Forest-mill integration: a transaction cost perspective

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Outline

• Policy background in Canada.
• Brief overview of transaction cost theory
• Forestry and transaction cost economics
• Empirical model of forest-mill integration
• Discussion/Conclusions

Full paper can be found at:
Working paper 2008-07
Policy background in Canada

• Vertical integration traditionally favored through appurtenance agreements
• Concerns: Pearse (1976). 1991 FRC recommended 50% of volume devoted to markets.
• BC - 2003 FRP 20% auction on open market and increased arms length transactions through small scale tenures.
• Quebec – 2008 new forest regime 25% market.
Policy background in Canada

• Follow de-integration in US?
• Globermann and Schwindt (1986) study suggests transaction costs are driving integration decision.
• Industry expresses need for secure supplies for investment
• What is an appropriate proportion to devote to markets?
Transaction cost theory

• Origins owed to Coase (1937). Questioned the emergence and boundaries of firms. Developed and formalized by Williamson (1975), Klein et al. (1978), Joskow (1985) etc.

• “make or buy” decision

• Ranges from anonymous spot markets through to vertical integration with several “hybrid” arrangements in between.
Transaction cost theory

• Choice of organization form is dictated by transaction costs.

• Transaction costs depend on:
  1. Asset specificity – physical, geographical etc.
  2. Uncertainty
  3. Transaction frequency

• Avoid “hold up” problem (quasi rent extraction)
Forestry and transaction cost economics


• Prior forest mill integration studies (Globerman and Schwindt 1986, Yin et al. 2000, Lönnstedt 2007) have mentioned transaction costs but no empirical testing.
Empirical forest-mill integration model

• Surveyed 136 mills in New Zealand and Sweden. 88 participated.
• Survey gained information on proportion of fibre sourced from market (\textit{fibrem}), long term contract (\textit{fibrec}), and own forest (\textit{fibreo})
• Also retrieved potential transaction cost variables
Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>description</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>fibrem</td>
<td>Proportion of fibre from market</td>
<td>0.50</td>
<td>0.39</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>fibrec</td>
<td>Proportion of fibre from long term contract</td>
<td>0.37</td>
<td>0.37</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>fibreo</td>
<td>Proportion of fibre from own forest</td>
<td>0.13</td>
<td>0.26</td>
<td>0</td>
<td>1</td>
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<tr>
<td>NZ</td>
<td>Indicator variable for New Zealand</td>
<td>0.38</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
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<tr>
<td>pulp</td>
<td>Indicator variable for Pulp mill</td>
<td>0.32</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
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<tr>
<td>fibresp</td>
<td>Ranking of fibre specificity</td>
<td>3.25</td>
<td>1.36</td>
<td>1</td>
<td>5</td>
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<tr>
<td>uncert</td>
<td>Ranking of market uncertainty</td>
<td>2.93</td>
<td>1.36</td>
<td>1</td>
<td>5</td>
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<tr>
<td>mills</td>
<td># of mills owned in fibre basin</td>
<td>2.24</td>
<td>2.09</td>
<td>1</td>
<td>13</td>
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<tr>
<td>size</td>
<td>Fibre consumption</td>
<td>224.53</td>
<td>279.22</td>
<td>1</td>
<td>1250</td>
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<tr>
<td>Mod_con</td>
<td>3 firm forest ownership concentration ratio 0.3 to 0.6</td>
<td>0.41</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
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<tr>
<td>high_con</td>
<td>3 firm forest ownership concentration ratio &gt;0.6</td>
<td>0.30</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
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<tr>
<td>net_export</td>
<td>Region is net exporter of fibre</td>
<td>0.34</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Empirical forest-mill integration model

- Dependent variable *fibrem*
- OLS biased and inconsistent with proportion as dependent variable
- Log odds ratio conversion and beta distribution model can’t handle extreme points (0,1)
- Two limit tobit (Hobbs 1997): 0 and 1 points are not really censored or missing data.
- Instead use fractional logit model (FLOGIT) developed by Papke and Wooldridge (1996)
### Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>P value</th>
<th>Marginal Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>3.213</td>
<td>0.760</td>
<td>0.000</td>
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<tr>
<td>NZ</td>
<td>1.132</td>
<td>0.478</td>
<td>0.018</td>
<td>0.275</td>
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<tr>
<td>pulp</td>
<td>-1.518</td>
<td>0.460</td>
<td>0.001</td>
<td>-0.354</td>
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<tr>
<td>fibresp</td>
<td>-0.540</td>
<td>0.145</td>
<td>0.000</td>
<td>-0.135</td>
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<tr>
<td>uncert</td>
<td>-0.285</td>
<td>0.127</td>
<td>0.024</td>
<td>-0.071</td>
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<tr>
<td>mills</td>
<td>-0.171</td>
<td>0.075</td>
<td>0.023</td>
<td>-0.043</td>
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<tr>
<td>size</td>
<td>0.001</td>
<td>0.001</td>
<td>0.040</td>
<td>0.0003</td>
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<tr>
<td>net_export</td>
<td>0.336</td>
<td>0.347</td>
<td>0.333</td>
<td>0.084</td>
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<tr>
<td>mod_con</td>
<td>-0.804</td>
<td>0.445</td>
<td>0.071</td>
<td>-0.198</td>
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<tr>
<td>high_con</td>
<td>-0.986</td>
<td>0.648</td>
<td>0.128</td>
<td>-0.239</td>
</tr>
</tbody>
</table>

Log pseudo-likelihood = -40.61

# of observations: 88
Discussion

• Overall target of 50% market suggested by 1991 FRC supported.
• However, transaction costs factors are significant so flexibility desirable.
• Pulp sector seems to have legitimate demands for longer term supply commitment.
• If greater market use is desired, reducing overall supply uncertainty (land use decisions etc.) could be critical.
Conclusion

• Transaction cost factors are significant in explaining forest-mill integration decision.
• Future research: other regions and variables (potentially outside TCE theory).
• Do factors such as growth rates, possibilities for alternative land use (agriculture, real estate) affect landowners willingness to enter into longer term supply commitment?
• How and why do contract duration and pricing adjustments in long-term contracts vary?