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**INTERIOR
MARKET PRICING SYSTEM
UPDATE - 2010**



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Interior Market Pricing System: Update – 2010

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1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2010 update to the Interior Market Pricing System (MPS).¹

2. AUCTION DATASET

The new auction dataset used in the update contains winning bids and data from 1148 sales over the 5 year period January 1, 2005 through December 31, 2009.

3. EQUATIONS

The 2009 equations were re-estimated with the new dataset.

The benchmark equations are shown below.

Note, there were no horse logging data points in the new five-year data set.

¹ This paper is not intended to provide the basis for calculating stumpage rates nor should it be used as guidance for interpreting the legal policies and procedures for calculating stumpage rates, which are contained in the *Interior Appraisal Manual*. The *Interior Appraisal Manual* contains the policies and procedures referred to in Section 105 of the *Forest Act*.

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Estimated Winning Bid Equation

Variable	2009 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	38.51049	7.174308	41.37846	6.586956
Exchange Rate (\$US/\$C)	-13.52762	-2.590294	-11.81232	-2.763279
Real Stand Selling Price	0.137278	4.556631	0.134893	3.165539
Fir Fraction	2.141779	0.822910	1.524293	0.570984
HemBal Fraction	-16.22558	-8.089727	-16.90908	-7.781774
Cedar Fraction	35.47185	6.424315	29.97245	5.370982
LN ¹ (Volume/1000)	1.876129	7.486984	1.773419	6.910274
1/Volume per tree *(1-HemBal Fraction)	-0.448265	-0.798802	-0.385661	-0.784573
Grade 3 Fraction	17.45411	7.294996	25.46205	7.847983
Deciduous Fraction *(1- Competitive Deciduous Indicator)	-7.169140	-3.989819	-2.309056	-0.783676
Decay Fraction	-18.60630	-2.613155	-17.15632	-2.347016
Cableyard Fraction	-9.700249	-4.662345	-8.642343	-3.930104
Helicopter Logging Fraction	-59.45913	-8.263142	-54.96794	-7.220024
Horse Logging Fraction	-5.068073	-3.521082	n/a	n/a
Fire Damaged Fraction	-12.34584	-4.354102	-11.14533	-2.459769
Cycle Time	-1.160686	-7.822829	-0.819588	-5.740272
LN (Number of Bidders)	4.309488	15.98931	3.503825	13.78527
Salvage Logging Indicator * Insect Attack Codes Indicator	-2.363163	-3.070182	-1.130416	-1.120789
Insect Attack Codes Indicator	-2.043697	-2.076379	-2.069453	-1.939954
Fort Nelson – Peace Zone	-4.227893	-4.536586	-5.606074	-5.845539
2005 auctions	6.304695	8.460824	n/a	n/a
2006 auctions	-3.979921	-3.323519	-8.064508	-6.083371
2007 auctions	-3.081665	-1.928570	-7.713335	-4.314982
2008 auctions	-7.351426	-3.924049	-12.40317	-6.144914
2009 auctions	n/a	n/a	-15.31425	-7.616184
Decked Volume Fraction	71.20273	2.292031	34.81963	1.422516
LN (Volume per tree)	6.978657	4.143715	7.613638	4.795158
Competitive Deciduous Indicator	-12.47049	-6.601439	-9.544885	-5.269035
Green MPB & Other Pest Attack Fraction	-5.433196	-3.269497	-5.109108	-3.656686
Red & Grey MPB Attack Fraction	-5.136030	-4.626314	-3.447994	-2.944338
Number of Observations	1145		1148	
Adjusted R ²	0.809213		0.821380	
¹ LN means the natural logarithm				

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Number of Bidders Equation

Variable	2009 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	-0.738699	-6.656704	-1.056475	-8.495487
Forecast Real Winning Bid	0.034948	15.88674	0.035417	15.71008
District Average Number of Bidders	0.181821	9.087173	0.221708	12.14928
Partial cut fraction	-0.433798	-1.818166	-0.745880	-2.220555
Slope %	-0.004445	-2.813468	-0.005345	-3.341535
Horse logging fraction	-0.356635	-1.516481	n/a	n/a
Second Quarter Auctions	0.157667	3.875887	0.116188	2.698101
2005 auctions	-0.196740	-3.628455	n/a	n/a
2006 auctions	0.538273	8.645583	0.731498	11.60757
2007 auctions	0.325698	4.664545	0.530040	7.486592
2008 auctions	0.509242	6.474055	0.713057	8.996527
2009 auctions	n/a	n/a	0.692700	8.462192
Highway Haul	0.107839	2.709801	0.155637	3.492770
LN (Volume / 1000)	-0.029832	-1.468329	-0.032085	-1.499723
Fire Damaged Fraction	0.585166	2.601930	0.210845	0.575237
Number of Observations	1145		1148	
Adjusted R ²	0.343828		0.358782	

New variables were tested to see if they would improve the statistics, compared to the benchmark equations. Likewise, variables that were no longer significant were removed. The final data set contains 1148 auction sales.

The final equations, compared to the Benchmark Equations, are shown below.

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Estimated Winning Bid

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
Constant	41.37846	6.586956	32.30169	4.601519
Exchange Rate (\$US/\$C)	-11.81232	-2.763279	-10.35731	-2.626380
Real Stand Selling Price	0.134893	3.165539	0.133081	3.351026
Fir Fraction	1.524293	0.570984	n/a	n/a
HemBal Fraction	-16.90908	-7.781774	-16.50942	-7.998232
Cedar Fraction	29.97245	5.370982	32.36758	5.650837
LN (Volume/1000)	1.773419	6.910274	1.613444	6.070246
1/Volume per tree *(1-HemBal Fraction)	-0.385661	-0.784573	n/a	n/a
Grade 3 Fraction	25.46205	7.847983	25.75902	7.890448
Deciduous Fraction *(1- Competitive Deciduous Indicator)	-2.309056	-0.783676	n/a	n/a
Decay Fraction	-17.15632	-2.347016	-16.67514	-2.338079
Cableyard Fraction	-8.642343	-3.930104	-8.276788	-3.925578
Helicopter Logging Fraction	-54.96794	-7.220024	-55.94115	-6.825349
Fire Damaged Fraction	-11.14533	-2.459769	-10.01784	-2.165811
Cycle Time	-0.819588	-5.740272	-0.877681	-6.306702
LN (Number of Bidders)	3.503825	13.78527	3.584007	14.46622
Salvage Logging Indicator * Insect Attack Codes Indicator	-1.130416	-1.120789	-1.300478	-1.280496
Insect Attack Codes Indicator	-2.069453	-1.939954	-1.972162	-1.876649
Fort Nelson – Peace Zone	-5.606074	-5.845539	-5.717404	-6.576374
2006 auctions	-8.064508	-6.083371	-8.174230	-6.257755
2007 auctions	-7.713335	-4.314982	-7.887634	-4.574204
2008 auctions	-12.40317	-6.144914	-12.54336	-6.364721
2009 auctions	-15.31425	-7.616184	-14.20042	-7.212222
Decked Volume Fraction	34.81963	1.422516	35.88706	1.474416
LN (Volume per Tree)	7.613638	4.795158	7.592205	11.29382
LN (Coniferous Volume per hectare)	n/a	n/a	1.307634	1.787632
Competitive Deciduous Indicator	-9.544885	-5.269035	-7.208321	-3.754342
Green MPB & Other Pest Attack Fraction	-5.109108	-3.656686	n/a	n/a
Red & Grey MPB Attack Fraction	-3.447994	-2.944338	n/a	n/a
Total Attack Fraction * (1 - Cruise Based)	n/a	n/a	-4.853690	-5.122027
Cruise Based	n/a	n/a	-7.936262	-9.580102
Adjusted R ²	0.821380		0.828038	
*LN means the natural logarithm				

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Number of Bidders Equation

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	-1.056475	-8.495487	-1.072971	-8.361849
Forecast Real Winning Bid	0.035417	15.71008	0.035439	14.57156
District Average Number of Bidders	0.221708	12.14928	0.212180	11.51418
Partial cut fraction	-0.745880	-2.220555	-0.695541	-2.180806
Slope %	-0.005345	-3.341535	-0.005097	-3.215683
First Quarter Auctions	n/a	n/a	0.113161	2.846793
Second Quarter Auctions	0.116188	2.698101	0.153716	3.404603
2006 auctions	0.731498	11.60757	0.722068	10.58677
2007 auctions	0.530040	7.486592	0.514497	6.573110
2008 auctions	0.713057	8.996527	0.701299	7.815715
2009 auctions	0.692700	8.462192	0.618113	6.784713
Highway Haul	0.155637	3.492770	0.172726	4.135948
LN (Volume / 1000)	-0.032085	-1.499723	-0.032808	-1.516622
Fire Damaged Fraction	0.210845	0.575237	n/a	n/a
Cruise Based	n/a	n/a	0.264201	3.188272
Adjusted R ²	0.358782		0.366690	

The new equations result in greater statistical accuracy and reliability. See Appendix 1 for detailed statistics and definitions.

The cruise based indicator is a new variable and signifies the bid from the auction data, and the resulting estimated winning bid applies to all grades.

To implement the new equations in the *Interior Appraisal Manual*, the two equations are reduced to one equation. This is done by substituting the Number of Bidders equation into the Estimated Winning Bid Equation (and thereby eliminating the variable: LN (Number of Bidders)). The Insect Attack Codes Indicator and Grade 3 Fraction are zero for implementation.

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4. SPECIFIED OPERATIONS

The auction dataset used to develop MPS is comprised of 1148 auctions. There are some harvesting situations that are not represented in the auction dataset (for example, skyline yarding and horse logging) and therefore, a specified operation cost estimate is used in the calculation of stumpage rates.

The specified operations are shown below and described in Appendix 2.

Specified Operations	Current Adjustment	Update July 1, 2010
1. Rail Haul	Appraisal Manual	Appraisal Manual
2. Barge/Ferry	Appraisal Manual	Appraisal Manual
3. Dump, Boom, Tow, Dewater and Reload	Appraisal Manual	Appraisal Manual
4. Camp Costs	\$2.69/m ³	\$2.57/m ³ \$4.83/m ³ if rail
5. Skyline Yarding	\$8.42/m ³	\$5.51/m ³
6. Suitable Secondary Stand Structure Survey	Appraisal Manual	n/a (removed as specified operation; now included in forest management administration cost)
7. Horse Logging	n/a	\$8.67/m ³

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5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (dated June 5, 2006), the adjustments are based on cost surveys.

The tenure obligation adjustments are shown below and described in Appendix 3.

Tenure Obligation	Current Adjustment	Update July 1, 2010
Total Administration Cost	2006/07 Cost Base ¹	2007/08 Cost Base
Development Cost	2006/07 Cost Base ¹	2007/08 Cost Base
Total Road Management Cost	2006/07 Cost Base ¹	2007/08 Cost Base
Market Logger Road Cost	\$1.01/m ³	\$1.01/m ³
Total Silviculture Cost	2006/07 Cost Base ¹	2007/08 Cost Base
Return to Forest Management	1.037	1.044
Low Grade Percent Adjustment	Mark Specific 1/(1-%low grade/100)	Mark Specific 1/(1-%low grade/100)

¹ See Interior MPS Update – July 1, 2009, Appendix 3

6. SUMMARY

The new final equations, specified operations and tenure obligation adjustments will be used to calculate the average market price for the Interior, starting July 1, 2010.

APPENDIX 1

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FINAL ESTIMATED WINNING BID

Dependent Variable: BID*109.3/CPI

Method: Least Squares

Date: 04/12/10 Time: 14:12

Sample: 1 1900 IF MARK_IN_1148 = 1

Included observations: 1148

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	32.30169	7.019788	4.601519	0.0000
Exchange Rate (\$US/\$C)	-10.35731	3.943569	-2.626380	0.0087
Real Stand Selling Price	0.133081	0.039714	3.351026	0.0008
HemBal Fraction	-16.50942	2.064134	-7.998232	0.0000
Cedar Fraction	32.36758	5.727926	5.650837	0.0000
LN(Volume/1000)	1.613444	0.265796	6.070246	0.0000
Grade 3 Fraction	25.75902	3.264583	7.890448	0.0000
Decay Fraction	-16.67514	7.131982	-2.338079	0.0196
Cableyard Fraction	-8.276788	2.108425	-3.925578	0.0001
Helicopter Logging Fraction	-55.94115	8.196086	-6.825349	0.0000
Fire Damaged Fraction	-10.01784	4.625443	-2.165811	0.0305
Cycle Time	-0.877681	0.139166	-6.306702	0.0000
LN(number of Bidders)	3.584007	0.247750	14.46622	0.0000
Salvage Logging Indicator * Insect				
Attack Codes Indicator	-1.300478	1.015605	-1.280496	0.2006
Insect Attack Codes Indicator	-1.972162	1.050896	-1.876649	0.0608
Fort Nelson – Peace Zone	-5.717404	0.869385	-6.576374	0.0000
2006 Auctions	-8.174230	1.306256	-6.257755	0.0000
2007 Auctions	-7.887634	1.724373	-4.574204	0.0000
2008 Auctions	-12.54336	1.970764	-6.364721	0.0000
2009 Auctions	-14.20042	1.968939	-7.212222	0.0000
Decked Volume Fraction	35.88706	24.33986	1.474416	0.1407
LN (Volume per tree)	7.592205	0.672244	11.29382	0.0000
LN (Coniferous Volume per hectare)	1.307634	0.731489	1.787632	0.0741
Competitive Deciduous Indicator	-7.208321	1.919996	-3.754342	0.0002
Total Attack Fraction * (1 - Cruise				
Based)	-4.853690	0.947611	-5.122027	0.0000
Cruise Based	-7.936262	0.828411	-9.580102	0.0000
R-squared	0.831787	Mean dependent var	23.14033	
Adjusted R-squared	0.828038	S.D. dependent var	14.25937	
S.E. of regression	5.913110	Akaike info criterion	6.414608	
Sum squared resid	39230.58	Schwarz criterion	6.528886	
Log likelihood	-3655.985	Hannan-Quinn criter.	6.457750	
F-statistic	221.9238	Durbin-Watson stat	1.716040	
Prob(F-statistic)	0.000000			

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FINAL NUMBER OF BIDDERS

Dependent Variable: LOG(NB)

Method: Least Squares

Date: 04/12/10 Time: 15:28

Sample: 1 1900 IF MARK_IN_1148 =1

Included observations: 1148

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-1.072971	0.128317	-8.361849	0.0000
Forecast Real Winning Bid	0.035439	0.002432	14.57156	0.0000
District Average Number of Bidders	0.212180	0.018428	11.51418	0.0000
Partial Cut Fraction	-0.695541	0.318938	-2.180806	0.0294
Slope %	-0.005097	0.001585	-3.215683	0.0013
First Quarter Auctions	0.113161	0.039750	2.846793	0.0045
Second Quarter Auctions	0.153716	0.045150	3.404603	0.0007
Highway haul	0.172726	0.041762	4.135948	0.0000
2006 Auctions	0.722068	0.068205	10.58677	0.0000
2007 Auctions	0.514497	0.078273	6.573110	0.0000
2008 Auctions	0.701299	0.089729	7.815715	0.0000
2009 Auctions	0.618113	0.091104	6.784713	0.0000
LN(Volume/1000)	-0.032808	0.021632	-1.516622	0.1296
Cruise Based	0.264201	0.082867	3.188272	0.0015
R-squared	0.373868	Mean dependent var		1.003854
Adjusted R-squared	0.366690	S.D. dependent var		0.701796
S.E. of regression	0.558495	Akaike info criterion		1.684978
Sum squared resid	353.7134	Schwarz criterion		1.746512
Log likelihood	-953.1773	Hannan-Quinn criter.		1.708208
F-statistic	52.08605	Durbin-Watson stat		1.890714
Prob(F-statistic)	0.000000			

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Variables and Definitions for Equations

Variable	Definition
2010 Equation	
Real Stand Selling Price	Estimated stand lumber value (\$/m ³) in 1997 dollars. Weighted average of (LRF * Lumber price by coniferous species). See Appraisal Manual section 3.2.
Partial Cut Fraction	Fraction of the harvest method volume that is appraised as partial cut. $PC = (100 - CAPCUT\%)/100$. See section 4.5 of Appraisal Manual for definition of CAPCUT%. The 80% limit in the definition of CAPCUT in section 4.5 does not apply.
Volume	Total net coniferous cruise volume (m ³). If the cutting authority is for a BCTS licence, the volume is from the cutting authority area cruise compilation. Otherwise it is the volume from Table 3-3 for the selling price zone the cutting authority area is located in.
Cableyard Fraction	Fraction of total harvest method volume that is appraised as overhead cable yarding.
Helicopter Logging Fraction	Fraction of total harvest method volume that is appraised as helicopter yarding.
Fire Damaged Fraction	Fraction of total net coniferous cruise volume that is fire damaged.
Cycle Time	Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs)). See section 3.5.1 of Appraisal Manual.
HemBal Fraction	Fraction of total net coniferous volume that is Hemlock and Balsam.
Cedar Fraction	Fraction of total net coniferous volume that is Cedar.
Volume per Tree	Cutting permit average volume per tree from the cruise (m ³).
Deciduous Fraction	$\text{Total net deciduous cruise volume (m}^3\text{)} / ((\text{total net deciduous cruise volume (m}^3\text{)} + \text{total net coniferous cruise volume (m}^3\text{)})$.
Slope %	Cutting permit average slope from cruise.
District average number of bidders	Average number of bidders by district from the auction dataset.
Decay	Prorated coniferous species decay (%) from the cruise / 100.
Zone 9	Fort Nelson – Peace selling price zone variable. Zone 9 = 1 if cutting authority is appraised with selling price zone 9, otherwise Zone 9 = 0.
2006 Auctions	If auction sold in 2006 then AUC 2006 = 1.
2007 Auctions	If auction sold in 2007 then AUC 2007 = 1.

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2008 Auctions	If auction sold in 2008, then AUC 2008 = 1.
2009 Auctions	If auction sold in 2009, then AUC 2009 = 1.
Decked Volume Fraction	Fraction of timber sale total net coniferous cruise volume that has been felled and decked.
Decked Volume	Total net coniferous volume that has been felled and decked in the timber sale (m ³).
Exchange Rate	Exchange rate (\$US/\$C). Bank of Canada three month average rate beginning five months prior to the stumpage rate effective date, as published by Pricing Branch.
Grade 3 Fraction	Fraction of coniferous billed volume that was Grade 3. In the modeling dataset this was set to zero for sales December 5, 2005 and later, because after that date Bids applied to Grade 3 as well as green sawlogs. This variable is set to zero for calculation of the average market price because grade 3 is no longer a valid grade.
First Quarter Auctions	If auction sold in January to March, Q1 = 1.
Second Quarter Auctions	If auction sold in April to June, Q2 = 1.
Consumer Price Index (CPI)	Monthly B.C. Consumer Price Index (CANSIM 326-0020, 2002 = 100) X 1.1787
Consumer Price Index Factor (CPIF)	CPIF = CPI/109.3
Insect Attack Codes Indicator	If volume of pest attack unavailable, Insect Attack Codes Indicator = 1.
Total Attack Fraction	Fraction of the total net coniferous volume that is lodgepole pine green, red, and grey attack plus the fraction of the total net cruise volume that is other insect attack.
Competitive Deciduous Indicator	If upset stumpage rate is determined under section 7.5.1(5) Competitive Deciduous = 1, otherwise CD = 0.
Volume per hectare	Net coniferous volume per hectare (m ³ /ha)
Cruise Based	Cruise based billing for Mountain Pine Beetle damage variable. MPB Cruise Based = 1 if IAM section 6.9 is applicable, otherwise MPB Cruise Based = 0. Signifies the bid and resulting estimated winning bid applies to all grades.

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2009 & Benchmark Equations	
Fir Fraction	Fraction of the total net coniferous volume that is Douglas Fir.
Volume	Total net coniferous cruise volume (m ³).
Horse Logging Fraction	Fraction of the total harvest method volume that is appraised as horse yarding.
Salvage Logging Indicator	Where greater than one third of the net coniferous cruise volume is attacked by mountain pine beetle or other pests, salvage = 1, otherwise salvage = 0.
2005 Auctions	If auction sold in 2005 then AUC 2005 = 1.
Highway Haul	1 if primary haul method is highway, otherwise HWY = 0.
Green MPB & Other Pest Attack Fraction	Fraction of the total net coniferous volume that is lodgepole pine green attack plus the fraction of the total net cruise volume that is other insect attack.
Red & Grey MPB Attack Fraction	Fraction of the total net cruise volume that is lodgepole pine red attack plus the fraction of the total net cruise volume that is lodgepole pine grey attack.

APPENDIX 2

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DEFINITIONS OF SPECIFIED OPERATIONS

If sufficient auction data is not available, the ministry will, for those identified situations, implement specified operations.

The specified operations will be used to adjust the MPS stumpage rate for the estimated incremental cost of the identified situation. The explicit assumption is that if a bidder was faced with a similar situation he or she would lower the bid by the extra cost incurred because of the identified situation.

The situations that may be eligible for specified operations adjustment will be determined according to the following principles:

- The expectation that a bid would be influenced by this situation;
- representation (number of samples, if any, in the auction data set);
- materiality of estimated cost differential (supported by verifiable financial data); and,
- statistical analysis (including the premise that other represented situations and variables in the MPS database and equations may serve as a proxy for the situation in question).

The ministry, after considering the above and any other relevant technical information, may or may not designate the situation as an identified situation eligible for a specified operations and, if eligible, specify the dollars per cubic metre adjustment.

The ultimate objective is to have a representative auction database and hence, few, if any, specified operations adjustments.

The following are identified as specified operations for the Interior MPS. Cost estimates from the updated Interior Appraisal Manual are used for the following:

1. Rail Haul
 - Rail haul including truck to rail transfer and rail transport.
2. Barge/Ferry
 - Barge/ferry used to truck haul (private).
 - Barge/ferry not used for truck haul (private).
3. Dump, Boom, Tow, Dewater, Reload
 - Dump, boom
 - Tow
 - Dewater and reload
4. Camp costs
5. Skyline Yarding
6. Horse Logging
7. High Development Cost (BCTS only)