FO 21 Revenue Analyst – Timber Pricing Branch Analysis Project

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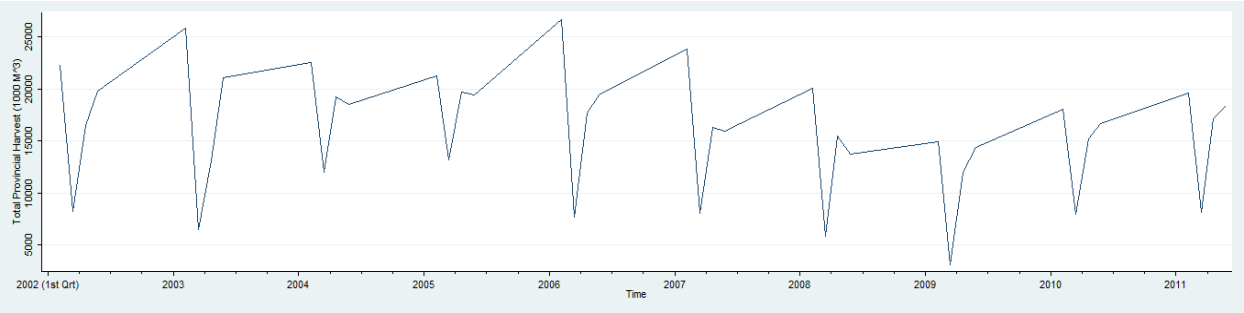
Introduction

This report comprises a brief assessment of raw forestry industry data received from the Timber Pricing Branch Division of the Ministry of Forests, Lands and Natural Resource Operations. The report begins by analyzing trends in the data, including an identification and analysis of outlying observations and concludes with quarterly and annual forecasts of harvest volume and revenue. All harvest volume and revenue data are taken to represent forest products billed to crown land. Export data is taken as total Provincial exports, with the indicated tariff representing a BCTS revenue stream.

Harvest Volumes

The investigation of the data indicates both long-run and short-run trends. In the long-run, the total harvest of forest products billed to crown land has diminished slightly. The 10 year average total harvest of 63,499,601 m^3 , is larger than the 5 year average total harvest of 56,934,226 m^3 , which is larger than the 3 year average total harvest of 55,164,064 m^3 .

A quarterly time series graph of the total provincial harvest highlights the more prominent cyclically seasonal short-term trend.



This seasonal trend suggests harvest volume from scale quarter 2 marks a low that follows directly the seasonal high. Superimposing a moving average line would highlight a long-run harvest volume cycle similar in shape and shift to an atypical business cycle fluctuation. This is relevant because it suggests any ordinary least squares lines fitted through quarterly points are likely to underestimate 2012 volumes.

If the 2 scale quarter of the harvest volume data matches with the 1st quarter of the fiscal year (April 1st to June 30th), the low volume in the 2 scale quarter could represent small winter volumes that were not scaled until the spring. This is relevant because the 2ond scale quarter is the common time period among each of the outlying observations in an examination of harvest volume vs revenue.

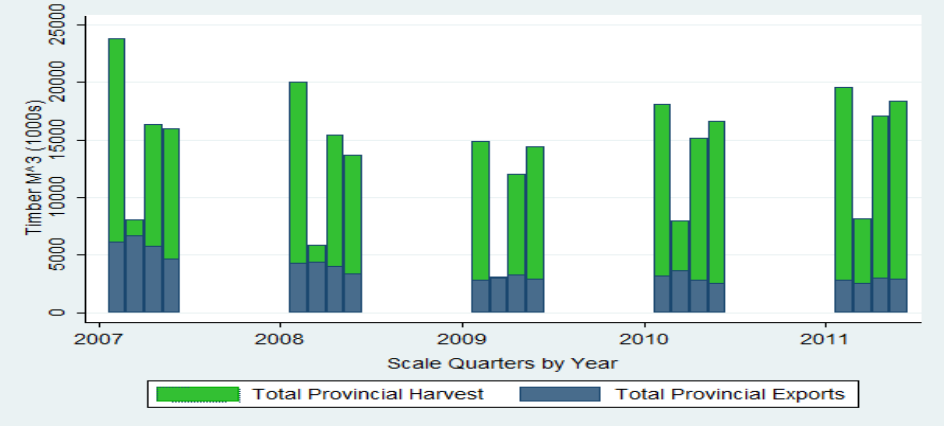
Outliers

The regressions of harvest volumes on provincial revenues indicate positive correlation coefficients. Yet, there are many 2 scale quarter observations with large positive harvest volumes and large negative revenue postings.

These outliers could be reversals for revenues posted, due to the abandonment of payables by buyers in default. They could also represent write downs of uncovered forward sales that changed in value when the Canadian dollar appreciated relative the forward buyers currency. This would explain the grouping of outliers in turbulent business cycle time periods, like the second quarter of 2008 and the second quarter of 2002. The former conclusion is supported by the fact that each of the data pair anomalies are common to the second scale quarter. Accounting revenue reversals seem more likely to be posted in a consistently optimal fiscal quarter. In either case, seasonally adjusting the data, by detrending it, or simply removing the outliers, could allow for more accurate time series forecasting, as could forecasting by quarter.

Exports and Harvest Volumes

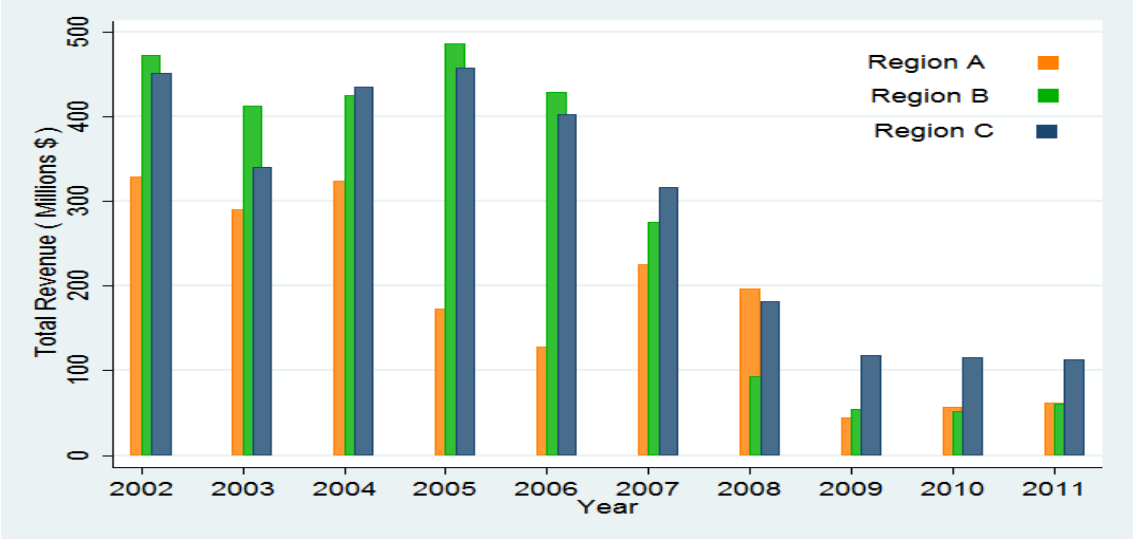
An examination of provincial exports since the Softwood Lumber Agreement came into effect, in 2006, suggests that exports have not moved in unison with quarterly total harvests.



$1000\,bfm = 1\,mbf = 2.36\,m^3$

Instead, while total quarterly harvests rebounded slightly in 2010 and 2011, exports have declined or remained at lows. A regression of exports on harvest volumes indicates that exports do predict harvest volumes, but only slightly. Furthermore, the r-squared is very low and the results are not significant to the 1, 5 or 10 percent levels. The indication is that total provincial harvest volumes are predicted by other variables in addition to total provincial exports.

Revenues



The above graph shows that revenues have dropped off from 2002 and 2005 highs by a much greater margin than harvest volumes have dropped off, across the same time period. A rate of decline in revenue than is greater than the rate of decline in annual harvest volume suggests that timber market prices have declined significantly. Further, a relative change in regional revenue could indicate intra-industry dynamics (operator entry and exit) and/or changes in average regional timber grades.

Stumpage

A 2 year stumpage rate sample showing average stumpage rates by region and tenure group does show that region C has a larger combined average stumpage rate than region B. The quarterly regional average stumpage tables, dating back to 2007, confirm the fall in prices, while highlighting which regions were particularly sensitive to economic downturns in which quarters.

Average Stumpage Rates ($\$/m^3$)

2010 by Region and Tenure

Region	Major	BCTS	TL	Sum of Averages
A	1.48	22.12	1.93	25.53
B	1.19	6.87	2.48	10.54
C	2.72	12.61	4.55	19.88

2011 by Region and Tenure

Region	Major	BCTS	TL	Sum of Averages
A	1.43	25.44	2.12	28.99
B	1.22	8.45	1.95	11.62
C	2.65	14.29	2.77	19.71

2007 by Region and Quarter

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	16.79	16.27	18.31	18.52
B	12.94	5.06	11.51	9.35
C	13.92	12.82	10.35	9.92

2008 by Region and Quarter

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	20.77	21.89	16.43	21.56
B	6.6	-0.66	3.30	3.54
C	8.58	5.57	6.09	7.60

2009 by Region and Quarter

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	12.26	5.39	3.16	4.68
B	4.03	0.49	2.46	2.94
C	8.44	8.24	4.55	4.63

2010 by Region and Quarter

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	5.58	4.80	3.38	4.57
B	2.84	1.38	1.78	2.76
C	5.40	5.69	3.99	4.25

2011 by Region and Quarter

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	4.81	4.46	3.65	4.87
B	2.70	2.92	2.36	2.18
C	4.64	4.84	4.82	4.06

Forecasts

The assumption of linear relationships between prior and future period observations of regional quarterly harvest volume data allows for a rudimentary forecast. A regression model using harvest volumes to predict revenues, by quarter and region, across 2002 to 2011, allows for a revenue forecast.

2012 Harvest Volume Forecast m^3

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	2,062,279	3,088,267	2,799,903	2,405,497
B	7,744,957	995,043	5,352,584	5,355,911
C	7,595,804	2,100,326	7,076,947	7,127,768

Regression Coefficients when Harvest Volume Predicts Revenue

Region	1st quarter	2nd quarter	3rd quarter	4th quarter
A	14.16344	12.55913	10.42413	11.8427
B	13.02469	14.169	12.87253	11.34413
C	12.1088	10.2055	10.28792	10.49246

2012 Revenue Forecast ($ millions)

Region	1st quarter	2nd quarter	3rd quarter	4th quarter	Total
A	29.2	38.8	29.2	28.5	125.7
B	100.9	14.1	68.9	60.8	244.7
C	91.9	21.4	72.8	74.8	260.9

This model forecasts 2012 calender year revenues of $631.3 million, 275% larger than the BCTS Business Plan fiscal 2012/13 forecast of $169.2 million. There are several reasons why the above model is inaccurate. Firstly, harvest volumes move yearly in a more cyclical manner. A linear prediction of future period harvest volumes from prior periods would presumably be more reliable if a moving average model, auto-regressive or both (ARIMA) model were used. Secondly, the regression model used to predict revenues is likely miss-specified. Though the r-squareds average near 0.70 and the coefficients are each highly significant, a logarithmic model might fit the data better. Also, the inclusion of several additional variables (timber prices, exchange rates, foreign housing starts, GDP) might lower the above coefficients to more realistic levels. A further challenge is that econometric models that forecast timber revenues are known to have high correlations between predicting variables and often require forecasting of independent variables, which can compound uncertainty (Lutz, 2008)[1].

An ideal forecasting model might include a bottoms up approach to estimating timber demand specific to individual markets. This approach may not be as cost effective as time series modelling, when relative mean absolute percentage errors (MAPEs) are contrasted with relative costs.

Conclusion

This report highlighted changes in forestry statistic dynamics. Harvest volumes were evidently more stable than provincial revenues, which diminished significantly. Regional and quarterly average stumpage rates demonstrated seasonal and regional fluctuations. Two linear models were used to forecast provincial harvest volumes and revenues. These forecasts, when compared to BCTS forecasts, were inaccurate. An ARIMA model, or zero-mean ARMA model, fitted to transformed data (detrended or differenced) was suggested for the quantitative analysis of the univariate harvest volume time series.

1 Jack Lutz, 2008. “Timber Price Trends”, unpublished PHD dissertation paper, University of New Hampshire.