THE VALIDITY OF CROSS-BORDER STUMPAGE COMPARISONS:
A Review of "Assessing the Market Value of Public Softwood Sawtimber in Canada (Updated)" by D.R. Cox, C. Ehlen and J. Lutz

April 15, 2004

Michael Stone
Brice Macgregor
Susan Phelps
Industry, Economics and Programs Branch
Canadian Forest Service
Natural Resources Canada

Table of Contents

Forward

This report was one of a number of reports prepared by the CFS as part of Canada's legal defence during the fourth Canada/US Softwood Lumber Dispute. It formed part of the legal record used in the NAFTA and WTO dispute resolution proceedings.

SECTION 1
INTRODUCTION

1.1 Background

The Coalition for Fair Lumber Imports Executive Committee[1] has put on record a report by their consultants, D.R. Cox, C. Ehlen and J. Lutz (hereafter referred to as the "Cox & Lutz 2004b Report"), entitled "Assessing the Market Value of Public Softwood Sawtimber in Canada (Updated)." The report attempts to portray cross-border stumpage price comparisons as a valid method for determining the adequacy of remuneration for Crown timber in Canada.[2]

1.2 Purpose and Summary of the Report

The purpose of this report is to:

- review the economic reasoning behind the cross-border stumpage price comparisons proposed by Cox and Lutz to determine if such comparisons can provide an economically meaningful result;
- review the stumpage price data placed on the record by the Executive Committee to see if the data support the hypothesis that cross-border comparisons provide valid economic results;
- examine the additional price data placed on the record by the Department for consistency with the cross-border comparison hypothesis;
- consider whether stumpage prices published by public agencies provide prices that are representative of private stumpage prices sales;
- review the economic literature to determine what conclusions can be drawn from that body of research with regard to cross-border comparisons.

The report concludes that:

- The economic logic presented in the Cox & Lutz 2004b Report is flawed. Cox and Lutz believe that by averaging stumpage prices over large areas one can ignore differences in average timber and market characteristics between areas. This is false.
- A cornerstone of the cross-border methodology is the premise that the stumpage markets being compared are integrated. The report shows that stumpage market integration fails in all comparisons made within U.S. states and for all comparisons made between U.S. states. If the premise fails within

[1] Hereafter referred to as the "Executive Committee" or the "Coalition."

[2] Cox and Lutz's previous reports, in which the same arguments were made, include D.R. Cox and J. Lutz (2001) Examining the Market Value of Public Softwood Sawtimber in Canada, July 17, 2001, and D.R. Cox, C. Ehlen and J. Lutz (2002) Review of Department of Commerce Preliminary Determination Stumpage Subsidy Methodology, January 7, 2002.

the United States, it cannot be expected to hold across an international boundary; thus the methodology must be rejected as inappropriate.

- Numerous factual errors in the Cox & Lutz 2004b Report invalidate the results contained therein.
- U.S. public agency stumpage prices are not representative of private stumpage sales in the United States.
- The academic literature on factors that affect stumpage price is extensive, but was not taken into account by Cox and Lutz in the 2004b Report. A review shows that the literature supports the conclusions drawn in this paper and rejects the conclusions drawn by Cox and Lutz.

SECTION 2
STUMPAGE PRICE COMPARISONS

2.1 Introduction

This section addresses the following:

- a discussion of the in-situ factors that affect stumpage prices, and that must be accounted for in any stumpage price comparison;
- a description of the logic by which Cox and Lutz arrive at the conclusion that stumpage price adjustments are not required in conducting cross-border comparisons, and a discussion of the flaws in that logic;
- a review of Cox and Lutz's stumpage price data from Washington, Idaho and Montana, a data set which clearly demonstrates the difficulties and arbitrariness of cross-border comparisons;
- a discussion of the need for stumpage markets to be integrated if cross-border comparisons are to be valid, and of the available evidence, which does not support the hypothesis that stumpage markets are integrated; and
- a detailed description of some of the major factual errors contained in the Cox & Lutz 2004b Report.

2.2 Comparison of In-Situ Resource Values Within a Jurisdiction

The value of standing timber is determined by a wide variety of complex factors that vary between and even within jurisdictions. It is simply not enough to average stumpage prices in one area and compare them to stumpage prices in another. One must adjust for differences as set out below. Failure to do so would mean that an apples-to-apples comparison was not being made.

The factors affecting the value of standing timber include the following:

- *Locational differences*. These include log haul distance from the harvest sites to the sawmills, the distance from the mills to the lumber markets, and the remoteness of the harvest sites from population and support centres. A casual glance at lumber price reports, such as the Random Lengths weekly report, shows that fob mill prices received by sawmills increase the closer the mill is to major markets.

- *Timber differences*. It is clear that variations in a number of timber characteristics, such as species and wood quality, affect stumpage values (which affects the value of downstream products that can be made from timber). However, it is logical to expect that the dramatic differences in species mix in the cross-border comparison areas are caused by the same factors that also cause substantial differences in quality and other timber characteristics that affect stumpage values.

- *Operating cost differences*. Operating costs vary significantly, both within and between Canada and the United States, due to substantial differences in terrain, growing season, obligations imposed on timber harvesters, and a variety of other factors.[3]

All of the stumpage price data sources put on the record by both the Executive Committee and the Department contain extensive warnings to the reader about the use of the reported stumpage prices. Typical of these cautions is that provided in the Cox & Lutz Exhibit 31, the Maine Forest Service stumpage report that the Cox & Lutz 2004b Report proposes to use for the cross-border comparisons with Québec. The report states:

> *Stumpage prices on a given timber harvest are influenced by a number of factors including but not limited to the following:*
>
> - *Volume to be cut per acre or total harvest volume*
> - *Average size of trees to be cut*
> - *Mix of species to be harvested*
> - *Percentage of pulpwood and sawlogs*
> - *Log quality*
> - *Logging terrain change*
> - *Distance to public roads*
> - *Type of logging equipment*
> - *Time of year*
> - *Landowner needs or special requirement*
> - *Market demand {i.e. number of mills}*
> - *Distance to market*
> - *Property taxes*
> - *Landowner knowledge of market value*
> - *Sale by competitive bid*
> - *Type of harvest: i.e., partial or clearcut*
> - *Regulatory constraints*
>
> *Any one of the above factors can have a significant effect on stumpage prices for a species, while another factor my have an insignificant effect in a particular area. Under certain circumstances reasonable prices may occur outside the given ranges within this report.*

[3] Canada Cross-Border Report I at 69.

2.3 Are Adjustments Needed in Cross-Border Stumpage Price Comparisons?

The Cox & Lutz 2004b Report acknowledges that numerous factors can and do affect stumpage prices. However, Cox and Lutz contend that such adjustments are only required for site-specific stumpage assessment and are not required for inter-jurisdictional comparisons. The following excerpts from pages 7 and 8 of their report summarises the authors' logic in reaching this conclusion:

> *"Sale appraisals" which determine prices expected in individual timber sales are very different from appraisal of timber values in entire forests. The larger the tract of timber being examined, the greater the chance that it will be closer to the average, other things being equal. So, for very large tracts, site-specific appraisal factors become less of an issue because conditions with then average out. Therefore, not all appraisal factors will be relevant for all tracts.*
>
> *For extremely large tracts (or entire states), many individual variations will cancel out and become irrelevant. ….*
>
> *The comparisons of timber values that the DOC is undertaking, then, vary in fundamental ways from a common appraisal of a typical small tract of commercial timber. An ordinary appraisal differs from the DOC's undertaking much as a comparison of two lots of automobiles differs from a comparison of Hertz's and Avis's fleets of cars. Appraisal factors may be relevant and might be <u>considered</u> by the DOC. But the likelihood that an <u>adjustment</u> will be warranted by any given factor is considerably lower than for a site specific appraisal or value of one car, because variations are neutralized due to the vast size of the assets compared.* (footnote omitted)

<u>First Flaw</u>

The logic of the Cox & Lutz 2004b Report is that as the size of the forestland being assessed increases, the value converges to an overall mean value. As Canadian provinces and U.S. states are large, their average stumpage values will converge to a common mean. This logic seems to appeal to the law of large numbers, under which the mean of a sample drawn from a population converges towards the population mean as the size of the sample increases. But it is flawed. When a sample size is increased, the average value will converge towards the population mean, but the average value will be conditional on the average characteristics of the sample and the population. Of critical importance is that two different populations will have the same mean *if and only if* they have the same average characteristics. If they do not have the same average characteristics, then they will *not* have the same average value. Adjustments in differences in average characteristics *must* be undertaken if valid comparisons are to be made between populations. Therefore, even if there are large samples of stumpage prices available for two jurisdictions, the sample means will only be equal if the stumpage sales

in each jurisdiction have the same average characteristics. If they do not, then *all* differences in characteristics must be accounted for.

To illustrate using the Cox and Lutz car example, the average value of the Hertz and Avis fleet will differ if they have different mixtures of cars in their fleets. That is, if Hertz has more luxury cars and SUVs, and Avis more subcompacts, then the average values for their two fleets will differ substantially. It is not enough to have large samples from each population if the populations have different characteristics.

The flaws in the Cox & Lutz 2004b Report's appeal to large area averages are easy to demonstrate. First, consider that Cox and Lutz do not propose to use a Washington State average as their benchmark; rather, they break Washington into the Westside (coastal) and Eastside (interior) regions. This is an appropriate distinction, as the two in-state regions have vastly different ecosystems, and thus vastly different stumpage prices. Nevertheless, this clearly demonstrates that large area averaging is not appropriate, and that comparisons between areas must account for differences in timber quality.[4]

It is not the case that the Washington Westside-Eastside comparison is aberrational, and that Cox and Lutz's arguments in the 2004b Report apply elsewhere. Figure 2-1 shows the average all-species stumpage price for timber sold from U.S. National Forests for four USDA Forest Service regions.[5] Note the Westside is excluded, so that only interior regions are considered. Note also the large differences in stumpage prices across regions and over time. These differences reflect differences in average timber and sales conditions within each region; they are not, as Cox and Lutz suggests, evidence of stumpage subsidies.

[4] Haynes (1998) examined US National Forest stumpage prices in the eastside and westside of both Washington and Oregon and found wide variation in stumpage prices. He states: "These differences are due to more than just transport costs: They also embody differences in species, size of timber, sales arrangements, end product markets and potential uses, and a host of other factors" (at page 12).

[5] Source: Warren, D.D. (2003) *Production, Prices, Employment and Trade in Northwest Forest Industries, All Quarters 2001*. USDA Forest Service Resource Bulletin PNW-RB-239, Pacific Northwest Research Station, Portland Oregon.

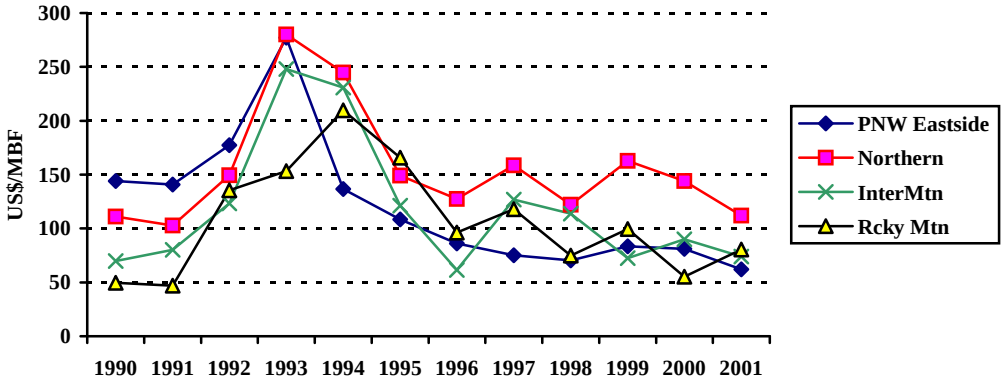

FIGURE 2-1
National Forest All Species Stumpage Prices by USDA Forest Service Region

If one accepts the proposition that unadjusted cross-jurisdiction stumpage price comparisons are meaningful and that differences in such prices are evidence of stumpage subsidies, then one must accept the implied stumpage subsides reported in Table 2-1 for three USDA Forest Regions. In that table, the northern region is taken as the benchmark, and the subsidies received by harvesters in the PNW Eastside, the Intermountain region, and the Rocky Mountain region are the differences in their stumpage prices from the northern region benchmark. As shown, the implied stumpage subsidies are substantial, reaching a high of US$90.27/MBF for the Intermountain region in 1999, followed by US$83.29/MBF in the PNW Eastside in 1997. Over the period shown, the PNW Eastside had the highest average subsidy. The substantial variation in implied subsidies over time highlights the absurdity of the cross-jurisdiction stumpage price comparison methodology. Simply compare the Intermountain region's 1998 result with its 1999 result.

Cox and Lutz could claim that the comparisons made in Table 2-1 are wrong because they were based on all-species stumpage price averages, and what Cox and Lutz advocates are individual species comparisons. However, such species-specific comparisons are no less valid, as shown in Figure 2-2, which provides a comparison of Douglas-fir prices across the same inland regions. Again, there are large differences in stumpage prices that are not evidence of stumpage subsidies, but of differences in average timber quality, sales conditions, and local market supply and demand factors.

TABLE 2-1
Implied Stumpage Subsidy for Three USDA Forest Service Regions
Using the Northern Region as the Stumpage Benchmark
(US$/MBF)

	PNW Eastside	Intermountain	Rocky Mountain
1996	41.39	66.16	31.14
1997	83.29	31.72	40.74
1998	51.55	8.21	47.01
1999	79.12	90.27	63.22
2000	63.10	54.17	88.80
2001	49.98	38.15	31.58
Mean	61.41	48.11	50.42

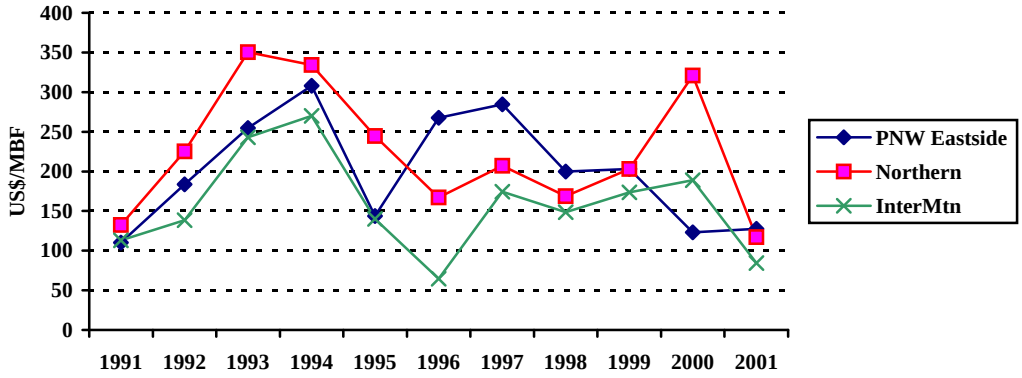

FIGURE 2-2
National Forest Douglas-fir Stumpage Prices by USDA Forest Service Region

The authors of the 2004b Report cannot claim that by using state-wide species-specific averages they are controlling for these in-situ factors when doing a cross-border comparison. The site conditions and other conditions of sale in the Canadian provinces are vastly different from those in the selected U.S. states, and the stumpage prices are affected by these differences. Also note that Cox and Lutz do not propose to use state-wide averages for their benchmarks. Instead, they use only a portion of all stumpage sales in a state, which leads to their second error.

Second Flaw

Cox and Lutz contend that samples of stumpage prices they gathered provide a benchmark price for all stumpage sales within their chosen jurisdictions, public and private. However, the samples have not been shown to be representative of all stumpage sales within these jurisdictions. Instead, they rely on a sample of sales from an

identifiable sub-group of sales and assert that these sale samples will be representative of the entire jurisdiction, but provide no evidence to back up this assertion.

To understand this in statistical terms, consider that the law of large numbers only applies if the sample mean is based on independent and identically distributed random draws from a given population. The population in this case is *all* stumpage sales in the selected U.S. jurisdiction. Thus, a representative sample must be a random draw taken from all sales types, and each sale must have an equal probability of being drawn from the population. What Cox and Lutz present as their benchmark in the 2004b Report is not a random draw from all stumpage sales. Except for Maine, the timber sale samples used are taken only from timber sales by public agencies; private timber sales are excluded. In Maine, on the other hand, only private timber sales are included

The Timber Data Company compiled the data for Washington, Idaho and Montana reported by Cox and Lutz in the 2004b Report. Stumpage price reports from this same company were used for the cross-border comparisons conducted by the Department respecting British Columbia in the final determination and were included in the Department's calculation memos. Included in these reports is the caution: "Because species quality and stumpage prices often vary by geographic area and selling agency, sales are reported separately for each of 29 sub-regions."[6] The accuracy of the caveat is demonstrated in Figures 2-3 and 2-4 below, which show the average stumpage price for different public agencies selling timber in Montana and Idaho. BLM and BIA are, respectively, the Federal Bureau of Land Management and Bureau of Indian Affairs. DNR is the Montana Department of Natural Resources and Conservation, and DL is the Idaho Department of Lands.

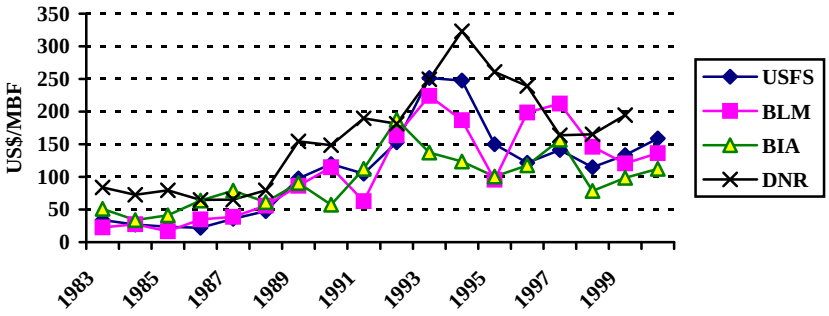

FIGURE 2-3
Public Agency Stumpage Prices In Montana

[6] Timber Data Company, Stumpage Price Report, at page 3. Attached to Department of Commerce's March 21, 2002 Memorandum Regarding Calculations for the Final Affirmative Determination in the Countervailing Duty Investigation.

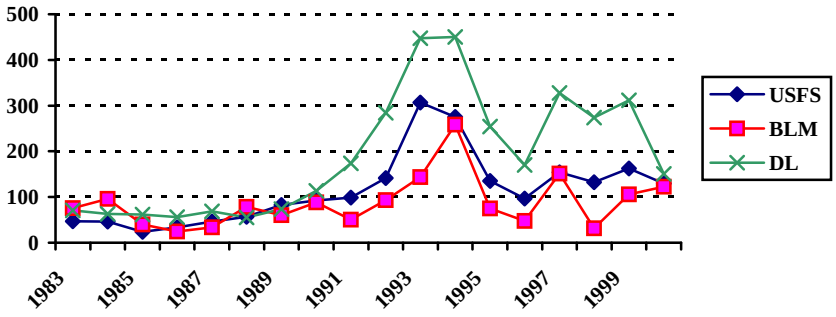

FIGURE 2-4
Public Agency Stumpage Prices In Idaho

The figures show wide differences in the stumpage prices received by the different agencies. In the 2004b Report, Cox and Lutz claim that the differences are evidence of stumpage subsidies. However, in reality, they reflect differences in the average timber quality and sales conditions. This leads to the question of which agencies' stumpage price is the most representative of private stumpage sales in each state. Furthermore, will averaging across agencies produce an average price that is representative of all stumpage sales in the state, including private stumpage sales? Cox and Lutz provide no evidence to answer these questions; thus, their assertion that the chosen benchmarks are representative of all stumpage sales is unfounded.

In short, Cox and Lutz have not shown that their stumpage sale samples are representative of all stumpage sales within the jurisdictions they wish to use as benchmarks. Indeed they cannot do so, as comparable private stumpage data are rarely available in most states.

The issue of the representativeness of public agency stumpage prices of private stumpage prices will be examined in detail in Section 3

Third Flaw

An additional reason for rejecting out-of-country benchmarks is that even when two separate markets are perfectly competitive, there is no economic requirement for the market-clearing prices in each market to be equal. The market-clearing price would only be the same if the markets were integrated, in which case there would be a common price. However, when market areas are distinct there is no *a priori* reason to believe that the price in one market area will be equal to the price in another market area. This is what we observe in U.S. stumpage markets – there is not one U.S. price, but numerous different prices across the different U.S. timber market areas. If two market areas are not integrated, price comparisons as between these markets are invalid. No amount of adjustment can correct this flaw.

2.4 An Examination of the Cox and Lutz Data for Washington, Idaho and Montana

We now examine the stumpage data contained in the Cox & Lutz 2004b Report to demonstrate the implications of the logical flaws in the authors' arguments. Attached as Exhibit 41 to the Cox & Lutz 2004b Report are summaries of public timber sales in Washington, Northern Idaho, and Montana during the Period of Review. Only timber sales by public agencies are included in their sample. The sales were collected by four sub-regions, western Washington, eastern Washington, northern Idaho, and Montana, and by four public agencies, USDA Forest Service, Washington Department of Natural Resources, Idaho Department of Lands, and Montana Department of Natural Resources and Conservation.

Table 2-2 summarises some of the main characteristics of the sales, while Table 2-3 provides a percent distribution of the species contained in the stumpage sales in each region by agency.

TABLE 2-2
Average Sale Characteristics for Public Timber Sales Reported by Cox & Lutz (2004b) for the Period of Review

Agency	USFS	WDNR	Westside	USFS	WDNR	USFS	Idaho D. of Lands	USFS	DNRC	Eastside	All
Area	W. Wash	W. Wash.	Total	E. Wash	E. Wash.	N. Idaho	N. Idaho	Montana	Montana	Total	All
Sales (#)	5	180	185	12	28	19	51	50	15	175	360
Volume (MBF)	11,994	511,322	523,316	34,801	58,935	58,133	134,382	90,582	30,874	407,707	931,023
% Oral Auctions	63.6%	0.1%	1.5%	60.8%	0.0%	56.5%	100.0%	42.9%	0.0%	55.7%	25.3%
% Sealed Bid Auctions	36.4%	99.9%	98.5%	39.2%	100.0%	43.5%	0.0%	57.1%	100.0%	44.3%	74.7%
% SBA	63.6%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	23.5%	0.0%	5.2%	3.1%
Bidders (#)	1.2	3.6	3.5	2.2	2.0	2.1	3.3	2.3	3.4	2.6	3.1
Haul Dist (miles)	83.0	12.0	13.6	41.0	16.0	31.0	34.0	50.0	n.a.	35.2	22.7
Volume/Sale (MBF)	2,398.8	2,840.7	2,828.7	2,900.1	2,104.8	3,059.6	2,634.9	1,811.6	2,058.3	2,329.8	2,586.2
VPA (MBF/acre)	14.2	26.5	26.0	8.6	8.1	1.3	10.2	1.5	5.9	3.0	6.0
Contract Length (months)	41	23	23.4	47	22	47	35	28	31	34.0	28.0
DBH (inches)	11.2	17.5	17.3	10.3	12.5	13.1	n.a.	12.7	11.8	12.3	15.6
Avg Bid (US$/MBF)	56.93	282.77	277.59	129.64	203.01	130.82	231.50	65.08	161.24	162.04	226.99

SBA – Small Business Administration set aside sale
VPA – volume per acre
DBH – diameter at breast height, calculated as the volume weighted average of the individual species DBH reported by Cox & Lutz
Averages for the Westside, Eastside and All columns are the volume-weighted averages.

TABLE 2-3
Species Breakdown for the Washington, Idaho and Montana Public Land Sales Cited by Cox & Lutz

Agency	USFS	WDNR	Westside	USFS	WDNR	USFS	I. D. of Lands	USFS	DNRC	Eastside	All
Area	W. Wash.	W. Wash.		E. Wash	E. Wash.	N. Idaho	N. Idaho	Montana	Montana		All
Species											
Doug.-fir	0.757	0.620	0.623								0.350
Doug.-fir-Larch				0.460	0.552	0.378	0.253	0.540	0.554	0.418	0.183
Hemlock	0.243	0.237	0.237	0.011	0.008					0.002	0.134
True Firs		0.039	0.038	0.160	0.133	0.360	0.413	0.039	0.102	0.237	0.125
Cedar		0.029	0.029	0.039	0.025	0.026	0.160	0.009	0.017	0.066	0.045
Sitka Spruce		0.004	0.004								0.002
Pines		0.001	0.001	0.001	0.219	0.075	0.032	0.075	0.079	0.076	0.033
LP-ES		0.000	0.000	0.211	0.063	0.081	0.029	0.177	0.239	0.106	0.046
Other		0.070	0.068	0.119		0.080	0.113	0.161	0.010	0.095	0.080
TOTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

LP-ES Lodgepole pine and Englemann spruce

Regional and Agency Price Comparisons

Figure 2-5 shows the average all-species stumpage price reported by Cox and Lutz in the 2004b Report for each region and selling agency. There are remarkable differences in prices. Compared to the state agencies, the USDA Forest Service receives much lower prices for its timber. Note also that on the Eastside (eastern Washington, Idaho and Montana) there is considerable variation in the prices received by the different state agencies. These sales appear to be taken from different populations of timber, rather than the same population, as Cox and Lutz assert. It appears that the caution provided by the Timber Data Company in its price reports against cross-agency price comparisons is warranted. In addition, it does not appear that stumpage prices on either the Eastside or Westside converge towards a mean value.

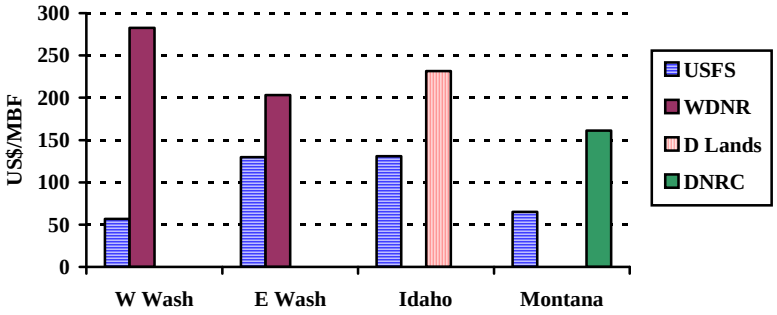

FIGURE 2-5
Comparison of Average Stumpage Prices by Agency and Area
For the Timber Sales Sample Reported by Cox & Lutz

This picture does not improve if we move from the all-species average price to imputed species-specific stumpage prices (which, as explained below, are not actual species-specific prices). Figure 2-6 shows the average stumpage price for Douglas-fir on the Westside and for Douglas-fir and larch on the Eastside. This is the largest species group sold by all agencies in all regions, except the Idaho Department of Lands. If the price for this species is not converging, then it is not likely that the prices for the other species will do so.

Indeed, this non-convergence does not improve when the minor species prices are looked at, such as Western Red Cedar and the lodgepole pine-Engelmann spruce group, as shown in Figures 2-7 and 2-8 below.

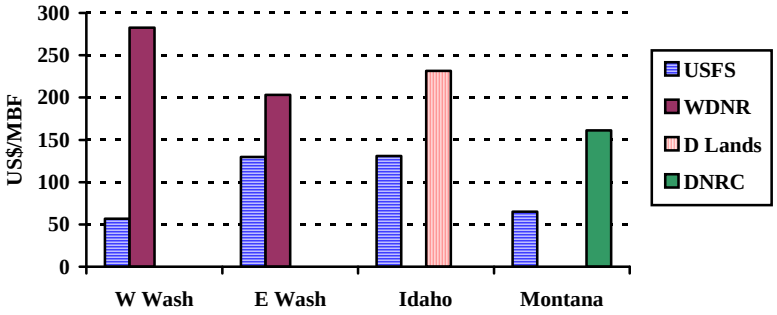

FIGURE 2-6
Comparison of Average Douglas-fir and Douglas-fir and Larch Stumpage Prices by Agency and Area for the Timber Sales Sample Reported by Cox & Lutz

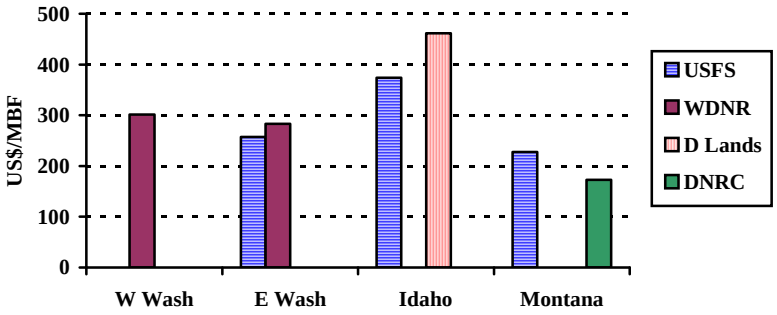

FIGURE 2-7
Comparison of Average Red Cedar Stumpage Prices by Agency and Area for the Timber Sales Sample Reported by Cox & Lutz

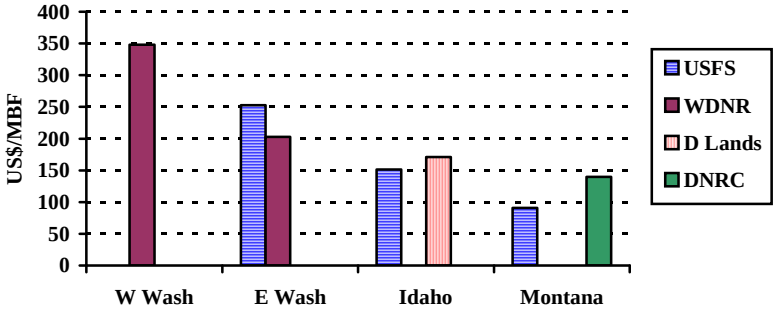

FIGURE 2-8
Comparison of Average Lodgepole Pine-Englemann Spruce Stumpage Prices by Agency and Area for the Timber Sales Sample Reported by Cox & Lutz

The sales data reported by Cox and Lutz provide information for only a limited number of the many variables that affect stumpage prices. Nevertheless, they are sufficient to show that differences in average conditions exist across regions and agencies, that they will affect stumpage prices, and that the differences in average conditions cannot simply be assumed away.

Species Distribution

Figure 2-9 graphs the species distribution for the Eastside regions and agencies given in Table 2-3 above. Douglas-fir is the major species for all agencies, except Idaho Department of Lands, which has true firs as its major species group. Note that the USDA Forest Service sales in Idaho also have a large percentage of true fir volume. Note also the minor volumes of the other species and the variation between agencies. The small volumes of these other species make inferences about species-specific prices highly questionable.

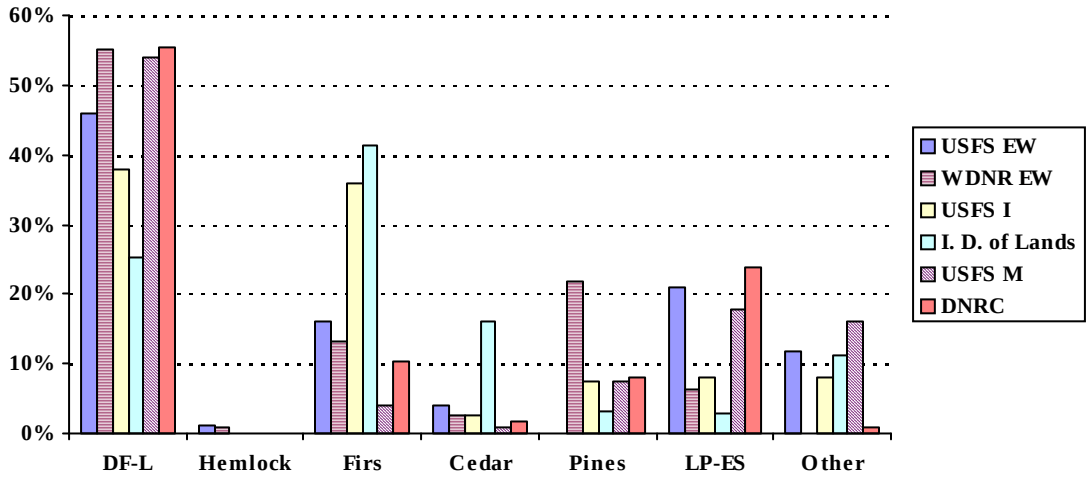

FIGURE 2-9
Percentage Distribution of Species Volume by Region and Agency Contained in the Cox & Lutz Stumpage Data Set

Factors Affecting Harvest Costs

Because stumpage charges do not exceed the difference between the value of the logs that can be harvested from a site and the cost of harvesting and transporting the logs to market, including the harvester's profit, differences in average harvest costs between agencies and regions will affect average stumpage prices. A host of factors affect harvest costs, such as terrain roughness, ground slope, soil conditions, distance from market, remoteness from support centres, and required harvest method (e.g. ground skidding, cable yarding or heli-logging).

The Cox & Lutz 2004b Report provides insufficient data to assess all of these variables; however, those variables that are provided show substantial differences between agencies and regions. Figure 2-10 compares volume per acre and Figure 2-11 the average haul distance.[7] The figures show considerable variation in average conditions that cannot be assumed away.

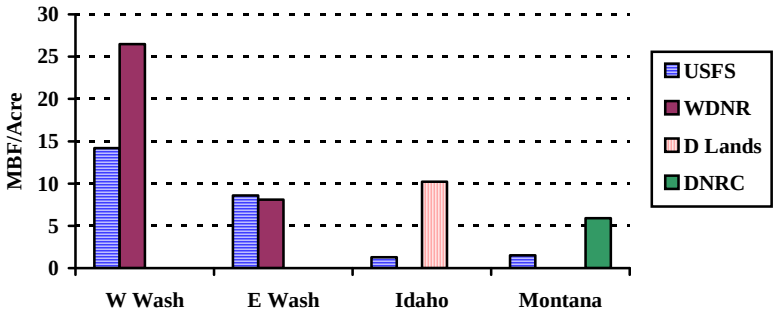

FIGURE 2-10
Comparison of Average Volume Per Acre by Agency and Area
For the Timber Sales Sample Reported by Cox & Lutz

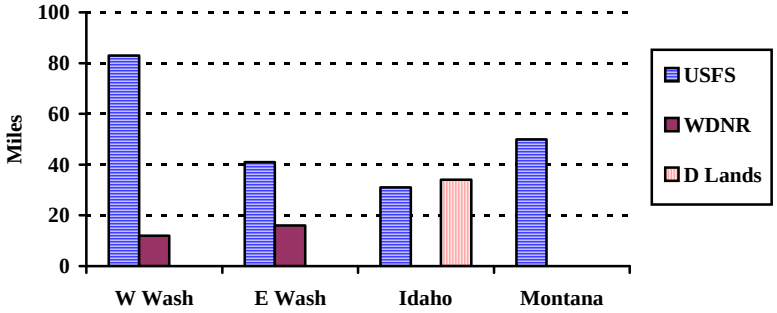

FIGURE 2-11
Comparison of Average Haul Distance by Agency and Area
For the Timber Sales Sample Reported by Cox & Lutz

Sales Conditions that Affect Bid Prices

[7] Some US colleagues have suggested that accurate volume per acre comparisons may be confounded by the differences in the way the various agencies record sale area. Some include only the area to be harvested while others include areas that will not be harvested within the sale area. This further highlights the difficulties in doing cross-agency, let alone cross-border comparisons, when the various agencies do not even measure stand characteristics in a consistent manner.

The manner in which agencies sell timber and the contract conditions placed on timber purchasers can and do affect the prices received by the agency. This result is well established in the economic literature, a literature that Cox and Lutz do not address in their 2004b Report. This literature is reviewed in Section 4. As shown in that section, the sales conditions that affect stumpage prices include sales method (auction or negotiated sales), auction method (oral vs. sealed-bid auctions), contract length (affects the purchaser's flexibility and intensity of harvesting operations), number of bidders participating in the auctions, payment method (lump sum or scaled based sales), adjustable or fixed stumpage prices, etc.

The data provided by Cox and Lutz in the 2004b Report provide limited information on conditions of sale, but what data are provided show considerable variation between agencies and regions. Figure 2-12 compares average contract length by agency and region. The USDA Forest Service provides the greatest flexibility by providing the longest contracts, while the Washington DNR provides only about half the length of the USDA Forest Service contracts.

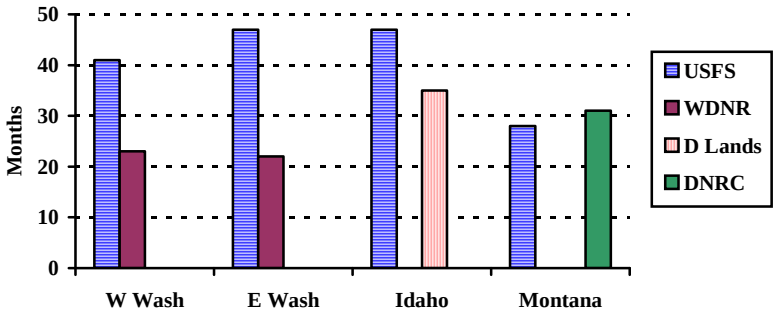

FIGURE 2-12
Comparison of Average Contract Length by Agency and Area
For the Timber Sales Sample Reported by Cox & Lutz

The Idaho Department of Lands uses oral auctions exclusively, while Montana DNRC uses sealed-bid auctions exclusively. The USDA Forest Service uses a mix with an approximate 50/50 split, but this varies by region. Washington DNR's legislation allows it to use either method, but for Cox and Lutz's sample, all Eastside sales were sealed-bid, and less than 1% of volume auctioned on the Westside was by oral auction.

2.5 Market Integration

The cross-border stumpage price comparison methodology advanced by Cox and Lutz must meet a critical requirement in order to be economically valid. That is, the markets being compared must be integrated.

If two markets for a homogeneous good are integrated, then the same supply and demand forces act in both areas, and the equilibrium price in each market will be equal except for adjustments for transportation costs. When goods are not homogeneous, then a host of other adjustments will need to be made, but the prices, after adjustment, should in principle be equal. However, without market integration, no amount of adjustments will produce an apples-to-apples comparison. Each market would instead establish its own equilibrium price based on local market supply and demand conditions, and the equilibrium prices can and do differ. Note that, even if the output markets are integrated between two areas, there is no basis to conclude that the input markets will also be integrated.

Evidence Provided by Cox & Lutz

Cox and Lutz, perhaps unwittingly, put evidence on the record indicating that U.S. stumpage markets are not integrated. First, Exhibit 32 of the 2004b Report is a map of Maine showing sawlog and studwood prices by county from the Maine Forest Service's 2000 stumpage price report.[8] Average county sawlog prices on the map range from a low of US$97/MBF in Knox County to a high of US$163/MBF in Cumberland County. The studwood prices vary from a low of US$10/cord in Lincoln County to a high of US$28/cord in Franklin and Somerset Counties. The 2002 Stumpage Price Report given as Exhibit 31 in the Cox & Lutz 2004b Report shows that substantial inter-county price differences remain in effect. If prices are not equal within the State of Maine, why should it be expected that they be similar across state borders? Such an expectation would be unfounded, and the record evidence shows remarkable differences in stumpage prices across state borders. If the variation in stumpage prices across county borders within states is not evidence of subsidies, then differences across international borders likewise cannot be taken as evidence of subsidies.

Second, at Exhibit 46 of the 2004b Report, Cox and Lutz provide an Oklahoma State University extension service note on stumpage price determination for private landowners. On page 1 the note states:

> *While stumpage prices are available for surrounding states, it is important to remember that these prices may not reflect the trends in your immediate area.*

This suggests that market integration doesn't extend very far into Oklahoma from the surrounding states.

[8] Note that the list of Exhibits in the Cox & Lutz 2004b Report incorrectly identifies the map as "Minnesota's Forest Resources 2000 Stumpage Price Report Figure 11-A." It is in fact a map of Maine.

Perhaps the strongest evidence against stumpage market integration comes from Cox and Lutz's attempt to dismiss Alaska stumpage prices as being unsuitable benchmarks for British Columbia. If markets are integrated, and as Alaska is free of allegations of stumpage subsidies, there is no reason not to accept Alaska prices as suitable benchmarks. Further, if the low stumpage prices in Alaska reflect less than market value, this should attract new entrants into the area, which would cause prices to rise. In Section 3.5 of this report, Alaska's stumpage prices are compared to Western Washington's prices, and it is shown that over the twelve-year period from 1990 to 2001, stumpage prices in Alaska were on average US$195/MBF lower than prices in Western Washington. This demonstrates that Alaska's stumpage markets are not integrated with Western Washington's markets, and the integration of U.S. stumpage markets is a fallacy. The lower prices in Alaska are due to local market conditions such as different timber characteristics and greater distance to market, and do not reflect stumpage subsidies. If this is true for Alaska, there is no reason why it would not also be true of stumpage prices in Canada.

Commerce's Price Data

The Department gathered stumpage and log price data from a number of sources, including state forestry departments, private reporting services, and university forestry extension services. The statements made in these pricing reports contradict the notion that stumpage markets are integrated within these states, let alone between states.

- Wisconsin Department of Natural Resources

Annually, the DNR estimates average stumpage rates for thirteen zones across Wisconsin from sales data collected by foresters. Prices vary from zone to zone because of different timber markets influenced by the distance to processing facilities and other site or quality factors.

- Pennsylvania State University – Timber Market Report

The four regions, shown in the map above, were designed to more accurately reflect the forest product markets in Pennsylvania. The markets within each of the four regions are unique.

- Illinois Department of Natural Resources

Illinois is divided into three price-reporting zones, based on timber resources, similarity, utilization standards and practices and soil types.

Other state stumpage price reports which are not included in the Department's data source, but which reinforce the comments above include:

- University of Maryland – Maryland and Delaware Stumpage Price Report

The four regions described in this report reflect unique forest product markets in Maryland and Delaware

- Mississippi State University

Mississippi is divided into four market regions that reflect distinct timber markets within the state and average product prices for common forest products are listed.

- Purdue University – Guide to Marketing Timber

Logs are bulky and expensive to haul. For that reason, the market area for timber is defined by the timber buyers with processing facilities within approximately one hundred miles of the sale site.

Analysis of U.S. Eastern Stumpage Price Data

Earlier, we compared variations in stumpage prices across USDA Forest Service regions in the western United States and across public agencies in the U.S. Northwest (see Figures 2-1 to 2-4). Considerable variation in stumpage prices was seen, even when we controlled for species. This is clear empirical evidence that stumpage markets are not integrated in the U.S. West. To determine whether this is also the case in the eastern half of the United States, we examine timber prices from data sources identified by Cox and Lutz in their 2004b Report and by the Department.

Maine Stumpage Data

In their 2004b Report, Cox and Lutz recommend the use of Maine stumpage prices for the cross-border comparison with Québec. The data come from a Maine Forest Service annual survey of Maine woodland owners. Survey results for the calendar years 1996 to 2002 are available on the Maine Forest Service website. The survey provides prices by species and product, i.e. sawlogs, veneer logs, pulpwood, bolts, etc. The nominal dollar prices were first converted to constant 2002 dollar prices using the U.S. Producer Price Index for all commodities.

We employed two tests of market integration with this data. The first involved calculating the correlation coefficients of spruce and fir sawlog stumpage prices between the state's sixteen counties over the period 1996 to 2002. The correlation matrix is presented in Table 2-4 below. Note that the highlighted entries identify correlations that are negative. That is, the prices in these county pairs move in the opposite direction. Also note that 59 of the 120 correlation pairs have coefficients that are less than 0.5 (these are shown in italics). Indeed, only 23 of 120 county pairs have coefficients of 0.8 or greater, and the average correlation coefficient was only 0.49. Thus, stumpage prices within the State of Maine are poorly correlated. This is definitely not a sign of market integration.

The second test involved dividing the state in half and then comparing the stumpage prices in each half. There are six large counties in the northern half of Maine and ten smaller counties in the southern half, clustered along the state's coast. The north is defined as Oxford, Franklin, Somerset, Piqcataquis, Penobscot and Aroostook Counties. The south is the remaining 10 counties. Note each area forms a contiguous land mass. According to the Cox and Lutz theory, this artificial division of the state should have no impact on stumpage prices. However, as shown in Table 2-5, this is not what is observed. Instead, prices in the north are consistently higher than prices in the South. If Cox and Lutz's theory is used, the difference is a stumpage subsidy for southern harvesters. The subsidy ranged from a low of US$12/MBF to a high of US$22/MBF, with a mean subsidy of US$17/MBF.

TABLE 2-4
Correlation Between Maine Counties for Spruce and Fir Sawlog Prices

	Andros-Coggin	Aroostook	Cumberland	Franklin	Hancock	Kennebec	Knox	Lincoln	Oxford	Penob-scot	Piscata-quis	Sagad-ahoc	Somerset	Waldo	Wash.
Androscoggin	1.00														
Aroostook	0.72	1.00													
Cumberland	0.93	0.83	1.00												
Franklin	*0.47*	*0.30*	*0.44*	1.00											
Hancock	0.72	0.77	0.76	*-0.18*	1.00										
Kennebec	0.88	0.86	0.84	0.52	0.70	1.00									
Knox	0.76	*0.30*	0.65	*0.44*	*0.31*	*0.42*	1.00								
Lincoln	0.79	0.61	0.64	*0.31*	0.53	0.67	0.78	1.00							
Oxford	0.85	*0.36*	0.73	0.63	*0.33*	0.60	0.85	0.65	1.00						
Penobscot	0.53	*0.37*	*0.46*	*0.31*	*0.20*	*0.30*	0.85	0.86	0.57	1.00					
Piscataquis	0.72	0.97	0.78	*0.16*	0.83	0.83	*0.32*	0.70	*0.36*	*0.43*	1.00				
Sagadahoc	*0.37*	*0.01*	*0.39*	0.84	*-0.23*	*0.26*	*0.41*	*-0.01*	0.66	*0.07*	*-0.14*	1.00			
Somerset	*0.47*	0.91	0.56	*0.17*	0.65	0.76	*-0.06*	*0.42*	*0.07*	*0.10*	0.90	*-0.19*	1.00		
Waldo	0.57	0.91	0.69	0.51	0.52	0.83	*0.07*	*0.38*	*0.30*	*0.12*	0.82	*0.22*	0.92	1.00	
Washington	0.64	0.96	0.73	*0.03*	0.87	0.78	*0.18*	0.59	*0.22*	*0.29*	0.98	*-0.24*	0.92	0.81	1.00
York	*0.10*	*0.46*	*0.08*	0.53	*-0.14*	*0.37*	*0.00*	*0.39*	*0.05*	*0.36*	*0.43*	*0.04*	0.58	0.61	*0.34*

TABLE 2-5
Spruce and Fir Stumpage Price Comparison
Between Northern and Southern Maine
(US$/MBF)

Year	North	South	South Subsidy
1996	108	92	16
1997	122	110	12
1998	126	112	14
1999	147	125	22
2000	138	123	15
2001	123	104	19
2002	126	105	21
Mean	127	110	17

An alternative theory for the price difference might be that the northern area of the state is closer to the Québec border mills that import large quantities of Maine softwood timber. Being closer to this vibrant market, the timberland owners in these northern counties can command higher stumpage prices.

Southern New England Stumpage Price Survey

The Universities of Connecticut and Massachusetts jointly produce the Southern New England Stumpage Price Survey, together with their respective state forestry agencies. The survey reports prices by species for stumpage sales in two regions, defined as east and west of the Connecticut River. A check of a road atlas revealed there were numerous bridges across the Connecticut River, and thus it was not an impassable water barrier to log movements. As such, the division of the two regions should provide an ideal test for timber market integration.

The quarterly survey reports the median stumpage price and price range by species. Quarterly data for 1988 to 2003 was obtained from the survey website. The nominal prices were converted to real prices, measured in constant 2003 dollars, using the U.S. Producer Price Index for all commodities. Figure 2-13 graphs the median prices in the eastern and western regions separately by softwood species. Panel A shows the price for white pine, and that the price was consistently higher in the East. Panel B displays red pine prices, with little in the way of any correlation in price movements indicated. Panel C shows hemlock prices, and eastern prices appear somewhat higher over the period shown. In Panel D, spruce prices are graphed, and the West seems to have higher prices, but again, with little correlation between east and west prices.

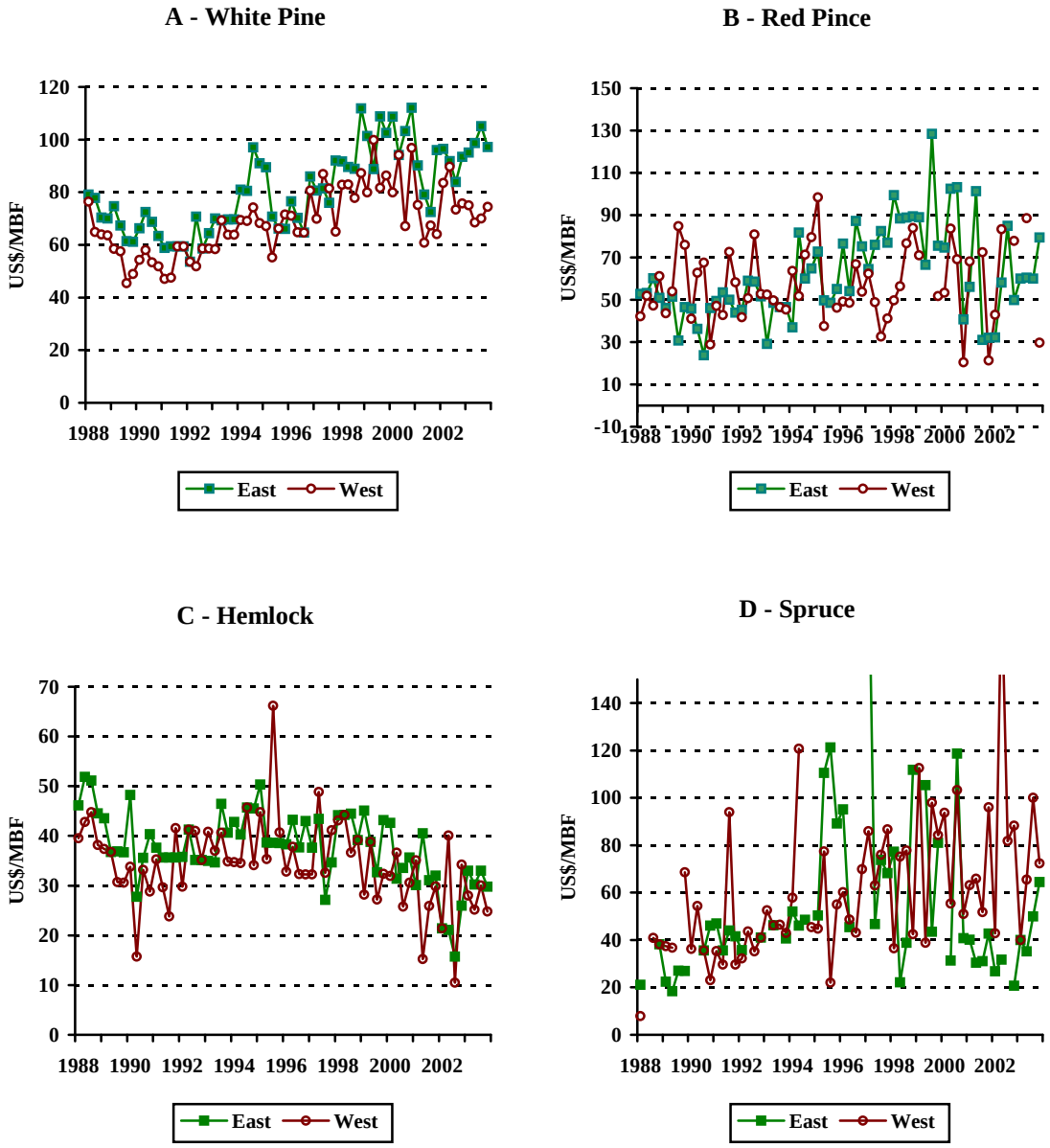

Figure 2-13
Stumpage prices by Species in Southern New England
(Prices East and West of Connecticut River)

The correlation coefficients for species prices east and west of the Connecticut River were not remarkably robust. For white pine it was 0.746, red pine 0.195, hemlock 0.506 and spruce only 0.092. This is not even weak evidence in support of market integration.

Table 2-6 shows the species average values over the entire period of 1988-2003 and for the Period of Review. If we accept Cox and Lutz's logic of cross-border comparisons, then a higher price in one region implies the other region's prices are subsidized. From the total period averages, the subsidy received by harvesters in the West would be

US$11.8/MBF for white pine, US$4.48/MBF for red pine, US$3.25/MBF for hemlock and US$-6.34/MBF for spruce. The spruce result would indicate that harvesters in the East receive a subsidy for any spruce harvested.

TABLE 2-6
Average Species Values and Implied Subsidies
(US$/MBF)

	White Pine	Red Pine	Hemlock	Spruce
1988-2003 Average				
East	80.73	61.56	37.69	54.17
West	68.87	57.08	34.44	60.50
West Subsidy	11.85	4.48	3.25	-6.34
Period of Review Average				
East	91.05	63.21	23.95	30.81
West	78.48	80.61	28.21	100.01
West Subsidy	12.56	-17.40	-4.26	-69.20

The subsidy calculation is even more bizarre when we examine the average for only the Period of Review. In that case, eastern harvesters receive subsidies on three species, and their subsidy for spruce is an amazing US$69.20/MBF. It would appear that, by simply picking an arbitrary time period, one could find subsidies on either side of the river.

Vermont

The University of Vermont extension services provide quarterly stumpage prices by species for Vermont. Average state-wide prices are not given; rather, the prices are reported separately for three regions, the Northern, Central and Southern portions of the state. Figure 2-14 graphs quarterly sawtimber stumpage prices for white pine, spruce/fir, hemlock and red pine. Panel A shows white pine prices, which of the four species are the closest across the three regions. Still, the North has far more volatility than the other two regions. Panel B shows spruce/fir; there, the South clearly has consistently lower prices over the period shown, differences that are substantial at times. Panel C shows hemlock prices, with results that are similar to the spruce/fir panel. Panel D shows red pine prices. The price movement across the three regions is highly erratic.

Vermont is a small state, particularly when compared to the six Canadian provinces whose stumpage programs are under investigation. If stumpage market integration does not hold within a state as small as Vermont, it cannot be expected to hold between Cox & Lutz's cross-border benchmarks and the entire area of the Canadian province to which prices are being compared.

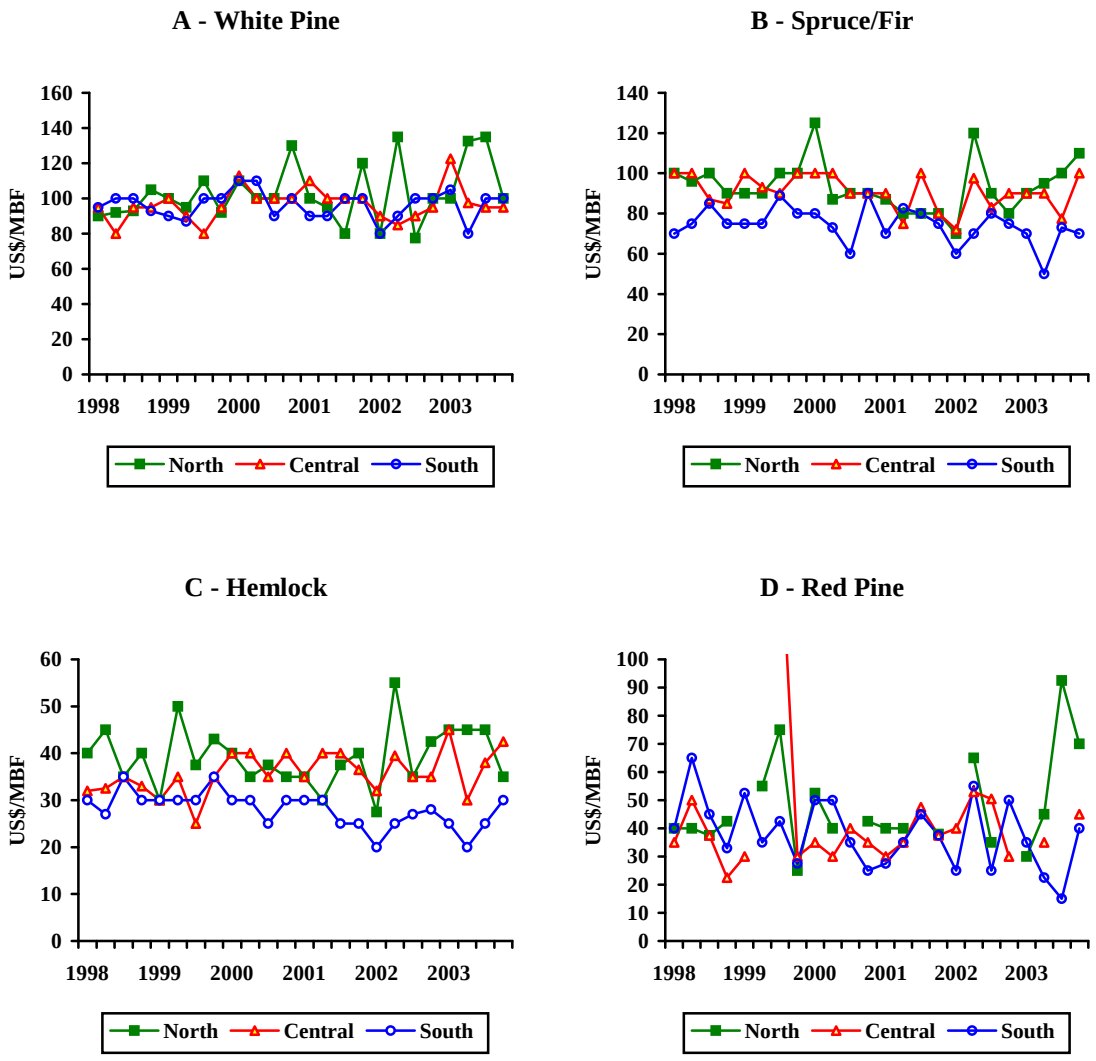

FIGURE 2-14
Quarterly Sawtimber Stumpage Prices in Vermont

Michigan

Timber Mart North publishes semi-annual stumpage and delivered log prices for Michigan. Prices are reported for three regions. Note that the report begins with the following statement:

> *WARNING: This report is intended to be an unbiased and accurate source of information on timber markets and prices in a specified region and time period, but timber prices vary greatly within and among regions and depend on a substantial number of factors.*

It would appear that Timber Mart North does not believe that timber markets are integrated.

The Michigan Department of Natural Resources publishes an average stumpage price report. The report includes only auctioned prices and excludes all direct sales. The report does not report state-wide average prices because, as the report clearly states:

> *Volumes and values are only totalled when comparable measurement units exist, e.g. International ¼" to a 10.0" DIB is only added to International ¼" to a 10.0" DIB. For example, there is no Statewide total, except for # of Sales Sold, because cruising specification and log rules are different between Region I – Upper Peninsula and Region II – Northern Lower Peninsula.*

It would indeed be difficult for prices to be integrated across Michigan when the prices are not even measured in comparable units. That is, a price based on a sawtimber volume taken to a 8-inch top diameter and measured in Scribner log scale cannot be directly compared to a price based on a sawtimber volume taken to a 10-inch top and measured in International ¼ log scale.

TABLE 2-7
Sawtimber Stumpage Rates for Red Pine, White Pine and Spruce in Wisconsin 2002-2004
(US$/MBF)

Zone	Red Pine			White Pine			Spruce		
	2004	2003	2002	2004	2003	2002	2004	2003	2002
Wasukesha	123.02	125.00	141.29	85.00	105.26	105.26	69.37	81.35	83.70
Green Bay	89.53	125.00	125.00	97.20	165.00	182.97	69.00	69.00	69.00
Crivitz	126.04	107.27	107.27	127.88	146.49	153.63	103.68	120.00	150.00
Wausau	96.28	107.72	143.34	110.84	145.69	195.50	87.27	100.00	141.90
Wautoma	78.73	130.33	130.33	78.20	130.00	141.17	87.27	90.00	141.90
Dodgeville	110.00	140.12	141.29	74.31	100.00	102.00	69.37	81.35	83.70
Rhinelander	145.34	112.19	118.19	154.46	173.01	225.32	60.59	90.00	60.87
Adams	149.98	121.61	154.95	145.61	134.84	160.26	69.37	81.35	83.70
Richland Center	110.00	140.12	141.29	118.97	100.00	105.26	69.37	81.35	83.70
Hayward	123.05	156.30	153.36	114.76	140.67	141.76	86.96	80.00	73.45
Eau Claire	154.37	149.18	140.65	125.71	117.08	113.75	69.37	81.35	83.70
River Falls	120.36	128.95	124.44	104.47	125.72	111.80	69.37	81.35	83.70
Sparta	136.09	124.19	125.00	110.62	142.84	126.98	69.37	81.35	83.70
Mean	120.21	128.31	134.34	111.39	132.82	143.51	75.41	86.03	94.08
Min	78.73	107.27	107.27	74.31	100.00	102.00	60.59	69.00	60.87
Max	154.37	156.30	154.95	154.46	173.01	225.32	103.68	120.00	150.00

Source: Wisconsin DNR

Wisconsin

To assist private timberland owners, the Wisconsin Department of Natural Resources (DNR) provides annual estimates of stumpage prices by 13 zones. The estimates are based on recent timber sales and are released in November of the year prior. Table 2-7 reports the stumpage rates estimated by DNR staff. Note the large price variation across zones.

Minnesota

The Minnesota Department of Natural Resources (DNR) produces an annual listing of stumpage prices by species. The data is based on timber sales by public agencies, including USDA National Forests, Bureau of Indian Affairs, Minnesota counties, and the Minnesota DNR. Only state averages are reported. This data is used below in a three-state stumpage price comparison.

Comparisons of Minnesota, Wisconsin, and Michigan Sawtimber Stumpage Prices

We now compare average sawtimber stumpage prices in Wisconsin to those in two of its neighbouring states, Minnesota and Michigan. To do this, we ignore the cautions against doing so in the Wisconsin and Michigan reports. Ignoring such cautions is a necessary precondition of any cross-border comparison. We also average red and white pine prices in Michigan and Wisconsin in order to make them comparable to the Michigan price, which is reported for the two species together. Comparable data was only available for all three states for 2002, but for Minnesota and Wisconsin prices were also available for 2001 and 1999. The results are given in Table 2-8.

The table shows large price differences between states for all species. The only comparable species prices were spruce prices, and then only between Minnesota and Wisconsin. Next, we calculate the implied stumpage subsidy for Wisconsin using Minnesota stumpage prices as the benchmark. This is shown in Figure 2-15. It shows that red and white pine, jack pine and fir are all heavily subsidized in Wisconsin, using the logic proposed by Cox and Lutz. However, it is Minnesota's harvesters that receive a substantial subsidy when it comes to the harvest of cedar.

TABLE 2-8
A Comparison of Minnesota, Wisconsin and Michigan Sawtimber Stumpage Prices by Species
(US$/MBF)

Species	Minnesota	Wisconsin	Michigan
		2002	
Red & White Pine	153.78	133.58	201.07
Jack Pine	155.76	51.40	120.59
Spruce	94.95	94.08	45.94
Fir	136.32	47.50	Na
Cedar	29.43	101.25	54.00
		2001	
Red & White Pine	170.13	134.38	Na
Jack Pine	154.35	105.66	Na
Spruce	91.27	87.49	Na
Fir	144.20	75.03	Na
Cedar	30.46	99.17	Na
		1999	
Red & White Pine	198.99	121.68	Na
Jack Pine	124.00	50.25	Na
Spruce	81.91	70.92	Na
Fir	80.82	40.00	Na
Cedar	39.13	110.45	Na

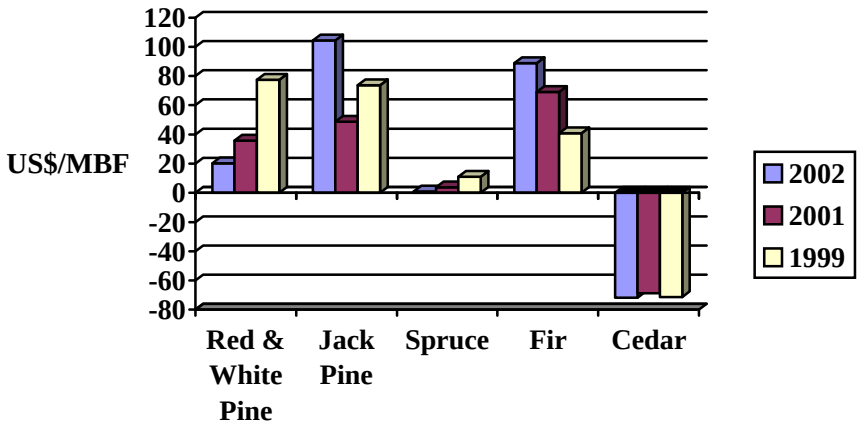

FIGURE 2-15
Implied Wisconsin Stumpage Subsidy Using Minnesota as the Price Benchmark

Pennsylvania

The *Pennsylvania Woodlands Timber Market Report* is produced quarterly by The Pennsylvania State University's School of Forestry. It reports stumpage and delivered log prices by four regions, which are described in the report as "unique" markets. The reports provide stumpage prices for only two softwood species, white pine and hemlock. Quarterly prices were obtained from the 2nd quarter of 1998 to the 3rd quarter of 2003.

Panel A of Figure 2-16 plots white pine prices by the four regions. It confirms that prices across the four "unique" markets differ greatly. The Northwest region has substantially lower prices than the other three regions. Panel B plots hemlock prices. Once again, there is substantial divergence of prices, with the Northwest region having much lower prices. The level of stumpage "subsidy" received by any region would depend on which regions were chosen as the price benchmark, and also on the selection of the period in which the comparisons were made.

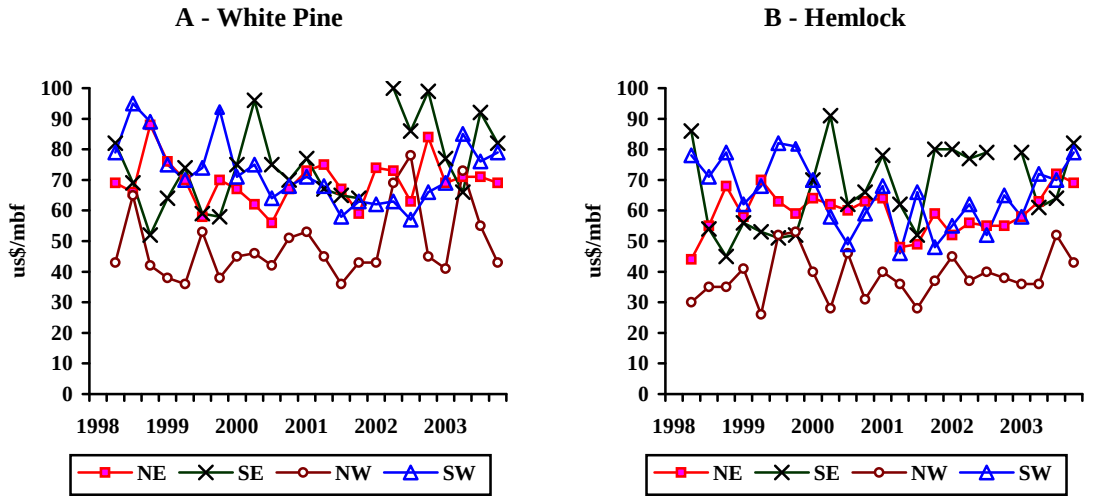

FIGURE 2-16
Comparison of White Pine and Hemlock Stumpage Prices in Pennsylvania

Both panels in Figure 2-16 indicate that there is little correlation in price movements between regions. This is confirmed in Tables 2-9 and 2-10, which present correlation coefficients for prices between regions for white pine and hemlock respectively over the period 1998 to 2003. No regional correlation pair has a coefficient greater than 0.5; two of the pairs are negative in the white pine table, and three are negative in the hemlock table. These results are a decisive rejection of the market integration hypothesis within Pennsylvania.

TABLE 2-9
Correlations in White Pine Prices

	NE	NW	SE	SW
NE	1.000000			
NW	-0.132631	1.000000		
SE	0.012678	0.309989	1.000000	
SW	0.235582	0.036039	-0.391934	1.000000

TABLE 2-10
Correlations in Hemlock Prices

	NE	NW	SE	SW
NE	1.000000			
NW	0.212442	1.000000		
SE	-0.285238	-0.193068	1.000000	
SW	0.267240	0.171054	-0.444922	1.000000

James W. Sewall Company's Timberland Report

The James W. Sewall Company produces a quarterly publication entitled the *Timberland Report*. These reports have been published since 2000 and are freely available on the Company's website (www.jws.com). As the Department has placed some of these reports on the record, we examine them for any relevance to cross-border stumpage price comparisons.

The *Timberland Report* contains the disclaimer that the opinions expressed in the reports are those of the editor, "who is solely responsible for its content, and may not reflect the opinions of James W. Sewall Company." The editor is J. Lutz, who is also one of the coauthors of the Cox & Lutz 2004b Report. Thus, we would expect that any conclusions reached in the *Timberland Report* would be consistent with the conclusions found in the Cox & Lutz 2004b Report.

A review of the individual *Timberland Reports* found that the following issues contained material of relevance to cross-border stumpage price comparisons:

- Vol. 1 No. 2 Northeast Timberlands and Volatility – This report examined the greater-than-expected volatility in timberland returns in the north eastern United States and the potential cause. The Northeast is defined as the states of Maine, New Hampshire, Vermont, New York and Pennsylvania. To explain the increase in volatility in timberland returns, Lutz breaks the Northeast into two areas, the northeast Northeast (Maine, New Hampshire, Vermont and northern New York) and the southwest Northeast (Pennsylvania and southern New York). Lutz justifies this breakdown by saying:

  The species composition, growing conditions and markets in these two regions are different enough to produce substantially different risk and return results.

This suggests that market integration does not hold over the entire Northeast; and further, that it does not hold even within New York State.

The returns to timberland investments are derived from stumpage sales and land value appreciation. Lutz then examines differences in hardwood sawtimber stumpage prices within the Northeast region. His Figure 2 compares sugar maple prices, while his Figure 3 compares black cherry prices. Both figures show considerable and persistent differences in stumpage prices across states. Thus, his results confirm a lack of integration between stumpage markets in the north eastern United States. He states:

In summary, stumpage prices tend to be higher and more volatile in the "southwest" Northeast.

Does this then mean that the northeast Northeast is subsidized?

- Vol. 3 No. 2 Northeast Timberlands – In this edition Lutz, examines trends in stumpage prices in the north eastern United States based on periodic surveys conducted by the Sewall Company. Of particular interest is his Figure 3, which displays spruce/fir stumpage prices from June 1994 to June 2001 for Maine and northern New York State. The graph shows Maine prices being consistently higher than Northern New York prices; a brief review of the graph suggests that the price difference varied by US$40 to US$50 per MBF.

- Vol. 4 No. 4 Northeast Timberlands – In this edition, Lutz reports on another of the Sewall Company's periodic surveys of stumpage prices in the Northeast. After reviewing Maine prices, he examines regional sawtimber stumpage prices. He again compares prices in northern New York State to Maine prices, this time over the period June 1994 to June 2003. In addition, his Figure 3 shows both spruce and white pine stumpage prices in both states. Once again, Maine is shown to have consistently and significantly higher stumpage prices than northern New York State for both species. Lutz then turns to hardwood sawtimber stumpage prices, and in his Figure 4 compares sugar maple and red oak prices in Maine, northern New York State and north western Pennsylvania. The price differences between the three states is massive, with Pennsylvania showing significantly higher prices than the other two states. This difference is particularly dramatic in his Figure 5, which shows black cherry sawtimber prices. There, the Pennsylvania stumpage prices exceed the other two states by US$1000/MBF.

- Vol. 5 No. 1 Diversification among Timberland Regions – Lutz examines portfolio diversification for the timberland investor in this edition. In particular, the option of diversifying geographically by holding timberlands in three different regions of the United States: the West, the Southeast and the Northeast, is reviewed. Diversification is a common strategy for stock

portfolios, as it allows the investor to achieve a given return at a lower risk. That is, by mixing assets whose returns are not correlated, or – even better -- negatively correlated, an investor can reduce the risk to his entire portfolio. Lutz then examines the correlation between timberland returns in the three regions and finds a weak correlation between the Southeast and both the Northeast and the West. He also finds a negative correlation between the Northeast and the West. On this basis, he concludes that regional diversification can provide assistance in reducing timberland portfolio risk. This lack of correlation is positive evidence that timber markets in the United States are not integrated. If the markets were integrated, then returns in each market would be highly correlated, and there could be no benefit from regional diversification.

It is extremely difficult to reconcile the material presented in the *Timberland Report*, of which Lutz is the editor, with the findings of Cox and Lutz in their 2004b Report. The *Timberland Report* provides comparisons that consistently require the rejection of the hypothesis that timber markets are integrated, both between, and even within, states. These results stand in stark contrast to the Cox and Lutz conclusion that comparisons across international borders will provide an accurate and meaningful comparison.

Log Exports

The matter of log exports, including the fact that exported logs have different characteristics than domestic logs due to the different characteristics desired by offshore log markets, is extensively discussed in "An Examination of Canadian Log Import and Export Data and Their Potential Use for Log Price Comparisons," Canadian Forest Service (March 15, 2004). Two editions of the *Timberland Report* also address this issue:

- Vol. 1 No. 1 Western Timberlands – In this edition Lutz, reviews log prices in the U.S. PNW, including both domestic and export prices. With regard to export logs, he states:

  Domestic prices were forced down by the availability of export logs sitting on Western docks with no overseas markets. However, export grades are not directly substitutable for domestic grades. Export logs tend to be butt logs, and Asian buyers are quite happy to pay extra for the butt swell, which is chipped to supply fibre for Asian paper mills.

- Vol. 2 No. 2 US Softwood Exports to Japan – Lutz examines U.S. log exports to Japan and noted that, at that time, export prices were strong while domestic log prices were weak. He then states:

  The weak domestic market is putting upward pressure on export prices and downward pressure on domestic log prices. It is not possible to harvest only export or domestic grade logs: timber stands (and individual trees) contain a

mix of both. Therefore, export log prices must be high enough to compensate timberland owners for the low prices they will receive for the domestic logs.

From this it appears that the Timberland Report, and Lutz himself as editor, must agree with the Canadian parties' position that export log grades are different from domestic grades.

Other Views on Market Integration and Stumpage Prices

A recent USDA Forest Service profile of sawmills in the United States and Canada provides another view on stumpage prices and timber supply (Spelter and Alderman, 2003). These authors, in examining differences in stumpage prices, argue:

Another cause of differences in timber pricing is the interplay of supply and demand. Where supply in the form of inventory is large in relation to utilization, prices tend to be lower than in regions where inventory-to-use is small.

To test this claim, Spelter and Alderman plotted stumpage prices for selected U.S. states against a supply variable they call the "drain to inventory" ratio. "Drain" refers to the volume of timber utilized in a given period, while "inventory" is the total stock of timber at that given time. A low to drain/inventory ratio implies a relative higher supply, while a high ratio implies a low relative supply.

Figure 2-17 repeats Spelter and Alderman's Figure 9. It confirms their hypothesis that prices will be high when the drain/inventory ratio is high (and relative supply is low) and that prices are low when the drain/inventory ratio is low (supply is relatively abundant).

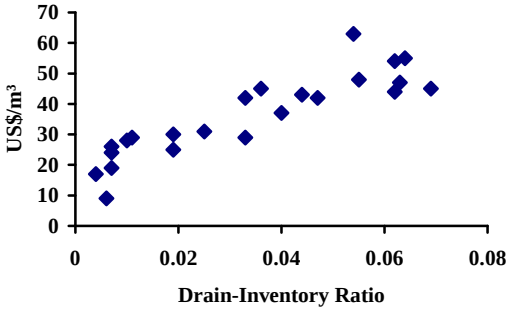

FIGURE 2-17
Timber Drain/Inventory Ratios for Selected U.S. States
in Relation to Standing Timber Prices
(Data from Spelter and Alderman (2003))

Note that this relationship completely contradicts Cox and Lutz's theory of complete stumpage market integration. The wide range of stumpage prices shown in the figure and

the obvious relationship with individual supply in each state shows that U.S. stumpage markets are not integrated.

Conclusion on Market Integration

We have reviewed the price reports and data placed on the record by the Executive Committee and the Department. We have failed to find one example that supports the hypothesis that timber markets are integrated in the United States. Not only does the hypothesis not hold across state boundaries, it does not hold within state boundaries. The hypothesis therefore must be rejected.

2.6 Other Factual Errors Made by Cox and Lutz

To this point we have restricted our comments to the overall logic of the cross-border stumpage price comparisons proposed by Cox and Lutz. We now examine some of their specific factual errors.

Sawtimber Price Comparisons

Cox and Lutz allege that they are recommending a sawlog-to-sawlog price comparison in their proposed cross-border price methodology. In fact, they are not. In contrast to the United States, in Canada, sawtimber or sawlogs are not appropriate measures of log quality. In the United States, a sawlog is typically defined as a log with a top inside bark diameter of 7 inches or more, depending on the jurisdiction. In Canada, a sawlog is simply any log processed at a sawmill, regardless of top diameter. In fact, the majority of Crown timber harvested east of the Rocky Mountains, and also much of the timber processed in British Columbia, would not meet the U.S. sawlog definition.

In fact many U.S. sawmills also process more than just sawlogs, as demonstrated by the relatively recent subdivision of pulp logs into pulpwood and bolts. The bolts, with small-end diameters less than that of sawlogs, are now processed into lumber.[9]

By comparing U.S. sawlog prices to Canadian stumpage prices, Cox and Lutz are taking the high-end of the U.S. stumpage prices and comparing it to the average price for all Canadian logs. This method necessarily biases the U.S. stumpage prices upward. This, by itself, makes such comparisons invalid.

Haul Distance is the Same

Cox and Lutz reject the need to make adjustments for differences in haul distances between Canadian provinces and U.S. states. Instead, at page 17, they claim "… haul distances in the United States and Canada are similar." Record evidence belies this claim. Cox and Lutz's own stumpage price data given in Table 2-1 above shows that the

[9] The Minnesota 2002 Stumpage Price Review, filed by the Executive Committee, reports pulpwood prices, sawtimber prices and pulpwood and bolts prices sold in combination. The review defines bolts as "a short log, usually 100" length, with a specific minimum diameter and generally sawn for lumber."

average haul distance on the Eastside was 35.2 miles. British Columbia has provided Commerce with the average haul distance for the interior region of British Columbia as 55.6 miles (89.5 km). Thus, the statement in the Cox & Lutz 2004b Report is invalid.

Species Mix Has No Relevance

On page 23, the authors make the following statement:

> *…species mix has no relevance to the appraisal of the value of timber on a species-by-species basis. The value of any given tree in a stand is not affected by the species of other trees.*

This statement is factually incorrect on two grounds. First, whenever trees are sold on a stand-as-a-whole basis, rather than on an individual-species basis, there are in fact no species prices as such. For example, when a stand is sold on a lump-sum basis, or on an all-species price basis, the same price applies to all species contained in the stand. However, such prices are greatly affected by species mix.

An example of this is given in Table 2-11. This table shows four hypothetical timber sales that were sold on the basis of a stand-as-a-whole prices. The species price for pine is then calculated as the weighted average of the sale prices. The weights are to the percent of total pine volume contained in the four sales. That is, there is a total pine volume of the 2,000 m³ in the four sales, and the first sale has 800 m³, or 40% of the total pine volume. Each sale price is then multiplied by the pine percentage in the last column, and then summed to yield the weighted average prices of $147.50/MBF in this hypothetical example.

TABLE 2-11
Calculation of a Hypothetical Price for Pine from Four Stand-as-a-Whole Prices

Sale	Bid Price	Total Volume	Pine Volume	Pine Percent	Weighted Pine Price
	($/MBF)	(MBF)	(MBF)	(%)	($/MBF)
	(a)			(b)	(a × b)
1	100	1,000	800	40	40.00
2	200	2,000	200	10	20.00
3	50	3,000	500	25	12.50
4	300	4,000	500	25	75.00
Total			2000	100	147.50

At Exhibit 44 of the 2004b Report, Cox and Lutz note that for the Washington State Department of Natural Resources "…most sales were sold as lump sum sales…" At Exhibit 21, Cox and Lutz state that the Montana Department of Natural Resources and

Conservation sells its timber "… on a camp run basis, not by species."[10] The USDA Forest Service uses a mixture of lump-sum and individual-species sales. This leaves the State of Idaho as the only agency to use individual species price sales exclusively, meaning that the majority of the stumpage sales data used by Cox and Lutz to construct benchmarks for British Columbia and Alberta are based on stand-as-a-whole prices that are affected by species mix. Cox and Lutz note this effect on page 19 but omit mention of it at page 23.

The second flaw in the statement by Cox and Lutz relates to the problem of skewed species-bid prices. This well-known problem occurs when stands are sold on an individual-species basis in a manner that allows bidders to win auction at bid prices higher than the prices actually paid when the stand is harvested. This problem is described in greater detail in Section 3.

For these reasons, the statement in the Cox & Lutz 2004b Report on the irrelevance of species mix must be rejected.

The Quality of Québec vs. Maine Timber

At the end of the 2004b Report, Cox and Lutz urge the Department to make no adjustments in cross-border comparisons of Québec and Maine for differences in timber quality. At page 116 they state:

> *We are aware of no changes in the Québec or Maine sawtimber harvests in the intervening two years that would change our analysis, and no contrary evidence or arguments have been put forth to date…*

In fact, the Executive Committee has put evidence on the record which negates the conclusion of Cox and Lutz in the 2004b Report. The author of this evidence was J. Lutz, one of the co-authors of the Cox & Lutz 2004b Report. Lutz (2004) provides a minimum diameter distribution for spruce/fir, hemlock and white pine sawlogs in Maine.[11] This distribution was not derived from empirical measurements by Lutz, but rather were "developed through discussion with Sewall's Management Forester." Table 2-12 summarizes his results.

[10] Camp run basis is a common forestry term indicating the timber is sold with a single price for all species.

[11] The term "sawlog" in Maine means a log with a diameter of 9 inches and above. The Canadian parties provided Commerce with documentation confirming this. *See* letter from Jonathan Ford to the Department of Commerce (December 20, 2001) (Maine Landowners' Letter) attached to Memorandum from Melissa Skinner to All Interested Parties (February 20, 2002) P.R. 752.

TABLE 2-12
Diameter Distribution for Maine Sawlogs
(Inches)

Minimum Top Diameter	Spruce/Fir	Hemlock	White Pine
5”	8%		
6”	85%		
8”	5%	20%	55%
10“		80%	45%
12”			
14”	2%		
Weighted Average Minimum Top Diameter	6.28	9.60	8.90

Source: Jack Lutz, James W. Sewall Company, March 5, 2004. Weighted average calculated from diameter distribution reported by Lutz (2004).

The weighted-average minimum top diameter for sawlogs in Maine, by species, can be calculated using the diameter distribution. This was done in the last row of Table 2-12. Note that this average is based on the distribution of the minimum top diameters, which necessarily means that the average diameter for Maine sawlogs will exceed this minimum. Also note that data from Québec during the POI indicated that the average size of trees harvested from Québec Crown lands was only 4.9 inches measured at the small end.[12] Thus, there is a sizeable difference in timber diameter in Québec and Maine.

Cox and Lutz’s Contradictions in Timber Quality and Conversion Factors

Throughout their 2004b Report, Cox and Lutz maintain that no adjustments for timber quality between Canadian provinces and their selected U.S. benchmarks are needed. This conclusion comes from the false comparisons made on data, such as the B.C. average diameter discussed below, and on a failure to acknowledge information on the record, as in the Québec-Maine example above. However, there is another contradiction that permeates all of the 2004b Report; the arguments about log scale conversion factors are inconsistent with the arguments about timber quality.

Log scale conversion factors are needed in any cross-border stumpage price comparison because U.S. stumpage prices are given in $/MBF log scale, while Canadian prices are given in $/m^3. However, log scale conversion factors vary with average tree size, with the conversion factor increasing as trees get smaller.

It should be noted that differences in conversion factors between regions are positive evidence of differences in average log diameters between those regions. For example, based on large-scale dual-scaling studies, British Columbia, Alberta and Saskatchewan provided Commerce with the following conversion factors in the initial investigation:

[12] Québec Dec. 17, 2001 Supp. Questionnaire Response, GOQ-5-8 attached at Tab I-G of the Government of Canada’s March 15, 2004 Submission of Factual Information.

- B.C. Coast 6.99 m³/MBF
- B.C. Interior 6.66 m³/MBF
- Alberta 8.51m³/MBF
- Saskatchewan 8.62 m³/MBF

In addition, Québec provided evidence that a representative conversion factor for its Crown timber would be in the range of 9.02-9.32 m³/MBF.

In the 2004b Report, Cox and Lutz contend that the appropriate conversion factor for most of the United States is 4.53 m³/MBF. They do this in order to inflate the U.S. price when it is converted to $/m^{3,}$ and thus increase the alleged subsidy. However, if they believe that such a low conversion factor, which necessarily means a very large average log size, is appropriate for the United States, then they must also accept that there is a significant difference in average tree size between Canadian provinces and U.S. states. Failure to do so implies a significant logical inconsistency.

Same Forest Types

Cox and Lutz contend that there is little difference between the types of forests found in Canadian provinces and the U.S. state(s) they selected as benchmarks. The fallacy of this statement is demonstrated below.

Ontario vs. Minnesota

Figure 2-18 shows the breakdown of harvest in Minnesota and Ontario by total hardwood and softwoods. Wisconsin and Michigan are also shown, as they have been included in the Department's stumpage data lists. In the three U.S. states, hardwood makes up 75% of the total harvest, with softwood adding the remaining 25%.[13] In Ontario, the distribution is exactly the opposite, with softwoods making up 75% of the harvest and hardwoods accounting for only 25%. This is a nontrivial difference, which shows that the claim is false that the forests are the same.

[13] Michigan data from Haugen and Weatherspoon (2002). Minnesota data from Reading and Krantz (2002). Wisconsin data from Reading and Whipple (2003). Ontario data from Ontario Ministry of Natural Resources (2002).

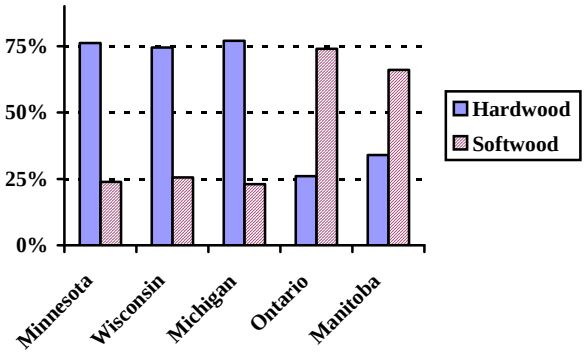

FIGURE 2-18
Hardwood and Softwood Harvest Breakdown in Minnesota, Wisconsin and Ontario

Even if we put aside the hardwood/softwood split, there are substantial differences in the softwood species distributions. Figure 2-19 compares the softwood species distribution for Minnesota and Ontario. Note that Ontario's softwood harvest is dominated by SPF (spruce, pine, fir), which together account for 95% of the total softwood harvest. By itself, spruce accounts for 58% of Ontario's harvest. In comparison, Minnesota's harvest is far more evenly divided amongst the different species. There is far less spruce and jack pine in Minnesota, and far more balsam, red pine and tamarack.

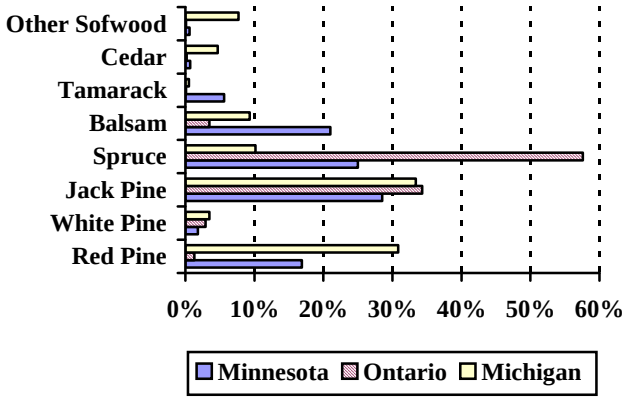

FIGURE 2-19
Softwood Species Distribution in Minnesota, Michigan and Ontario

Ontario's harvest is also dramatically different from Michigan's harvest. Also note the dissimilarity between the neighbouring states of Minnesota and Michigan. Given this, Cox and Lutz are incorrect to portray the northern boreal forest as homogeneous.

Manitoba vs. Minnesota

Figure 2-18 also included the hardwood and softwood harvest distribution in Manitoba. Like Ontario, Manitoba's harvest is dominated by softwoods, not hardwoods, as was the case with the three U.S. states shown. The softwood harvest in Manitoba is comprised of spruce 56%, jack pine 43%, with all other softwood making up the remaining 1%. Again, this is different from the Minnesota softwood distribution shown in Figure 2-19.

British Columbia vs. Washington State

Figure 2-20 compares the species distribution in eastern Washington with that of the B.C. Interior.[14] The distributions are not remotely similar. The major species in the B.C. Interior are lodgepole pine and spruce, which, to allow comparisons to the Washington distributions, are lumped into "other pines" and "other conifers" groupings, respectively. In contrast, the major species in eastern Washington is Douglas-fir and larch, which is a relatively minor species group in the B.C. Interior. Note also the large ponderosa pine harvest in Washington and its negligible harvest in British Columbia (<0.6%).

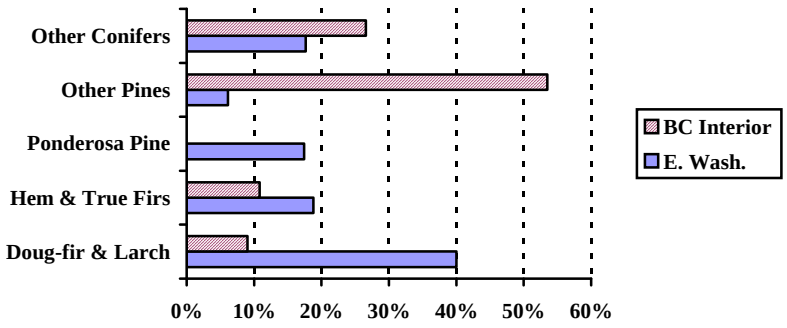

FIGURE 2-20
Comparison of Species Distribution of Eastern Washington Harvest to the Interior of British Columbia

Figure 2-21 provides the species distribution comparison for western Washington and coastal British Columbia. As with the interior comparison, the coastal distribution is radically different from the Washington distribution.

[14] Washington State data from Larsen and Nguyen (2002).

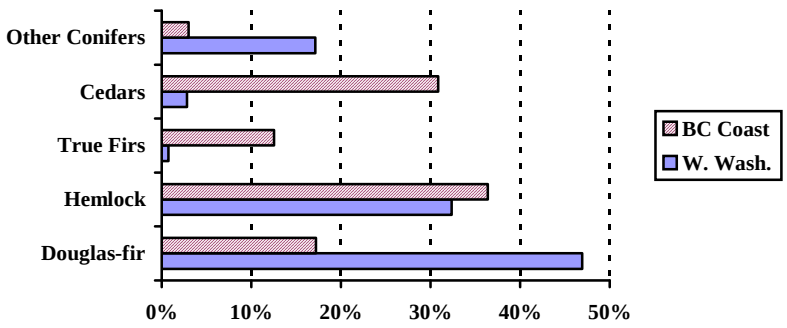

FIGURE 2-21
Comparison of Species Distribution of Western Washington Harvest to Coastal British Columbia

Québec vs. Maine

Figure 2-22 shows the hardwood/softwood harvest breakdown for Québec and Maine.[15] The Québec harvest is subdivided into the harvest from private lands and from public lands. The private lands are mostly located in the south, along the Canada/U.S. border, while the public lands are predominately in the north. It should be kept in mind that it is the public land stumpage prices that Cox and Lutz are attempting to compare with Maine stumpage prices. Thus, while there is not a large difference in the hardwood/softwood composition of the forests in the immediate vicinity of the border, there is a large and fundamental difference between Maine and the public land forest in the north of Québec.

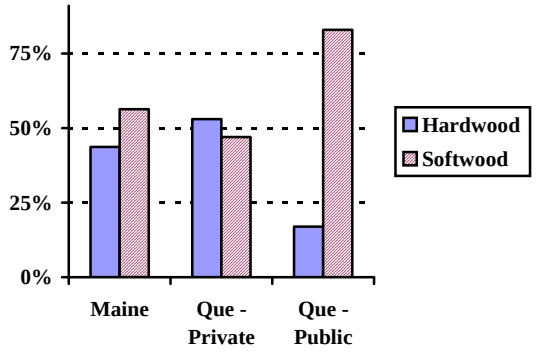

FIGURE 2-22
Hardwood/Softwood Harvest Breakdown in Maine and Québec

[15] Maine data from the 2002 Wood Processor Report. Québec data from Québec Ministere des Ressources naturalles, de la Fauna et des Parcs (2003).

Alberta vs. Montana

Figure 2-23 compares the species distribution of the Montana, Idaho, and Alberta timber harvests.[16] Alberta's scaling rules do not require the segregation of black spruce, white spruce, Engelmann spruce, lodgepole pine or jack pine. Thus, these species were aggregated together for Montana to provide a comparable distribution. Note that Montana's spruce harvest is Engelmann spruce, while Alberta's spruce harvest is mostly black and white spruce.

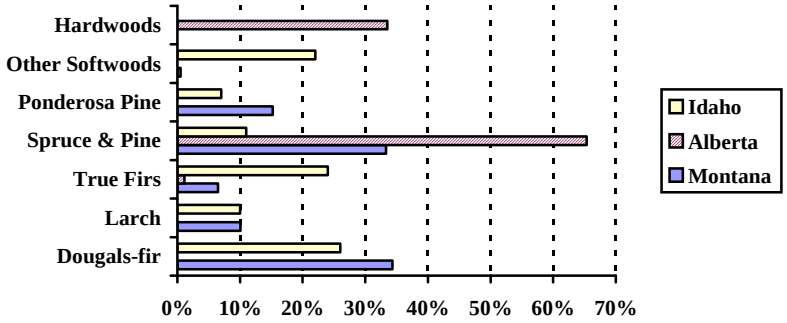

FIGURE 2-23
Comparison of Species Distribution in Montana, Idaho and Alberta

The species distribution shows that there is virtually no similarity between Montana and Alberta. The major species in Montana, Douglas fir, is virtually absent in Alberta, as are larch and ponderosa pine. Hardwoods that make up about a third of Alberta's harvest are absent in Montana. Cox and Lutz's claim that these are comparable forests must be rejected; it does not hold even between bordering U.S. states, as shown by the comparison of Idaho's and Montana's species distribution.

In its final determination, the Department used Minnesota as the cross-border benchmark for Alberta. A comparison of Alberta's species distribution in Figure 2-23 to Minnesota's species distribution in Figure 2-19 shows that this would also be a false comparison.

Conclusion on the Comparability of Forest Types

These simple species comparisons demonstrate that there are major differences in the forests of Canadian provinces and the benchmark states selected by Cox and Lutz for the 2004b Report. The fact that the range of species overlaps Canada and the United States does not mean that growing conditions and productivity are the same. Instead, the different species composition of the forests is direct evidence of different growing conditions and ecosystems, differences that Cox and Lutz gloss over in their cross-border methodology. Cox and Lutz would no doubt contend that this wouldn't matter, as they

[16] Montana data from Keegan *et al.* (2001). Idaho data from Morgan *et al.* (2004).

are doing species-specific stumpage price comparisons. This is false, as they recommend no adjustments for differences in timber quality. Further, we have already shown that the alleged species prices are not true species prices, but rather imputed averages, which are affected by species mix. The differences in forest composition highlighted above show that the forests are different and develop differently. As such, there should be no expectation that timber quality, and thus stumpage prices, be the same.

Modelling Average Stand Diameter In British Columbia

In the 2004b Report, Cox and Lutz claim that average tree diameter in British Columbia is similar to that in the benchmark states that they propose to use for cross-border comparisons. They base this conclusion not on actual tree measurement data, but on their appendix, which reports their use of a British Columbia growth and yield model of forest stand development. Unfortunately their results and conclusions are based on a gross misuse of the TIPSY (Table Interpolation Program for Stand Yields)[17] model.

The British Columbia Ministry of Forests, like agencies in other jurisdictions, has developed a number of growth and yield models to enable it to predict forest stand development under various silviculture regimes. The data on which the TIPSY model is based come from forest research plots of managed even-aged stands. The term "managed stands" refers to second-growth stands that have been regenerated as plantations or by carefully controlled natural regeneration. The plots have been controlled for uniformity of species and site conditions within each plot. These sites are also free of disease or pest damage. The yields that come from such plots form the upper limit on the growth potential for second-growth stands. The developers of this model have carefully noted this fact and have included two factors (known as operational adjustment factors) to be used when attempting to predict operational conditions rather than research plot conditions. These factors lower the predicted yields that will be achieved in an operational setting. Cox and Lutz do not report whether they used either one of the operational adjustment factors; nor do they provide sufficient information on their simulation to allow replication. In addition, because TIPSY is based on second-growth research plots, there is little information on stands developed at older ages. Thus, caution is required when extrapolating to stand ages of 250 years, as is done by Cox and Lutz in the 2004b Report.

Cox and Lutz were in error in using the TIPSY model at all in an attempt to impute current stand conditions. The stands currently being harvested in British Columbia are not managed even-aged second-growth stands. Instead, they are generally old-growth, naturally-regenerated, uneven-aged, multi-species stands, with each stand having its own history of pest, fire and disease damage.

The Timber Supply Reviews specifically state that TIPSY is used to predict yields for new stands and current stands less than 35 years of age. The Timber Supply Reviews

[17] Cox & Lutz in fact note the website from which the program and all of its documentation can be downloaded. Thus they had complete access to all materials needed for the appropriate use of the model. The website is http://www.for.gov.bc.ca/hre/gymodels/TIPSY/.

also carefully note the operational adjustment factors used in projecting yields from new stands. Cox and Lutz have examined these Reviews, and thus cannot claim that they were unaware of the limitations and caveats to the use of TIPSY or that it was in fact inappropriate to use TIPSY in an attempt to impute current stand conditions.

Given that Cox and Lutz's conclusions are based on projected second-growth stand conditions that could occur in 250 years, and that they misuse the TIPSY growth and yield model, their conclusions regarding average stand diameter in British Columbia must be rejected as unfounded.

2.7 Distances between Canadian and US Benchmark Mills

In the 2004b Report, Cox and Lutz state "Canadian timber prices would equilibrate with U.S. timber prices but for Canada's timber policies and practices" (Cox & Lutz 2004b, p. 1). However, as noted in our previous report[18], log markets are generally quite limited in geographic scope owing to the low value-to-weight ratio of logs. It naturally follows that the same also applies to timber, as timber is simply the uncut log on the stump. The assertion that prices would equilibrate is defended based on the observation that there are many sawmills in Canada and the United States that are located within close proximity of one another and, hence, would be competing for the same logs and timber in open markets.

To address the validity of this supposition, we calculate the distances between Canadian sawmills and their closest counterparts in the U.S. states proposed as benchmarks by Cox and Lutz. Distances calculated are straight-line distances between locations based on their latitude and longitude coordinates. Hence, they represent the shortest possible distances between mills. Data for Canada were taken from the Atlas of Canada's Sawmills, 2002 map produced by Natural Resources Canada.[19] The map data include sawmills that produced 10,000 cubic metres or more of lumber in any year from 1999-2002. For the locations of U.S. mills, we relied on data provided in Exhibit 27 of the Cox & Lutz 2004b Report, which show sawmill coordinates in selected U.S. states.

In our analysis, we conducted the following comparisons of sawmill locations:

Canadian Province	Benchmark State
British Columbia	Washington
Alberta	Montana
Saskatchewan and Manitoba	Minnesota
Ontario	Minnesota
Québec	Maine

[18] Canadian Forest Service (2004).

[19] The Atlas of Canada Sawmills, 2002 map can be accessed on the internet at: http://atlas.gc.ca/site/english/maps/forest/useforest/sawmills.

Table 2-13 shows a summary of the results from our comparisons. For the six provinces analyzed, the average distance between a Canadian mill and the closest U.S. mill in a benchmark state was 377 kilometres. There was considerable variation by province, with the shortest mean minimum distances observed in British Columbia and Québec at 280 and 281km, respectively. For the four remaining provinces, distances were much larger, with average minimum distances ranging from 665km to 915km.

Table 2-13 also shows the percent distribution of mills for each province by minimum distance. Even for a province such as British Columbia, which has the highest concentration of sawmills close to the U.S. border, less than 20% of mills are located within 50km of their closest U.S. counterparts in Washington State. This proportion is much lower in all other provinces, with Québec coming a distant second at 6%. On the flip side, the vast majority of mills in the remaining four provinces are at least 500km away from the nearest U.S. mill in the benchmark state.

TABLE 2-13
Straight-line Distances (km) between Canadian mills and the Closest US Mills in Benchmark States used in the Cox & Lutz (2004b) Report

Province	British Columbia	Alberta	Sask. and Manitoba	Ontario	Québec	Canada
Number of mills	185	40	9	60	175	469
Benchmark State	Washington	Montana	Minnesota	Minnesota	Maine	---
Mean Minimum Distance to Closest US Mill	280	697	915	665	281	377
% Distribution by Distance						
0-50	19%	0%	0%	3%	6%	10%
50-100	12%	3%	0%	0%	15%	11%
100-200	24%	0%	0%	10%	19%	18%
200-300	10%	5%	11%	3%	17%	11%
300-400	4%	3%	0%	8%	21%	11%
400-500	7%	5%	0%	5%	7%	7%
>500	24%	85%	89%	70%	14%	33%

To put these results in perspective, data provided in the Cox & Lutz 2004b Report show that the average haul distance for public timber sales in Washington, Idaho, and Montana during the POR was 22.7 miles, which is equivalent to 35.6km. This is less than one tenth of the average distance between Canadian sawmills and the *closest* U.S. mills to which they are being compared. In addition, the distances reported in Table 2-4 represent the straight-line distance between mills, which understates the true distance that logs would have to be hauled, were there unfettered competition for logs and timber on both sides of the border. The degree to which the straight-line distance understates the true

distance can be very significant. For example, the Atlas of Canada map reports that there is a large mill in Grand Forks, British Columbia, which is located in the southern interior very close to the U.S. border. When measured on a straight line, the nearest U.S. mill is located only 37km away, in the community of Northport, Washington. However, the driving distance between these two locations is 125km (obtained through Mapquest[20]), which is more than 3 times as long as the straight-line distance.

Another important caution is that simply looking at numbers of mills can be misleading, as this could misrepresent the amount of lumber production and, hence, timber harvest occurring close to U.S. benchmark states. This is particularly relevant in the cases of British Columbia and Québec, as the average mill size is smaller closer to the border. Table 2-14 reports the average minimum distance by size class of mills in British Columbia and Québec. These results show that there is a high correlation between mill size and distance, with large mills on average being located much further from their U.S. counterparts. The differences are quite striking, with the average distances for the smallest mills being 190 and 234km in British Columbia and Québec, respectively, while for the largest mills, mean minimum distances are 385 and 456km.

TABLE 2-14
Average Minimum Distance by Mill Size Class

Mill Size (1,000s m3)		British Columbia		Québec	
Class	**Capacity Range (1,000s m3)**	**Number**	**Distance**	**Number**	**Distance**
1	10.0 - 29.9	46	190	82	234
2	30.0 - 99.9	33	242	54	261
3	100.0 - 299.9	40	274	33	401
4	300.0 - 1,030.8	56	385	6	456
Correlation (Distance, Size)		0.29		0.35	

To fully account for mill sizes in British Columbia and Québec, we estimated the average distance per unit of productive capacity by weighting the distance of each mill by the mid-point of its capacity range reported in the Atlas of Canada. We also estimated the proportion of productive capacity of sawmills located within given distance intervals of U.S. benchmark mills. Table 2-15 summarizes these results and compares them with results based simply on the number of mills. The values under the "number" columns are the numbers from Table 2-15 for British Columbia and Québec, while the values in the "Capacity" column are the values that take into account mill size. In both cases, the average minimum distance per unit of sawmill capacity is significantly further than the simple average per mill. In British Columbia, the mean minimum distance increases

[20] http://www.mapquest.com

from 280km to 351km (25% increase), while in Québec we observe an even larger increase from 281km to 365km (30% increase). In both provinces, the percent located greater than 500km away from U.S. benchmark mills more than doubles in the case of Québec and nearly doubles for British Columbia.

TABLE 2-15
Average Minimum Distance (km) by Mill and by Unit of Capacity in British Columbia and Québec

Province	British Columbia		Québec	
	Number	Capacity	Number	Capacity
Mean minimum distance	280	351	281	365
% Distribution by distance				
0-50	19%	15%	6%	4%
50-100	12%	11%	15%	12%
100-200	24%	15%	19%	8%
200-300	10%	8%	17%	14%
300-400	4%	5%	21%	23%
400-500	7%	7%	7%	9%
>500	24%	38%	14%	31%

A final caution is that none of the calculations above distinguish between hardwood and softwood sawmills. While the majority of sawmills in Canada process softwood, Ontario and Québec have significant numbers of hardwood and mixed mills. In addition, these mills tend to be located further south and much closer to the U.S. border. In Québec, only 108 of the 175 mills reported processed softwood only, while in Ontario only 47 of the 60 reported sawmills were softwood only. Had we taken this into account in our calculations, the distances between Canadian mills and their U.S. counterparts in benchmark states would have been even greater.

In summary, our analysis shows that even when measuring distances between Canadian and U.S. benchmark mills on the shortest possible basis, the minimum distances between mills are still very large and certainly much greater than the hauling distances reported in data from U.S. timber sales provided by Cox and Lutz in the 2004b Report. Furthermore, in British Columbia and Québec, which are the two largest softwood lumber-producing provinces, the largest sawmills tend to be located much further away from the U.S. border. In addition, a significant number of border mills in Ontario and Québec are hardwood sawmills. Thus, the anecdotal observations made by Cox and Lutz and others that there are many sawmills close to the Canada-U.S. border lends little credence to their argument for using cross-border price comparisons. The evidence presented here, combined with our previous work on log markets, clearly shows that cross-border price comparisons have no validity.

2.8 Timber Supply and Competition

In the section of the 2004b Report on "Factors Relating to Availability and Marketability," Cox and Lutz come to a number of conclusions with respect to timber supply and competition as a factor to consider in comparing timber prices in Canada and the United States. With respect to Québec, they make the following statements:

> *There is no indication that there is an overabundance of sawtimber relative to the United States. In Québec, sawmills must import substantial volumes of sawlogs from the United States. If there is a relative timber shortage, it would be in Québec. (p. 25)*

With respect to British Columbia, Cox and Lutz cite data showing that the average number of bidders in B.C. auctions is much higher on both the Coast and the Interior regions relative to comparable auctions in the Pacific Northwest. Based on this data, they conclude that:

> *This indicates that available subject timber was scarcer in BC than in the corresponding benchmark areas. (p. 26)*

They attribute this to differences in growth rates for trees in Canadian and U.S. forests. Summing up, they state that:

> *This means that over the course of several growing cycles more timber will be grown and available per square mile in the United States because the forestland is more productive.(p. 26)*

In summary, Cox and Lutz argue that:

- competition for timber is more intense in Canada than in the United States;
- this is illustrated by the fact that reported Canadian auctions have more bidders, and by the import of logs by Québec mills;
- this stronger competition is due in large part to the higher growth rates of U.S. forests compared to Canadian counterparts.

These observations directly contradict many other assertions made by the authors. The first two observations are arguments in favour of using prices from Canadian auctions and private markets as benchmarks for Canadian public stumpage prices. The third observation also runs counter to their assertions that Canadian forests are comparable with those in U.S. benchmark states. Collectively, these observations illustrate that there are significant differences between Canadian and U.S. markets.

SECTION 3
MISUSE OF US PUBLIC TIMBER SALES DATA

3.1 Introduction

This section examines the use of timber sales data from public agencies in the United States to determine if they can be used as indicators of market prices in the United States. As detailed below, it is shown that they cannot and should not be used as representative of overall market prices in any region of the United States. Serious biases occur in the public agencies' prices that cannot be corrected for, and the use of individual species prices is shown to be invalid due to the skewing of species prices caused by the manner in which auction prices are awarded.

3.2 Are US Public Land Stumpage Prices Representative of Fair Market Prices?

Cox & Lutz have portrayed stumpage price data from U.S. public lands as representative of "fair market prices." However, the USDA Forest Service has concluded that they are not representative. Consider the following direction given by the USDA Forest Service to appraisers in the Forest Service's Appraisal Handbook:

> *Stumpage or forest products sold by the United States or other public entities are not reliable indicators of value and should not be used as the primary support for the value conclusion.*
>
> *If sales of private stumpage or forest products are insufficient or inappropriate for comparison, use Forest Service or other public agency, such as Bureau of Land Management (BLM) or States sales, but adjust for differences to the extent appropriate. The selected sales should be as comparable as possible to the subject tract.*
>
> *When using Government sales, recognize that the bid price is not cash. In fact, a buyer of Government sales seldom pays the actual bid price*.[21]

Thus the USDA Forest Service, the largest forestland manager in the United States, does not believe that public stumpage bid prices are reliable, and believes that bid prices overstate the actual prices paid for public timber.

That this conclusion by the USDA Forest Service is valid can be seen by comparing bid and cut stumpage prices. A "bid" stumpage price is the average bid price received in a given period for sales of public timber. Note that a bid price is not the price paid during the current period for public stumpage, as the timber from current stumpage sales is not instantaneously harvested. Rather, it is harvested over the length of the contract. For

[21] U.S. Forest Service Handbook FSH 5409.12 – Appraisal Handbook, Section C-2 Additional Specifications for Stumpage or Forest Products Appraisal. In Amendment No. 5409.12-93-6. Available at http://www.fs.fed.us/im/directives/fsh/5409.12/5409.12,6.9,ex.03-06.txt

USDA Forest Service timber sales, the contract lengths can exceed five years. The "cut" stumpage price is the stumpage price paid on timber actually harvested in a given period.

If the bid prices were accurate measures of the actual price paid for all sales, then the cut price should be a weighted average of past bid prices. If we then graphed cut and bid stumpage prices, we should see bid rates above cut rates when current prices are rising and cut rates above bid rates when current prices are falling. Over a long period, we should see bid rates above cut rates half the time and below cut rates the other half of the time. Over a reasonably lengthy period of time, the cut and bid rates should be approximately equal. But is this what is observed in practice?

Figure 3-1 graphs average quarterly cut and bid stumpage prices for the USDA Forest Service stumpage sales over the period 1973 to 2002.[22] Note that the bid rate is rarely less than the cut rate. In fact, the bid rate is less than the cut rate in only 17 quarters over the period shown. That is, the bid rate is above the cut rate 88% of the time and below it only 18% of the time. This is very far from the 50/50 split that should have been observed if bid prices were not upward-biased indicators of the price actually paid for timber harvested from public lands. That this conclusion holds over the thirty years shown means that it cannot be rejected as a short-term anomaly.

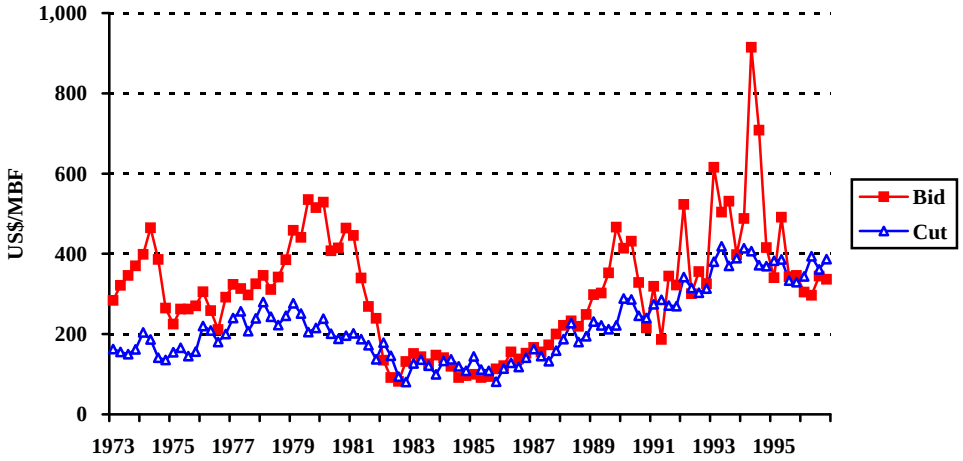

FIGURE 3-1
USDA Forest Service Bid and Cut Quarterly Stumpage Prices for the Pacific Northwest Westside 1973-96
(Constant 1996 US$/MBF)

Figure 3-2 shows the ratio of bid to cut stumpage prices over the period shown. If bid price was not an upward-biased indicator of the stumpage price paid for public stumpage, then the ratio should fluctuate around 1, being above 1 half the time and below 1 the other half of the time. Clearly, it is not.

[22] Data from Haynes and Warren (1989) and Haynes (1998).

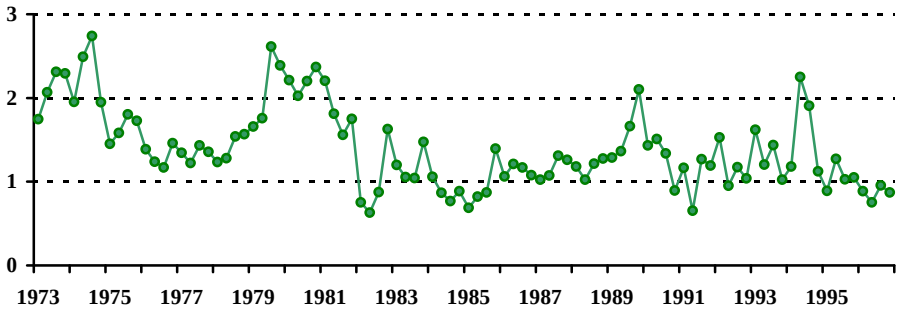

FIGURE 3-2
Ratio of Bid to Cut Quarterly Stumpage Prices
in the Pacific Northwest Westside 1973-96

Figure 3-3 plots the quarterly average cut price against the quarterly average bid price for each quarter over the period 1973 to 1996. Also shown in the figure is a 45° line that indicates when bid and cut prices are equal. Three observations with bid price averages of greater than US$600/MBF are not shown. These observations had corresponding cut prices well below the bid price, and thus would also be above the 45° line shown in the graph.

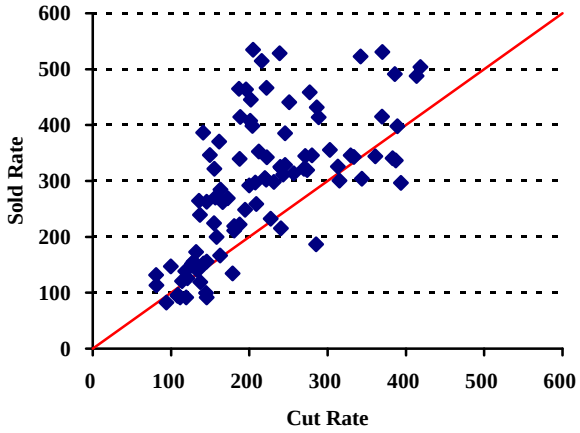

FIGURE 3-3
USFS Bid and Cut Quarterly Stumpage Prices
in the Pacific Northwest Westside 1973-96
(Constant 1996 US$/MBF)

Regressing bid prices on cut prices yields the following results:

$$Cut = \underset{(5.93)}{90.67} + \underset{(9.52)}{0.4269}\, Bid \qquad R^2 = 0.49 \quad F = 90.6$$

The figures in brackets below the estimated coefficients are the "t" statistics, which show that the coefficients are significant at better than the 95% confidence level. If the bid rate was an unbiased estimate of the cut rate, then the constant terms should be equal to zero and the coefficient for the bid price should be equal to 1. Neither of these conditions holds, and the bid price is clearly a biased indicator of the cut price. In addition, the low value for the coefficient for the bid price indicates that the sold price greatly exceeds the cut price.

Figure 3-4 provides quarterly cut and bid prices for the whole of the USDA Forest Service's Region 6, the Pacific Northwest.[23] It shows that the cut and bid price difference remained a problem during the Period of Review.

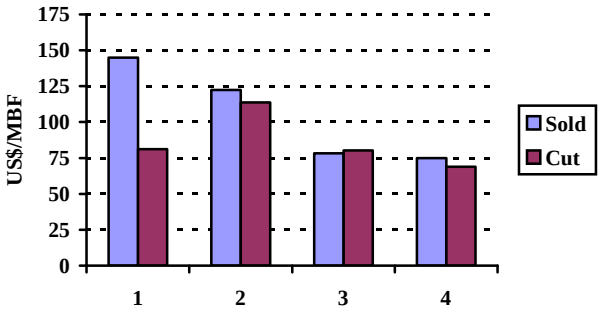

FIGURE 3-4
Average USFS Bid and Cut Stumpage Prices in the US PNW
by Quarter for the Period of Review

3.3 Exclusion of Public Timber Sales Not Sold by Auction

The timber sale data used by Cox and Lutz in the 2004b Report include only public sales sold by auction, and excludes all direct, or negotiated, sales. Direct sales are perhaps the most common method of sale in private timber sales, and there is no reason for the exclusion of direct public sales from Cox and Lutz's price data. The need for direct sales in US public timber sales occurs when the public agencies overestimate the upset rate (reserve price) at which the auction begins. In those cases, all bidders refuse the sale offer. The agencies are then typically empowered to sell the sale, over the next year, as a direct sale. Exclusion of the direct sales has the effect of truncating the data set and biasing upwards the average price.

[23] The quarterly cut and sold harvest reports can be downloaded from the USDA Forest Service Headquarters website. The reports provide only regional totals.

3.4 Skewed Species Prices

A second problem with the timber sales data used by Cox and Lutz is that individual species prices can be "skewed" or distorted. This problem is particularly important, as the Cox & Lutz 2004b Report recommends the use of species prices to adjust for differences in species mix across borders. Skewed species prices are a longstanding and well-known problem in the United States.[24] It results from the practice of having bidders on multi-species sales submit individual-species prices, with the sale awarded to the bidder with the highest weighted-average bid price based on the pre-sale estimate of the volume in the sale by species.

This bid price skewing is best demonstrated with a hypothetical example, as shown in Table 3-1. Prior to a timber sale, the agency conducts a timber cruise that provides an estimate of the volume of timber in the sale by species. This is shown in the column headed Cruise Volume. Bidders, in inspecting the sale, note that there has been an error in the cruise in that the volume of one species is over-estimated. This is shown in the column headed Actual Volume. In this example, the volume of cedar has been overestimated in the cruise. However, the sale will be awarded to the bidder who submits the highest total bid based on the cruise volume estimate. That is, each bidder submits a list of species bid prices. The species bid prices are then multiplied by the cruise volume to get a total bid value for each species. The species totals are then summed to get the total bid value. This is shown in the column headed Cruise Total Value. The average bid price in the example is $233/MBF.

In preparing his bid, the bidder estimates the average value of each species. Assume his estimate was US$200/MBF for all species. Assume he also recognized that the cruise estimates were incorrect, and realized that he can increase his profits by substantially increasing his bid on the overestimated species and decreasing his bids on the underestimated species. Thus, instead of bidding US$200/MBF for each species, he skews his species bid prices as shown in the column headed Bid Price. However, when he harvests the stand he pays the individual species bid price multiplied by the actual volume, not the cruise volume. This is shown in the column headed Actual Total Value. The result is that he pays substantially less for the total sale volume than indicated by his cruise total value. The average price actually paid in this example is significantly less than the sale price.

---

[24] For example see:

United States General Accounting Office, 1983. "Skewed Bidding Presents Costly Problems for the Forest Service Timber Program" Report no. RCED-83-37, February 1983

Rynearson, G., *et al*, 1997. "A Nationwide Study Comparing Tree Measurement and Scaled Sale Methods for Selling United States Forest Service Timber". Report prepared by Natural Resources Management Corp for the U.S. Forest Service.

Athey, S. and J. Levin, 2001. "Information and Competition in U.S. Forest Service Timber Auctions" Journal of Political Economy, Vol. 109, No. 2, pp 375-417.

TABLE 3-1
A Hypothetical Example of Species Bid Price Skewing

Species	Bid Price	Cruise Volume	Cruise Total Value	Actual Volume	Actual Total Value
	($/MBF)	(MBF)	($)	(MBF)	($)
Douglas-fir	100	1,000	100,000	1,500	150,000
Cedar	500	1,000	500,000	200	100,000
Hemlock	100	1,000	100,000	1,300	130,000
Total		3,000	700,000	3,000	380,000
Weighted Bid Price			$233.33/MBF		$126.66/MBF

This example shows that species bid prices can be unrepresentative of the actual species value. Cox and Lutz did not address or account for this well-known problem.

3.5 Arbitrary Selection of Cross-Border Comparisons

Examining the cross-border benchmarks selected for coastal British Columbia shows the arbitrariness of the cross-border stumpage price comparisons presented by Cox and Lutz in the 2004b Report. For example, Cox and Lutz could have used stumpage prices from Alaska as the benchmark for coastal British Columbia. This is the U.S. state with the longest shared border with British Columbia. In addition, the Alaska National Forests on the Alaska panhandle would fall within the same ecosystem zones as the forest of coastal British Columbia. Thus, the Alaska timber sale data should have served as well as the western Washington data. However, Alaska stumpage prices from National Forests during 2001 averaged only US$35/MBF, while western Washington stumpage prices averaged US$136/MBF.[25] If one used Cox and Lutz's logic, one would have to conclude that Alaska stumpage prices were being subsidized by US$101/MBF in comparison to western Washington. Over the period shown in the graph, the "subsidy" averaged US$195/MBF. Indeed, the Alaska stumpage prices would also be "subsidized" in comparison to coastal British Columbia stumpage prices. However, these are false conclusions. Instead, the added distance to market, differences in site-specific conditions, the changes in timber quality as one moves further and further north, and differences in economic conditions account for the stumpage price differences. If this is true in comparing stumpage prices between two U.S. states, then it is even more true when comparisons are made across national boundaries.

[25] Source: Warren (2003) Tables 98 and 92. Western Washington price is the volume weighted average of the National forest and Washington Department of Natural Resource prices.

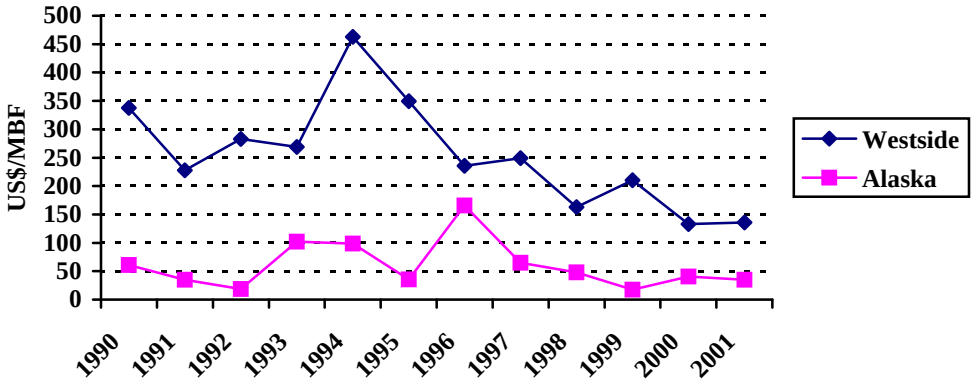

FIGURE 3-5
All Species Sold Average Stumpage Price

It is not surprising then that Cox and Lutz attempt to dismiss the use of Alaska prices as a potential price benchmark.

3.6 Are Public Stumpage Prices Representative of Market Prices?

If a researcher is using a sample of stumpage sales to represent the average value of all timber sold within a jurisdiction, then the researcher should ensure that the sale sample is in fact representative of all sales in the jurisdiction. Failure to do so would result in an inaccurate price benchmark. Cox and Lutz did not do so in the 2004b Report, relying instead on their averaging logic discussed in detail in Section 2.

We examine Cox and Lutz's analysis in the 2004b Report in four ways. First, we provide the breakdown of harvests by ownership class in western and eastern Washington to see how much of the total harvest comes from the two agencies from which Cox and Lutz draw the timber sale data. Second, we examine information available on the characteristics of public and private timber in Washington State. Third, we look for auxiliary material that could provide a guide to the relative, if not absolute, values of timber on public and private lands. Washington State timber tax assessments provide the means for such an approach. Finally, we examine the available literature on the sales methods used by private landowners as compared to public agencies.

Washington State Harvest by Ownership Class

The importance of ensuring representativeness is seen in Figures 3-6 and 3-7 below. The figures provide a breakdown of total harvest by ownership class in eastern Washington, western Washington, Montana and Idaho. The Washington data are for 2000 and come from the Washington State Department of Natural Resources (Larsen and Nguyen, 2002). The Montana and Idaho data are for 2001 and are taken from the USDA Forest Service (Warren, 2003). As shown, the agencies from which Cox and Lutz drew their stumpage sale sample represent only 14.2% of the total western Washington harvest and only 15.5% of the eastside harvest. For Montana and Idaho, the selected agencies' harvest share was a little higher, at 21.1% and 29.6% of the total harvests respectively. In all cases, the large majority of the harvest comes from private lands with a smaller amount from other public agencies. Cox and Lutz are thus drawing their stumpage sale sample from two small sub-populations of the total harvest in each region and extrapolating the sample prices to a much larger total population.

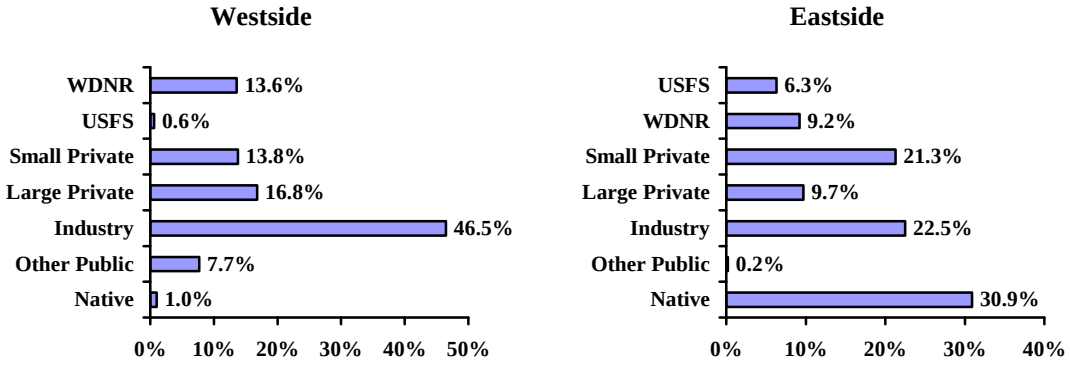

FIGURE 3-6
Distribution of Washington Harvest By Ownership Category 2000
Source: Washington State Department of Natural Resources

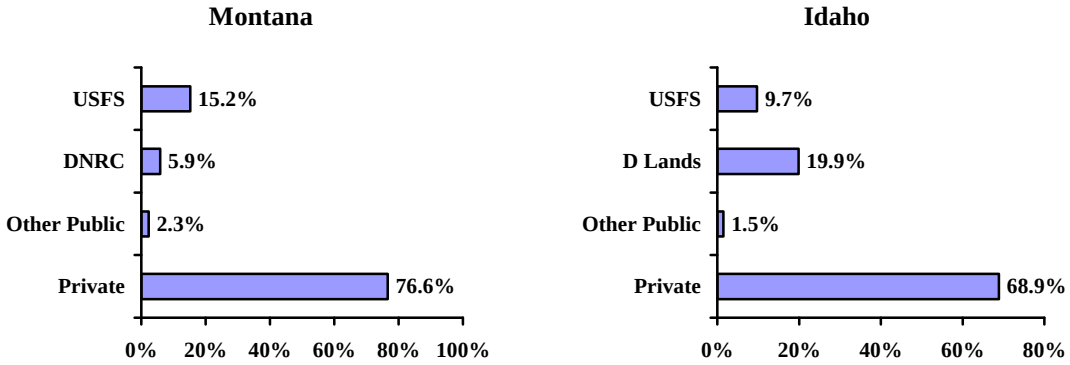

FIGURE 3-7
Distribution of Montana and Idaho Harvest By Ownership Category 2001
Source: USDA Forest Service

Comparison of Timber Characteristics

In Figure 2-9, it was shown that there was substantial variation in the species distribution of the timber sales taken from the different agencies and regions by Cox and Lutz in the 2004b Report. We now compare the samples for eastern and western Washington for total harvest in Figure 3-8 below. Data for the total harvest by species are again taken from Larsen and Nguyen (2002). The figure shows that the sample data are highly skewed towards Douglas-fir & larch. Hemlock & true firs are also over-represented. The sample is almost devoid of Ponderosa pine volume, which makes up 17.4% of the total harvest. The other pines and other conifers are also seriously underrepresented by the sample distribution.

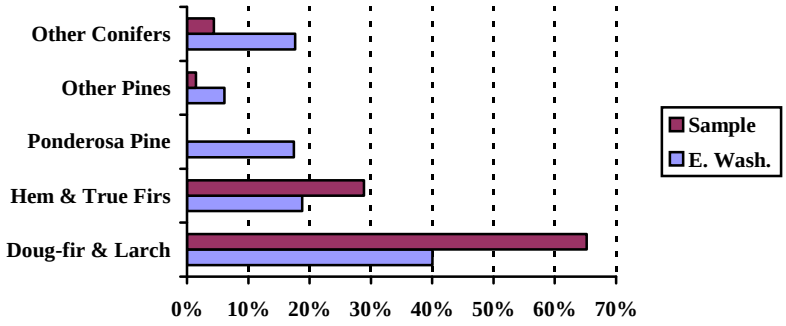

FIGURE 3-8
Comparison of Species Distribution of the Total Eastern Washington Harvest to the Species Distribution in the Sample of Timber Sales Taken from Eastern Washington

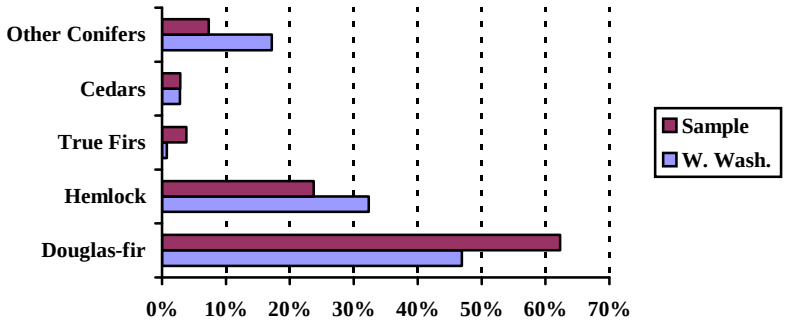

FIGURE 3-9
Comparison of Species Distribution of the Total Western Washington Harvest to the Species Distribution in the Sample of Timber Sales Taken from Western Washington

Figure 3-9 compares the species composition for western Washington. Again, Douglas-fir is over-represented in Cox and Lutz's sample data, while other conifers and hemlock are underrepresented.

Implications

The timber sale samples selected by Cox and Lutz in the 2004b Report are shown to be unrepresentative of the total state harvest. Cox and Lutz would attempt to dismiss this concern by stating that species mix doesn't matter when comparing species prices. But as earlier shown in Section 2.6 this is a factually incorrect statement. The Washington Department of Natural Resources sells its timber using the lump sum stand-as-a-whole sale method. As such, the species mix does matter, as do the species weighted-average values that Cox and Lutz incorrectly portray as species prices. Note that the WDNR sales contained in Cox and Lutz's sample make up 63% of the eastern Washington sample volume and 98% of the western Washington sample volume. On this basis, not only should the overall stumpage prices derived from Cox and Lutz's sample be rejected as unrepresentative of the overall state stumpage price, but the individual species prices must also be rejected as unrepresentative and biased measures of individual species values.

Washington State Stumpage Tax Assessment Data

Since 1971, Washington State has imposed an excise or yield tax on private timber sales within the state.[26] In 1982 the timber excise tax was extended to harvests from all state and federal lands. The tax is 5% of the assessed "stumpage value" of the timber. These state-assessed values can and do vary from the actual prices received for the timber. Thus, the assessed values are *not* reliable indicators of true stumpage prices and should not be used for such. However, because the values are assessed in the same manner over time, they can perhaps provide an indicator of the *relative* value of timber on public and private lands within Washington State. That is, if the assessed stumpage value is higher for one group than for another over time, then it is an indication that one group has higher-valued timber than the other group.

Figure 3-10 shows the quarterly average assessed stumpage values from public and private lands in Washington State from 1993 to 2002. It shows that public assessed stumpage values are generally higher than private values. Figure 3-11 graphs the ratio of public to private assessed values. In 30 of the 40 quarters shown, public assessed values were greater than private values. The average ratio over the period shown was 1.23, which indicates that on average public stumpage values were 23% higher than private values.

[26] Further details of Washington's timber excise tax can be found on the Department of Revenue's website at http://dor.wa.gov.

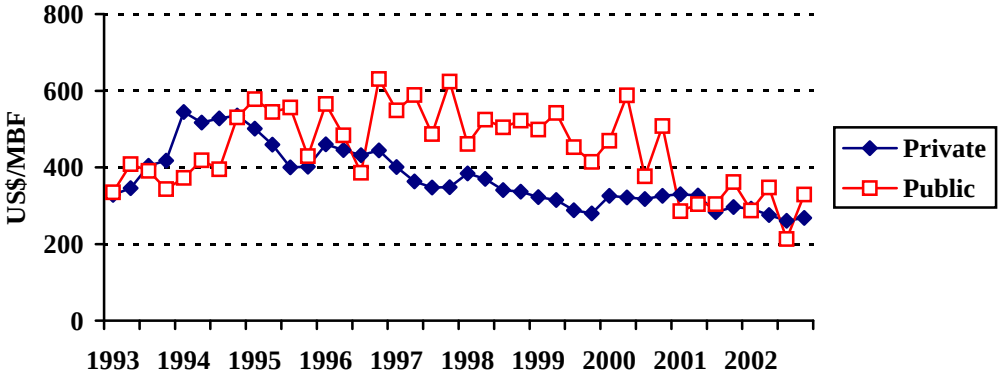

FIGURE 3-10
Assessed Stumpage Values for Public and Private Timber Harvests in Washington State 1993-2002

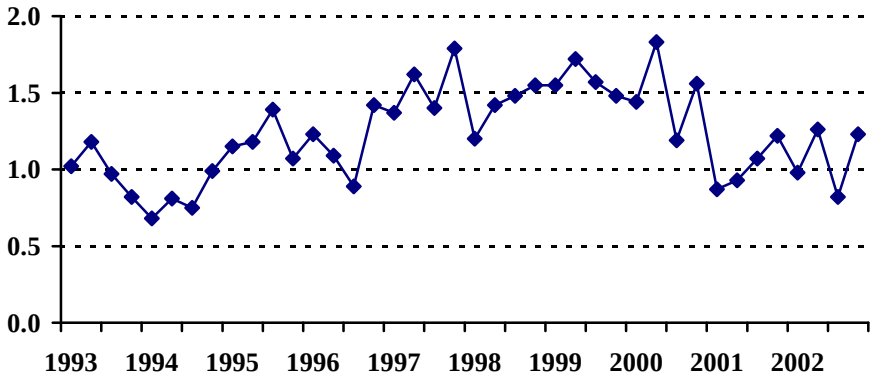

FIGURE 3-11
Ratio of Public to Private Taxable Harvest Values in Washington State 1993-2002

SECTION 4
Failure to Use the Available Economic Literature

4.1 Introduction

There is substantial economic literature on the factors that affect stumpage prices. In addition, because U.S. researchers have undertaken most of this work, its relevance to U.S. conditions cannot be dismissed. However, Cox and Lutz failed to make use of it to bolster their claims. They instead choose to rely on their own previous work, and on newspaper clippings and press releases. The Cox & Lutz 2004b Report does not contain a single citation to a scholarly peer-reviewed journal.[27]

The purpose of this section is to summarize the economic literature on stumpage prices and demonstrate that it fails to support the conclusions of Cox and Lutz in the 2004b Report.

4.2 Main Conclusions of the Literature

Do Site-Specific Factors Affect Stumpage Prices?

Development of bid value functions appears to have begun in the U.S. South, mainly with pulpwood sales (Rowe and Guttenberg (1961), Fasick and Sampson (1966) and Anderson (1969a, 1976b)), but also with sawtimber sales (Guttenberg (1956) and Anderson (1969b, 1976a)). The use of bid value functions seems to have then spread to the U.S. Forest Service's northern Region, and from there to western Oregon, where they were used as part of the equation-based transaction evidence appraisal method used by the U.S. Forest Service and the U.S. Bureau of Land Management (Combes *et al.* 1989).

Since then, numerous authors have developed stumpage pricing functions that relate stand conditions to timber species, quality, site-specific harvest conditions, and log haul distance. The authors' results have repeatedly shown a statistically significant relationship between these explanatory variables and the resulting stumpage prices. Examples of these functions include: Jackson and McQuillan (1974), Johnson (1979), Mead et al. (1981 and 1983), Buongiorno and Young (1984), Huang and Buongiorno (1986), Hansen (1986), Brannman et al. (1987), McQuillan and Johnson-True (1988), Huang and Buongiorno (1986), Puttock et al. (1990), Sendak (1992), Munn and Rucker (1994 and 1995), Schuster and Niccolucci (1994), MacKay and Baughman (1996), Brannman (1996), Munn and Palmquist (1997), Baldwin et al. (1997), Stone and Rideout (1997), Carter and Newman (1998), and Athey and Levin (2001).

[27] The Bare and Smith (1999) citation given in Cox and Lutz might be from a journal but they provide an incomplete citation so this cannot be confirmed. Cox and Lutz also make reference to two USDA Forest Service papers that do undergo external review prior to publication. Nevertheless two citations from the massive research work conducted by the USDA Forest Service on stumpage values is inadequate to say the least.

Does Ownership Type Affect Timber Sales Values?

Jackson (1987) used timber value functions to assess differences between Montana State stumpage prices and U.S. Forest Service stumpage prices. Sendak (1992) examined differences in bid prices received by state and federal timber sales in Vermont and found that state sales had a higher average sale price.

Marketing by Private Landowners – Effect of a Forestry Consultant

Munn and Rucker (1994) examined the effect of a private landowner decision to hire a consultant on the stumpage price eventually received. They found that it had a significant and positive effect on price. Other studies showing similar results include Munn and Franklin (1995), Hubbard and Abt (1989), Hardie and Wieland (1987), Cubbage *et al*. (1985) and Kittredge and Haslam (2000). The majority of the increased sale price was due to the use of sealed-bid sales methods by forestry consultants; this indicates that auction results are not representative of the timber sales by private landowners who do not employ a forestry consultant.

Will the Exclusion of Direct Sales from the Timber Sale Sample Bias the Price?

Huang and Buongiorno (1986) explored the effect of excluding timber sales on average bid values in cases where a substantial number of the timber offerings did not receive a bid. They argue that excluding these offerings from a data set, or alternatively, setting the bid value for these offerings to zero, would in both cases result in biased predictions from any regression equation based on the truncated or censored database. This problem frequently occurs in U.S. Forest Service timber sales offerings, as the Forest Service is required by law not to sell any offering for less then the Forest Service's appraised value. Thus, offerings with no sales will occur whenever the true market value of the stand is less than the Forest Service's appraised value. The authors conclude that censored or truncated databases will bias any results that do not account for this effect.

As discussed above in Section 3.3, the exclusion of direct sales from the timber sale sample by Cox and Lutz in the 2004b Report provides a similar truncation of the sample, and thus biases upward the benchmark stumpage price they report.

Do Variations in Local Market Competitiveness Affect Prices?

McQuillan and Johnson-True (1988) stressed the importance of accounting for variations in local market conditions when assessing stumpage values. Their final regression equation included three variables that attempt to reflect the relative competitiveness of local markets and the relative scarcity of timber resources. The study area, located in northern Montana, was divided into nine milling sub-areas. The authors conclude that "variables that describe the local marketplace can be significant when application is sought over a broad sub-region." This finding belies Cox and Lutz's suggestion that averaging over broad areas cancels out such effects. It also attacks the very heart of the

Cox and Lutz's cross-border-methodology, as it rejects the notion of stumpage market integration.

Does Sales Method Affect Prices: Oral vs. Sealed Bid Auctions?

The U.S. Forest Service uses both oral and sealed bid auctions in its timber sales program, while state agencies typically use sealed-bid auctions. The Idaho Department of Lands is an exception that uses oral auctions exclusively. Can this simple change in method of auction affect auction results?

The effect of auction methods has been an extensively studied area of research. Tests of differences in the results of oral versus sealed bids for timber sales includes the works of Mead (1967), Haynes (1979, 1980a, 1980b, and 1983), Mead et al. (1981, 1983) Wiener (1969, 1979), Johnson (1979a), Hansen (1985, 1986), Haung and Boungiorno (1986), Paarsch (1989a, 1989b), Schuster and Niccolucci (1994), Brannman (1991, 1996) and Stone and Rideout (1997).

The majority of the authors conclude that the auction method does affect auction results, but that this effect declines as the number of bidders participating in an auction increases. Given the low number of bidders in Cox and Lutz's stumpage sale sample shown in Table 2-2, this may be of concern when comparing between jurisdictions.

Does the Number of Bidders Participating in an Auction Affect Prices?

Auction theory suggests that winning bid values will increase, all other factors held constant, with an increased number of bidders participating in the auction. However, the pattern of the winning bid value increase would be dependent on the type of auction, the characteristics of the good being sold, plus the characteristics of the bidders and the industry (Brannman et al. 1987). Numerous other articles also address this issue, such as Johnson (1979), Mead and Hamilton (1968), Mead et al. (1981, 1983), Brannman (1991, 1996), Wiener (1969, 1979) and Carter and Newman (1998).

In the 2004b Report, Cox and Lutz note that competition in timber auctions in British Columbia is greater than that in their data set, yet conclude at page 47 that B.C. timber sales are not viable benchmarks. This is not a tenable conclusion.

Does the Level of the Auction Reserve Price Affect Auction Results?

Carter and Newman (1998), in their analysis of federal timber sales in North Carolina, examined the effects of the auction's reserve price (upset rate) on sealed bids. They found that both the number of bidders and the reserve price were important determinants of timber auction bid prices.

Are Stumpage Markets Integrated in the US?

This is a critical question for the whole notion of cross-border stumpage price comparisons, because if stumpage markets are not integrated there is no expectation that prices will be similar. Studies that have examined stumpage market integration in the United States include Yin et al. (2001), Washburn and Binkley (1993), Nagubadi (2000), and Prestemon and Holmes (2000). These studies reject the notion of stumpage market integration, meaning that local stumpage prices will be determined in great part by local supply and demand conditions and will not converge to some uniform price.

References

Anderson, W.C. 1969a. *Determinants of southern pine pulpwood stumpage*. USDA Forest Service Research Paper SO-44. Southern Forest Experiment Station, New Orleans, Louisiana.

Anderson, W.C. 1969b. Pine sawtimber price behaviour in South Carolina. USDA Forest Service Research Paper SO-42. Southern Forest Experiment Station, New Orleans, Louisiana.

Anderson, W.C. 1976a. *A method of appraising multiple-product sales of southern pine stumpage*. USDA Forest Service Research Paper SO-126. Southern Forest Experiment Station, New Orleans, Louisiana.

Anderson, W.C. 1976b. *Appraising southern pine pulpwood stumpage*. USDA Forest Service Research Paper SO-129. Southern Forest Experiment Station, New Orleans, Louisiana.

Athey, S. and J. Levin, 2001. Information and Competition in U.S. Forest Service Timber Auctions, *Journal of Political Economy*, Vol. 109, No. 2, pp 375-417.

Baldwin, L., R. Marshall and J.F. Richard 1997. Bidder collusion in U.S. Forest Service timber sales. *Journal of Political Economy,* 105(August): 657-699

Bingham, M.F., J.P. Prestemon, D.J. MacNair and R.C. Abt. 2003. Market structure in U.S. southern pine roundwood. *Journal of Forest Economics*, vol. 9, pp. 97-117.

Brannman, L.E. 1991. Hauling distances in Forest Service timber sales: Economic efficiency in oral and sealed bidding. *Journal of Forestry,* 89(February):18-21.

Brannman, L.E. 1996. Potential competition and possible collusion in Forest Service timber auctions. *Economic Inquiry*, XXXIV(October):730-745

Brannman, L., J.B. Klein and L.W. Weiss. 1987. The price effects of increased competition in auction markets. *Review of Economics and Statistics*, 69(February):24-32.

Buongiorno, J., and T. Young. 1984. Statistical appraisal of timber with an application to the Chequamegon National Forest. *Northern Journal of Applied Forestry*, 1(4):72-76.

Canadian Forest Service 2002. Selection of Conversion Factors for Stumpage Price Comparisons. Natural Resources Canada, Canadian Forest Service, Industry, Economics and Programs Branch.

Canadian Forest Service 2004. An Examination of Canadian Log Import and Export Data and Their Potential Use in Log Price Comparisons. Natural Resources Canada, Canadian Forest Service, Industry, Economics and Programs Branch.

Carter, D.R. and D.H. Newman 1998. The impact of reserve prices in sealed bid federal timber sale auctions. *Forest Science*, 44(4):485-495.

Combes, J.A., M.J. Niccolucci, and E.G. Schuster. 1989. Stumpage appraisal: TEA and the Northern Region. *Forest Industries*, 118(Oct):18-20.

Cubbage, F.W., T.M. Skinner and C.D. Risbrudt 1985. An Economic Evaluation of the Georgia Forestry Assistance Program. Research Bulletin 322. University of Georgia, College of Agriculture Experiment Station.

Fasick, C.A., and G.R. Sampson. 1966. Price behaviour of pine pulpwood stumpage from National Forests in Mid-South: 1955-1965. *Pulpwood Prod*. 14(3):18, 20.

Guttenberg, S. 1956. *Influence of timber characteristics upon stumpage prices*. USDA Forest Service, Southern Forest Experiment Station, Occasional Paper 146. New Orleans, Louisiana.

Hansen, R.G. 1985. Empirical testing of auction theory. *American Economic Review*, 75(2): 156-159.

Hansen, R.G. 1986. Sealed-bid versus open auctions: The evidence. *Economic Inquiry*, 24(1): 125-142.

Hardie, I.W., and D.M. Larson 1994. Buyer and seller behaviour in single-buyer stumpage sales. *Forest Science*, 40(4):759-773.

Haugen, D.E. and A. Weatherspoon 2002. *Michigan Timber Industry – An Assessment of Timber Product Output and Use, 1998*. USDA Forest Service Resource Bulletin NC-212. North Central Research Station, St. Paul, Minnesota.

Haynes, R.W. 1979a. *An evaluation of two measures of competition for National Forest timber sales*. USDA Forest Service Research Note PNW-337. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Haynes, R.W. 1979b. A comparison of open and set-aside timber sales on National Forests in the Douglas-fir region. *Land Economics*, 55(2):277-284.

Haynes, R.W. 1980a. *Competition for National Forest timber in the Northern, Pacific Southwest, and Pacific Northwest Regions*. USDA Forest Service Research Paper PNW-266. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Haynes, R.W. 1980b. Sealed bidding and activity of outside bidders for National Forest timber. *Journal of Forestry*, 78:344-346.

Haynes, R.W. ed. 1983. *Competition for National Forest timber: Effects on timber-dependent communities*. USDA, Forest Service General Technical Report PNW-148. Pacific Northwest Forest and Range Experiment Station, Portland. Oregon.

Haynes, R.W. 1998. *Stumpage prices, volume sold, and volumes harvested from the National Forests of the Pacific Northwest Region, 1984 to 1996*. USDA, Forest Service General Technical Report PNW-GTR-423. Pacific Northwest Research Station, Portland, Oregon.

Haynes, R.W. and D.D. Warren 1989. *Volume and Average Prices of Stumpage Harvested from the National Forest of the Pacific Northwest Region, 1974-1987*. USDA Forest Service Research Note PNW-RN-488.

Huang, F.M., and J. Buongiorno. 1986. Market value of timber when some offerings are not sold: Implications for appraisal and demand analysis. *Forest Science*, 32(4):845-854.

Hubbard, W.G., and R.C. Abt 1989. The Effect of Timber Sale Assistance on Returns to Landowners. *Resource Management and Optimization*, 6(3): 225-234.

Jackson, D.H. 1987. Why stumpage prices differ between ownerships: A statistical examination of state and Forest Service sales in Montana. *Forest Ecology and Management*, 18:219-236.

Jackson, D.H., and A.G. McQuillan. 1979. A technique for estimating timber value based on tree size, management variables, and market conditions. *Forest Science*, 25(4): 620-626.

Johnson, R.N. 1979. Oral auctions versus sealed bids: An empirical investigation. *Natural Resources Journal*, 19(2): 315-335.

Johnson, T.G. 2001. *United States Timber Industry – An Assessment of Timber Product Output and Use, 1996*. USDA Forest Service General Technical Report GTR-SRS-45. Southern Research Station, Asheville North Carolina.

Kalt, J.P. 2001. *Log Export Restraints, Price "Gaps," and the Transmission of Softwood Log Price Effects Across Canada*.

Keegan, C.E. III, K.M. Gebert, A.L. Chase, T.A. Morgan, S.E. Bodmer and D.D. Van Hooser 2001. Montana's Forest Products Industry: A Descriptive Analysis, 1969-2000. University of Montana, Bureau of Business and Economic Research, Missoula, Montana.

Kittredge, D.B. Jr. and W. Haslam 2000. The Spread in Lump Sum Stumpage Price Bids. *Northern Journal of Applied Forestry*, 17(1): 7-8.

Larsen, D.N. and Q. Nguyen, 2002. *Washington Timber Harvest – 2000*. Washington State Department of Natural Resources.

Leffler, K.B. , and R.R. Rucker. 1991. Transaction costs and the efficient organization of production: A study of timber harvesting contracts. *Journal of Political Economy*, 99(5): 1060-1087.

MacKay, D.G. and M.J. Baughman 1996. Multiple Regression-Based Transactions Evidence Timber Appraisal for Minnesota's State Forests. *Northern Journal of Applied Forestry*, 13(3): 129-134.

McQuillan, A.G., and C. Johnson-True. 1988. Quantifying marketplace characteristics for use in timber stumpage appraisal. *Western Journal of Applied Forestry*, 3(3): 66-69.

Mead, W.J. 1967. Natural resource disposal policy: Oral auction versus sealed bids. *Natural Resources Journal*, 7(2): 195-224.

Mead, W.J., and T.E. Hamilton. 1968. *Competition for federal timber in the Pacific Northwest - An analysis of Forest Service and Bureau of Land Management timber sales*. USDA Forest Service Research Paper PNW-64. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Mead, W.J., M. Schniepp and R.B. Watson 1981. The effectiveness of competition and appraisal in the auction markets for National Forest timber in the Pacific Northwest. USFS Contract No. 53-3187-1-43 and PSW G-34.

Mead, W.J., M. Schniepp and R.B. Watson 1983. Competitive bidding for U.S. Forest Service timber in the Pacific Northwest, 1963-83. USDA, Forest Service, Timber Management. USFS Contract No. 53-3187-2-59.

Morgan, T.A., D.E. Keegan III, T.P Spoelma, T. Dillon, F.G. Wagner and L. DeBlander 2004. *Idaho's Forest Products Industry: A Descriptive Analysis*. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Munn, I.A., and E.C. Franklin 1995. Valuation of Consulting Foresters' Contribution to Timber Sale Prices. *The Consultant*, Winter (1995).

Munn, I.A., and R.B. Palmquist. 1997. Estimating hedonic price equations for a timber stumpage market using stochastic frontier estimation procedures. Canadian Journal of Forest Research, 27:1276-1280.

Munn, I.A., and R.R. Rucker. 1994. The value of information services in a market for factors of production with multiple attributes: The role of consultants in private timber sales. *Forest Science* 40(3): 474-496.

Nagubadi, V., I.A. Munn and A. Tahai 2000. Integration of hardwood stumpage markets in the southcentral United States. *Journal of Forest Economics*, 7(1):

Nordhaus, W.D. 2004. *The Economics of the Law of One Price as it Applies to Logs*.

Ontario Ministry of Natural Resources 2002. Annual Report on Forest Management 2000/2001. Ontario Ministry of Natural Resources.

Paarsch, H.J. 1989a. An empirical examination of British Columbian timber sales. Forest Economics and Policy Analysis Research Unit Working Paper 118. The University of British Columbia, Vancouver, B.C.

Paarsch, H.J. 1989b. Structural econometric models of British Columbian timber sales. Forest Economics and Policy Analysis Research Unit Working Paper 133. The University of British Columbia, Vancouver, B.C.

Prestemon, J.P. and T.P Holmes 2000. Timber price dynamics following a natural catastrophe. *American Journal of Agricultural Economics*, 82:145-160.

Puttock, G.D., D.M. Prescott, and K.D. Meilke. 1990. Stumpage prices in southwestern Ontario: A hedonic function approach. *Forest Science*, 36(4):1119-1132.

Québec Minstere des Ressources naturalles, de la Fauna et des Parcs 2003. *Québec's Forest Resources and Industry: A Statistical Report 2003 Edition.*

Reading, W.H. IV and J. Krantz 2002. *Minnesota Timber Industry – An Assessment of Timber Product Output and Use, 1997*. USDA Forest Service Resource Bulletin NC-204. North Central Research Station, St. Paul, Minnesota.

Reading, W.H. IV and J. Whipple 2003. *Wisconsin Timber Industry – An Assessment of Timber Product Output and Use, 1999*. USDA Forest Service Resource Bulletin NC-204. North Central Research Station, St. Paul, Minnesota.

Rowe, C., and S. Guttenberg. 1961. Why pulpwood stumpage prices vary. *Pulpwood Prod*. 9(10):14, 16.

Rosen, B.N., H.F. Kaiser and M. Baldeck 1989. Nonindustrial private forest landowners as timber marketers: a field study of search for market information and decision quality. *Forest Science*, 35(3): 732-744.

Rosen, B.N. 1995. A longitudinal analysis of attitudes and marketing practices of non-industrial private forest landowners. *Northern Journal of Applied Forestry*, 12(4): 174-179.

Rucker, R.R. and K.B. Leffler 1988. To harvest or not to harvest? An analysis of cutting behavior on federal timber sale contracts. *The Review of Economics and Statistics*, 70:207-213.

Sendak, P.E. 1992. State and federal timber stumpage prices in Vermont. *Northern Journal of Applied Forestry*, 9:97-101.

Spelter, H. 2002. *Conversion of board foot scaled logs to cubic meters in Washington State, 1970-1998*. USDA Forest Service, Forest Products Laboratory, FPL-GTR-131

Spelter, H. 2003. *Challenges in converting among log scaling methods*, USDA Forest Service, Forest Products Laboratory, FPL-RP-611

Spelter, H. and M. Alderman, 2003. *Profile 2003: Softwood Sawmills in the United States and Canada*. USDA Forest Service Research Paper FPL-RP-608, Forest Products Laboratory, Madison Wisconsin.

Stone, J.S., and D.B. Rideout. 1997. Does sealed bidding promote competition in the auctioning of public timber? *Journal of Forest Economics*, 3(2): 133-142.

United States Forest Service. 1998. *Timber sale preparation handbook*. Washington, D.C.

U.S. Forest Service Handbook FSH 5409.12 – Appraisal Handbook, Section C-2 Additional Specifications for Stumpage or Forest Products Appraisal.

United States General Accounting Office, 1983. Skewed Bidding Presents Costly Problems for the Forest Service Timber Program. Report no. RCED-83-37, February 1983.

Warren, D.D. 2003. *Production, Prices, Employment, and Trade in Northwest Forest Industries, All Quarters 2001*. USDA Forest Service Research Bulletin PNW-RB-239, Pacific Northwest Research Station, Portland Oregon.

Washburn, C.L. and C.S. Binkley 1993. Informational efficiency of markets for stumpage: reply. *American Journal of Agricultural Economics*, 75: 239-242.

Wiener, A.A. 1969. *A study of one-bid timber sales in the normally competitive Douglas-fir Region in Oregon and Washington*. USDA Forest Service.

Wiener, A.A. 1979. Sealed bids or oral auction: Which yield higher prices? *Journal of Forestry*, 77(6): 353-356.

Yin, R., D.H. Newman and J. Siry 2002. Testing for market integration among southern pine regions. *Journal of Forest Economics*, 8(2): 151-166.