Port basin choice with Russian container trade

By

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The study objective is

To establish

a demand choice function for Russian container port services per maritime basin

The study approach is

- To estimate the coefficients of a Multi-Nomial Logit (MNL) Model with regression analysis
- To calculate a demand function by simulating the impact of cost changes on port demand

Estimation of logit models on port choice

- Malchow & Kanafani (2001) and (2004):
- Tiwari et al. (2003)
- Veldman & Bückmann (2003)
- Blonigen & Wilson (2006)
- Veldman & Rachman (2008)
- Anderson et al. (2009)
- Garcia-Alonso & Sanchez-Soriano (2009):
- Veldman et al. (2010)

related model applications concern

- modal split land versus maritime transport

The port choice: model proposed

$$P_{ijk}(p=k \mid p=1...P) = \frac{e^{-Uijk}}{\sum_{p=1}^{p=P} e^{-U_{ijp}}}$$

utility attached to the routing via port *k* for trade between *i* and *j*

probability of choosing port *k* from all possible ports *p = 1..P*, for province *i = 1..I* and trade partner *j= 1…J*

$$U_{ijk} = \alpha_0^k + \alpha_1 CL_{ik} + \alpha_2 CM_{jk} + \alpha_3 Q_k$$

Quality of service aspects for *i, j* and port *k*

Maritime transport cost between trade partner *j* and port *k*

Inland transport cost between province *i* and port *k*

Basic model tested

$$U_{ijk} = a_0^k + a_1 CL_{ik} + a_2 CM_{jk} + a_3 TL_{ik} + a_4 TM_{jk} \quad (2)$$

where:

CL_{ik}: inland transport costs between region i and port k;

CM_{jk}: maritime transport cost between trade partner j and port k;

TL_{ik}: inland transport time between region i and port k;

TM_{jk}: maritime transport time between trade partner j and port k;

$$Ln(P_{ijk} / P_{ijp}) = U_{ijp} - U_{ijk} = \alpha_0 + \alpha_1 (CL_{ip} - CL_{ik}) + \alpha_2 (CM_{jp} - CM_{jk}) + \alpha_3 (TL_{ip} - T$$
$$+ \alpha_4 (TM_{jp} - TM_{jk})$$

(4)

where $\alpha_0 = \alpha^k_0 - \alpha^p_0$.

The explanatory variables or attributes of the logit model

- Inland transport cost

Transport takes place by rail and road. We take the distance by road and rail between the provincial gravity point and the seaport as basis multiplying this with unit costs

- Maritime transport cost

The port basins of the Baltic basin, the Black Sea basin and the Far East basin do not have have direct liner services with the main areas of the world and therefore have to rely on feeder transport. This situation, however, is changing

- Inland transport time

It is based on rail and road distance using specific unit costs

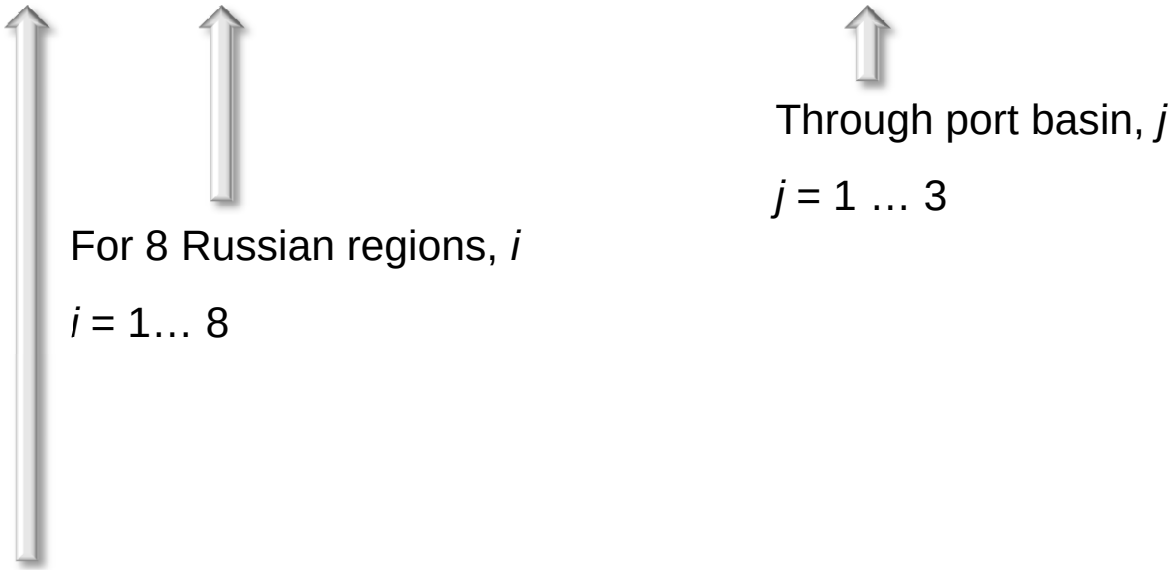
- Maritime transport time

It is based on the sum of mainline and feeder line costs by taking half of the time of a roundtrip

Statistical analysis

- **Data**

Russian containerised imports and exports channeled by sea.



For 8 Russian regions, *i*

i = 1… 8

Through port basin, *j*

j = 1 … 3

Imports and exports

All the trade partner countries are grouped into 10 foreland regions
This leads to 8 x 3 x10 = 240 potential flows

Source of data

Russian Custom Statistics

Port basin choice in Russia

Russian districts

Russian container trade by border area
(in 1000 tons)

Data 2006			
	volume	shares in subtotal	shares in grand total
Border category			
Baltic	12,729	72%	
South	2,069	12%	
Far East	2,831	16%	
subtotal	17,629	100%	89%
Other categories			
Asian rail	408	19%	
unknown	1,707	81%	
subtotal	2,115	100%	11%
Grand total	**19,744**		**100%**
Data 2007			
	volume	shares in subtotal	shares in total
Border category			
Baltic	3,474	68%	
South	570	11%	
Far East	1,084	21%	
subtotal	5,127	100%	22%
Other categories			
Asian rail	271	1%	
unknown	17,874	99%	
subtotal	18,145	100%	78%
Grand total	**23,273**		**100%**

Russian container trade by hinterland region
(in 1000 tons)

Hinterland region	2006				2007			
	import	export	total	shares	import	export	total	shares
1 Northwest	6,289	1,934	8,223	42%	7,150	2,193	9,344	40%
2 Central	5,025	366	5,391	27%	6,199	429	6,628	28%
3 South	804	120	924	5%	1,067	106	1,174	5%
4 Southeast	279	1,204	1,484	8%	443	1,123	1,565	7%
5 Ural	146	664	810	4%	209	871	1,080	5%
6 West Siberia	218	588	806	4%	281	764	1,044	4%
7 East Siberia	58	961	1,019	5%	83	1,046	1,129	5%
8 Far East	849	144	993	5%	1,064	139	1,203	5%
9 Unspecified	86	8	94	0%	98	8	105	0%
Total	**13,756**	**5,988**	**19,744**	**100%**	**16,594**	**6,678**	**23,273**	**100%**

Russian container trade by foreland region
(in 1000 tons)

Foreland region	2006				2007			
	import	**export**	**total**	**shares**	**import**	**export**	**total**	**shares**
1 Northwest Europe	3,766	1,246	5,012	32%	3,783	1,153	4,935	27%
2 West Mediterranean	645	203	848	5%	721	202	923	5%
3 East Mediterranean	668	608	1,276	8%	790	652	1,441	8%
4 South Am. East Coast	1,060	81	1,140	7%	1,196	104	1,300	7%
5 Arabian Sea Area	551	523	1,073	7%	522	1,314	1,836	10%
6 Southeast Asia	863	213	1,077	7%	866	266	1,132	6%
7 Oceania	141	6	147	1%	101	11	112	1%
8 East Asia	2,604	935	3,539	22%	3,995	912	4,907	27%
9 Korea	961	150	1,111	7%	1,050	141	1,191	6%
10 Japan	121	529	650	4%	161	498	659	4%
Total selected regions	11,380	4,493	15,874	100%	13,183	5,253	18,436	100%
Other regions	2,376	1,495	3,870	-	3,411	1,425	4,837	-
Total	**13,756**	**5,988**	**19,744**	**-**	**16,594**	**6,678**	**23,273**	**-**

Results of regression analysis

Variables	Imports 2006		Exports 2006		Imports 2007		Exports 2007	
	coefficient	t-value	coefficient	t-value	coefficient	t-value	coefficient	t-value
Separate cost and time variables								
Constant	-5.03	-4.06	-3.05	-3.54	-1.796	1.23	-2.04	-2.44
Maritime costs	-0.002	-5.21	-0.003	-6.25	-0.002	-3.54	-0.003	-5.80
Inland costs	0.001	0.99	-0.000015	-0.01	0.0021	1.59	-0.0024	-2.06
Maritime time	-0.036	-1.56	-0.022	-1.00	0.00413	0.14	-0.012	-0.52
Inland time	-0.675	-2.24	-0.488	-1.73	-0.987	-2.91	0.0156	0.58
Dummy south	2.13	1.56	-3.40	-3.36	1.462	0.858	-2.701	-2.71
Adj. R Square	0.44	-	0.57		0.58	-	0.51	
Total cost and time variables								
Constant	-2.81	-4.05	-2.152	0.083	-2.19	-2.54	-1.50	-1.86
Total costs	-0.0014	-7.06	-0.002	-9.29	-0.0019	-8.15	-0.0018	-8.65
Total time	-0.052	-2.33	-0.046	-2.21	0.001	0.03	-0.034	-1.59
Dummy south	0.064	0.066	-4.14	-4.12	1.38	1.11	-3.126	-3.16
Adj. R Square	0.42	-	0.55	-	0.55	-	0.51	-
No of observ.	150	-	144	-	91	-	143	-

Result of regression analyses

- Maritime cost variable does well: both imports and exports and for 2006 and 2007. T-values range from 3.5 to 6.3
- Related coefficient values vary between -0.002 for imports and -0.003 for exports

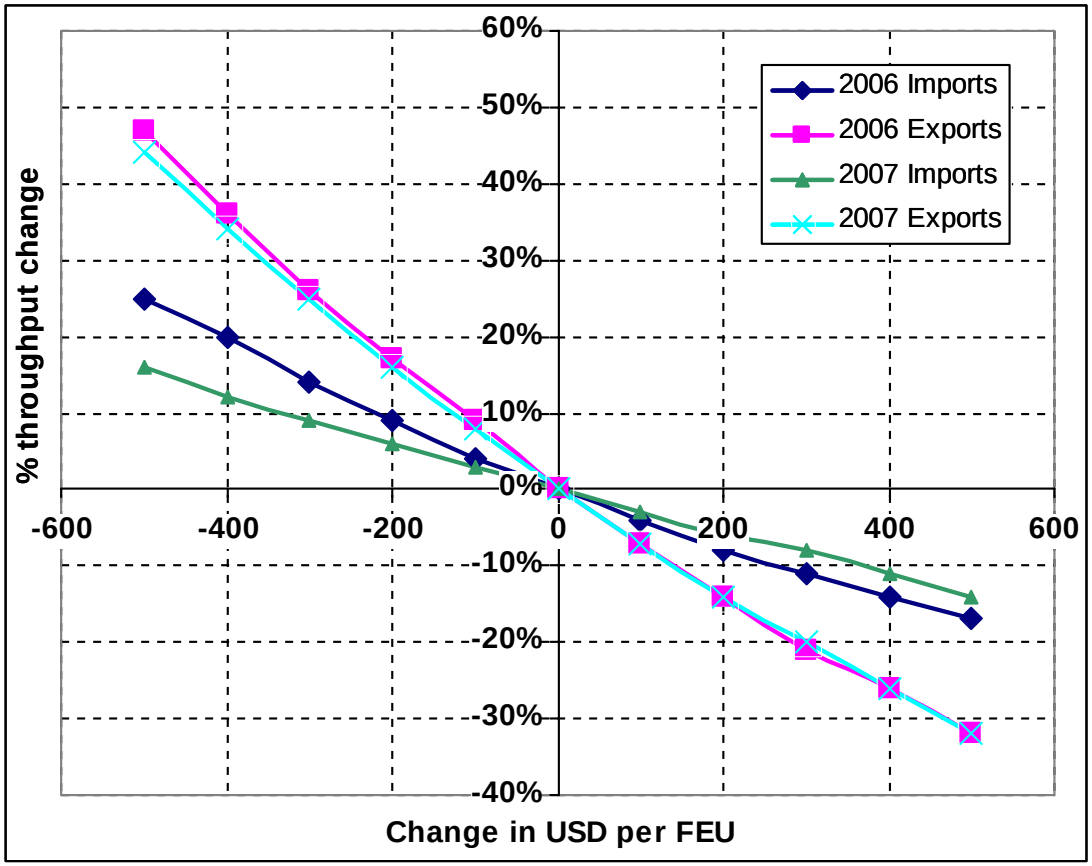
- Inland cost variable does less well: t-values are low
- Related coefficient values for exports even have the wrong sign

- Time variables show a mixed results: in some cases significant in other cases not

- Total cost variable does well in all cases with t-values ranging from 7.1 to 9.3
- Total time variable is significant for 2006 data only

- The constant value is negative indicating an over-estimation of the share of the Baltic Region ports

Demand choice function



Conclusions

- **Statistical tests show a significant influence of inland and maritime transport costs (t-values are high)**
- **Results can be used to derive a demand choice function to be used for economic and financial evaluation**
- **The value of port choice elasticties for the South Basin ports is low with elasticity values ranging from -0.02 to -0.06**
- **Veldman and Buckmann (2003) measured a value of -1.44 for the port of Rotterdam**
- **Blonigen and Wilson (2006) a value of -1.5 for US containerised imports**
- **Anderson et al. (2009) values ranging from -0.28 to -2.11 for US imports**
- **Veldman et al. (2010) values of -0.2 for Spanish container imports and exports**

It can be concluded that the values we measured are low

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Thank you for your attention!