

# **A Comparison of Equation-Based and Parity Pricing of Stumpage Fees for British Columbia Timber Under Long-Term Tenures**

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Two major concerns arise when pricing timber stands in British Columbia. The first concern is that timber should, on average, be priced correctly. This concern is most relevant in trade negotiations, because the net flow of product from British Columbia to the United States will depend on the average price of B.C. lumber, which depends in part on stumpage fees. Trade between the United States and British Columbia will be distorted if stumpage fees are set too high or too low. The second concern is the accuracy with which the pricing mechanism is able to predict the true market value of a *particular* timber stand. This concern is most relevant to the B.C. industry. Inaccurate pricing will lead to inefficient cutting decisions. In addition, company profits are distorted to the extent that a tenure-holder's harvest is systematically under-priced or over-priced.

We addressed the correct average pricing of Timber in our paper, "Auction-Based Timber Pricing and Complementary Market Reforms." Here, we consider the effectiveness of alternative methods to accurately price individual non-auctioned timber stands. In particular, we consider the benefits and drawbacks of two proposed mechanisms: the equation-based Transaction Evidence Pricing System (TEPS) and parity pricing, which uses both auction data and the appraisal system to determine stumpage. The enormous variety of timberlands in British Columbia complicates the issue, but all things considered, we find that the equation-based system, if implemented with proper care, is far superior to the parity system.

Below, we outline the differences between the two systems, comparing the advantages and disadvantages of both, and conclude that the equation-based method is best. We then attempt to address concerns that the B.C. industry has expressed over the possible implementation of an equation based method. We believe that a proper implementation of the equation-based system can allay these concerns.

## **1 THE ADVANTAGES OF EQUATION-BASED VERSUS PARITY PRICING**

TEPS uses an econometric model to estimate what auction prices would be on the long-term tenures using the bid data from auctioned timber. The data include all of the main determinants of auction prices. In this way, the price for a stand of non-auctioned timber is set based on the particular characteristics of the stand. Parity pricing uses both auction data and an appraisal approach to determine value. Auction data is used to set the price of a stand of average value, and appraisal data is used to set the relative prices of other stands. Typically both qualitative and

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quantitative variables are used in setting price. We now list and discuss the advantages and disadvantages of the two methods.

The first advantage of the equation-based system is that it is more transparent than the parity system. In the equation-based approach, statistical analysis determines whether a variable should be included in the model. If the variable does not add sufficient explanatory power, then it may be deemed superfluous, and can be excluded. In a parity approach, the decision to include variables is subjectively determined or even negotiated. From an observer's perspective, the parity approach is therefore less transparent, and debate about the subjective decisions of the pricing system is likely. The parity system also requires ongoing, detail-oriented regulation by the Crown, who must continually update the appraisal manual as well as the amounts allowed for various adjustments. This regulation is time-consuming and potentially controversial. Looking forward, simplifying the appraisal manual could improve future trade negotiations, and reduce the attractiveness of the parity system.

Second, the equation-based method is much more systematic and easy to implement. Appraisals will be greatly simplified, since fewer critical features of the tract must be measured. Of course, any variable that is deemed especially important in a parity system can, in principle, be added to the equation-based system. In practice, those variables will only be incorporated if they have sufficient explanatory power, and there will be a limited number of variables in the equation.

Third, the equation-based system accounts better for "speculation." It is straightforward to exclude non-performing sales from the regression analysis. In the parity method, it would not yet be apparent that a recent sale was non-performing.

Fourth, the equation-based system allows firms to better anticipate prices they will pay for timber. In determining which tracts to prepare for harvest within its area, a firm can forecast prices. Under the proposed reforms, a firm will have more freedom and responsibility to determine the total volume that it harvests. This information will be very important and useful. By contrast, the parity system leaves a firm vulnerable to the uncertain outcomes of a few auctions that may occur after the firm decides which tracts, and how many tracts to prepare for harvest.

Fifth, the equation-based system can respond objectively to market changes, because it can be re-estimated annually to reflect the most recent auction data. The model can also be evaluated for the inclusion of new variables that become important determinants of prices and the exclusion of variables that are no longer important. This evaluation should occur on a less-frequent basis. Every few years, or as needed in response to structural changes in the market should suffice. The method for both re-estimation and re-formulation can be done using objective statistical techniques.

Sixth, after many years of debate, most of the US Forest Service has moved to an equation-based system for setting reserve prices. One argument (which we have not independently verified) made in favor of the equation-based system in the US is that it leads to more accurate predictions than the US Forest Service's "residual value" system. In any case, the track record of the US Forest Service over the last 10 years is a point of reference, in addition to the recent experience in British Columbia.

Thus, we strongly believe that British Columbia should adopt the equation-based system to price non-auctioned timber stands.

## 2 IMPLEMENTATION OF THE EQUATION-BASED SYSTEM

We now address issues that must receive attention in implementation. First, it will be important to select a sample of tracts for auction that adequately spans the range of sale characteristics present in the stands outside the auction market. In particular, British Columbia has a wide array of timber stands. To the extent it is feasible, stand characteristics that have significant statistical and/or economic importance should be included in the pricing model so that accurate timber prices for non-auctioned stands is achieved.<sup>2</sup> To accomplish this task, a sample of timber that represents the full array of characteristics in British Columbia should be used.

Second, it will be important to exercise care in handling data from auctions where the timber is not harvested. For example, it may be prudent to eliminate such sales from the dataset. This will mitigate the effect of “speculation” on the price of non-auctioned timber.

Third, it will be important to carefully consider the best equation to be used, and to establish a process for evaluating changes to the equation (not too frequently). Qualitative variables that are shown to be statistically and economically important in predicting auction prices should be incorporated. However, it is most desirable to include variables that take on different values in a variety of geographic areas, rather than variables that might proxy for regional dummy variables. As an example, several extraction methods are now included in the specification. If such extraction methods are found to serve as regional dummy variables in the regression, then the percent of timber harvested from ground skidding may be substituted instead. This specification controls for the average effect of the high-cost extraction methods (horse, helicopter, etc.), because the percent of extraction that is “not ground skidded” is accounted for in the constant term. In addition, if it is determined that clear cut and partial cut extraction have decidedly different effects on stand value, then these percentages may enter the specification as separate variables.

Fourth, to prevent auction manipulation, the specification should avoid the use of dummy variables for specific localities, or other variables that essentially identify small local markets (such as extraction methods that were mentioned above). Fifth, care should be taken to consider the types of “outlier” sales that might occur, and if necessary, the equation and/or the sampling scheme can be adjusted to avoid mispricing sales with unusual characteristics. By auctioning a representative sample of stands, the possibility of outliers is minimized. One alternative is to set guidelines for “unusual” sales such that particularly unusual sales are sold at auction as often as possible. Care should be taken in how, and whether, the data from such unusual sales are incorporated into the pricing model.

A final issue is how, and whether, to incorporate information that predicts the level of competition into the equation. The goal of the transactional evidence system is to approximate the price that would have been paid, had the tract been let for auction. Prices would naturally be higher in areas where there is more competition for timber, and so it is natural for the transactional evidence system to incorporate that information. The number of bidders variable can

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<sup>2</sup> Statistical significance is based on having a sufficiently high likelihood (typically 95 percent) that the variable’s coefficient in the price regression is different from zero. Economic importance is measured from the size of the estimated coefficient, which determines the economic impact of the variable on price. Often, statistical and economic significance go hand in hand. However, it is possible for a variable to have a large economic impact on price and yet be statistically insignificant. When this happens, a greater effort should be expended to better measure the variable in question. Alternatively, other variables can be introduced that can more accurately explain the large impact on price that the insignificant variable suggests exists, but measures imprecisely.

be thought of as a proxy for quality or cost differences. It can also reflect differences in local supply and demand conditions.

### **3 CONCLUSION**

We believe that the Ministry should adopt the equation based pricing method to value timber that is not sold at auction. The equation-based method has many attractive advantages over the parity method, and if implemented correctly, the equation method should far outperform a parity system. That said, careful attention must be paid to certain details to assure that the system is implemented so that non-auctioned timber is accurately priced, and the integrity of the auction market is maintained.