwood lumber production increases to 472.8 million m^3 in 2012 and to 541.8 million m^3 in 2025. FAO (1991) projects the total demand for softwood and hardwood lumber to be 742.0 million m^3 cubic metres in 2010. Currently hardwoods make-up about 30% of all lumber production. Production projections from SLM and CGTM (Cardellichio *et al.* 1989) are reasonably close for 2002 and 2000.[9] Direct comparisons, however, are difficult due to a different set of assumptions regarding supply and demand conditions in the base case.

The model, was applied to examine two distinct policy options and the emergence of a new supplier. The findings of the research support the significance of BC's export share on global trade. This is evident in the projected global lumber price increase in response to a

[9] The CGTM only reports results up to the year 2000.

reduction in the BC timber harvest. Another conclusion that can be drawn concerns the future export destinations for BC lumber. BC will increase exports to Japan and decrease exports to the US. Perez-Garcia (1993) reached the same conclusion when modeling a reduction in US production. Hence, BC is less affected by the emergence of a new supplier of softwood lumber than other traditional supply regions.

Increased timber production levels in Chile and New Zealand (the fast growth radiata pine) were found to have little effect on traditional suppliers. Increased production in the US South, distance from the markets and lower quality are reasons why the US South, Chile and New Zealand are unable to capture more market share at the expense of BC. The results from the model suggest that, even when supply is low, the US South is expected to increase production than to import from Chile and New Zealand.

This sticky supply response is expected to change as consumers become increasingly comfortable with the performance of certain of the fast-growth plantation species and the various engineered wood products. Indeed, the Japanese market is already showing a willingness to use radiata pine sourced from New Zealand as the laminates in traditional post components wrapped with a clear veneer. This is well beyond the pallet stock limitation imposed by the Japanese in previous years. Another example is the major emergence of oriented strand board products in US residential construction as exterior wall sheathing in place of plywood.

Somewhat surprising are the estimated economic impacts of the two AAC reduction scenarios—one being a permanent reduction and the other being a temporary reduction mitigated by increased silviculture investment. The increase in silviculture expenditures (both planting and intensive) contribute to greater timber growth rates which allow an expanded sustainable cut. This is called the accelerated cut effect. The results of the analysis show greater economic returns arising from the permanent reduction in AAC.

As with any expenditure it is important to examine the impact and the returns to that expenditure. Forestry is increasingly capital intensive, forest product markets are highly competitive, and public sector fiscal options strained. Silviculture is a major investment decision in BC and it is imperative that improvements in silviculture decision-making be continually sought out and delivered upon.

Select silviculture investment combined with technological gains, development of new products, new markets, enhanced marketing savvy, and a skilled workforce will be required to ensure the forest sector is positioned to maintain a position as a key economic component of BC.

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Figure 3: Two Region Trade Model

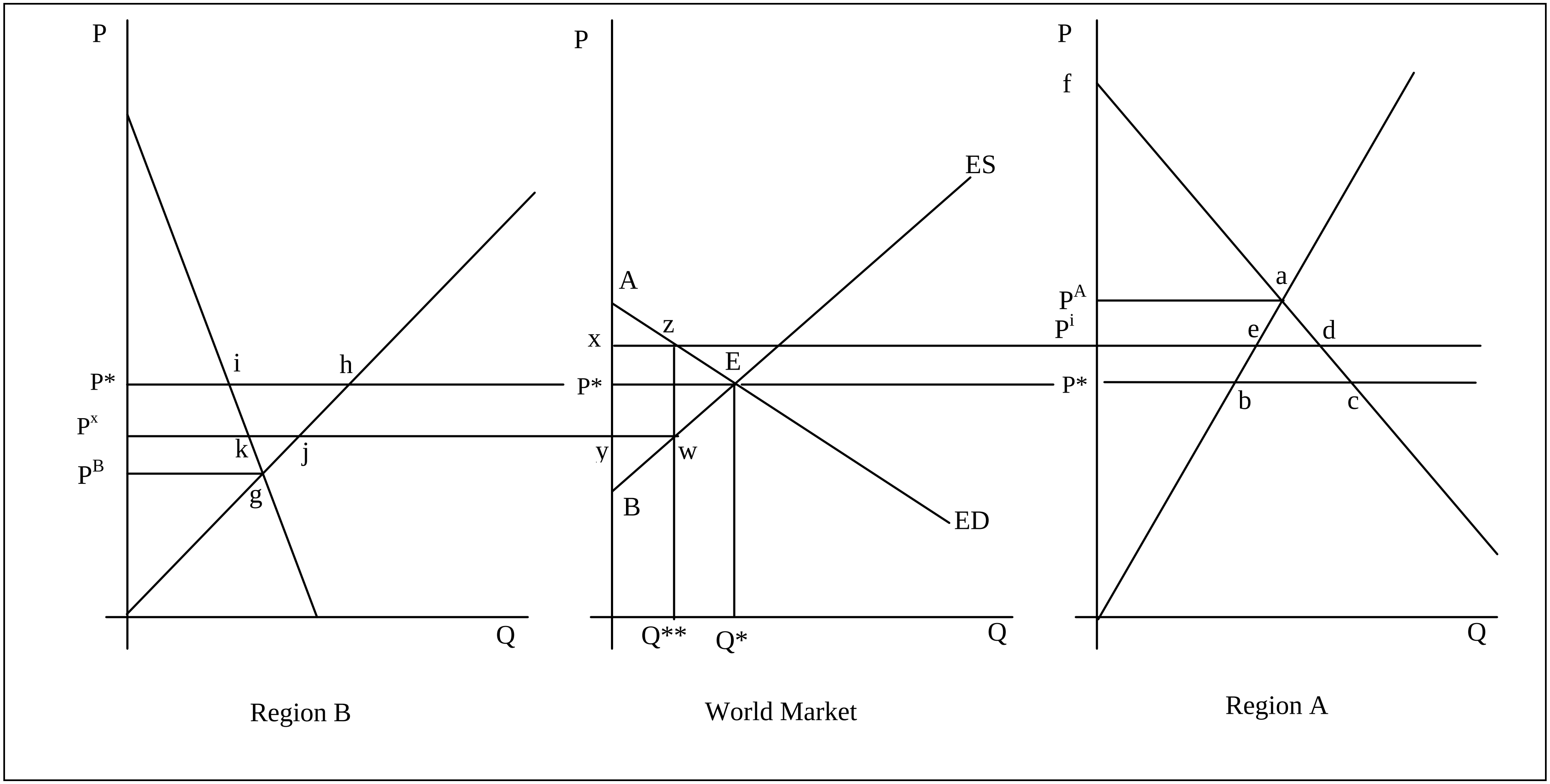

Table 7

Production, Consumption, Exports and Prices - Base Case

British Columbia

Year	*Base Case*	*Reduced AAC in BC Scenario a)*	*Reduced AAC in BC Scenario b)*	*Increased Production in Former USSR*
Production (in millions of cubic metres)				
1987	36.91	36.91	36.91	36.91
1992	34.50	34.50	34.50	34.50
1997	38.63	25.75	25.75	37.57
2002	37.49	25.49	25.40	37.69
2007	36.36	28.90	23.90	35.26
2012	37.66	31.23	26.61	37.55
2025	37.04	36.90	27.60	37.42
Consumption (in millions of cubic metres)				
1987	4.43	4.43	4.43	4.43
1992	4.50	4.50	4.50	4.50
1997	4.79	4.68	4.68	4.83
2002	5.06	5.04	4.95	5.06
2007	5.38	5.37	5.31	5.43
2012	5.76	5.81	5.63	5.77
2025	6.65	6.68	6.51	6.64
Exports (in millions of cubic metres)				
1987	32.48	32.48	32.48	32.48
1992	30.00	30.00	30.00	30.00
1997	33.84	21.07	21.07	32.74
2002	32.43	20.45	20.45	32.62
2007	30.98	23.53	18.59	29.83
2012	31.90	25.42	20.98	31.78
2025	30.39	30.23	21.09	30.78
Prices (in 1980 US$)				
1987	95.23	95.23	95.23	95.23
1992	90.14	90.14	90.14	90.14
1997	101.90	109.85	109.85	99.17
2002	106.45	107.51	113.93	106.75
2007	110.78	111.37	114.96	107.78
2012	112.73	108.08	121.04	112.32
2025	130.07	127.95	136.98	130.88

Eastern Canada

Year	*Base Case*	*Reduced AAC in BC Scenario a)*	*Reduced AAC in BC Scenario b)*	*Increased Production in Former USSR*
Production				
1987	14.82	14.82	14.82	14.82
1992	14.47	14.47	14.47	14.47
1997	16.24	17.47	17.47	15.86
2002	16.90	17.84	17.84	16.92
2007	17.66	17.48	18.03	17.10
2012	17.60	18.96	18.95	17.53
2025	19.60	19.63	20.57	19.90
Consumption				
1987	4.14	4.14	4.14	4.14
1992	4.22	4.22	4.22	4.22
1997	4.49	4.35	4.35	4.53
2002	4.73	4.62	4.62	4.73
2007	5.00	5.00	4.94	5.06
2012	5.38	5.21	5.21	5.40
2025	6.21	6.16	6.05	6.19
Exports				
1987	10.67	10.67	10.67	10.67
1992	10.25	10.25	10.25	10.25
1997	11.75	13.11	13.11	11.33
2002	12.17	13.23	13.23	12.19
2007	12.66	12.48	13.09	12.04
2012	12.22	13.75	13.74	12.13
2025	13.39	13.47	14.53	13.72
Prices				
1987	114.93	114.93	114.93	114.93
1992	109.49	109.49	109.49	109.49
1997	120.38	129.91	129.91	117.45
2002	125.53	132.83	132.83	125.70
2007	131.41	130.01	134.27	127.08
2012	130.96	141.49	141.40	130.42
2025	146.44	146.70	154.01	148.81

US West Coast

Year	*Base Case*	*Reduced AAC in BC Scenario a)*	*Reduced AAC in BC Scenario b)*	*Increased Production in Former USSR*
Production				
1987	29.66	29.66	29.66	29.66
1992	28.08	28.08	28.08	28.08
1997	25.00	26.15	26.15	24.13
2002	22.63	23.84	23.84	22.63
2007	24.15	23.62	24.42	23.00
2012	24.00	25.54	25.51	24.07
2025	29.64	28.99	31.64	29.76
Consumption				
1987	13.45	13.45	13.45	13.45
1992	13.61	13.61	13.61	13.61
1997	14.58	14.43	14.43	14.70
2002	15.50	15.31	15.31	15.53
2007	16.46	16.49	16.38	16.64
2012	17.72	17.47	17.46	17.75
2025	20.62	20.64	20.27	20.65
Exports				
1987	16.21	16.21	16.21	16.21
1992	14.48	14.48	14.48	14.48
1997	10.42	11.72	11.72	9.44
2002	7.13	8.53	8.53	7.11
2007	7.69	7.14	8.04	6.36
2012	6.28	8.07	8.05	6.33
2025	9.02	8.35	11.37	9.10
Prices				
1987	133.47	133.47	133.47	133.47
1992	127.98	127.98	127.98	127.98
1997	140.97	146.13	146.13	137.06
2002	144.36	150.44	150.44	143.88
2007	151.19	149.47	153.08	145.54
2012	150.52	158.11	157.98	150.35
2025	168.89	166.13	178.08	168.90

US South Central

Year	*Base Case*	*Reduced AAC in BC Scenario a)*	*Reduced AAC in BC Scenario b)*	*Increased Production in Former USSR*
Production				
1987	10.26	10.26	10.26	10.26
1992	10.89	10.89	10.89	10.89
1997	14.40	14.66	14.66	14.22
2002	18.65	19.17	19.17	18.54
2007	23.25	23.38	23.74	22.85
2012	26.20	27.20	27.21	26.11
2025	36.03	36.56	36.93	35.75
Consumption				
1987	5.81	5.81	5.81	5.81
1992	5.91	5.91	5.91	5.91
1997	6.32	6.28	6.28	6.35
2002	6.71	6.63	6.63	6.73
2007	7.15	7.15	7.09	7.21
2012	7.68	7.54	7.54	7.68
2025	8.95	8.92	8.86	8.98
Exports				
1987	4.46	4.46	4.46	4.46
1992	4.98	4.98	4.98	4.98
1997	8.07	8.38	8.38	7.86
2002	11.94	12.54	12.54	11.82
2007	16.10	16.23	16.65	15.65
2012	18.52	19.66	19.67	18.43
2025	27.08	27.65	28.07	26.77
Prices				
1987	135.51	135.51	135.51	135.51
1992	127.49	127.49	127.49	127.49
1997	141.47	144.97	144.97	139.09
2002	145.40	151.34	151.34	144.62
2007	150.65	149.87	154.61	146.45
2012	151.24	161.69	161.23	151.75
2025	168.67	168.68	172.91	166.95

Table 7 (continued)

Production, Consumption, Exports and Prices - Base Case

Scandinavia

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Former USSR
Production (in millions of cubic metres)				
1987	18.61	18.61	18.61	18.61
1992	19.28	19.28	19.28	19.28
1997	20.19	20.41	20.41	19.44
2002	21.18	21.60	21.60	20.18
2007	22.38	22.63	22.64	21.62
2012	23.69	23.47	23.69	22.09
2025	26.85	26.95	27.03	25.15
Consumption (in millions of cubic metres)				
1987	6.41	6.41	6.41	6.41
1992	6.39	6.39	6.39	6.39
1997	6.98	6.96	6.96	7.06
2002	7.42	7.38	7.38	7.53
2007	7.91	7.88	7.88	7.99
2012	8.42	8.44	8.42	8.60
2025	9.90	9.89	9.88	10.11
Exports (in millions of cubic metres)				
1987	12.20	12.20	12.20	12.20
1992	12.89	12.89	12.89	12.89
1997	13.21	13.45	13.45	12.39
2002	13.76	14.22	14.22	12.65
2007	14.48	14.75	14.76	13.62
2012	15.26	15.03	15.27	13.49
2025	16.95	17.06	17.16	15.04
Prices (in 1980 US$)				
1987	155.21	155.21	155.21	155.21
1992	157.09	157.09	157.09	157.09
1997	160.70	162.54	162.54	154.45
2002	164.71	168.18	168.18	156.54
2007	170.36	172.25	172.37	164.33
2012	176.56	174.59	176.40	163.76
2025	190.10	190.86	191.45	177.31

Chile

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Former USSR
Production				
1987	2.67	2.67	2.67	2.67
1992	2.36	2.36	2.36	2.36
1997	3.22	3.45	3.45	2.91
2002	4.31	4.37	4.37	4.20
2007	5.25	5.58	5.65	4.76
2012	6.61	6.73	6.75	6.22
2025	10.07	10.23	10.22	9.60
Consumption				
1987	1.28	1.28	1.28	1.28
1992	1.30	1.30	1.30	1.30
1997	1.41	1.40	1.40	1.43
2002	1.49	1.49	1.49	1.50
2007	1.59	1.57	1.57	1.62
2012	1.68	1.68	1.68	1.70
2025	1.99	1.98	1.99	2.00
Exports				
1987	1.40	1.40	1.40	1.40
1992	1.05	1.05	1.05	1.05
1997	1.80	2.05	2.05	1.47
2002	2.82	2.88	2.88	2.70
2007	3.66	4.01	4.08	3.14
2012	4.92	5.05	5.07	4.52
2025	8.09	8.25	8.24	7.60
Prices				
1987	100.52	100.52	100.52	100.52
1992	93.96	93.96	93.96	93.96
1997	98.82	102.19	102.19	94.25
2002	104.29	104.37	104.37	103.64
2007	107.03	110.97	112.05	101.07
2012	113.44	113.57	113.67	110.40
2025	120.21	120.00	119.50	118.38

New Zealand

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Former USSR
Production				
1987	2.18	2.18	2.18	2.18
1992	2.03	2.03	2.03	2.03
1997	2.87	2.90	2.90	2.70
2002	3.58	3.60	3.60	3.56
2007	4.31	4.42	4.45	4.16
2012	5.22	5.30	5.32	5.06
2025	7.81	7.88	7.88	7.66
Consumption				
1987	1.69	1.69	1.69	1.69
1992	1.73	1.73	1.73	1.73
1997	1.84	1.83	1.83	1.87
2002	1.96	1.95	1.95	1.95
2007	2.09	2.07	2.06	2.11
2012	2.22	2.21	2.20	2.23
2025	2.61	2.61	2.61	2.62
Exports				
1987	0.49	0.49	0.49	0.49
1992	0.30	0.30	0.30	0.30
1997	1.03	1.06	1.06	0.83
2002	1.62	1.65	1.65	1.61
2007	2.22	2.35	2.39	2.06
2012	3.01	3.09	3.12	2.83
2025	5.20	5.27	5.27	5.04
Prices				
1987	157.58	157.58	157.58	157.58
1992	149.13	149.13	149.13	149.13
1997	162.02	162.91	162.91	156.29
2002	164.17	164.62	164.62	164.86
2007	167.53	170.90	171.99	164.11
2012	173.01	174.59	175.09	169.83
2025	180.08	180.11	179.89	179.73

Rest of the World

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Former USSR
Production				
1987	77.60	77.60	77.60	77.60
1992	79.18	79.18	79.18	79.18
1997	82.43	84.15	84.15	96.13
2002	87.25	87.83	87.83	99.32
2007	91.36	93.22	93.27	105.54
2012	96.94	97.27	97.31	109.21
2025	111.34	111.34	111.11	122.25
Consumption				
1987	64.17	64.17	64.17	64.17
1992	64.24	64.24	64.24	64.24
1997	70.34	69.91	69.91	70.88
2002	74.57	74.41	74.41	75.64
2007	79.68	79.19	79.17	80.38
2012	84.83	84.69	84.68	86.15
2025	99.33	99.26	99.31	101.45
Exports				
1987	13.43	13.43	13.43	13.43
1992	14.95	14.95	14.95	14.95
1997	12.08	14.23	14.23	25.25
2002	12.68	13.42	13.42	23.68
2007	11.68	14.03	14.09	25.16
2012	12.11	12.58	12.64	23.06
2025	12.01	12.09	11.80	20.80
Prices				
1987	151.64	151.64	151.64	151.64
1992	151.10	151.10	151.10	151.10
1997	153.57	156.93	156.93	149.41
2002	158.97	160.01	160.01	150.94
2007	162.75	166.25	166.35	158.24
2012	169.18	169.62	169.70	160.25
2025	185.00	184.77	184.31	171.87

Table 7 (continued)

Production, Consumption, Exports and Prices - Base Case

Global Total

		Reduced AAC in BC		Increased
Year	*Base Case*	*Scenario a)*	*Scenario b)*	*Production in Former USSR*
Production (in millions of cubic metres)				
1987	192.71	192.71	192.71	192.71
1992	190.79	190.79	190.79	190.79
1997	202.97	194.93	194.93	212.96
2002	212.00	203.74	203.65	223.05
2007	224.72	219.22	216.10	234.30
2012	237.92	235.71	231.36	247.84
2025	278.38	278.49	273.00	287.49
Consumption (in millions of cubic metres)				
1987	101.37	101.37	101.37	101.37
1992	101.90	101.90	101.90	101.90
1997	110.76	109.84	109.84	111.64
2002	117.45	116.83	116.74	118.66
2007	125.26	124.71	124.41	126.43
2012	133.69	133.05	132.82	135.28
2025	156.26	156.12	155.46	158.65
Exports (in millions of cubic metres)				
1987	91.34	91.34	91.34	91.34
1992	88.89	88.89	88.89	88.89
1997	92.21	85.09	85.09	101.32
2002	94.55	86.91	86.91	104.39
2007	99.46	94.50	91.69	107.87
2012	104.23	102.66	98.54	112.57
2025	122.11	122.37	117.54	128.84
Prices (in 1980 US$)				
1987	134.06	134.06	134.06	134.06
1992	132.05	132.05	132.05	132.05
1997	138.63	145.65	145.65	135.87
2002	143.81	148.88	149.70	140.16
2007	148.93	151.88	154.53	145.48
2012	152.83	156.05	158.67	148.28
2025	169.16	168.58	173.13	162.92

Table 8

Production, Consumption, Imports and Prices - Base Case

Interior Canada

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production (in millions of cubic metres)				
1987	9.31	9.31	9.31	9.31
1992	9.08	9.08	9.08	9.08
1997	10.35	10.96	10.96	9.97
2002	10.64	11.19	11.19	10.64
2007	10.92	11.06	11.37	10.72
2012	11.23	11.16	12.11	11.49
2025	12.80	12.62	13.27	12.80
Consumption (in millions of cubic metres)				
1987	15.51	15.51	15.51	15.51
1992	15.73	15.73	15.73	15.73
1997	16.79	16.49	16.49	16.98
2002	17.82	17.54	17.54	17.84
2007	19.03	18.91	18.76	19.14
2012	20.42	20.40	19.93	20.31
2025	23.63	23.67	23.25	23.63
Imports (in millions of cubic metres)				
1987	6.20	6.20	6.20	6.20
1992	6.65	6.65	6.65	6.65
1997	6.44	5.53	5.53	7.01
2002	7.18	6.35	6.35	7.20
2007	8.11	7.85	7.39	8.41
2012	9.19	9.24	7.82	8.83
2025	10.83	11.05	9.98	10.83
Prices (in 1980 US$)				
1987	116.35	116.35	116.35	116.35
1992	110.65	110.65	110.65	110.65
1997	123.76	131.37	131.37	118.98
2002	127.39	134.14	134.14	127.34
2007	130.80	132.64	136.50	128.36
2012	131.60	130.75	142.53	134.89
2025	151.23	148.91	157.01	151.30

US West Interior

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production				
1987	10.09	10.09	10.09	10.09
1992	9.49	9.49	9.49	9.49
1997	8.56	9.11	9.11	8.29
2002	7.79	8.40	8.40	7.83
2007	8.08	8.08	8.31	7.94
2012	8.41	7.57	8.95	8.40
2025	10.37	9.97	10.78	10.23
Consumption				
1987	13.88	13.88	13.88	13.88
1992	14.08	14.08	14.08	14.08
1997	15.05	14.83	14.83	15.16
2002	15.98	15.69	15.69	15.99
2007	17.06	17.00	16.90	17.14
2012	18.28	18.55	17.99	18.31
2025	21.28	21.40	21.00	21.37
Imports				
1987	3.79	3.79	3.79	3.79
1992	4.59	4.59	4.59	4.59
1997	6.49	5.71	5.71	6.87
2002	8.20	7.29	7.29	8.16
2007	8.98	8.92	8.59	9.19
2012	9.87	10.99	9.04	9.91
2025	10.91	11.44	10.22	11.14
Prices				
1987	137.18	137.18	137.18	137.18
1992	130.60	130.60	130.60	130.60
1997	145.37	152.93	152.93	141.74
2002	149.43	158.70	158.70	149.52
2007	153.42	154.31	157.51	151.12
2012	155.43	144.91	163.62	154.87
2025	174.63	170.85	180.60	172.31

US South Atlantic

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production				
1987	10.12	10.12	10.12	10.12
1992	11.02	11.02	11.02	11.02
1997	14.41	14.79	14.79	14.15
2002	18.62	19.89	19.89	18.58
2007	21.30	21.59	21.77	21.08
2012	22.97	23.77	23.82	22.88
2025	25.67	26.16	26.29	25.60
Consumption				
1987	20.31	20.31	20.31	20.31
1992	20.49	20.49	20.49	20.49
1997	22.00	21.78	21.78	22.16
2002	23.40	22.70	22.70	23.39
2007	24.95	24.86	24.76	25.04
2012	26.77	26.40	26.37	26.79
2025	31.29	31.05	30.97	31.29
Imports				
1987	10.19	10.19	10.19	10.19
1992	9.47	9.47	9.47	9.47
1997	7.59	6.98	6.98	8.01
2002	4.78	2.81	2.81	4.81
2007	3.65	3.27	2.99	3.97
2012	3.80	2.62	2.55	3.91
2025	5.62	4.89	4.67	5.69
Prices				
1987	142.45	142.45	142.45	142.45
1992	138.06	138.06	138.06	138.06
1997	150.86	156.27	156.27	147.13
2002	154.34	170.72	170.72	154.78
2007	159.25	159.67	162.16	157.25
2012	160.37	167.58	168.08	160.42
2025	177.30	179.42	181.10	177.70

US North

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production				
1987	2.96	2.96	2.96	2.96
1992	2.87	2.87	2.87	2.87
1997	3.29	3.59	3.59	3.15
2002	3.48	3.68	3.68	3.44
2007	3.72	3.71	3.82	3.60
2012	3.86	4.04	4.09	3.83
2025	4.53	4.55	4.70	4.53
Consumption				
1987	28.49	28.49	28.49	28.49
1992	28.81	28.81	28.81	28.81
1997	30.98	30.38	30.38	31.27
2002	32.93	32.50	32.50	33.03
2007	35.10	35.07	34.83	35.36
2012	37.62	37.21	37.09	37.72
2025	44.12	43.96	43.64	44.17
Imports				
1987	25.53	25.53	25.53	25.53
1992	25.94	25.94	25.94	25.94
1997	27.69	26.79	26.79	28.12
2002	29.45	28.82	28.82	29.59
2007	31.38	31.36	31.01	31.76
2012	33.76	33.17	33.00	33.89
2025	39.60	39.41	38.94	39.64
Prices				
1987	153.42	153.42	153.42	153.42
1992	147.53	147.53	147.53	147.53
1997	160.45	171.47	171.47	155.21
2002	164.43	171.49	171.49	163.06
2007	169.90	169.08	173.44	165.71
2012	171.94	178.05	179.88	170.94
2025	187.14	187.19	192.36	187.51

Table 8 (continued)

Production, Consumption, Imports and Prices - Base Case

Western Europe

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production (in millions of cubic metres)				
1987	33.73	33.73	33.73	33.73
1992	35.19	35.19	35.19	35.19
1997	36.75	36.86	36.86	35.42
2002	38.15	38.73	38.73	36.82
2007	40.06	40.55	40.50	39.00
2012	42.30	42.28	42.17	39.71
2025	47.80	47.79	47.63	45.14
Consumption (in millions of cubic metres)				
1987	53.31	53.31	53.31	53.31
1992	52.49	52.49	52.49	52.49
1997	56.89	56.76	56.76	58.56
2002	60.27	59.54	59.54	62.02
2007	63.60	62.94	63.00	65.09
2012	66.81	66.76	66.91	70.30
2025	76.40	76.33	76.55	80.45
Imports (in millions of cubic metres)				
1987	19.59	19.59	19.59	19.59
1992	17.30	17.30	17.30	17.30
1997	20.14	19.90	19.90	23.14
2002	22.11	20.82	20.82	25.20
2007	23.54	22.38	22.51	26.09
2012	24.51	24.47	24.74	30.59
2025	28.60	28.54	28.92	35.31
Prices (in 1980 US$)				
1987	179.09	179.09	179.09	179.09
1992	182.58	182.58	182.58	182.58
1997	186.18	186.74	186.74	179.10
2002	188.74	191.77	191.77	181.83
2007	193.79	196.32	196.03	188.51
2012	200.39	200.13	199.52	187.13
2025	214.97	214.75	213.95	202.21

Japan

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production (in millions of cubic metres)				
1987	26.13	26.13	26.13	26.13
1992	26.05	26.05	26.05	26.05
1997	28.04	28.81	28.81	27.63
2002	29.14	29.90	29.90	29.13
2007	30.33	30.39	30.86	29.92
2012	31.22	31.73	32.16	31.15
2025	35.20	34.89	36.07	35.07
Consumption (in millions of cubic metres)				
1987	33.07	33.07	33.07	33.07
1992	33.72	33.72	33.72	33.72
1997	35.85	35.12	35.12	36.23
2002	37.98	37.24	37.24	38.01
2007	40.40	40.27	39.83	40.80
2012	43.31	42.75	42.32	43.41
2025	49.91	50.05	48.87	50.10
Imports (in millions of cubic metres)				
1987	6.94	6.94	6.94	6.94
1992	7.67	7.67	7.67	7.67
1997	7.81	6.31	6.31	8.61
2002	8.84	7.34	7.34	8.88
2007	10.08	9.89	8.97	10.87
2012	12.09	11.02	10.16	12.26
2025	14.71	15.16	12.80	15.04
Prices (in 1980 US$)				
1987	228.29	228.29	228.29	228.29
1992	221.50	221.50	221.50	221.50
1997	234.44	241.98	241.98	230.44
2002	238.33	245.52	245.52	238.32
2007	242.76	242.99	247.56	238.98
2012	244.06	248.65	252.70	243.59
2025	263.08	259.34	270.36	261.97

Rest of the World

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production (in millions of cubic metres)				
1987	94.09	94.09	94.09	94.09
1992	96.04	96.04	96.04	96.04
1997	100.07	101.66	101.66	97.49
2002	105.22	105.59	105.59	100.42
2007	109.61	111.72	112.16	106.82
2012	115.95	115.83	115.76	114.40
2025	127.02	126.98	126.88	127.56
Consumption (in millions of cubic metres)				
1987	113.20	113.20	113.20	113.20
1992	113.31	113.31	113.31	113.31
1997	116.11	115.53	115.53	117.06
2002	119.21	119.07	119.07	120.97
2007	123.33	122.55	122.39	124.39
2012	126.95	126.97	127.00	127.57
2025	138.86	138.86	138.89	138.75
Imports (in millions of cubic metres)				
1987	19.11	19.11	19.11	19.11
1992	17.27	17.27	17.27	17.27
1997	16.05	13.87	13.87	19.56
2002	13.99	13.48	13.48	20.55
2007	13.72	10.83	10.23	17.57
2012	11.01	11.15	11.23	13.17
2025	11.85	11.88	12.01	11.19
Prices (in 1980 US$)				
1987	171.73	171.73	171.73	171.73
1992	171.16	171.16	171.16	171.16
1997	174.13	177.04	177.04	169.43
2002	178.97	179.57	179.57	170.33
2007	182.19	185.95	186.75	177.43
2012	188.75	188.35	188.21	186.38
2025	195.20	194.95	194.77	196.83

Global Total

Year	Base Case	Reduced AAC in BC Scenario a)	Reduced AAC in BC Scenario b)	Increased Production in Russia
Production (in millions of cubic metres)				
1987	186.43	186.43	186.43	186.43
1992	189.74	189.74	189.74	189.74
1997	201.47	205.79	205.79	196.10
2002	213.05	217.37	217.37	206.86
2007	224.01	227.10	228.79	219.09
2012	235.94	236.38	239.07	231.85
2025	263.38	262.95	265.62	260.91
Consumption (in millions of cubic metres)				
1987	277.76	277.76	277.76	277.76
1992	278.64	278.64	278.64	278.64
1997	293.68	290.88	290.88	297.41
2002	307.59	304.28	304.28	311.24
2007	323.47	321.60	320.48	326.95
2012	340.17	339.04	337.60	344.42
2025	385.50	385.32	383.16	389.75
Imports (in millions of cubic metres)				
1987	91.34	91.34	91.34	91.34
1992	88.89	88.89	88.89	88.89
1997	92.21	85.09	85.09	101.32
2002	94.55	86.91	86.91	104.39
2007	99.46	94.50	91.69	107.87
2012	104.23	102.66	98.54	112.57
2025	122.11	122.37	117.54	128.84
Prices (in 1980 US$)				
1987	174.47	174.47	174.47	174.47
1992	172.99	172.99	172.99	172.99
1997	179.02	182.78	182.78	174.20
2002	182.79	186.72	186.72	177.43
2007	186.54	188.94	190.47	182.32
2012	191.21	192.17	193.50	187.68
2025	203.03	202.29	204.61	201.28

Table 9

Direction of Trade - Base Case

in millions of cubic metres

1987

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.33	2.81	6.99	9.88	3.39	3.50	1.59	32.48
Eastern Canada	0.34	0.07	1.09	6.55	1.24	0.00	1.39	10.67
US West Coast	1.30	0.72	2.09	7.33	0.00	3.27	1.50	16.21
US South Central	0.23	0.19	0.02	1.73	1.06	0.00	1.23	4.46
Scandinavia	0.00	0.00	0.00	0.05	12.11	0.00	0.04	12.20
Chile	0.00	0.00	0.00	0.00	0.81	0.17	0.42	1.40
New Zealand	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49
ROW	0.00	0.00	0.00	0.00	0.98	0.00	12.45	13.43
Total Imports	6.20	3.79	10.19	25.53	19.59	6.94	19.11	91.34

1992

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.15	3.54	2.48	14.82	0.33	2.49	1.19	30.00
Eastern Canada	0.34	0.07	0.98	7.69	0.00	0.00	1.18	10.25
US West Coast	0.93	0.77	5.99	0.72	0.00	5.03	1.05	14.48
US South Central	0.24	0.19	0.02	2.72	0.94	0.00	0.87	4.98
Scandinavia	0.00	0.00	0.00	0.00	12.89	0.00	0.00	12.89
Chile	0.00	0.02	0.00	0.00	0.15	0.15	0.73	1.05
New Zealand	0.00	0.00	0.00	0.00	0.20	0.00	0.10	0.30
ROW	0.00	0.00	0.00	0.00	2.78	0.00	12.16	14.95
Total Imports	6.65	4.59	9.47	25.94	17.30	7.67	17.27	88.89

1997

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.13	5.25	2.45	14.50	0.00	4.89	1.62	33.84
Eastern Canada	0.35	0.06	1.22	8.35	0.00	0.00	1.78	11.75
US West Coast	0.51	0.98	3.89	0.73	0.00	2.90	1.40	10.42
US South Central	0.45	0.20	0.02	4.09	1.79	0.00	1.54	8.07
Scandinavia	0.00	0.00	0.00	0.00	13.21	0.00	0.00	13.21
Chile	0.00	0.00	0.00	0.00	0.07	0.00	1.72	1.80
New Zealand	0.00	0.00	0.00	0.00	0.08	0.00	0.95	1.03
ROW	0.00	0.00	0.01	0.03	4.99	0.02	7.03	12.08
Total Imports	6.44	6.49	7.59	27.69	20.14	7.81	16.05	92.21

2002

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.46	6.19	2.18	10.53	0.00	7.79	0.27	32.43
Eastern Canada	0.35	0.07	1.64	9.77	0.00	0.00	0.34	12.17
US West Coast	0.90	1.46	0.91	0.69	0.00	0.97	2.19	7.13
US South Central	0.27	0.29	0.02	8.43	2.45	0.00	0.47	11.94
Scandinavia	0.00	0.00	0.00	0.01	13.74	0.00	0.00	13.76
Chile	0.02	0.02	0.00	0.00	0.01	0.02	2.76	2.82
New Zealand	0.16	0.16	0.00	0.00	0.32	0.04	0.94	1.62
ROW	0.03	0.00	0.02	0.01	5.59	0.02	7.01	12.68
Total Imports	7.18	8.20	4.78	29.45	22.11	8.84	13.99	94.55

2007

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	6.50	7.51	1.60	7.23	0.00	7.08	1.06	30.98
Eastern Canada	0.35	0.07	1.06	10.04	0.00	0.00	1.14	12.66
US West Coast	0.50	0.99	0.49	2.19	0.00	2.59	0.93	7.69
US South Central	0.37	0.21	0.03	11.49	2.87	0.00	1.12	16.10
Scandinavia	0.00	0.00	0.00	0.00	14.47	0.00	0.00	14.48
Chile	0.17	0.15	0.18	0.13	0.16	0.19	2.68	3.66
New Zealand	0.06	0.06	0.08	0.05	0.55	0.01	1.42	2.22
ROW	0.15	0.00	0.20	0.26	5.49	0.21	5.37	11.68
Total Imports	8.11	8.98	3.65	31.38	23.54	10.08	13.72	99.46

2012

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	7.63	8.25	2.66	5.35	0.00	8.01	0.01	31.90
Eastern Canada	0.35	0.07	0.96	10.77	0.00	0.00	0.08	12.22
US West Coast	0.76	1.17	0.02	0.64	0.00	3.67	0.03	6.28
US South Central	0.46	0.30	0.02	16.79	0.83	0.00	0.12	18.52
Scandinavia	0.00	0.00	0.00	0.00	15.26	0.00	0.00	15.26
Chile	0.00	0.06	0.00	0.11	0.28	0.10	4.38	4.92
New Zealand	0.00	0.03	0.07	0.00	0.25	0.17	2.48	3.01
ROW	0.00	0.00	0.06	0.11	7.89	0.15	3.91	12.11
Total Imports	9.19	9.87	3.80	33.76	24.51	12.09	11.01	104.23

2025

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	8.66	9.52	0.00	4.46	0.00	7.74	0.01	30.39
Eastern Canada	0.08	0.06	0.08	13.11	0.00	0.00	0.06	13.39
US West Coast	0.84	0.60	0.00	1.16	0.00	6.42	0.00	9.02
US South Central	1.21	0.65	5.41	16.97	2.68	0.00	0.17	27.08
Scandinavia	0.00	0.00	0.02	1.82	15.09	0.01	0.00	16.95
Chile	0.02	0.06	0.03	0.22	0.45	0.12	7.18	8.09
New Zealand	0.00	0.03	0.04	0.00	0.42	0.26	4.44	5.20
ROW	0.02	0.00	0.03	1.85	9.95	0.15	0.00	12.01
Total Imports	10.83	10.91	5.62	39.60	28.60	14.71	11.85	122.11

Table 10

Projected Real Softwood Lumber Prices

1980 US$ per cubic metre

	Actual	*Predicted*						
Export Regions	**1987**	**1987**	**1992**	**1997**	**2002**	**2007**	**2012**	**2025**
British Columbia	97	95.23	90.14	101.90	106.45	110.78	112.73	130.07
Eastern Canada	116	114.93	109.49	120.38	125.53	131.41	130.96	146.44
US West Coast	135	133.47	127.98	140.97	144.36	151.19	150.52	168.89
US South Central	136	135.51	127.49	141.47	145.40	150.65	151.24	168.67
Scandinavia	156	155.21	157.09	160.70	164.71	170.36	176.56	190.10
Chile	95	100.52	93.96	98.82	104.29	107.03	113.44	120.21
New Zealand	155	157.58	149.13	162.02	164.17	167.53	173.01	180.08
ROW	150	151.64	151.10	153.57	158.97	162.75	169.18	185.00

	Actual	*Predicted*						
Import Regions	**1987**	**1987**	**1992**	**1997**	**2002**	**2007**	**2012**	**2025**
Interior Canada	118	116.35	110.65	123.76	127.39	130.80	131.60	151.23
US West Interior	140	137.18	130.60	145.37	149.43	153.42	155.43	174.63
US South Atlantic	145	142.45	138.06	150.86	154.34	159.25	160.37	177.30
US North	155	153.42	147.53	160.45	164.43	169.90	171.94	187.14
Western Europe	180	179.09	182.58	186.18	188.74	193.79	200.39	214.97
Japan	229	228.29	221.50	234.44	238.33	242.76	244.06	263.08
ROW	170	171.73	171.16	174.13	178.97	182.19	188.75	195.20

Table 11

Projected Softwood Lumber Price Index

1987=100

Export Regions	**1987**	**1992**	**1997**	**2002**	**2007**	**2012**	**2025**
British Columbia	1.00	0.95	1.07	1.12	1.16	1.18	1.37
Eastern Canada	1.00	0.95	1.05	1.09	1.14	1.14	1.27
US West Coast	1.00	0.96	1.06	1.08	1.13	1.13	1.27
US South Central	1.00	0.94	1.04	1.07	1.11	1.12	1.24
Scandinavia	1.00	1.01	1.04	1.06	1.10	1.14	1.22
Chile	1.00	0.93	0.98	1.04	1.06	1.13	1.20
New Zealand	1.00	0.95	1.03	1.04	1.06	1.10	1.14
ROW	1.00	1.00	1.01	1.05	1.07	1.12	1.22

Import Regions	**1987**	**1992**	**1997**	**2002**	**2007**	**2012**	**2025**
Interior Canada	1.00	0.95	1.06	1.09	1.12	1.13	1.30
US West Interior	1.00	0.95	1.06	1.09	1.12	1.13	1.27
US South Atlantic	1.00	0.97	1.06	1.08	1.12	1.13	1.24
US North	1.00	0.96	1.05	1.07	1.11	1.12	1.22
Western Europe	1.00	1.02	1.04	1.05	1.08	1.12	1.20
Japan	1.00	0.97	1.03	1.04	1.06	1.07	1.15
ROW	1.00	1.00	1.01	1.04	1.06	1.10	1.14

Table 12

Direction of Trade - Reduced AAC in BC (Scenario a)

in millions of cubic metres

1987

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.33	2.81	6.99	9.88	3.39	3.50	1.59	32.48
Eastern Canada	0.34	0.07	1.09	6.55	1.24	0.00	1.39	10.67
US West Coast	1.30	0.72	2.09	7.33	0.00	3.27	1.50	16.21
US South Central	0.23	0.19	0.02	1.73	1.06	0.00	1.23	4.46
Scandinavia	0.00	0.00	0.00	0.05	12.11	0.00	0.04	12.20
Chile	0.00	0.00	0.00	0.00	0.81	0.17	0.42	1.40
New Zealand	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49
ROW	0.00	0.00	0.00	0.00	0.98	0.00	12.45	13.43
Total Imports	6.20	3.79	10.19	25.53	19.59	6.94	19.11	91.34

1997

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.15	4.21	1.32	8.37	0.00	2.45	0.56	21.07
Eastern Canada	0.34	0.06	1.01	11.03	0.00	0.00	0.68	13.11
US West Coast	0.57	1.20	4.39	0.86	0.00	3.76	0.95	11.72
US South Central	0.47	0.20	0.02	5.95	0.92	0.00	0.82	8.38
Scandinavia	0.00	0.00	0.23	0.29	12.93	0.00	0.00	13.45
Chile	0.00	0.00	0.00	0.21	0.07	0.00	1.75	2.05
New Zealand	0.00	0.03	0.00	0.05	0.08	0.08	0.83	1.06
ROW	0.00	0.00	0.01	0.03	5.90	0.02	8.27	14.23
Total Imports	5.53	5.71	6.98	26.79	19.90	6.31	13.87	85.09

2007

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.72	7.59	1.34	0.84	0.00	7.69	0.35	23.53
Eastern Canada	0.31	0.06	0.88	11.15	0.00	0.00	0.07	12.48
US West Coast	0.47	0.84	0.50	3.33	0.00	1.75	0.24	7.14
US South Central	0.33	0.20	0.03	15.53	0.02	0.00	0.11	16.23
Scandinavia	0.61	0.00	0.00	0.00	14.13	0.00	0.00	14.75
Chile	0.18	0.16	0.21	0.14	0.16	0.20	2.94	4.01
New Zealand	0.06	0.06	0.08	0.05	0.58	0.01	1.50	2.35
ROW	0.16	0.00	0.23	0.32	7.48	0.23	5.61	14.03
Total Imports	7.85	8.92	3.27	31.36	22.38	9.89	10.83	94.50

2025

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	9.48	10.25	0.31	1.89	0.00	8.29	0.01	30.23
Eastern Canada	0.08	0.06	0.08	13.20	0.00	0.00	0.05	13.47
US West Coast	0.60	0.48	0.00	1.00	0.00	6.28	0.00	8.35
US South Central	0.85	0.56	4.37	19.24	2.48	0.00	0.16	27.65
Scandinavia	0.00	0.00	0.02	1.90	15.12	0.01	0.00	17.06
Chile	0.02	0.06	0.03	0.24	0.52	0.12	7.25	8.25
New Zealand	0.00	0.03	0.04	0.00	0.48	0.30	4.42	5.27
ROW	0.02	0.00	0.03	1.94	9.94	0.16	0.00	12.09
Total Imports	11.05	11.44	4.89	39.41	28.54	15.16	11.88	122.37

1992

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.15	3.54	2.48	14.82	0.33	2.49	1.19	30.00
Eastern Canada	0.34	0.07	0.98	7.69	0.00	0.00	1.18	10.25
US West Coast	0.93	0.77	5.99	0.72	0.00	5.03	1.05	14.48
US South Central	0.24	0.19	0.02	2.72	0.94	0.00	0.87	4.98
Scandinavia	0.00	0.00	0.00	0.00	12.89	0.00	0.00	12.89
Chile	0.00	0.02	0.00	0.00	0.15	0.15	0.73	1.05
New Zealand	0.00	0.00	0.00	0.00	0.20	0.00	0.10	0.30
ROW	0.00	0.00	0.00	0.00	2.78	0.00	12.16	14.95
Total Imports	6.65	4.59	9.47	25.94	17.30	7.67	17.27	88.89

2002

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.29	4.44	0.73	4.85	0.00	5.90	0.23	20.45
Eastern Canada	0.35	0.07	1.01	11.51	0.00	0.00	0.29	13.23
US West Coast	1.22	2.30	1.02	0.87	0.00	1.36	1.77	8.53
US South Central	0.27	0.30	0.02	11.57	0.00	0.00	0.38	12.54
Scandinavia	0.00	0.00	0.00	0.01	14.21	0.00	0.00	14.22
Chile	0.02	0.02	0.00	0.00	0.01	0.02	2.81	2.88
New Zealand	0.18	0.17	0.00	0.00	0.32	0.04	0.93	1.65
ROW	0.03	0.00	0.02	0.01	6.27	0.02	7.07	13.42
Total Imports	6.35	7.29	2.81	28.82	20.82	7.34	13.48	86.91

2012

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	7.36	9.15	1.50	2.04	0.00	5.36	0.01	25.42
Eastern Canada	0.36	0.07	0.92	12.32	0.00	0.00	0.08	13.75
US West Coast	0.83	1.37	0.02	0.66	0.00	5.16	0.03	8.07
US South Central	0.48	0.31	0.02	17.92	0.81	0.00	0.12	19.66
Scandinavia	0.09	0.00	0.01	0.00	14.85	0.08	0.00	15.03
Chile	0.06	0.06	0.01	0.11	0.29	0.10	4.43	5.05
New Zealand	0.00	0.03	0.07	0.00	0.25	0.17	2.56	3.09
ROW	0.06	0.00	0.06	0.11	8.28	0.15	3.92	12.58
Total Imports	9.24	10.99	2.62	33.17	24.47	11.02	11.15	102.66

Table 13

Direction of Trade - Reduced AAC in BC (Scenario b)

in millions of cubic metres

1987

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.33	2.81	6.99	9.88	3.39	3.50	1.59	32.48
Eastern Canada	0.34	0.07	1.09	6.55	1.24	0.00	1.39	10.67
US West Coast	1.30	0.72	2.09	7.33	0.00	3.27	1.50	16.21
US South Central	0.23	0.19	0.02	1.73	1.06	0.00	1.23	4.46
Scandinavia	0.00	0.00	0.00	0.05	12.11	0.00	0.04	12.20
Chile	0.00	0.00	0.00	0.00	0.81	0.17	0.42	1.40
New Zealand	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49
ROW	0.00	0.00	0.00	0.00	0.98	0.00	12.45	13.43
Total Imports	6.20	3.79	10.19	25.53	19.59	6.94	19.11	91.34

1992

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.15	3.54	2.48	14.82	0.33	2.49	1.19	30.00
Eastern Canada	0.34	0.07	0.98	7.69	0.00	0.00	1.18	10.25
US West Coast	0.93	0.77	5.99	0.72	0.00	5.03	1.05	14.48
US South Central	0.24	0.19	0.02	2.72	0.94	0.00	0.87	4.98
Scandinavia	0.00	0.00	0.00	0.00	12.89	0.00	0.00	12.89
Chile	0.00	0.02	0.00	0.00	0.15	0.15	0.73	1.05
New Zealand	0.00	0.00	0.00	0.00	0.20	0.00	0.10	0.30
ROW	0.00	0.00	0.00	0.00	2.78	0.00	12.16	14.95
Total Imports	6.65	4.59	9.47	25.94	17.30	7.67	17.27	88.89

1997

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.15	4.21	1.32	8.37	0.00	2.45	0.56	21.07
Eastern Canada	0.34	0.06	1.01	11.03	0.00	0.00	0.68	13.11
US West Coast	0.57	1.20	4.39	0.86	0.00	3.76	0.95	11.72
US South Central	0.47	0.20	0.02	5.95	0.92	0.00	0.82	8.38
Scandinavia	0.00	0.00	0.23	0.29	12.93	0.00	0.00	13.45
Chile	0.00	0.00	0.00	0.21	0.07	0.00	1.75	2.05
New Zealand	0.00	0.03	0.00	0.05	0.08	0.08	0.83	1.06
ROW	0.00	0.00	0.01	0.03	5.90	0.02	8.27	14.23
Total Imports	5.53	5.71	6.98	26.79	19.90	6.31	13.87	85.09

2002

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.29	4.44	0.73	4.85	0.00	5.90	0.23	20.45
Eastern Canada	0.35	0.07	1.01	11.51	0.00	0.00	0.29	13.23
US West Coast	1.22	2.30	1.02	0.87	0.00	1.36	1.77	8.53
US South Central	0.27	0.30	0.02	11.57	0.00	0.00	0.38	12.54
Scandinavia	0.00	0.00	0.00	0.01	14.21	0.00	0.00	14.22
Chile	0.02	0.02	0.00	0.00	0.01	0.02	2.81	2.88
New Zealand	0.18	0.17	0.00	0.00	0.32	0.04	0.93	1.65
ROW	0.03	0.00	0.02	0.01	6.27	0.02	7.07	13.42
Total Imports	6.35	7.29	2.81	28.82	20.82	7.34	13.48	86.91

2007

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.85	6.94	1.00	0.66	0.00	5.14	0.00	18.59
Eastern Canada	0.36	0.07	0.96	11.62	0.00	0.00	0.07	13.09
US West Coast	0.53	1.13	0.47	2.32	0.00	3.36	0.23	8.04
US South Central	0.39	0.22	0.03	15.89	0.00	0.00	0.11	16.65
Scandinavia	0.83	0.00	0.00	0.00	13.93	0.00	0.00	14.76
Chile	0.19	0.17	0.21	0.14	0.17	0.22	2.98	4.08
New Zealand	0.06	0.06	0.08	0.05	0.59	0.01	1.53	2.39
ROW	0.17	0.00	0.23	0.31	7.82	0.25	5.30	14.09
Total Imports	7.39	8.59	2.99	31.01	22.51	8.97	10.23	91.69

2012

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.93	7.20	1.42	1.89	0.00	4.53	0.01	20.98
Eastern Canada	0.36	0.07	0.92	12.31	0.00	0.00	0.08	13.74
US West Coast	0.83	1.37	0.02	0.65	0.00	5.14	0.03	8.05
US South Central	0.48	0.31	0.02	17.92	0.82	0.00	0.12	19.67
Scandinavia	0.09	0.00	0.01	0.00	15.09	0.08	0.00	15.27
Chile	0.06	0.06	0.01	0.11	0.29	0.10	4.45	5.07
New Zealand	0.00	0.03	0.07	0.00	0.25	0.17	2.59	3.12
ROW	0.06	0.00	0.06	0.11	8.30	0.15	3.96	12.64
Total Imports	7.82	9.04	2.55	33.00	24.74	10.16	11.23	98.54

2025

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	7.51	8.72	0.00	1.32	0.00	3.54	0.01	21.09
Eastern Canada	0.09	0.06	0.08	14.24	0.00	0.00	0.06	14.53
US West Coast	0.92	0.64	0.00	1.11	0.00	8.70	0.00	11.37
US South Central	1.42	0.71	4.46	18.48	2.84	0.00	0.16	28.07
Scandinavia	0.00	0.00	0.02	1.77	15.36	0.01	0.00	17.16
Chile	0.02	0.06	0.03	0.23	0.48	0.12	7.30	8.24
New Zealand	0.00	0.03	0.04	0.00	0.44	0.27	4.49	5.27
ROW	0.02	0.00	0.03	1.79	9.81	0.16	0.00	11.80
Total Imports	9.98	10.22	4.67	38.94	28.92	12.80	12.01	117.54

Table 14

Direction of Trade - Increased Production in the Former USSR

in millions of cubic metres

1987

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	4.33	2.81	6.99	9.88	3.39	3.50	1.59	32.48
Eastern Canada	0.34	0.07	1.09	6.55	1.24	0.00	1.39	10.67
US West Coast	1.30	0.72	2.09	7.33	0.00	3.27	1.50	16.21
US South Central	0.23	0.19	0.02	1.73	1.06	0.00	1.23	4.46
Scandinavia	0.00	0.00	0.00	0.05	12.11	0.00	0.04	12.20
Chile	0.00	0.00	0.00	0.00	0.81	0.17	0.42	1.40
New Zealand	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.49
ROW	0.00	0.00	0.00	0.00	0.98	0.00	12.45	13.43
Total Imports	6.20	3.79	10.19	25.53	19.59	6.94	19.11	91.34

1992

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.15	3.54	2.48	14.82	0.33	2.49	1.19	30.00
Eastern Canada	0.34	0.07	0.98	7.69	0.00	0.00	1.18	10.25
US West Coast	0.93	0.77	5.99	0.72	0.00	5.03	1.05	14.48
US South Central	0.24	0.19	0.02	2.72	0.94	0.00	0.87	4.98
Scandinavia	0.00	0.00	0.00	0.00	12.89	0.00	0.00	12.89
Chile	0.00	0.02	0.00	0.00	0.15	0.15	0.73	1.05
New Zealand	0.00	0.00	0.00	0.00	0.20	0.00	0.10	0.30
ROW	0.00	0.00	0.00	0.00	2.78	0.00	12.16	14.95
Total Imports	6.65	4.59	9.47	25.94	17.30	7.67	17.27	88.89

1997

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.68	5.64	2.61	12.75	0.00	5.46	0.60	32.74
Eastern Canada	0.35	0.06	1.28	9.03	0.00	0.00	0.61	11.33
US West Coast	0.51	0.96	3.83	0.71	0.00	2.85	0.58	9.44
US South Central	0.47	0.20	0.02	5.27	1.10	0.00	0.81	7.86
Scandinavia	0.00	0.00	0.26	0.20	11.65	0.23	0.05	12.39
Chile	0.00	0.00	0.00	0.09	0.07	0.00	1.30	1.47
New Zealand	0.00	0.00	0.00	0.04	0.09	0.04	0.66	0.83
ROW	0.00	0.00	0.01	0.03	10.23	0.02	14.97	25.25
Total Imports	7.01	6.87	8.01	28.12	23.14	8.61	19.56	101.32

2002

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	5.47	6.16	2.20	10.69	0.00	7.83	0.27	32.62
Eastern Canada	0.35	0.07	1.64	9.79	0.00	0.00	0.34	12.19
US West Coast	0.90	1.47	0.92	0.69	0.00	0.98	2.16	7.11
US South Central	0.27	0.29	0.02	8.39	2.37	0.00	0.47	11.82
Scandinavia	0.00	0.00	0.00	0.01	12.64	0.00	0.00	12.65
Chile	0.02	0.02	0.00	0.00	0.01	0.02	2.64	2.70
New Zealand	0.16	0.16	0.00	0.00	0.32	0.04	0.93	1.61
ROW	0.03	0.00	0.02	0.01	9.85	0.02	13.75	23.68
Total Imports	7.20	8.16	4.81	29.59	25.20	8.88	20.55	104.39

2007

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	6.64	7.77	1.75	5.22	0.00	7.81	0.64	29.83
Eastern Canada	0.36	0.07	1.17	9.74	0.00	0.00	0.71	12.04
US West Coast	0.48	0.92	0.49	1.68	0.00	2.23	0.55	6.36
US South Central	0.38	0.22	0.03	14.10	0.19	0.00	0.73	15.65
Scandinavia	0.16	0.00	0.00	0.00	13.46	0.00	0.00	13.62
Chile	0.17	0.16	0.19	0.12	0.16	0.11	2.23	3.14
New Zealand	0.06	0.06	0.08	0.05	0.51	0.01	1.30	2.06
ROW	0.16	0.00	0.25	0.86	11.78	0.71	11.40	25.16
Total Imports	8.41	9.19	3.97	31.76	26.09	10.87	17.57	107.87

2012

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	7.13	8.28	2.74	5.56	0.00	8.06	0.01	31.78
Eastern Canada	0.34	0.07	0.96	10.68	0.00	0.00	0.08	12.13
US West Coast	0.75	1.17	0.02	0.64	0.00	3.70	0.03	6.33
US South Central	0.45	0.30	0.02	16.70	0.84	0.00	0.12	18.43
Scandinavia	0.03	0.00	0.03	0.00	13.38	0.03	0.03	13.49
Chile	0.00	0.06	0.00	0.11	0.28	0.10	3.98	4.52
New Zealand	0.00	0.03	0.07	0.00	0.24	0.17	2.31	2.83
ROW	0.12	0.00	0.06	0.19	15.85	0.20	6.62	23.06
Total Imports	8.83	9.91	3.91	33.89	30.59	12.26	13.17	112.57

2025

Export/Import	Int. Canada	US West Int.	US South Atl.	US North	W. Europe	Japan	ROW	Total Exports
British Columbia	8.66	9.74	0.00	4.40	0.00	7.97	0.01	30.78
Eastern Canada	0.08	0.06	0.08	13.43	0.00	0.00	0.06	13.72
US West Coast	0.84	0.60	0.00	1.15	0.00	6.52	0.00	9.10
US South Central	1.21	0.65	5.48	16.54	2.72	0.00	0.17	26.77
Scandinavia	0.00	0.00	0.02	1.77	13.23	0.01	0.00	15.04
Chile	0.02	0.06	0.03	0.22	0.46	0.12	6.69	7.60
New Zealand	0.00	0.03	0.04	0.00	0.43	0.26	4.28	5.04
ROW	0.02	0.00	0.03	2.12	18.47	0.16	0.00	20.80
Total Imports	10.83	11.14	5.69	39.64	35.31	15.04	11.19	128.84

Tabel 15

Projected Consumer and Producer Surplus - All Scenarios

in millions 1980 US$

Base Case

Export Regions	1987 CS	1987 PS	2002 CS	2002 PS	2025 CS	2025 PS
British Columbia	720.14	1757.49	940.3446	2542.70	1621.29	4326.36
Eastern Canada	602.98	851.47	785.41	1015.72	1354.49	1382.41
US West Coast	3035.56	1979.31	4035.57	3077.03	7142.54	4081.66
US South Central	1317.51	695.37	1761.17	800.59	3132.06	1077.29
Scandinavia	1669.05	1443.88	2236.76	1625.96	3981.50	2165.97
Chile	198.72	379.39	270.88	487.95	480.27	489.82
New Zealand	288.40	447.62	387.72	530.48	691.75	483.30
ROW	15989.51	5883.59	21595.29	6465.68	38314.69	8756.98
Total	*23821.88*	*13438.11*	*32013.14*	*16546.10*	*56718.59*	*22763.78*

Import Regions	1987 CS	1987 PS	2002 CS	2002 PS	2025 CS	2025 PS
Central Canada	3062.61	541.69	4045.36	649.30	7112.40	915.14
US West Interior	3259.08	692.21	4318.94	1090.95	7657.25	1429.41
US South Atlantic	4933.40	720.67	6550.29	846.03	11710.55	1116.43
US North	7381.47	423.31	9864.53	474.03	17707.97	559.88
W. Europe	6022.21	3020.20	7695.58	3354.51	12365.62	4351.48
Japan	5662.85	2683.31	7470.31	2924.50	12902.30	3563.40
ROW	31974.58	8078.95	35461.19	8774.83	48117.99	10437.84
Total	*62296.20*	*16160.35*	*75406.19*	*18114.15*	*117574.08*	*22373.59*

Change in Consumer and Producer Surplus

	Change in AAC - Scenario a				Change in AAC - Scenario b				Increased Production in Former USSR			
	2002		2025		2002		2025		2002		2025	
Export Regions	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
British Columbia	-8.17	423.99	13.99	-152.74	-40.24	748.43	-68.36	287.05	-0.52	7.08	-1.50	49.97
Eastern Canada	-37.22	121.57	-23.54	4.79	-37.22	121.57	-70.36	146.48	0.17	2.74	-9.97	45.10
US West Coast	-99.21	259.66	7.31	-122.10	-99.21	259.66	-243.32	430.11	11.76	-21.94	19.67	-6.63
US South Central	-41.25	66.70	-25.83	0.16	-41.25	66.70	-66.43	54.93	6.36	-8.57	20.65	-21.88
Scandinavia	-26.69	69.40	-10.49	17.41	-26.69	69.40	-19.88	30.83	64.31	-157.27	172.28	-281.66
Chile	-0.48	1.69	-0.99	-1.74	-0.48	1.69	-0.23	-5.77	1.44	-7.68	6.90	-14.79
New Zealand	-0.99	2.57	-2.00	0.14	-0.99	2.57	-1.93	-1.04	-0.56	5.45	4.62	-1.88
ROW	-95.47	85.39	-58.84	-22.19	-95.47	85.39	-16.02	-65.25	624.44	-636.15	1651.57	-1199.02
Total	*-309.48*	*1030.97*	*-100.39*	*-276.27*	*-341.55*	*1355.41*	*-486.54*	*877.33*	*707.39*	*-816.35*	*1864.21*	*-1430.80*

	2002		2025		2002		2025		2002		2025	
Import Regions	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
Central Canada	-128.86	70.70	22.09	-27.86	-128.86	70.70	-229.89	71.27	6.77	-0.46	-0.53	0.79
US West Interior	-155.19	136.65	88.06	-49.03	-155.19	136.65	-202.01	95.10	2.58	0.67	63.56	-37.54
US South Atlantic	-386.29	189.12	-176.69	26.88	-386.29	189.12	-238.91	48.48	-4.17	4.82	2.58	5.09
US North	-255.95	38.49	-128.42	-2.75	-255.95	38.49	-387.48	25.65	57.51	-7.26	37.09	3.32
W. Europe	-183.85	108.56	-23.30	-8.82	-183.85	108.56	49.02	-41.20	452.83	-241.15	1345.74	-500.95
Japan	-290.19	179.08	70.17	-100.58	-290.19	179.08	-534.12	199.90	11.27	-0.40	96.65	-30.06
ROW	-83.14	58.54	-3.88	-26.25	-83.14	58.54	18.70	-45.84	1057.37	-826.81	-81.37	175.63
Total	*-1483.47*	*781.13*	*-151.96*	*-188.40*	*-1483.47*	*781.13*	*-1524.69*	*353.35*	*1584.16*	*-1070.59*	*1463.73*	*-383.73*

Note: CS refers to Consumer Surplus and PS refers to Producer Surplus