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# Regional variation in radiata pine sawlog prices in New Zealand

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**Abstract**

There is regional variation in market structure and log quality for radiata pine sawlogs in New Zealand. This should be reflected in a corresponding variation in sawlog prices between regions. This paper presents a study of log price variation for three broad categories of domestic sawlogs in four wood supply regions in New Zealand. A survey of log producers was used to gather data on log prices and log attributes. A regression model was then used to estimate log prices that could be compared to actual prices received. The results show that there are significant price differences between some regions, and for some log grades, and that these differences can be explained by differences in log attributes.

## Introduction

Estimation of log prices is an important part of forestry valuation. In New Zealand, the generally accepted method of forest valuation, discounted cash flow analysis, relies on estimates of future log revenues that would be received from harvesting a forest (NZIF 1999). When evaluating mature or near-mature forests, the estimated log revenue may be the single most influential variable.

There is considerable heterogeneity in the radiata pine log resource throughout New Zealand. Important log characteristics, such as wood density and strength, vary markedly with climate and other site conditions (Cown 1999). Similarly, Bloomberg (2001) found that markets for radiata pine logs varied in structure between four New Zealand wood supply regions. The largest regional market for logs was the Central North Island, which still produces over 50 per cent of New Zealand's total annual wood harvest (MAF 2000). Nelson/Marlborough was the largest and most well-developed wood supply region in South Island. Otago/Southland was expanding rapidly, with a large proportion of sawlog production being exported. Canterbury was smaller than the other regions, with a low concentration in sawmill ownership and a low proportion of sawlog production being exported.

Given regional variation in wood quality and log markets, one might expect this to be reflected by variation in prices paid for logs between different regions. An example of price differences due to variation in log quality can be found in the prices for different sawlog grades of radiata pine in New Zealand (Agri-Fax 1999; MoF 1996). However, only Agri-Fax publishes price data that also accounts for differences in regional prices.

Therefore, while regional differences in log attributes and market structure should be reflected in the variation in sawlog prices between regions, most evidence of any relationship is anecdotal, and regional variation in sawlog prices has never been formally studied in New Zealand. The purpose of this paper is therefore to examine if regional price differences can be explained by regional differences in sawlog and market attributes, for four New Zealand wood supply regions (Central North Island, Nelson/Marlborough, Canterbury and Otago/Southland). The results of this study can be used by forest valuers to establish appropriate regional prices for sawlogs.

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**Methods and Data**

The approach in this study is to use a "hedonic" model to explain variation in sawlog prices. The hedonic pricing model provides a theoretical basis for the relationship between the price of a good and the attributes embodied in the good (Munn & Rucker 1994). These attributes can be physical quality or size characteristics (Lucas 1975), or market and contractual attributes (e.g. regional location of the sale) (Munn & Rucker 1994, 1995).

The hedonic model can be specified as,

$$P = f(z_1 \ldots\ldots z_n) \quad (1)$$

where P is the selling price for a good and $z_n$ is the set $n$ attributes of the good which determine its price. As was discussed previously, two factors are generally considered to be important for determining log value, physical log attributes and market structure.

An example of a hedonic relationship between sawlog attributes and sawlog value is the calculation of residual value. Residual Value (RV) for a sawmill is calculated as,

$$RV = ((\text{Value of green lumber} - \text{Cost of sawing}) * CF) + \text{Value of wood residue} \quad (2)$$

where *CF* is the sawmill conversion factor from roundwood to sawn volume, and wood residues are non-sawn timber arisings such as slabwood (which is either chipped, or burned for steam or electricity generation), bark, and sawdust.

The important aspect of residual value here is that it integrates the relevant physical attributes of a sawlog which influence its value to a sawmiller. As such, it estimates a price that a sawmiller can pay for a sawlog, and still be able to process and market the sawn timber and arisings at a given profit.

The hedonic price model in Equation 1 was specified in a regression using RV and regional dummy variable as explanatory variables for price.

$$\text{Price} = f(\text{RV, CNI, NN, CY}) \quad (3)$$

where RV is the calculated sawlog residual value from Equation 2, and CNI, NN, CY are dummy variables for three of the four regions covered in the study, Central North Island, Nelson/Marlborough and Canterbury respectively. The dummy variables for each region are used to pick up regional differences in markets that are not explained by residual value. For each regional dummy variable, the variable takes the value of 1 if the sale is in that region and zero otherwise. The value for the fourth region, Otago/Southland, is calculated when all other dummy variables are zero.

Residual sawlog values in this study were calculated using log attribute data from a survey. In 2000, "mill door" prices for pruned (P), structural/framing (S), and utility (L) grade sawlogs were obtained by surveying forest owners and log suppliers in four wood supply regions (Central North Island, Nelson/Marlborough, Canterbury and Otago/Southland). Prices for each grade were requested for 1997, 1998 and 1999. The survey also requested Pruned Log Index (PLI) and resin pocket factor for pruned logs, estimated wood density and maximum branch size for S and L grades. Log length, small end diameter (SED, average and minimum) and maximum sweep was collected for all log grades. Residual values were calculated for S and L grade logs using SAWMOD, a sawmill simulation module in STANDPAK (FRI 1995). For P grade sawlogs, log values (sawn lumber plus residue values) were calculated using spreadsheets developed by INTERFACE.[1]

Data were collated and statistically analysed using MINITAB 11.

**Results**

The prices received for sawlogs were found to be quite variable even within regions. Table 1 shows the range of prices for the 70 sales covered by the survey.

**Table 1: Price Range for Sawlogs ($/tonne)**

| Wood Supply Region | P Grade | S Grade | L Grade |
|---|---|---|---|
| Central North Island | 151-190 | 61-102 | 65-86 |
| Nelson/Marlborough | 125-165 | 61-108 | 56-66 |
| Canterbury | 135-154 | 61-82 | 52-65 |
| Otago/Southland | 135-175 | 61-82 | 56-76 |

A notable feature of the survey responses was the paucity of sales involving P2 sawlogs (pruned sawlogs with a minimum SED of 300 mm). Table 2 shows that the majority of firms participating in the survey sold pruned sawlogs as a single grade with a minimum SED of 350 mm. Some firms sold a P1 grade only, with a minimum SED of 400 mm.

**Table 2: Minimum SED Range for Sawlogs**

| Minimum SED Range | 250-299 mm | 300-349 mm | 350-399 mm | ≥400 mm |
|---|---|---|---|---|
| No. of P Grade sales | - | 1 | 19 | 5 |
| No. of S Grade sales | 2 | 6 | 19 | - |
| No. of L Grade sales | 6 | 9 | 3 | 0 |

As with the pruned sawlogs, the majority of S grade sawlog specifications were for logs with a minimum SED of 350 mm. Log sales for logs down to the S2 specification (minimum SED of 300 mm) or lower, comprised only one-third of the sales reported by participating firms.

The majority of L grade sales had a minimum SED specification in the L2/L3 range (300-349 mm, and <299mm) i.e. markedly smaller than the SED values for the S grade logs.

***Hedonic Price Model for Sawlogs***

The hedonic model in Equation 1 attempts to explain the regional variation in the survey data in terms of the physical attributes of the logs, as well as the regional location of the market where the logs were sold. Of the pruned sawlog sales covered by the survey data, only eight included a pruned log index (PLI) value. Due to the limited sample size a regression was fitted using only log residual value (calculated from the eight sales) as an explanatory variable, and leaving out regional dummy variables.

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$$\text{Price} = 6.46 + 0.8074 * \text{RV}$$
$$\text{NS} \quad \dagger$$

(† and ‡ denote that the t-statistic for the coefficient is significant at 5% or 1% levels respectively. NS denotes that the t-statistic for the coefficient is not significant.)

The regression provided a reasonably good explanation of the variation in log prices for the eight data values. The R-squared value was 63.7% and the t-value for the coefficient for log residual value was close to being significant at the 1% level.

For unpruned sawlogs, a linear regression was fitted to data for both S and L sawlog data, with log residual value and regional dummy variables as the explanatory variables:

$$\text{Price} = 27.69 + 0.85 * \text{RV} + 8.02 * \text{CNI} + 12.52 * \text{NN} + 2.91 * \text{CY}$$
$$\ddagger \quad \ddagger \quad \ddagger \quad \ddagger \quad \text{NS}$$

(† and ‡ denote that the t-statistic for the coefficient is significant at 5% or 1% levels respectively. NS denotes that the t-statistic for the coefficient is not significant.)

The results show that there is significant price variation due to RV and regional effects. The regression had an R-squared value of 92.6%. The values for the coefficients for the dummy variables specify the difference in price levels ($/tonne at mill door) between Otago/Southland and the three other regions, after allowing for differences in price due to sawlog quality. Unpruned sawlog prices in the CNI and Nelson/Marlborough were significantly higher than prices in Otago/Southland. There was a smaller difference between Canterbury and Otago/Southland prices, which was not statistically significant.

## Conclusions

This study has collected evidence of significant variation in sawlog prices between wood supply regions. Much of this variation can be explained by variation in the physical attributes of the sawlogs, as specified by a sawlog residual value. However, the region of sale was also significant, with the Central North Island and Nelson/Marlborough appearing to have higher unpruned sawlog prices even after allowing for differences in physical log attributes. This difference in sawlog prices may be caused by differences in markets between regions. For example, economic theory suggests that buyer rivalry should result in increased prices for logs or forestry stumpage (Hardie & Larson 1994). Therefore sawlog markets with many smaller sawmills or log exporters competing for sawlogs should result in higher prices.

In practice, it may be difficult to relate sawlog prices to variables measuring market structure or market competitiveness. Bloomberg (2001) found that in four New Zealand regions, various factors leading to market competition tended to cancel each other out. For example, Canterbury had the least concentration of sawmill ownership, which should lead to more price competition between sawmills for sawlog supply. However, Canterbury also had the smallest proportion of sawlogs exported, suggesting that price competition from log exporters was not significant. By contrast, Central North Island and Nelson/Marlborough had strong concentration of sawmill ownership in the hands of one or two companies, but this was balanced by strong export sawlog activity. This export sawlog activity should increase price competition for sawlogs by the domestic sawmills.

In summary, physical sawlog attributes are easy to measure, and appear to have a strong influence on sawlog prices. The differences between regional sawlog markets are less easy to measure and use as explanations for sawlog price variation. The evidence in this paper shows that in valuing a forest resource, forest managers should account for the region where the resource is growing and the expected log quality of the resource. Apart from log yields being classified by broad log grades, there is no published evidence that this is being done. To validate this conclusion, a more detailed survey of forestry firms and forestry consultants is needed to determine the sources of data and methods used to compile the in-house log price data which are likely to be the log prices actually used for forest valuation and project evaluation in New Zealand.

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