

## **Log Supply and Price Adjustment Mechanisms in Industrialized Economies: Impacts on Small-scale Forest Farmers**

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Log pricing and supply arrangements vary between countries. Some countries use open markets to determine log prices while others regulate supply and offer medium to long-term contracts to log buyers. A study of four industrialised countries – the United States, Canada, New Zealand and Australia – is undertaken to compare variations in log pricing methodologies and contract price adjustment mechanisms. Market concentration and market power is found to vary between these countries. Variations also exist in supply arrangements, contract term and price adjustment mechanisms both between countries and across regional jurisdictions within each country. The United States and New Zealand are strongly market oriented while Canada and Australia remain highly regulated. Both Canada and Australia use a weighted wood price index to adjust contract log prices. Policies are required in these regulated markets to encourage entry of small-scale suppliers if seller concentration is to be reduced and competitive market efficiency increased.

### **INTRODUCTION**

Small-scale forest farmers in industrialised countries have the potential to contribute considerably to regional economic activity in terms of forest products grown for the commercial processing industry. Financial returns, economic viability and ecological sustainability are dependent on a number of parameters including yield, species, growth rate, log prices, supply contracts, market structure and timber quality control (Leskinen and Kangas 1998). But it is normally the case that small-scale forest farmers have little influence in determining prices and supply arrangements for their log sales. In a number of industrialised log-producing countries, log markets are dominated by large industrial and commercial suppliers and highly concentrated processors who together determine price and supply arrangements.

Contracts that involve the sale of assets or resources can be transacted in private competitive markets (Furubotn and Pejovich 1974, p. 12). The contract acts as a

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vehicle to transfer property rights of ownership of assets or resources from one party to the other and stipulate the terms and conditions of transfer of ownership. Price, delivery, term, volume, species type, location and minimum size of log are standard stipulations of log contracts in most countries.

Many log-producing countries use both the spot and contract markets to determine log prices. In some countries, log sales are arranged through a spot market at the 'roadside'. Supply arrangements in other countries include short and long-term contract periods. Auctions, tenders, negotiations, expressions of interest and proposition calls are commonly used for log price determination in spot and term-contract markets. A price adjustment mechanism is required in contracts to ensure that as the property rights pass from one party to the other, the original value of the resource is maintained and the economic rents are shared equitably. Processors claim their cash flows from processed timber outputs vary with economic and market conditions over the business cycle, but their input log costs remain constant in real terms, thus shifting the economic rents to the suppliers. Choosing price adjustment mechanisms is therefore controversial. Different price adjustment methods have different impacts on the financial returns that suppliers receive over the duration of a contract. A clear perspective of the nature and role of term contracts in log sales is critical for understanding international variations in log prices.

Log supply agreements and log prices are negotiated as a contract between grower and processor in market conditions that vary considerably from country to country. In markets that require both continuity and guaranteed supply, contractual sale agreements are standard practice. Log sales and price setting occurs in three recognized markets: the spot market, the short-term contract market and the long-term contract market. Different market structures and characteristics lead to different log prices in different countries. A mechanism is needed for price adjustment for logs consigned under long-term agreements. Without an efficient price adjuster, the real value of the resource to the forest owner and their share of the economic rent may diminish throughout the term of the contract. Moreover, productivity gains in the processing industry will not be shared with timber resource suppliers in the form of higher log prices if price realignment processes are absent. Choosing an appropriate price adjustment mechanism therefore is crucial for ensuring market efficiency in supply through time and the maintenance of the real value of returns for the resource.

Appropriate market prices and price adjustment options written into term contracts are critical if small-scale forest farmers are to be viable economically, and if they are to be a reliable source of commercial forest outputs that can compete with larger industrial operators. Small-scale forest farmers require knowledge of market pricing, price adjustment mechanisms and contractual conditions of log supply on the spot and long-term markets. Only with an understanding of these conditions and their implications will a wider and more diverse composition of producers emerge in commercial forest activities.

To assess the extent of variation in log pricing practices and the different contract price adjustment mechanisms, an international study of four industrialised countries is undertaken. Comparisons are made between price determination and adjustment practices in the United States, Canada, New Zealand and Australia, at both national and regional levels. These four countries are chosen to illustrate the impact of

different log supply and pricing arrangements in markets that are competitive compared to countries and regions where log supply arrangements are still highly regulated. The paper is divided into two main sections, the first on log pricing and supply arrangements and the second on contract price adjustment models. Each country's log supply and pricing arrangements are examined and regional variations evaluated. Evidence is supplied to support the argument that high concentration on the supply and or the demand side of the market strongly influences log prices in all four countries, but it is noted that although some markets are still highly regulated, competitive forces are strengthening in all of these markets.

### **LOG PRICING AND SUPPLY ARRANGEMENTS IN FOUR INDUSTRIALISED COUNTRIES**

Industry structure and the degree of competitiveness in any industry determine the opportunity for entry of new suppliers into the industry. Small-scale forest farmers' ability to sell their logs and be economically viable depends upon market entry conditions. Market entry conditions vary from country to country depending on industry structure, forest ownership, regional advantage, regulatory environment and market power by buyers to determine log prices. Market conditions also vary across regions and jurisdictions within countries, highlighting the importance of location and regional advantage. Pricing and supply arrangements also affect market entry incentives. A number of alternative pricing and supply arrangements are apparent in different timber producing countries in the industrial world. The industry in many of these countries is highly concentrated, conferring substantial market power on large suppliers and buyers. Divergence from a competitive market structure also occurs further along the timber processing chain.<sup>2</sup> Small-scale forest farmers are therefore dependent on market prices for logs normally set by large commercial suppliers negotiating with large log processors. An across-country and within-country analysis in four industrialised countries sheds light on market concentration and log pricing arrangements internationally.

#### **Stumpage Pricing Mechanisms in the USA**

##### *North-west region*

High concentration of ownership on the supply side and strong market power from the processors due to regional advantage is evident in the United States timber industry. In the Pacific North West (PNW) region, forest ownership is dominated by the public sector with about 63% of the forested land owned and managed by state and federal governments (Margules *et al.* 1995, p. 3). Ownership of the balance of forested land is shared fairly equally by industrial and other private (non-industrial) forest farmers, who together supply most of the raw timber to mill for processing. Since the implementation of the *North West Forest Plan* under the Clinton Administration, the federal and state governments play only a minor role in supplying timber to the market for processing (New Zealand Ministry of Forestry

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<sup>2</sup> For example, in Australia, all but one of the six major activities in the forestry product chain have high levels of seller concentration (Quayle 2001).

1993, p. 7). Moreover, over the past decade, the timber harvested from federal forests has diminished relative to that harvested from state government holdings. Most of the timber supplied from this region is softwood, harvested by clearfell operation, and used in the sawlog industry. Of the estimated 425 sawmills operating on the West Coast, medium-sized independent processors dominate with annual throughputs of between 34,000m<sup>3</sup> and 110,000m<sup>3</sup> (Margules *et al.* 1995). The large industrial plantation owners and the medium size forest private cooperatives dominate supply and set prices for all suppliers in the market. Previously, long-term contracts operated, but these have now been reduced to one to two years, resulting in increased number of sales transactions of smaller timber volume and more competition in the log market. Most timber sales are negotiated between these parties in a relatively open and competitive market, where the public sector has a diminished role and a reduced influence over the determination of log prices.

Logs supplied from federal forests are appraised to assess minimum value of the resource, by a 'transaction evidence appraisal system' introduced in the mid-1990s. A minimum price for current log sales is estimated on the basis of average log prices in the past three years. Modifications to the base price are then applied based on specific market conditions (this could include the rough terrain and increased harvesting costs). Sales are by closed bid submissions and open auction bidding. With the public sector supplying a considerably reduced volume to the market, the importance of the 'transaction evidence appraisal system' is much diminished and merely acts as a benchmark for market price determination. Private operators, including small-scale forest farmers, are increasing their role in the supply of logs and in determining contract prices in the market. AMC (1990) concluded that softwood sawlog and veneer log processors in the PNW region of the USA were the least efficient operators when compared to counterparts in Canada, New Zealand and Australia. Moreover, when compared to production efficiency for processors in other regions within the USA, production costs in the PNW were nearly three times as high as in the eastern and southern states, due to higher logging costs in the rugged West Coast terrain.

#### *Eastern and Southern region*

Greater diversity is present on the demand side of the log market in the southern USA. A small number of large processors source softwood logs from the open market, while other large companies have their own plantation forests. The small number of large buyers has strong market power, purchasing logs in the open market from a more fragmented non-industrial private sector. Moreover, large mill size and ability to pressure log prices down make processors in the eastern and southern States of the USA some of the most efficient in the industrial world (AMC 1990). The vertically integrated softwood timber processors with large processing capacities own their softwood commercial forests and supply about 20% to 30% of their log resource requirements from their own forests. Additional log supplies are sourced from the open market. Forest owners that are located substantial distances from the company's mill often sell logs by negotiation to other millers or to log dealers and stumpage prices rise as demand for more remotely located timber increases. Direct negotiation between buyer and seller is the preferred sale mechanism.

Timber is supplied mainly by privately-owned, non-industrial forest farmers with a diversity of plantation sizes, and with little market power. With nearly 60% of the forests in the southern States privately owned and classified as non-industrial, most private forest farmers use the open market system for selling logs. Small landholders normally negotiate directly with loggers, while owners of larger forests may deal with a consulting contractor who organises a closed competitive bid to the processor. Logs from public forests are sold through formal sealed bids after a pre-sale assessment of the timber lot, based on species type, yield and volume. This is then published in a prospectus for intending buyers. Sale contract periods are for one to two years only.

Dominance by a few large buyers implies buyer control over price determination, volume purchased, conditions of sale and product specification, but this control is diminishing. Contract periods are short and opportunities exist for suppliers to offer logs through a competitive bidding system. However with the withdrawal of the public sector as a major timber supplier, millers are now more dependent on suppliers from industrial and private commercial plantation owners. In many instances this involves increased transport costs as logs are sourced from more distant locations and increased stumpage prices as mills bid for scarce timber resources. With this turn in market conditions private forest farmers are gaining a greater share of the economic rents from the scarce forest resource.

### **Log Pricing in Canada**

In British Columbia in western Canada much of the logging occurs on land owned by the provincial government and pricing and supply arrangements are highly regulated. In 1994, 89% of all logging licenses issued were for Crown land (Scarfe 1998, p. 188), from which 65 M m<sup>3</sup> of timber was harvested (Margules *et al.* 1995). This strong market position held by the provincial government as a supplier implies market power in stumpage fees set for logging contractors. Buyers are assured of continuity of supply through a combination of long and short-term contracts (two to 25 years duration, with an average of 15 years). Long-term contracts are renewable and considered as offering security of supply to the buyer (Scarfe 1998). Individual logging contractors gain harvesting rights by bidding for a 'stand of trees' listed by the British Columbia Forest Service. Trees are logged for sawlogs and woodchip, the former generating more government revenue. In 1998, stumpage fees on sawlog sales in the coastal and interior regions of B.C. earned 89% of all timber sales revenues (B.C. Ministry of Forests 1998).

To simulate 'market-oriented' pricing in a highly regulated environment, the B.C. Ministry of Forests introduced the Full Market-Based Comparative Value Pricing System (CVPS) in the late 1980s. This was an attempt to go beyond the traditional 'residual log pricing methodology' that had been standard practice for many international log-producing countries in the 1960s and 1970s. A forward perspective on the value of timber outputs at the end of the processing chain was adopted, requiring appraisal of forest production costs and information on the value of the processed timber product. This second element was included in the formula to determine the 'target rate' or expected selling price for a stand of timber as distinct from the costs of producing the stand. Timber stands are put up for sale and bids invited, but final sales depend upon bids reaching the reserve or 'upset price' imposed by the B.C. Forest Service. In 1998, the CVPS was refined further to reflect

current market conditions in response to demands from processors. Moreover, stumpage rates and royalties for logs harvested from crown lands have been influenced by threats of litigation from the US Coalition for Fair Lumber Imports. It was alleged that breaches in the *Canada – US Softwood Lumber Agreement* occurred by provincial governments under-pricing logs from crown land and passing a subsidy to the Canadian softwood lumber industry. In response to threats of countervailing duty impositions by the US, British Columbia agreed that the forest tenure system should be reformed to reflect more competitive bidding and that the target rates for stumpage determination be considerably increased.

The CVPS stumpage appraisal system determines a ‘target rate’ or price for each stand of timber in each region. When first introduced in 1994, this formula was a simple weighted composite price index for lumber sales in the interior and coastal districts. In 1998, a weighted composite price index of price movements for both lumber and wood chip output from coastal and inland regions was adopted. Statistics Canada compiles a composite processed lumber and wood chip price index used in the stumpage formula, with log market values determined on a species and grade basis.<sup>3</sup> Monthly and quarterly estimates for every period can be estimated by applying the appropriate Statistics Canada composite timber index to immediate past sale values. Other adjustments are made to the ‘target price’ based on variations in the quality of the timber stand across regions, higher quality stands attracting a higher stumpage rate.

This pricing system appears to have led to pricing distortions due to the price averaging method, with prices for high quality timber lots not reflecting their true market potential (Janaki *et al.* 1997). The application of this formula in price setting varies across stands of timber. Small-scale forest enterprises are given concessions through bonus bids on their timber lots to encourage independent production. Overall, stumpage prices are prescribed to achieve government revenue objectives, but are applied in a ‘systematic and equitable fashion’ according to the Ministry of Forests (B.C. Ministry of Forests 1998).

Ontario and Quebec are the two main central Canadian provinces involved in the timber industry. Provincial governments own and assign logging rights to most of the 60 M ha of forest on Crown land, hence having considerable market power in the log market. Log supply agreements are by long-term contract of 20 years or more, renewable at five-year intervals. Stumpage prices for timber logged from Crown land are, as is the case in the west, determined by establishing a ‘target rate’ based on a weighted composite index of lumber and pulp prices for the immediate past periods. Again, this is designed to give a ‘market-oriented’ price of the timber resource (Margules *et al.* 1995). The processing industry in these central Canadian provinces is splintered and diversified. Many small private millers process most of the roundwood timber, while the larger mills are involved in pulp and paper manufacturing. Even though there are over 1,100 processing mills in Ontario and Quebec, most log processing is handled by a small number of large size mills, which are able to exert market pressure in price negotiations. However, in the case of the sawlog industry, and in contrast to the USA, the Canadian timber industry is highly regulated and uses simulated adjusted market prices to determine value of log sales.

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<sup>3</sup> As an example, in 1998 the weighted wood index method estimated market prices for timber from coastal regions on the west coast and derived an average stumpage rate of C\$23.54/m<sup>3</sup>.

This forms the basis for market pricing and is a distortion of open market pricing procedures.

### **Log Pricing in New Zealand**

New Zealand has moved close to a strong market-oriented pricing system for both the log export market and for local sales. The government sold most of its Crown forests to private enterprise in the late 1980s and has since taken a lesser role in price determination, log allocation and supply arrangements, leaving these activities to the open market. Many of the previously government-owned forests were purchased by large foreign-owned timber processors, vertically integrating timber supplies to their own local processing plants or exporting logs to processing plants offshore. Large public and privately-owned companies such as Carter Holt Harvey and Fletcher Challenge dominate with 92% of forest ownership while state owned enterprises and governments own the remaining 8%. Many small-scale forest farmers are registered private companies and represent a significant 30% area of forest plantations (Bawden 2002).

Much of the forest holdings are located in the North Island where *P. radiata* is the dominant species. Central North Island and Northland are the largest plantation regions with a combined area of 640,000 ha. Multinational processors own large commercial forest plantations and dominate the log supply market, supplying to their own processing facilities. These large multinational processors have substantial market power in price determination for logs sourced from the open market. Small-scale private forest farmers negotiate sale of logs through a number of contractual arrangements with the mill by using independent brokers or ‘managers’. Forest owners can offer forest timber for sale as a *Lump Sum Sale*, *Stumpage Sale*, or a *Prepared Log Sale*. Lump Sum Sales are auctions where bidders offer bid prices for the forest and the risks of achieving volume and quality in the log cut is shifted to the buyer. Stumpage Sales guarantees the grower a definite price per volume and shifts the risk of log grade volume, log quality and cost escalation to the buyer. On the other hand, Prepared Log Sales contracts gives the owner more control over cutting activities but the owner assumes the risks of log volume, quality, price fluctuations and cost increases. These alternative sales and risk-bearing options have widened the opportunities for small-scale forest farmers to maximize returns within a constrained choice framework.

These small-scale forest farmers not only have increased their share of plantation ownership but also have captured an increased market share of harvested logs. Collectively, they supply nearly 15% of the total harvest of logs to the local and export markets. The introduction of the Method for Assessment of Recoverable Volume by Log Types (MARVL) – that provides estimates for buyers of possible log volumes for harvesting from a specific area – has improved the marketability of logs from small-scale forest farmers and encouraged them to enter the log market and compete in supplying quality grade logs to the export market and receive premium prices.

The size of small-scale forest operations is of concern when economic viability is considered. Smaller and Meister (1983) concluded that a farm forest area of not less than 25-30 ha is necessary for sustainable economic returns. More recently, Bawden (2002) has suggested that the minimum economically viable area for small-scale forestry is about 30 ha. NZMAF (2001) reported that there are 13,139 small-scale

forest farmers in New Zealand with an area of less than 40 ha, and a further 598 with between 41 and 99 ha. Collectively these small-scale forest farmers represented 20% of the total forest plantation area. Small-scale foresters remain economically viable because they maximise returns by supplying logs to the premium export market and meeting the grading level requirements specified for high quality, high-grade logs, and reduce selling costs through use of log brokers.

Export parity pricing and log quality standards have led to a grading system on the basis of log quality. For example, in the December quarter 1997 premium pruned logs sold to the Japanese and Korean 'A' grade market attracted prices between NZD217-238/m<sup>3</sup>, while lower quality unpruned 'K' grade logs sold for NZD95-100/m<sup>3</sup> (New Zealand Ministry of Forestry 1998). This price differential system has encouraged small-scale forest farmers to participate more actively in the log market. Log export prices tracked on a quarterly basis and published by the NZ Ministry of Forests set benchmarks for market price negotiations between the domestic and international processors and non-industrial log suppliers.

With over a third of all New Zealand sawlogs exported to Japan, Korea and the USA, export price parity isolates log prices from the vagaries of the domestic building and construction industries. Over 5.4 Mm<sup>3</sup> of logs were exported from New Zealand in the year ending 1997, signifying the importance of the export parity pricing policy. Much of this log export market to Japan was gained at the expense of the slump in log exports from the USA to Japan when the US dollar appreciated sharply. Some of this export market has since been lost. These international market developments do not detract from the importance that export price parity and product quality requirements play in setting efficient market prices in the international and domestic markets for New Zealand.

Essentially, the New Zealand timber market is highly export oriented and operates in a free and open environment. Government ownership of forests has been reduced, and more suppliers have entered the market and brought about a stronger competitive element, such that the New Zealand log market is now more competitive than its North American counterpart.

### **Log Pricing in Australia**

Australian forests cover some 42 M ha with native forests representing 97% of this area. Commercial plantation forests consisting of both softwood and hardwood species account for approximately 1.2 M ha, and are located mainly in the eastern seaboard states of Queensland, New South Wales, Victoria, Tasmania and South Australia (ABARE 1999). Of the 831,000 ha of softwood plantations, New South Wales and Queensland dominate with 53% of the total plantation area, with 227,000 ha and 173,000 ha respectively (Bureau of Rural Sciences 2002). Despite a strong move towards privatisation and corporatisation in the early 1990s, nearly all the commercial softwood plantations in these two states are government owned and controlled. Public ownership of forest plantations in the eastern states of Australia was even higher before the Victorian Plantation Corporation sold harvesting rights to most of its commercial softwood plantation area of 219,000 ha to the private sector in 1995. Plantation ownership in the hands of a few suppliers implies market dominance and power in determining pricing and supply arrangements (Quayle 2001).



New South Wales has two main plantation areas – the Southern and Central Tablelands (SCT) and the Northern Tablelands and North Coast (NTNC) districts. The SCT district has nearly 100,000 ha of *Pinus radiata* plantations, with the capability of expanding to 150,000 ha over an 18 year rotation cycle. The NTNC district has an estimated 44,500 ha of commercial plantation forests 70% of which is hardwoods, particularly *Eucalyptus pilularis* and *E. grandis*. It has been estimated a further 44,500 ha can be planted over the next 20 years in line with industry processing capacity (ABARE 1999). While 78% of these softwood plantations remain in government ownership, the area under private ownership is growing at a faster rate. In 2001, plantation area increased by 1400 ha, 97% in the private sector (Bureau Rural Sciences 2002). The increasing number of private forest owners has the potential to create a market-oriented and competitive pricing environment.

Log buyers are major pulp and milling processors that have been located close to large government-owned plantations or have vertically integrated forest ownership with processing activities. A few large processors including APM, ANM, Westfields and North Forest Products normally exploit location advantage in log price negotiations, and little competitive pressure for efficient pricing exists.

Queensland plantations are predominantly in the South-East (SE) and North Queensland (NQ) districts. There are an estimated 174,000 ha of plantation forests in Queensland, 89% being government owned (ABARE 1999). The SE district is the largest with 148,000 ha of exotic softwood varieties *Pinus elliotii* and *P. caribaea* and the native variety *Aracauria cunninghamii*. Medium and large size processors have been located close to the government-owned plantations to exploit location cost advantages. Pricing and supply arrangements are determined through a negotiation process between a large dominant supplier (the government) and generally one large timber processor.

The Queensland Department of Primary Industries – Forestry (DPI-F), a government business enterprise, owns, controls, markets and sells logs from the public plantation estates with a market dominance of over 90% of all logs sold. In many instances, these sales are to a single processing firm. While sale by tender or expression of interest is a normal procedure, the number of firms actively involved in the bidding procedure is small. DPI-F offers timber lots by the cubic metre for sale on either a clearfell or selective felling basis, depending on species and location. Log product specification and certification is not part of the procedure for pricing logs. *Propositional calls* are invited from prospective buyers for the purchase and harvesting of the timber from the prescribed timber lots. These logging contracts are submitted to the supplier (DPI-F) for evaluation and further price negotiation. Sale by auction through a bidding process is not a feature of this market. Open market auctioning is used for the harvesting and sale of ‘thinnings’ as a means of testing movement in timber demand and prices. Logging contracts are either long-term (nine to 20 years) or short-term (three to five years).

The one buyer and one supplier scenario does not promote efficient competitive price determination. Logging contracts are settled through the process of calling for an expression of interest in a logging contract and a purchase agreement followed by negotiations between (often only one) buyer and the government as seller, which determine how the economic rents from the timber resource are to be shared.

**Table 1.** Market Concentration of Log sales by Country and Region

Country	Market Concentration	
	Buyer	Seller
USA – West Coast	Medium	High
USA – East Coast	High	Low
Canada – West Coast	Medium	High
Canada – Central	High	High
New Zealand	High	Low
Australia – NSW	High	High
Australia – Qld.	Medium	High

Table 1 summarises the variations in the degree of market concentration of log sales between the four countries and between regions within countries. It is notable that in the highly market-oriented countries of USA and New Zealand considerably market concentration and power exists at least on one side of the market. In the significantly regulated markets of Canada and Australia, structural competition is absent and high degrees of market concentration and market power exist on both sides of the market.

### STUMPAGE PRICE ADJUSTMENT MODELS

As well as differences in the stumpage pricing formula, differences arise between countries in the mechanism by which prices are adjusted over time to achieve rent sharing between grower and processor. Periodic price reviews are necessary to maintain the real value of the resource in current prices as economic and market conditions change

#### Stumpage Price Adjustment in the USA

Stumpage prices and sales volumes are recorded on a monthly basis for the states of Oregon, Washington, Idaho, Montana and California by the US Forest Service. In western Washington and Oregon, delivered log bid prices are used to measure stumpage prices. A log price index is then created, with 1978 as base year. An index of lumber prices is calculated using lumber outputs as relative weights in the formula. This index is in effect a *wood weighted price index* (WWPI). The two indexes are compared to measure variations between log prices and processed lumber prices. Evidence suggests that stumpage prices are influenced by previous period lumber prices and follow similar cyclical trends (Timber Data Company 1999). In early 1993-94, there was a price spike in the lumber price index with lumber prices rising from \$US600 to \$US750 per thousand board feet. In the subsequent quarters stumpage prices also rose from \$US450 to \$US800 per thousand board feet, indicating a lagged impact of lumber price changes on stumpage prices. These related price movements indicate that stumpage bid pricing for logs in current periods is influenced by the lumber price index in the immediately preceding quarter. Auction bid prices for logs at the stump are dependent on previous period lumber price movements.

In the southern United States, non-industrial private forest owners negotiate directly with large millers for sale agreements. Contract periods are typically one to two years and little adjustment to the contract price is required. New contract prices are negotiated according to prevailing economic and market conditions. Log sales from public forests occur through a formal sealed bidding system and are one to two years in duration. Timber lots for sale are appraised to determine minimum acceptable prices. Little adjustment to log prices is required for these short-term contracts. In the north-east, the Pennsylvania State University surveys loggers, millers, pulp and paper companies and public agencies to estimate stumpage prices for a number of species across various regions in Pennsylvania. Quarterly mill prices are estimated for lumber and pulp outputs, and growers and buyers use survey estimates of the previous quarter to negotiate prices on current contracts and spot market sales. A comparison of stumpage and mill prices for the March 2002 quarter indicates that for many of the harvested species little price markup variation occurs between the stump and lumber output (Land and Mapping Services 2002).

#### **Stumpage Price Adjustment in Canada**

In British Columbia, stumpage is determined and adjustments made by the complex Full market-based Comparative Pricing appraisal System (CVPS). This log pricing mechanism is an appraisal system that applies to setting stumpage rates and to their adjustment over the term of the contract. Stumpage rates for long-term contract sales are re-calculated and adjusted quarterly in accordance with movements in the lumber and pulp price index as an average for all cutting sites in the previous quarter. This composite price index weighted by relative output quantities is the average weighted wood price index (AWWPI) used in contract price adjustments. Annual stumpage price revision takes into account variations in site-specific conditions. Normally the relationship between the stumpage rate (target rate) and the average price index is fixed unless government policy changes are to be incorporated. This implies that in British Columbia where a heavily regulated administered log supply and pricing system operates, long-term contracts are adjusted on the basis of downstream price movements of processed timber which in turn affect future target prices for timber lots from provincial forests. This price adjustment process facilitates economic rent sharing over the life of the contract. Special stumpage rates are applied through a 'bonus' bid for timber sold competitively under the *Small Business Forest Enterprise Program* to encourage small forest farmers into the industry.

#### **Stumpage Price Adjustment in New Zealand**

In New Zealand, where the government now owns only 8% of the forest plantation estate, most sales are spot-market determined and few long-term contracts remain, hence stumpage price adjustment is not an issue. Spot prices are determined by market conditions, and log prices achieved in previous periods influence bid prices from buyers and acceptable minimum prices by suppliers in the domestic and export markets. Export log prices of timber sold to the Japanese and Korean markets are recorded by the Ministry of Forests for graded logs of 20 and 30 cm small end diameter. Growers supplying logs in the export market use this price series to estimate expected market prices in current periods. Other price series based on monthly surveys of rural commodities also provide current information on log sales

values that assist forest farmers in determining potential returns from logging contracts. Nevertheless, price expectations are dependent on log prices in the international market, log quality and consistency in log dimension.

### **Stumpage Price Adjustment in Australia**

Contracts from state forest plantations and native forests in New South Wales are initially negotiated on a one-to-one basis, for terms up to 15 years and with six-monthly reviews. Contract prices are adjusted according to price movements as recorded in the Consumer Price Index (CPI) or a weighted wood price index of structural timber to maintain the real price level of the contract. These price adjustment mechanisms do not reflect any productivity gains made in the processing industries or changes in demand for processed timber. Timber processors experience variability in lumber prices but stable input log prices over the business cycle, their profit margins being squeezed in times of declining economic conditions and increasing during economic recovery. This issue of variable profits over the business cycle is well recognised by the processors. They have pressured state government forest agencies to reconsider price adjustment processes to make long-term contracts more market sensitive to demand conditions further down the production chain.

State Forests of New South Wales (SFNSW) has partially introduced a contract price mechanism based on the movement in prices in the downstream lumber market, although implementation has been slow. A survey was carried out of timber merchants across the state to estimate price levels and changes on a range of processed timber products. Variations in price movements were distinguished for various species, end product use and hardwood and softwood breakdowns. A weighted wood price index of lumber (WWPI) was constructed at the wholesale level across the years 1997-98. During this period the percentage change in price for softwood timbers Radiata Pine and Hoop Pine increased by 5.5% and 3.3%, respectively (Austim 1998). This approach was an experiment to incorporate state level processed timber price movements into state logging contract agreements. SFNSW is currently undertaking the construction of a permanent price index series to replace the CPI as a price adjustment mechanism for long-term supply contracts. The term of the contract is also being shortened.

In Queensland, long-term log contracts between DPI-F and processors were typically for 10 to 25 years with price adjustment and supply reviews held every six months. Originally, price adjustments were based on movements in the CPI and major reviews were undertaken on a five-year basis to adjust contract conditions in line with current market and economic conditions. Since 1995, most contracts have been renewed for 3-5 year periods with price reviews every three months. Contracts are negotiated on a one-to-one basis between buyer and seller.

Recently, DPI-F moved towards implementing a wood weighted price index (WWI) of processed lumber for adjusting log contract prices to processors, to reflect more closely variations in market conditions affecting downstream processing industries. In 2001, this new price index method was adopted as standard practice for price adjustment on medium and long-term contracts. Annual reviews are used to adjust contract prices by a price index and to account for other arbitrary adjustments due to movements in market conditions. DPI-F refers to these arbitrary adjustments as the Factor Adjustment System (FAS). A limited product mix WWI price

adjustment mechanism was tested on a partial basis for some processors. The results from this trial indicated that DPI-F and some processors were prepared to move to a more market-sensitive price adjustment process for medium and long-term contracts. This simple index adjuster has now been adopted for contracts throughout the industry. Unfortunately, a WWI for timber produced from Queensland processors was not constructed. Rather, DPI-F preferred to use the simple price index for structured softwood timbers as compiled by the Australian Bureau of Statistics (Quayle and Cox 2001). Applying this national price index can bias price adjustments in individual states. DPI-F has demonstrated that it is only prepared to partially implement a price index adjustment mechanism, and has retained discretionary control over price adjustment of log contracts by including non-price factors in the formula. This allows for some arbitrary price adjustment decisions.

Both New South Wales and Queensland are slowly accepting market-oriented criteria for adjusting medium and long-term contract log prices to ensure prices reflect current market conditions. Applying broadly based price indexes such as the Australian CPI to specific industries for price adjustment purposes is often misleading. Changes in market conditions, productivity gains and relative production costs specific to the industry will often not be captured by the broadly based index. More industry-specific price indexes are required if log prices are to reflect accurately changes in these factors. While the WWI has its shortcomings, it is a more specific market-oriented price index than the CPI and therefore represents a major improvement in price adjustment methodology.

Table 2 summarises the variation of contract term and price adjustment mechanisms on a country and regional basis. Two categories are apparent. Countries that are highly market oriented use short-term contracts or the spot market for supply and have no need to adjust prices on the contracts. The more regulated log supplying countries use medium to long-term contracts, with contract prices adjusted according to a weighted output price index of lumber or lumber and pulp. In the highly regulated Canadian forest environment where long-term contracts remain, a price adjustment mechanism will continue to be necessary for equitable economic rent sharing and for establishing the value of the forest resource in current prices.

**Table 2.** Contract term and price adjuster by country and region

Country	Contract term	Price adjuster
USA – West Coast	1 - 2 yrs	Open market
USA – East Coast	1 - 2yrs	Open market
Canada – West Coast	1 - 25yrs	AWWPI
Canada – Central	1 - 25yrs	AWWPI
New Zealand	1 - 2yrs	Open market
Australia – NSW	5 - 15yrs	CPI/WWI
Australia – Qld.	3 - 20yrs	CPI/WWI

## CONCLUSIONS AND IMPLICATIONS

This analysis reveals that there is considerable variation in log pricing policies and supply conditions across the four industrialized countries studied. New Zealand and the United States are strongly market-oriented in determining stumpage or log prices while Canada and Australia remain highly government regulated. In both the United States and in New Zealand, log prices are determined by bids submitted in the open market. This system encourages small-scale suppliers to enter the market and sell logs at premium prices. In Canada and Australia where the market is regulated, strong market power exists on the supply and demand sides of the market and market concentration is high. In these countries log sales and prices are frequently negotiated between a single supplier and one large processor. The value of the timber is appraised and a minimum price is calculated. The buyer and supplier negotiate a price and share the economic rents from the resource. Both the United States and New Zealand determine log prices through the market. Contracts are one to two years duration and many smaller private growers have entered the market. Even though Australia and Canada have high concentration on the buyer and seller sides, they have become progressively more sensitive to market criteria in log price determination. These countries now encourage small-scale foresters to participate in the supply of logs to local processors, thereby changing the dynamics of the log market. Moreover, they are reducing the term of contract to three or five years and using the spot market to sell 'thinnings' to gauge market demand. In those countries that still use long-term supply contracts for logs, a price adjustment process is applied to maintain the real value of the log contract. The most favoured adjustment mechanism is a price index based on a moving average of prices achieved for semi-processed downstream timber outputs from the processors. For the more market-oriented sales environments, logs are sold through the spot market. Again, indices of spot market prices are generated to inform buyers and sellers of trend and expected sale prices of standing timber lots. In both instances, price indices play an important role in providing information to growers about current log sale prices and expected prices in future sales.

It has been argued that market structure is important in price determination. The entry of small-scale forest farmers in the United States and New Zealand markets has increased the competitive structure of the market and delivered competitive market pricing. In the other two countries, small-scale forest farmers receive prices that are aligned with price levels established for large commercial softwood plantation growers supplying logs on a long-term contract basis.

Price adjustments applied to the larger suppliers set a base price from which future sale prices in spot markets are determined. Because most small-scale growers operate in the spot market, spot market log prices will be underpinned by the long-term contract prices. Price variations in the spot market can be expected as economic conditions and demand for timber outputs change. Previous log prices and current economic conditions are important in determining current prices of logs.

Price adjustment mechanisms are used in those jurisdictions where medium and long-term contracts exist. This study has shown both Canada and Australia still use these supply arrangements and adjust prices over the term of the contract. While Canada's west coast province of British Columbia applies a composite wood weighted price index (WWPI) based on lumber outputs from the province, the large

softwood plantation states in eastern Australia use a simple price index for structural softwood timbers. Indeed, this is an improvement on the use of the CPI, which is a broad price index that has little specific relevance to the timber industry. Australia's softwood producing states need to adjust faster to a more market-oriented approach in log price determination and apply a price adjustment mechanism based on a composite wood-weighted price index to its medium term contracts if it is to remain competitive with its international counterparts.

Despite major variations in market structure, regulatory environment and log sale practices between the four industrialised countries, a number of similarities exist. All four countries acknowledge the importance of competitive market pricing and the value of the resource in downstream industries. Economic and market conditions in the lumber and pulp sectors have a strong influence on log prices and any price index to adjust log prices over time needs to include price movements from these industries. Canada has already moved in this direction in the construction and application of its CVPS pricing methodology but the Australian response has been slower. Price adjustment mechanisms are not an issue in the United States and New Zealand where spot and short-term log markets predominate. Policies designed to encourage small-scale foresters to enter the market as new suppliers will change the structure of log markets and change the competitive dynamics of those markets making them more competitively efficient.

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