RELATIONSHIP BETWEEN SPATIAL PRICE TRANSMISSION AND GEOGRAPHICAL DISTANCE IN BRAZIL

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1. Introduction

Spatial Cointegration: Price signals transmission across separate markets (Goletti et.al, 1995). It is an indicator of the performance of the market: infrastructure efficiency and transaction costs.

Baseon the Law of One Price: prices of the same product in two spatially separate markets would differ only in the transfer costs (Enke, 1951) → $P_t^y = transfer\cos t + \beta_1 P_t^x$

- Usually $\beta_1 \neq 1$ WHY? → ***Distance has been*** recently mentioned as a possible explanation. (Goletti, 1995; Rapsomanikis & Karfakis, 2004; Escobal & Vásquez, 2005)
- If the effect is not explained by transfer cost, why does it have an impact?→ Are there variables that affect the cointegration and are related with the geographical distance?

2. Objective

Investigate the influence of geographical distance on integration measures taking into consideration the bias caused by the omission of variables. These influence integration and are likely to be correlated with distance.

3. Brazilian Rice Markets

- In Latin America is the biggest producer of rice and 10th of per-capita consumption. Net importer: 5% of total world exports.
- Distance between regions creates divergences of natural resources, economic development, and access to external markets, among others.

4. Data

- Prices of rice: ECLAC Chile. Producer monthly data in dollar per kilo.
- Distance: Google maps, road distance in kilometers.

5. Methodology: Cointegration Analysis (between each pair of markets)

1. Cointegration is tested: Engle & Granger (1987). $P_t^y = \beta_0 + \beta_1 P_t^x + \mu_t$
   - X = leader and Y = follower defined by Granger Causality test (Granger, 1969; modified by Dolado & Luetkepohl, 1996)
2. Indentified the presence of structural breaks: Bai & Perron (1998), modified using the significant values proposed by Kejriwal & Perron (2008).
3. Cointegration allowing structural breaks: Gregory and Hansen (1996)

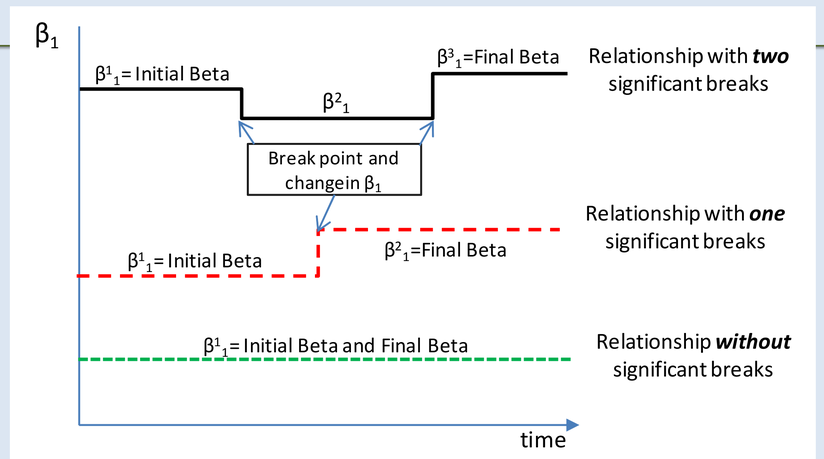
$$P_t^y = \beta_0^1 + \beta_0^i \psi^i{}_{t_1} + \beta_1^1 P_t^x + \beta_1^i \psi^i{}_{t_1} P_t^x + \eta_t$$

i= number of breaks, maximum 2

4. Error Correction Model (ECM). (ECT=η_t)

$$\Delta P_t^y = \alpha_y ECT + \sum_{j=1}^{n_2} \Gamma_j^y \Delta P_{t-j}^y + \sum_{j=1}^{n_2} \Gamma_j^x \Delta P_{t-j}^x + \alpha_0 + \alpha_1 t + \delta_i D_i + \varepsilon_t^y$$

Until here we have estimated three different integration measures the speed of adjustment (α_y) and the elasticity of cointegration before (β_1^1) and after (β_1^{final}) the breaks where:



6. Methodology: Bias and Incidence of the Related Factors

Normal OLS to explain the relationship between distance and cointegration

$$\text{Integration Measure} = \varphi_0 + \varphi_1 \text{ Distance between X and Y} + \varepsilon_1 \quad (1)$$

But the coefficient of the distance in (1) has a bias which is explained by the Omitted Variables (OV) which affect integration and are related to distance.

$$\text{Integration Measure} = \vartheta_0 + \vartheta_1 \text{ Distance between X and Y} + \vartheta_2 \text{ OV} + \varepsilon_2 \quad (2)$$

Where: $\text{OV} = \gamma_0 + \gamma_1 \text{ Distance between X and Y} + \propto \quad (3)$

Substituting (3) in (2) a new expression of (1) shows the amount of the bias

$$IM = (\vartheta_0 + \vartheta_2 \gamma_0) + (\vartheta_1 + \vartheta_2 \gamma_1) \text{Distance} + (\vartheta_2 \propto \epsilon_2)$$

bias

7. Results by Selected Related Variables (those linked to distance and with an effect on cointegration)

Central Markets: Highest Consuming and Producing States

Why is important to include this variable?: The most important consumers and producers are geographically concentrated.

Equation (3)			
γ_0	0,210 ***	Distance (γ_1)	0,002

Equation (2)	β_1Initial	β_1Final	α_y
ϑ_0	0,899 ***	0,797 ***	-0,326 ***
Distance (ϑ_1)	-0,007 ***	-0,005 ***	-0,001
ϑ_2	-0,139 ***	0,098 **	0,046 **
Bias †	-3,22%	3,17%	

Quality of Rice and Production Systems

Why is important to include this variable? Different price response for each rice quality (Cramer et al., 1993). Low quality is more competitive than high quality (Ghoshray, 2008).

Equation (3)			
γ_0	0,702 ***	Distance (γ_1)	-0,006 ***

Equation (2)	β_1Initial	β_1Final	α_y
ϑ_0	0,776 ***	0,717 ***	-0,347 ***
Distance (ϑ_1)	-0,006 ***	-0,003 **	0,005
ϑ_2	0,124 ***	0,122 ***	0,015
Bias †	-13,23%	-23,58%	

Gross Domestic Product per-capita

Why is important to include this variable?

Gravity model (Tinbergen, 1962): Explicates the size of trade between two countries using GDP (potential supply or potential demand)

GDP per-capita reflects purchase capacity of both partners.

Reflects discrepancies in infrastructure (Kyvik & Hildegum, 2004).

Relationship between:	Large markets	Small and Large market	Small markets
Equation (3)			
γ_0	0,320 ***	0,292 ***	0,387 ***
Distance (γ_1)	-0,004 ***	0,009 ***	-0,005 ***
Equation (2)		β_1Initial	
ϑ_0	0,812 ***	0,892 ***	0,889 ***
Distance (ϑ_1)	-0,006 ***	-0,006 ***	-0,007 ***
ϑ_2	0,180 ***	-0,078 *	-0,051
Bias †	*-12,7%*	*-11,1%*	*3,3%*
		β_1Final	
ϑ_0	0,753 ***	0,848 ***	0,832 ***
Distance (ϑ_1)	-0,004 ***	-0,004 ***	-0,005 ***
ϑ_2	0,200 ***	-0,103 ***	-0,036
Bias †	*-22,8%*	*-24,5%*	*3,5%*
		α_y	
ϑ_0	-0,341 ***	-0,317 ***	-0,292 ***
Distance (ϑ_1)	0,000	-0,001	-0,001
ϑ_2	0,758 ***	0,001	-0,639 ***

Access to International Markets: Port Export Points

Why is important to include this variable?

9.4% of the consumption is imported: 30% by maritime route.

98% of the imports of rice and its derived products come from Argentina, Uruguay or Paraguay, where rice is produced more efficiently and with lower costs than Brazil, for which market prices are lower in comparison to nationally produced rice.

	The **Leader** market has an export point in	The **Follower** market has an export point in
Equation (3)		
γ_0	0,386 ***	0,600 ***
Distance (γ_1)	0,005 ***	-0,008 ***
Equation (2)	β_1Initial	
ϑ_0	0,889 ***	0,875 ***
Distance (ϑ_1)	-0,007 ***	-0,007 ***
ϑ_2	-0,050	-0,009
Bias †	*-3,9%*	*1,1%*
	β_1Final	
ϑ_0	0,768 ***	0,857 ***
Distance (ϑ_1)	-0,005 ***	-0,005 ***
ϑ_2	0,129 ***	-0,066
Bias †	*12,5%*	*10,7%*
	α_y	
ϑ_0	-0,331 ***	-0,366 ***
Distance (ϑ_1)	-0,001	0,000
ϑ_2	0,377 **	0,083 ***

†Bias corresponds to the percent in which the coefficient differs by bias to the coefficient without bias. $\left(\frac{\vartheta_2 \gamma_1}{ABS(\vartheta_1)}\right) * 100$

Level of significance: * = 0.1, ** = 0.05 and *** = 0.01
Source: Author's Elaboration.

8. Conclusions

- Results show that there is a weak, negative and significant relationship between distance and the cointegration elasticity. Finally, three out of four variables cause, with their omission, a bias ranging from 10 to 25% of the real distance value coefficient. This shows that the distance effect on integration is explained not only by increments in transfer costs, but also by the existence of other variables which affect integration and of which values are more dissimilar between remote markets than closer ones.