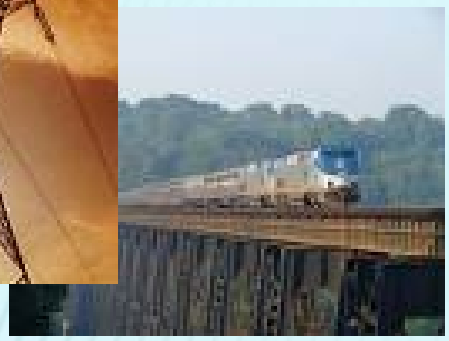
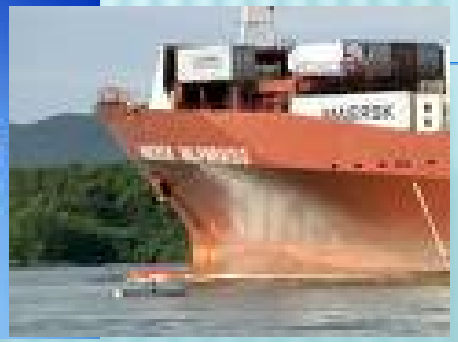



Trade and Infrastructure: Their Relationship in Brazilian States





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Introduction

Previous Studies:

- World Bank (2001)
- Limão and Venables (2001)
- Wilson et. al. (2003)
- Anderson and Van Wincoop (2004)

In Brazil:

- Hidalgo and Vergolino (2001)
- Castro (2001)
- Ferreira (1994 and 1996)
- Almeida and Silva (2006)

Methodology

Infrastructure Index:

$$II = \frac{(Actual - Minimum)}{(Maximum - Minimum)}$$

Variables Included:

- Extension of highways and railroads, by km^2;
- Consumption of electric power, per one thousand inhabitants;
- Lines of fixed and mobile telephones and access to the Internet, per one thousand inhabitants;
- Movement of containers in ports and of total aerial load;
- Total of passengers and landings and takeoffs, in airports.

Gravity Equation

$$\ln(X_{ij}) = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(D_{ij}) + \beta_4 \ln(\Sigma II) + \beta_5 (ADJ_{ij}) + \mu$$

where:

X_{ij} is exports from state i to state j ;

Y_i is GDP in state i;

Y_j is GDP in state j;

D_{ij} is the distance in km between state i and state j;

ΣII is the indicator of infrastructure and load movement;

ADJ_{ij} is a dummy variable to capture the effect of adjacency;

β's are parameters with positive signs, except for β_3;

μ is the error term.

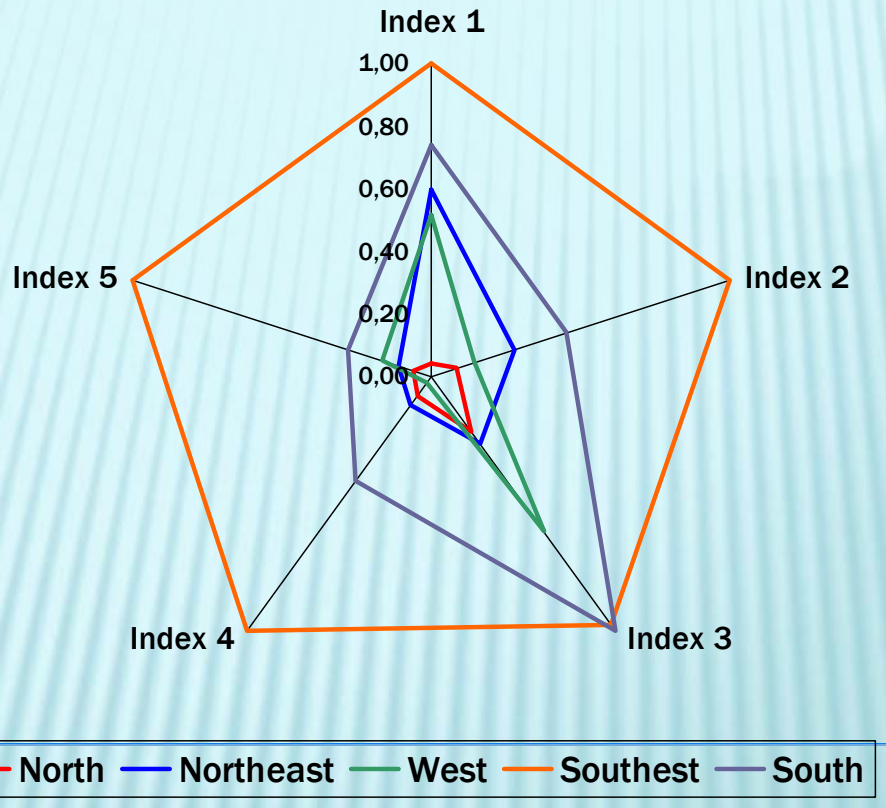
Results

- Average value, calculated index and minimum and maximum values for each variable:

Variable	Description	Average (Index)	Minimum Value	State	Maximum Value	State
Aerial Load	Total aerial load, in kg	46.039.884 (0,116)	1.085.262	TO	630.505.218	SP
Mobile Telephony	Access to mobile service, per one thousand inhabitants	0,113 (0,098)	0,039	MA	0,333	DF
Containers	Movement of containers in ports	57.032 (0,071)	0,000	AC, DF, GO, MA, MG, MS, MT, RR, SE,TO	547.455	SP
Eletric Power	Consumption of electric power (MWh), per one thousand inhabitants	1,302 (0,155)	0,464	PI	2,524	SP
Railroads	Extension of the Railroads / km^2	0,007 (0,104)	0,000	AC, AM, MT, RO, RR, TO	0,027	RJ
Internet	Access to the internet, per one thousand inhabitants	129,630 (0,407)	6,673	RR	232,165	SP
Passengers	Number of passengers in airports	2.329.790 (0,250)	81.470	TO	23.039.919	SP
Loadings and Takeoffs	Number of landings and takeoffs in airports	75.787 (0,084)	11.218	RR	569.161	SP
Highways	Extension of paved highways/ km^2	0,044 (0,163)	0,001	AP	0,128	DF
Fixed Telephony	Fixed telephony (residential and public), per one thousand inhabitant	77,664 (0,262)	42,041	MA	165,467	RS
Fluvial Transport	Loads in general in ports / tons	16.137.403,6 (0,338)	0,000	AC, DF, GO, PI, RR, TO	104.288.675	ES

Regions of Brazil

Availability of infrastructure in Brazil, by regions (1999).



Regression results on intra-state exports

Variables	Equations	
	(1)	(2)
Constant	-22,2091* (1,5011)	-5,9945* (1,1279)
Log Y_i	0,9725* (0,0717)	---
Log Y_j	1,3674* (0,0336)	1,3667* (0,0402)
Log D_{ij}	-0,7674* (0,0850)	-0,7280* (0,1096)
Log (ΣII_i)	-0,0934 (0,1075)	1,1838* (0,0734)
Dummy Adj.	0,9894* (0,1602)	1,1261* (0,1862)
R-squared (R^2)	0,8143	0,7734
F-statistic	592,2586*	465,32*
Durbin-Watson	1,9588	2,0610

Values in parenthesis are the standard errors. The "*"denotes significance at the one percent level.

Regression results for the equations with infrastructure sub-indexes.

Variables	Equations			
	(1)	(2)	(3)	(4)
Constant	-2,9259**	-2,9472**	-3,7660**	-4,4617**
	(0,9954)	(0,9934)	(0,9370)	(1,3461)
Log Y_j	1,3514**	1,3515**	1,3600**	1,3751**
	(0,0344)	(0,0344)	(0,0334)	(0,0527)
Log D_{ij}	-0,8085**	-0,8059**	-0,7174**	-0,8924**
	(0,0901)	(0,0898)	(0,0842)	(0,1191)
Dummy Adj.	0,8953**	0,8957**	1,0529**	0,8822**
	(0,1659)	(0,1658)	(0,1567)	(0,1879)
Sub-index 1	-0,1017*	-0,0940*	---	0,5151**
	(0,0475)	(0,0437)		(0,0726)
Sub-index 2	0,8083**	0,7897**	0,7324**	---
	(0,0727)	(0,0569)	(0,0531)	
Sub-index 3	0,4184**	0,3738**	0,3326**	---
	(0,1323)	(0,0760)	(0,0744)	
Sub-index 4	0,0736*	0,0683*	0,0833**	---
	(0,0372)	(0,0349)	(0,0339)	
Sub-index 5	-0,0373^{ns}	---	---	---
	(0,0907)			
R-squared (R^2)	0,8209	0,8208	0,8174	0,7335
F – Statistic	357,5521	409,1506	486,6660	356,2259
Durbin-Watson	1,9910	1,9911	1,9575	2,2557$^{\#}$

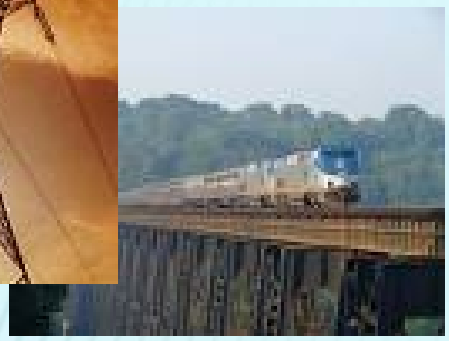
Values in parenthesis are standard errors of the estimates. * *, * denote significance at the levels of 1 and 5 percent, respectively. *ns* denotes absence of statistical significance, while # denotes correction for autocorrelation

Conclusions

- importance of infrastructure on trade flows between Brazilian states;
- asymmetries in infrastructure among states and regions
- future research should use disaggregated data, a larger and more recent database;
- endogeneity should be taken into account.

Correlation Matrix

	Log(Xij)	Log(Yi)	Log(Yj)	Log(Dij)	Log(Indexi)	Dummy_Adj	Log(Indexj)
Log(Xij)	1,0000	0,4307	0,7076	-0,4698	0,3832	0,3028	0,5947
Log(Yi)	0,4307	1,0000	-0,0709	-0,1060	0,8872	0,0232	-0,0593
Log(Yj)	0,7076	-0,0709	1,0000	-0,2092	-0,0574	0,0560	0,8847
Log(Dij)	-0,4698	-0,1060	-0,2092	1,0000	-0,1444	-0,6122	-0,2489
Log(Indexi)	0,3832	0,8872	-0,0574	-0,1444	1,0000	-0,0249	-0,0554
Dummy_Adj	0,3028	0,0232	0,0560	-0,6122	-0,0249	1,0000	0,0068
Log(Indexj)	0,5947	-0,0593	0,8847	-0,2489	-0,0554	0,0068	1,0000

Thank You!