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INTERIOR MARKET PRICING SYSTEM

UPDATE - 2011

July 1, 2011



Timber
Pricing
Branch

Interior Market Pricing System: Update – 2011

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1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2011 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 1192 sales over the 5 year period January 1, 2006 through December 31, 2010.

3. EQUATIONS

The 2010 MPS equations were re-estimated with the new dataset to establish the benchmark equations, shown below.

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	2010 Equation		Benchmark Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
Constant	32.30169	4.601519	15.54070	3.397174
Exchange Rate (\$US/\$C)	-10.35731	-2.626380	-10.41216	-2.814219
Real Stand Selling Price	0.133081	3.351026	0.180606	7.806304
HemBal Fraction	-16.50942	-7.998232	-11.24052	-9.810861
Cedar Fraction	32.36758	5.650837	27.61019	10.33920
LN (Volume/1000)	1.613444	6.070246	1.097791	5.844293
Grade 3 Fraction	25.75902	7.890448	n/a	n/a
Decay Fraction	-16.67514	-2.338079	-15.76926	-3.961640
Cableyard Fraction	-8.276788	-3.925578	-6.419324	-5.838846
Helicopter Logging Fraction	-55.94115	-6.825349	-53.13523	-8.621604
Fire Damaged Fraction	-10.01784	-2.165811	-6.092142	-2.417787
Cycle Time	-0.877681	-6.306702	-0.949031	-8.815381
LN (Number of Bidders)	3.584007	14.46622	2.767192	13.80193
Salvage Logging Indicator * Insect Attack Codes Indicator	-1.300478	-1.280496	-5.995014	-6.440432
Insect Attack Codes Indicator	-1.972162	-1.876649	1.697454	2.060094
Fort Nelson – Peace Zone	-5.717404	-6.576374	-4.815427	-6.792653
2006 Auctions	-8.174230	-6.257755	n/a	n/a
2007 Auctions	-7.887634	-4.574204	0.172071	0.297591
2008 Auctions	-12.54336	-6.364721	-4.392809	-5.956588
2009 Auctions	-14.20042	-7.212222	-6.109784	-7.915021
2010 Auctions	n/a	n/a	-5.219149	-7.204119
Decked Volume Fraction	35.88706	1.474416	-13.53639	-0.984047
LN (Volume per Tree)	7.592205	11.29382	5.410354	12.09720
LN (Coniferous Volume per hectare)	1.307634	1.787632	2.164341	4.832499
Competitive Deciduous Indicator	-7.208321	-3.754342	-5.161233	-5.076621
Total Attack Fraction * (1 - Cruise Based)	-4.853690	-5.122027	-2.821284	-4.369432
Cruise Based	-7.936262	-9.580102	-6.005357	-11.23536
Adjusted R ²	0.828038		0.766826	
*LN means the natural logarithm				

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Number of Bidders Equation

Variable	2010 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	-1.072971	-8.361849	-0.878401	-7.865821
2010 Forecast Real Winning Bid	0.035439	14.57156	n/a	n/a
Benchmark Forecast Real Winning Bid	n/a	n/a	0.052582	17.73000
District Average Number of Bidders	0.212180	11.51418	0.251029	14.81440
Partial cut fraction	-0.695541	-2.180806	-1.073406	-3.464941
Slope %	-0.005097	-3.215683	-0.009017	-5.735303
First Quarter Auctions	0.113161	2.846793	0.129970	3.430537
Second Quarter Auctions	0.153716	3.404603	0.140354	3.343925
2006 Auctions	0.722068	10.58677	n/a	n/a
2007 Auctions	0.514497	6.573110	-0.094837	-1.754454
2008 Auctions	0.701299	7.815715	0.227570	3.853687
2009 Auctions	0.618113	6.784713	0.143347	2.349944
2010 Auctions	n/a	n/a	0.205941	3.174930
Highway Haul	0.172726	4.135948	0.156954	3.849982
LN (Volume / 1000)	-0.032808	-1.516622	-0.018851	-0.923255
Cruise Based	0.264201	3.188272	0.248843	4.342597
Adjusted R ²	0.366690		0.414370	

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 1192 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	15.54070	3.397174	18.70405	3.640536
Exchange Rate (\$US/\$C)	-10.41216	-2.814219	-14.44597	-3.376776
Real Stand Selling Price	0.180606	7.806304	0.185622	7.065678
HemBal Fraction	-11.24052	-9.810861	-11.21857	-8.594995
Cedar Fraction	27.61019	10.33920	27.20245	6.309191
LN (Volume/1000)	1.097791	5.844293	1.091708	5.401925
Decay Fraction	-15.76926	-3.961640	-14.96586	-2.963674
Cableyard Fraction	-6.419324	-5.838846	-6.404287	-4.742974
Helicopter Logging Fraction	-53.13523	-8.621604	-53.09817	-11.19907
Fire Damaged Fraction	-6.092142	-2.417787	-6.283934	-3.052381
Cycle Time	-0.949031	-8.815381	-0.951861	-8.264312
LN (Number of Bidders)	2.767192	13.80193	2.762089	13.62301
Salvage Logging Indicator * Insect Attack Codes Indicator	-5.995014	-6.440432	-5.972180	-6.048174
Insect Attack Codes Indicator	1.697454	2.060094	1.593528	1.640268
Fort Nelson – Peace Zone	-4.815427	-6.792653	-4.800373	-6.592324
2007 Auctions	0.172071	0.297591	0.254521	0.349972
2008 Auctions	-4.392809	-5.956588	-3.701469	-3.864590
2009 Auctions	-6.109784	-7.915021	-6.050758	-6.824175
2010 Auctions	-5.219149	-7.204119	-4.765224	-5.675033
Decked Volume Fraction	-13.53639	-0.984047	n/a	n/a
LN (Volume per Tree)	5.410354	12.09720	5.391203	11.21156
LN (Coniferous Volume per hectare)	2.164341	4.832499	2.149231	4.237573
Competitive Deciduous Indicator	-5.161233	-5.076621	-5.116207	-4.234152
Total Attack Fraction * (1 - Cruise Based)	-2.821284	-4.369432	-2.792379	-3.995705
Cruise Based	-6.005357	-11.23536	-6.029845	-11.57966
Adjusted R ²	0.766826		0.767329	
*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	-0.878401	-7.865821	-0.916703	-8.464061
Benchmark Forecast Real Winning Bid	0.052582	17.73000	n/a	n/a
Final Forecast Real Winning Bid	n/a	n/a	0.052081	16.55705
District Average Number of Bidders	0.251029	14.81440	0.250261	14.78468
Partial cut fraction	-1.073406	-3.464941	-1.029159	-3.429713
Slope %	-0.009017	-5.735303	-0.009059	-5.854233
First Quarter Auctions	0.129970	3.430537	n/a	n/a
Second Quarter Auctions	0.140354	3.343925	n/a	n/a
First and Second Quarter Auctions	n/a	n/a	0.131000	4.009441
2007 Auctions	-0.094837	-1.754454	-0.096456	-1.801492
2008 Auctions	0.227570	3.853687	0.222170	3.539381
2009 Auctions	0.143347	2.349944	0.135894	2.056844
2010 Auctions	0.205941	3.174930	0.202571	3.006366
Highway Haul	0.156954	3.849982	0.153212	4.163916
LN (Volume / 1000)	-0.018851	-0.923255	n/a	n/a
Cruise Based	0.248843	4.342597	0.242481	4.208456
Adjusted R ²	0.414370		0.414338	

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 two equations together result in greater statistical accuracy and reliability compared to the 2011 benchmark equations. See Appendix 1 for detailed statistics on the estimated winning bid and number of bidders equations and variable definitions. The Insect Attack Codes Indicator is zero for implementation.

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4. SPECIFIED OPERATIONS

The auction dataset used to develop MPS is comprised of 1192 auctions. There are some harvesting situations that are not accounted for in the MPS equation 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, 2011
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	\$2.57/m ³ \$4.83/m ³ if rail	\$2.40/m ³ \$4.50/m ³ if rail
5. Skyline Yarding	\$5.51/m ³	\$3.21/m ³
6. Horse Logging	\$8.67/m ³	\$8.67/m ³
7. Market Logger Specified Operations Cost	N/A	\$0.16/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.

Tenure Obligation	Current Adjustment	Update July 1, 2011
Total Administration Cost	2007/08 Cost Base	2008/09 Cost Base
Development Cost	2007/08 Cost Base	2008/09 Cost Base
Total Road Management Cost	2007/08 Cost Base	2008/09 Cost Base
Market Logger Road Cost	\$1.01/m ³	\$1.26/m ³
Total Silviculture Cost	2007/08 Cost Base	2008/2009 Cost Base
Return to Forest Management	1.044	1.041
Low Grade Percent Adjustment	Mark Specific 1/(1-%low grade/100)	Mark Specific 1/(1-%low grade/100)

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, 2011.

APPENDIX 1

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FINAL ESTIMATED WINNING BID

Dependent Variable: RBID
 Method: Least Squares
 Date: 05/10/11 Time: 13:27
 Sample: 1 1419 IF IN_1192
 Included observations: 1192
 White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	18.70405	5.137718	3.640536	0.0003
Exchange Rate (\$US/\$C)	-14.44597	4.278036	-3.376776	0.0008
Real Stand Selling Price	0.185622	0.026271	7.065678	0.0000
HemBal Fraction	-11.21857	1.305245	-8.594995	0.0000
Cedar Fraction	27.20245	4.311559	6.309191	0.0000
LN(Volume/1000)	1.091708	0.202096	5.401925	0.0000
Decay Fraction	-14.96586	5.049765	-2.963674	0.0031
Cableyard Fraction	-6.404287	1.350268	-4.742974	0.0000
Helicopter Logging Fraction	-53.09817	4.741301	-11.19907	0.0000
Fire Damaged Fraction	-6.283934	2.058699	-3.052381	0.0023
Cycle Time	-0.951861	0.115177	-8.264312	0.0000
LN(number of Bidders)	2.762089	0.202752	13.62301	0.0000
Salvage Logging Indicator * Insect Attack Codes Indicator	-5.972180	0.987435	-6.048174	0.0000
Insect Attack Codes Indicator	1.593528	0.971505	1.640268	0.1012
Fort Nelson – Peace Zone	-4.800373	0.728176	-6.592324	0.0000
2007 Auctions	0.254521	0.727262	0.349972	0.7264
2008 Auctions	-3.701469	0.957791	-3.864590	0.0001
2009 Auctions	-6.050758	0.886665	-6.824175	0.0000
2010 Auctions	-4.765224	0.839682	-5.675033	0.0000
LN (Volume per tree)	5.391203	0.480861	11.21156	0.0000
LN (Coniferous Volume per hectare)	2.149231	0.507184	4.237573	0.0000
Competitive Deciduous Indicator	-5.116207	1.208319	-4.234152	0.0000
Total Attack Fraction * (1 - Cruise Based)	-2.792379	0.698845	-3.995705	0.0001
Cruise Based	-6.029845	0.520727	-11.57966	0.0000
R-squared	0.771822	Mean dependent var		16.83994
Adjusted R-squared	0.767329	S.D. dependent var		9.296866
S.E. of regression	4.484435	Akaike info criterion		5.859031
Sum squared resid	23488.67	Schwarz criterion		5.961381
Log likelihood	-3467.982	Hannan-Quinn criter.		5.897598
F-statistic	171.7745	Durbin-Watson stat		1.689906
Prob(F-statistic)	0.000000			

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FINAL NUMBER OF BIDDERS

Dependent Variable: LOG(NB)

Method: Least Squares

Date: 05/10/11 Time: 13:29

Sample: 1 1419 IF IN_1192

Included observations: 1192

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.916703	0.108305	-8.464061	0.0000
Forecast Real Winning Bid District Average Number of Bidders	0.052081	0.003146	16.55705	0.0000
Partial Cut Fraction	0.250261	0.016927	14.78468	0.0000
Slope %	-1.029159	0.300072	-3.429713	0.0006
First and Second Quarter Auctions	-0.009059	0.001547	-5.854233	0.0000
Highway haul	0.131000	0.032673	4.009441	0.0001
2007 Auctions	0.153212	0.036795	4.163916	0.0000
2008 Auctions	-0.096456	0.053542	-1.801492	0.0719
2009 Auctions	0.222170	0.062771	3.539381	0.0004
2010 Auctions	0.135894	0.066069	2.056844	0.0399
Cruise Based	0.202571	0.067381	3.006366	0.0027
	0.242481	0.057618	4.208456	0.0000
R-squared	0.419747	Mean dependent var		0.932410
Adjusted R-squared	0.414338	S.D. dependent var		0.709350
S.E. of regression	0.542855	Akaike info criterion		1.626067
Sum squared resid	347.7361	Schwarz criterion		1.677242
Log likelihood	-957.1362	Hannan-Quinn criter.		1.645351
F-statistic	77.59963	Durbin-Watson stat		1.833729
Prob(F-statistic)	0.000000			

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Variables and Definitions for Equations

Variable	Definition
2011 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 the total harvest method volume that is appraised as overhead cable yarding.
Helicopter Logging Fraction	Fraction of the total harvest method volume that is appraised as helicopter yarding.
Fire Damaged Fraction	Fraction of the total net coniferous cruise volume that is fire damaged.
Cycle Time	Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs)). See section 3.5.1.1 and 3.5.1.3 of Appraisal Manual.
HemBal Fraction	Fraction of the total net coniferous volume that is Hemlock and Balsam.
Cedar Fraction	Fraction of the total net coniferous volume that is Cedar.
Volume per Tree	Cutting permit average volume per tree from the cruise (m ³).
Slope %	Cutting permit average slope from the cruise.
District average number of bidders	Average number of bidders by district from the auction dataset. (see Table 3-2)
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.
2007 Auctions	If the auction sold in 2007 then AUC 2007 =1.
2008 Auctions	If the auction sold in 2008, then AUC 2008 =1.
2009 Auctions	If the auction sold in 2009, then AUC 2009 =1.
2010 Auctions	If the auction sold in 2010 then AUC 2010 =1.

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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.
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.
Highway Haul	1 if the primary haul method is highway, otherwise HWY = 0.
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 the volume of pest attack is 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.
First and Second Quarter Auctions	If the auction sold in January to June, D_ Q1 + Q2 =1.
Forecast Real Winning Bid	Estimated winning bid from winning bid equation

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2010 & Benchmark Equations	
2006 Auctions	If auction sold in 2006 then AUC 2006 = 1.
Grade 3 Fraction	Fraction of the 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 the auction sold in January to March, Q1=1.
Second Quarter Auctions	If the auction sold in April to June, Q2=1.
Decked Volume Fraction	Fraction of the 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).

APPENDIX 2

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DESCRIPTION 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 specified operations and, if eligible, will 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. Market Logger Specified Operations Cost
8. High Development Cost (BCTS only)