

Regional log market integration in New Zealand

Kurt Niquidet and Bruce Manley

Outline

- Research objective
- Methodology
- Overview of regions and log grades
- Results
- Conclusions

Full paper can be found at:

<http://www.vkooten.net/repa/publications.htm>

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Research objectives

- To date little applied work on the New Zealand log market
- time series properties – Informational efficiency
- Spatial integration – cointegration / law of one price
- Reservation pricing strategies and option value

Methodology - stationarity

- DF-GLS tests. Null hypothesis unit root. Lag selected by modified Akaike information criterion (Ng and Perron 2001)
- KPSS tests. null hypothesis stationary series. Hobijn et al. (1998) procedure to improve size and power of test.

Methodology - cointegration

$$p_{1t} = c + \beta p_{2t} + v_t$$

- If prices (p) in each region are $I(1)$, series are cointegrated if v_t is $I(0)$.
Use Engle-Granger test
- Strong LOP: $\beta = 1$ and $c = 0$
- Weak LOP: $\beta = 1$ and $c \neq 0$

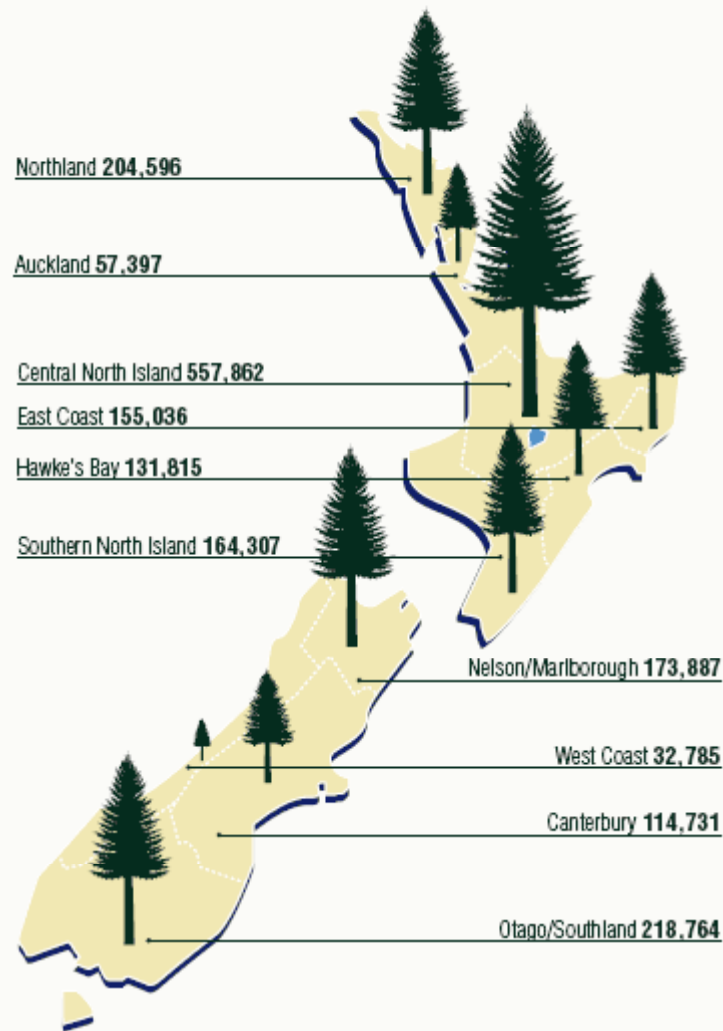
Methodology - Johansen

- Engle Granger method cannot handle more than one cointegrating relationship. Also endogeneity problems.
- Johansen (1988) multivariate format. Trace test for rank of matrix in VECM gives number of co-integrating relationships.
- Trace test sensitive to inclusion of deterministic terms and number of lags.

Regions

- Monthly spot market data provided by Agri-Fax 1995-2006
- New Zealand divided into four regions:
 1. Northern South Island – NSI
 2. Southern South Island – SSI
 3. Northern North Island – NNI
 4. Southern North Island - SNI

(Hectares)



Total 1.8 million hectares

Source: NEFD 2005

Radiata – 89%

Douglas fir – 6%

Other species – 5%

Recent production – 20 million cubic meters

Log grades – Radiata Pine

	P1	P2	KS	S1/S2	Pulp
Pruning	yes	yes	no	no	no
Minimum small end diameter (cm)	40	35	20	40/30	10
Maximum branch size (cm)	n/a	n/a	10	6	n/a
Minimum Length (m)	4	4	4	4.95 to 6.1	fixed/random
Destination market	Domestic	Domestic	Export	Domestic	Domestic/Export

Source: Adapted from Agri-fax

Results: DF-GLS

Grade		Region			
		NSI	SSI	NNI	SNI
P1	DF statistic	0.49	0.59	-2.26†	1.06
	lags	2	13	1	1
P2	DF statistic	0.73	0.5	-2.42†	-0.001
	lags	6	2	1	1
KS	DF statistic	-1.58	-0.82	-1.56	-1.60
	lags	1	9	1	1
S1 / S2	DF statistic	-0.92	0.23	-0.17	-0.25†
	lags	2	1	3	1
Pulp	DF statistic	-1.52†	-1.73†	-2.49**	-2.975***
	lags	1	2	2	1

Note: Unit root rejected at *, 10%; **, 5%; ***, 1% as determined by response surface analysis of Elliot et al. (1996)

† Deterministic trend included if significant at 5% level

Results: KPSS

Grade		Region			
		NSI	SSI	NNI	SNI
P1	KPSS statistic	2.36***	1.96***	0.49***	2.59***
	bandwidth	3	3	3	3
P2	KPSS statistic	2.78***	2.42***	0.63***	2.29***
	bandwidth	3	3	3	3
KS	KPSS statistic	1.78***	1.65***	1.28***	1.32***
	bandwidth	3	3	3	3
S1 / S2	KPSS statistic	0.53**	2.1***	2.63***	0.38***
	bandwidth	3	3	3	3
Pulp	KPSS statistic	0.36***	0.56**	1.29***	0.44*
	bandwidth	3	3	3	3

Note: Stationarity for the series rejected at *, 10%; **, 5%; and ***, 1% significance

Results: Engle-Granger

Log Grade

P1	<u>Market</u>	NSI	SSI	NNI
	SSI	-2.02		
	NNI	-3.22	-2.17	
	SNI	-3.83*	-2.07	-3.34*
P2	<u>Market</u>	NSI	SSI	NNI
	SSI	-1.59		
	NNI	-2.92	-3.24	
	SNI	-2.85	-3.50*	-3.40*
KS	<u>Market</u>	NSI	SSI	NNI
	SSI	-4.61**		
	NNI	-3.28	-4.93**	
	SNI	-4.49**	-4.40**	-4.30**
S1/S2	<u>Market</u>	NSI	SSI	NNI
	SSI	-2.57		
	NNI	-2.67	-2.96	
	SNI	-2.71	-2.88	-2.44
Pulp	<u>Market</u>	NSI		
	SSI	-3.44*		

Note: Unit root rejected at * , 5%; **, 1% using Davidson and MacKinnon (1993) critical values

Results: Johansen trace test

Log Grade	Lag	Null hypothesis	Trace statistic	5% critical value (case 2)
P1	2	$r=0$	43.69	53.12
		$r\leq 1$	23.58	34.91
		$r\leq 2$	11.15	19.96
		$r\leq 3$	4.51	9.24
P2	3	$r=0$	57.80*	53.12
		$r\leq 1$	30.29	34.91
		$r\leq 2$	13.70	19.96
		$r\leq 3$	2.88	9.24
KS	2	$r=0$	78.64*	53.12
		$r\leq 1$	50.93*	34.91
		$r\leq 2$	26.12*	19.96
		$r\leq 3$	6.46	9.24
S1/S2	2	$r=0$	45.04	53.12
		$r\leq 1$	26.91	34.91
		$r\leq 2$	15.43	19.96
		$r\leq 3$	5.17	9.24
Pulp	1	$r=0$	31.76*	19.96
		$r\leq 1$	5.14	9.24

* Reject null hypothesis at 5% significance level. Critical values from Osterwald-Lenum (1992)

Law of one price

- t tests did not support LOP for domestic series that were cointegrated. But weak LOP supported for KS export grade.
- Restriction on matrix in VECM also supported LOP for KS export grade.
 $\chi^2(3) = 2.332$ with a P-value of 0.508

Conclusions

- Non-stationarity in log prices implies that reservation prices based on mean reversion not appropriate for NZ
- Lack of integration in domestic market: transportation costs, wood quality?
- Cointegration doesn't necessarily equal market integration. Alternative models but need trade flow and transaction cost data.

Thank You

