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Artigo

THE ROLE OF THE PORT IN THE EXPORTS OF BRAZILIAN STATES

O Papel do Porto nas Exportações dos Estados Brasileiros

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THE ROLE OF THE PORT IN THE EXPORTS OF BRAZILIAN STATES

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Resumo

O objetivo deste artigo é o de avaliar o papel do porto nas exportações dos estados brasileiros para os seus principais parceiros comerciais. Utilizei o modelo gravitacional com variáveis dummy para cada um dos principais parceiros comerciais (Mercosul, União Européia, Nafta e a Área de Livre Comércio das Américas – ALCA) dos estados brasileiros e para cada um dos principais portos brasilerios, para tentar entender as especificidades destas relações comerciais. Utilizei um modelo de dados seccionados conjuntos (pooled cross-section, ou PCS) com dados para 24 countries, 27 estados, 5 anos e 12 portos brasileiros. Após controlarmos para os efeitos de tamanho e distância, mostrei que o grau de abertura e a competitividade são variáveis explicativas importantes para o comércio internacional dos estados brasileiros. Além disso, mostrei que há fatores específicos importantes no comércio dos estados brasileiros e seus parceiros comerciais, tal como o papel do porto de saída das exportações dos estados. Os resultados indicam que a especificidades de cada porto têm um papel significativo para explicar as exportações dos estados aos seus países e blocos econômicos parceiros.

Palavras-chave

Economia regional; comércio internacional; modelo gravitacional.

Abstract

This paper aims at assessing the role of the port on the exports of Brazilian states to their main trade partners. I use a gravity model with dummy variables for the main partner blocs (Mercosul, European Union, Nafta and the Free Trade Area of the Americas – FTAA) of Brazilian states and for each one of the main Brazilian ports, in order to account for the specificities of particular trade relations. I estimate a pooled cross-section model, with data for 24 countries, 27 states, 5 years and 12 Brazilian ports. After controlling for size and distance, I showed that the degree of openness and competitiveness are important explanatory variables to international trade of Brazilian states.

Moreover, there are important specific factors between Brazilian states and partner countries, such as the role of the port as the Brazilian states' gateways to international trade. The results indicate that port specificities play a significant role in explaining state's exports towards the state's main trade partners and economic blocs.

Keywords

Regional economics; international trade; gravity model.

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1 Introduction

How does international economic integration affect regions of countries involved? As relative prices change in these countries, they increasingly specialize in the production of goods in which they have a comparative advantage; regions within these countries which concentrate a large share of the booming or contracting sectors are more than proportionally affected by economic integration. It is thus expected that economic integration affects different regions within a country in a different way. The literature on the impacts of economic integration among countries on their regions lists computable general equilibrium (CGE), input-output models and gravity models. The latter isolates the effects of income and distance on trade flows, highlighting the net effects of other variables. Such effects are much easier to estimate with a gravity model, given its lower data requirements in comparison to CGE and IO models[1].

The objective of this article is to evaluate the role of the port in the exports of different states in Brazil. I deal with the export flows of 27 Brazilian states to 24 countries[2], in five different years (1990, 1994, 1998, 2004, and 2008). I use a gravity model, following previous work by Sá Porto (2002a and 2002b), Sá Porto and Canuto (2002 and 2004), and Sá Porto and Azzoni (2007). I extend their models to include dummy variables for Mercosur, Nafta, European Union, the Free Trade Area of the Americas – FTAA and the Mercosur-European Union Free Trade Area – Mercoeuro (the most relevant trading blocs for Brazil, given the country's total

[1] Sá Porto (2002b), p. 31.

[2] These countries account about 85 per cent of the country's total trade. The countries are: France, Germany, Italy, United Kingdom, Netherlands, Belgium, Spain (European Union); United States, Mexico, Canada (NAFTA); Argentina, Paraguay, Uruguay (Mercosur); Chile, Colombia, Venezuela, China, Japan, South Korea, Russia, Switzerland, Nigeria, Saudi Arabia and Algeria. The Brazilian states are: São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo (Southeast Region); Paraná, Santa Catarina, Rio Grande do Sul (South Region); Goiás, Mato Grosso, Mato Grosso do Sul, Distrito Federal (Center-West Region); Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia (Northeast Region); Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins (North Region).

trade). I include variables to represent the competitiveness and the openness of the state' economies. Finally, I evaluate whether there are specific effects on Brazilian states' exports to partner countries that can be explained by the port of exit towards the states's main trade partners, by differentiating the analysis across twelve different important Brazilian ports.

The paper is organized in four sections, including this introduction. In section 2 I briefly review the literature on the gravity model, as well as on the regional impacts of economic integration. In section 3 I present the econometric models and results, and the conclusions are presented in section 4.

2 Economic integration and regional development

A neoclassical view of economic theory recognizes that regions have different natural endowments and policy-created strengths. As economic integration proceeds and trade barriers fall for all participating countries, relative prices change for all sectors within regional economies. Each region will then specialize in the production of the goods that intensively use those endowments and strengths, and the industrial structure of the countries, as well as of regions within countries, will change accordingly to exploit comparative advantages. As trade barriers fall, welfare increases for the world as a whole and for countries participating in regional integration, but the theory does not tell how those effects are transmitted throughout the regions of participating countries. Trade liberalization brought by regional integration benefits the sectors (and the regions where these sectors are located) which use more intensively in the country's most abundant factors, increasing income and welfare in those sectors. A region within a country will gain from economic integration if it concentrates a large share of those gaining sectors. Moreover, trade liberalization increases the real returns of those factors specific to the country's exporting sectors. If a region concentrates a large share of those sectors, it will gain from regional integration.

The argument is further developed in the more recent New Economic Geography literature. Fujita, Krugman and Venables (1999) show that, in a relatively closed economy, firms typically have the best access to both domestically produced inputs and to domestic markets if they locate in the capital city (and its larger metropolitan area). This creates forward and backward linkages in this core economy, which lead to the agglomeration of economic activity there. As trade liberalization moves forward, those linkages become less important, as

firms receive more intermediate inputs from abroad and sell a larger part of their output abroad. Thus, there is less incentive to locate (in the case of new firms) or maintain location in the country's core. Firms and consumers become more outward-oriented, and trade liberalization leads to spatial deconcentration. Congestion costs may develop in the core region and help pushing industry away from the center. But as external trade now plays the role of balancing supply and demand for each sector's products in each location, industrial specialization is facilitated and driven by intra-industry linkages. Thus, regions specialize, and clustering of particular industries in each region will occur[3].

There are also impacts of preferential trade liberalization on industrial development. Venables (2003) highlights the role of regional comparative advantage in driving asymmetric distribution of benefits in trade agreements. In the case of developing countries, the spatial inequality of production activities "is due to the natural advantages of some regions relative to others and to the presence of agglomeration forces, leading to clustering of activity"[4]. Puga and Venables (1998) stress the role of the standard new economic geography forces by analyzing the role of trade in promoting industrial development. They show how trade liberalization can change the incentives for firms to locate in developing countries. They indicate that unilateral liberalization of imports of manufacturing goods can promote industrialization, and that membership in a preferential trading arrangement (PTA) can create even larger gains. They also show that South-South PTAs are sensitive to the market size of member states, while North-South PTAs offer better prospects for participating developing countries.

Different methods can be used to associate changes in international and interregional trade flows with changes in regional economic structures. One set of models is based on input-output tables, such as the interregional input-output (IRIO) model or the multiregional input-output (MRIO) model, as in Polenske (1980). Shift-share models are also used to estimate the regional impacts of PTAs (Kume and Piani, 1999). General equilibrium models have also been used to evaluate the economic integration impacts on the regional economies of participating countries. Barros (1997) used such a model to evaluate the impacts of Mercosur trade flows in Brazil's Northeastern region. Domingues (2002a) used a general equilibrium model to evaluate the impacts of the Free Trade Area of the Americas (FTAA) to the

[3] Fujita, Krugman and Venables (1999) pp. 329-343.
[4] Venables (2003), p. 2.

Brazilian economy, at both regional and sectoral levels. Brandão, Lopes and Pereira (1996) used a GTAP general equilibrium model to simulate the impacts of adopting a complete customs union in Mercosul by the year 2006 on the Brazilian economy as a whole and then on its sectors. Haddad and Azzoni (2003) used a CGE model to evaluate regional concentration of economic activity due to tariff reductions during the implementation phase (March of 1991 to December of 1994) of Mercosur. Haddad, Domingues and Perobelli (2001) used another type of general equilibrium model (EFES-IT) to evaluate the aggregate, regional and sectoral impacts in Brazil of three possible free trade arrangements: FTAA, a Free Trade Area between Mercosur and the European Union (EU), and a generalized free trade area with all Brazil's main trade partners. Finally, a GTAP general equilibrium model is also used in Domingues (2002b) to simulate the welfare impacts in Brazil, Argentina and Uruguay of two possible free trade arrangements: FTAA, and the a Free Trade Area between Mercosul and the European Union.

The gravity model is another possible tool. It was proposed independently by Tinbergen (1962) and Pöyhönen (1963), and was later on improved by Linnemann (1966). Tinbergen's initial objective was to account for the factors that explained the size of trade flows between two countries, namely, the total potential supply of the exporting country, factors related to the total potential demand of the importing country, and factors imposing resistance to trade. The first two factors were basically the Gross Domestic Product (GDP) of the exporting and importing country, respectively. Later on, Linnemann included the size of the populations of both countries, in order to reflect the role of economies of scale. Natural resistance to trade includes obstacles to trade imposed by nature, such as transportation costs, transport time, etc., and those imposed by governments, such as tariffs, quantitative restrictions, exchange controls, etc. Dummy variables were also included in the model, to account for the effects of preferential trade arrangements.

The original gravity model can be written as:

$$X_{ij} = a_0 (Y_i)^{a_1} (Y_j)^{a_2} (N_i)^{a_3} (N_j)^{a_4} (Dist_{ij})^{a_5} e^{(Pref)a_6} (e_{ij}), \quad (1)$$

where X_{ij} is the dollar value of exports from country i to country j; Y_i and Y_j are the nominal values of GDP; N_i and N_j are the population of the countries; $Dist_{ij}$ is the distance between the commercial centers of the two countries, and is used as a proxy for the trade resistance variables; Pref is a dummy variable which equals to 1 if both countries belong to a specific

preferential trade area, and zero otherwise; and e_{ij} is the error term. The coefficients a_0 through a_6 are to be econometrically estimated.

As it was originally proposed, the gravity model's main weakness was its lack of a solid theoretical microeconomic foundation. The model described in equation (1) above is not an economic model, although it is a plausible one. Many authors have contributed to building a theoretical microeconomic foundation for the gravity model, such as Anderson (1979), Bergstrand (1985 and 1989), Deardorff (1998), Anderson and van Wincoop (2003), Redding and Venables (2004) and Combes et al (2004)[5]. Other authors have added other explanatory variables to the original gravity equation (relative distance, GDP deflator, exchange rates, a country's openness index, etc.), in order to increase its explanatory power. The literature on empirical tests of the gravity model to evaluate regional integration cases is large, for since the end of the 1960s many studies have sought to evaluate the effects of the European Union, such as Aitken (1973), Frankel, Stein and Wei (1995), and Kume and Piani (2000), among others[6]. Empirical applications of the gravity model indicate that it explains a large part of international trade among countries[7]. It has been widely used to estimate the welfare impacts of regional integration schemes[8]. From an econometrics point of view, the gravity model also presents problems. It has been implemented empirically in most cases using cross section data. For instance, one can pick several years in a time series and compare different cross sections, evaluating how the estimated coefficients evolve over time. Even though this method can yield a high R^2, it tends to underestimate the trade volume between pairs of countries with high volume of trade, and to overestimate it for pairs of countries with low volume of trade. This generates a heterogeneity bias, which can be overcome by removing the

[5] For a detailed literature review of the theoretical foundations of the gravity model, see Sá Porto (2002b).
[6] See Sá Porto (2002b) for a detailed review of this literature.
[7] For example, Bergstrand's (1989) generalized gravity equation explained between 40% and 80% of the variation across countries in one-digit SITC trade flows.
[8] Viner (1950) noted that, while a customs union between some (and not all) countries would create trade and thus have positive effects on welfare, trade diversion might offset these positive effects. A regional integration scheme is net creator of trade if trade creation is larger than trade diversion. These net effects from trade creation and trade diversion are known as the static effects of economic integration. In the gravity model, when a bloc is net trade creator the coefficient for the bloc dummy variable is positive. Note, however, that in some cases it is possible that one or more countries in a regional bloc obtain significant gains even though the bloc's net trade creation is negative (as, for instance, argues Panagariya 1999, p. 483). As in the literature, we assume that a bloc is net trade creator when the net effect is positive.

gravity model's assumption of a sole intercept for all trade flows between pairs of countries (Cheng and Wall 1999)[9].

On the empirical side, tests of the gravity model have assessed the welfare impacts of trade arrangements on countries as a whole, but none considered how economic integration affects different regions within the countries. Indeed, few studies have tried to evaluate the regional impacts of economic integration[10]. Bröcker (1988) used a variation of the gravity model to estimate the impact of the EEC and EFTA on the regions of four countries in Northern Europe (Germany, Norway, Sweden, and Denmark). He extended the original gravity model to include other variables, such as regional supply, regional demand, and international and interregional trade flows among regions. The impacts of Mercosur in Brazil's regions was evaluated by Sá Porto (2002a). Using a gravity model expanded to include dummy variables for Mercosul and for a region in Brazil, he found that the trade bias[11] with Mercosur has increased from 3.4 in 1990 to 27.1 in 1998 in Brazil´s Southern region. That is, trade between a state in the Brazilian South (a region that borders all the Mercosur countries) in 1998 was more than 27 times larger than trade with other countries. Brazil's Southeast, a region which includes the country's three largest regional economies, saw its trade bias increase from 4.7 in 1990 to 21.9 in 1998. The other regions (North, Northeast and Center-West) also presented increases in their trade biases with Mercosur, although at a much smaller scale. He concluded that Mercosur impacted differently Brazilian regions.

Sá Porto and Canuto (2002) continued that study[12], including a sectoral dummy variable and extending the analysis to the year 2000, thus encompassing the change in Brazil's exchange rate regime in early 1999. They showed that Brazilian states' trade flows to Mercosur countries fell substantially in 2000, but remained higher that trade levels that prevailed prior to the implementation of Mercosur's custom union (January 1st 1995). Sá Porto and Canuto (2004) further extended this previous study by using panel data and the three models designed by Cheng and Wall (1999) previously mentioned. They showed that the impacts of Mercosur on Brazilian states trade flows are robust, regardless of the model used. Sá Porto and Azzoni (2007) added a few more explanatory variables to the main model, and showed that the degree

[9] Fratianni and Kang (2006) show that statistically and economically significant heterogeneity exists in the distance elasticity in trade gravity model. Another common problem with *cross-sections* models is the impossibility of testing for the stability of the coefficients (Soloaga and Winters, 2001).
[10] A more detailed version of this literature review of this subsection can be seen in Sá Porto (2002b).
[11] In the literature, trade bias is a measure of the net effect of trade creation and trade diversion.
[12] See also Sá Porto (2002b).

of openness (share of interregional and international trade) and competitiveness of the states were important in order to explain Brazilian states' export patterns. Moreover, they showed that, using specific state–country trade flow pairs, they showed that there are specificities that make trade more intense for some specific region-country trade pairs. In the case of Mercosur, region-partner country specific dummies are positive and significant for the Region South and Paraguay, for Region North and Argentina, and for Region North and Uruguay. For the exports towards European countries (EU and non-EU), there are important specificities to the export flows from Region South, Southeast and North. And export flows from the South and the Southeast regions towards the Nafta countries are also important. Finally, in evaluating the specific effects on Brazilian state's exports that can be explained by five sectoral factors, two of them esource-oriented goods (Agricultural and Natural Resources goods) and three manufacturing (Nondurable, Durable and Intermediate goods), they found that Brazilian states flows of resource-oriented activities are particularly intense, controlling for the other variables in the model.

3 Model and results

We use a standard gravity model in section 3.1 to explain the exports of the 27 Brazilian states, including dummy variables for the three main economic integration blocs relevant for Brazil, namely, Mercosur, Nafta and EU (European Union) and for two regional economic integration blocs that may be implemented in the near future, namely, the Free Trade Area of the Americas (FTAA) and the Mercosur-European Union Free Trade Area (Mercoeuro). We add time dummies and variables measuring the state's degree of openness and competitiveness. We use panel data in a pooled cross section model, but we check the effects of heterogeneity by estimating the model also with fixed effects and first differences. I then choose a model to be used in section 3.2, where I measure the specific effect that the port of exit may have on a state's exports towards its main trade partners. I do so by adding interaction dummy variables for each pair of port and bloc of destination for Brazilian states.

3.1 Main Model

The basic model to be estimated is:

$$\ln X_{ijt} = \ln a_0 + a_1 \ln Y_{it} + a_2 \ln Y_{jt} + a_3 \ln N_{it} + a_4 \ln N_{jt} + a_5 \ln Dist_{ij} + a_6 Mercosur + a_7 Nafta + a_8 EU + a_9 FTAA + a_{1o} MercoEuro + a_{11} Dummy94 + a_{12} Dummy98 + a_{13} Dummy02 + a_{14} Interreg + a_{15} Internat + a_{16} Compet + \log e_{ij} \quad (2),$$

where X_{ij} is the dollar value of exports from the state i to country j; Y_i is the nominal value of state i's Gross Regional Product (GRP); Y_j is the nominal value of country j's GDP; N_i is the population of state i; N_j is the population of country j; $Dist_{ij}$ is the distance between the commercial centers of the state and the country; *Mercosul*, *Nafta*, *EU*, *FTAA*, and *MercoEuro* are dummy variables equal to 1 if the country belongs to that bloc, and zero otherwise; *Dummy94*, *Dummy98*, and *Dummy02* are dummy variables equal to 1 if the export from state i to country j occurred in that specific year, and zero otherwise. Their function is to take into consideration changes that might have occurred over time, since until 1990 the Brazilian economy was quite closed to external trade, and since then the process of opening was quite fast.

The variables *Interreg, Internat and Compet* are introduced to control for the production conditions present in the state's economies. *Interreg* is the share of each state in total interstate trade (exports and imports) in the country. *Internat* is the share of each state in total national trade (exports and imports) with other countries. It is expected that states with larger shares in interregional and international trade have specificities that allow them to profit from commercial integration. *Compet* is the degree of competitiveness of each state, given by the ratio of total exports (to other states and other countries) to the state's GDP[13]. It is expected that states with a larger share of total exports on output are more competitive[14]. By controlling for these three variables, the influence of the traditional gravity model variables and the role played by commercial blocs in explaining the state's ability to export to other countries can be better measured. We first estimated a Pooled Cross Section (PCS) model, with pooled cross section data for the years 1990, 1994, 1998, 2004, and 2008[15]. As we use trade data between Brazilian states and the country's main trade partners, we have to deal with the heterogeneity bias, for the trade between São Paulo state and the USA, for example, is substantially different from the trade between Mato Grosso state and Paraguay. To check for this problem,

[13] These three variables refer to the year 1996, and information was taken from Haddad et al. (2002).
[14] A large share of trade of Brazilian states is with other Brazilian states (see Perobelli, 2004).
[15] The source of the trade data is SECEX (2008). The Gross Regional Product data and the population data for the Brazilian states was provided by IBGE (2009). The GDP and the population for the countries in the sample was obtained from the STARS CD-ROM from the World Bank. Finally, the distance data was extracted from the World Atlas MPC CD-ROM.

we estimate the model with Fixed Effects (FE) and First Differences (FD), and compare the coefficients. The fixed effects model is robust to a possible omission of time-invariant, non-observable regressors (Johnston and DiNardo, 2001). The first differences model is also robust to the omission of time invariant variables, but the intercept does not vary across trade pairs (Cheng and Wall, 1999). Moreover, in order to remove the influence of trade pairs with zero or minimum and erratic trade flows, we only kept the state-country trade flows which were not null for at least two years[16].

The results of the three models are displayed in Table 1. The coefficients for GDP and for distance have the expected signs and are significant; the coefficients for population were only significant for the exporting state; the time dummies were not significant, indicating that the process of opening-up of the Brazilian economy did not affect the influence of the variables included in the model. These results are similar to the ones obtained in other studies by the authors cited in the literature review. As for the regional integration dummies, Mercosur is significant but considerably less important than in Sá Porto and Canuto (2004), who considered flows of both exports and imports. The reason for this is that Mercosur is a less important destination for Brazilian exports than a source of Brazilian imports. The EU coefficient is significant, which means that the EU is important for Brazilian states' exports, even after controlling for the other variables in the model. That is, in spite of the absence of trade preferences between Brazil and the EU, that bloc of countries present specificities that make them important destinations for Brazilian states' exports. The Nafta coefficient is not significant, which may be an odd result at first, for NAFTA countries (specially the U.S.) are important trade partners for Brazil. This may be due to the fact that these trade flows may have specificities that cannot be explained by the variables introduced in the model so far. The FTAA coefficient is not significant either. The coefficient of the share of interregional trade variable was significant and negative, meaning that states which larger shares on Brazil's interregional trade tend to trade less internationally. The coefficient of the share of international trade (exports plus imports) was also significant and positive, indicating that states with larger shares on Brazil's international trade tend to trade more with foreign countries. The coefficient for the degree of competitiveness was significant and positive, meaning that states that are more competitive tend to trade more with Brazil's trade partners.

[16] See Sá Porto and Azzoni (2007), p. 8.

Comparing the results of the three models, we note that, with one exception, the signs and significance of the coefficients are the same. The values of the coefficients of the traditional gravity model variables are smaller in the FE and FD models, which is in part explained by the absence of some variables (distance, interregional, international and competitiveness) in these versions, which also causes lower R^2 values. The same analysis holds for the trade bloc dummies, with the exception of MercoEuro, which is negative and significant in two cases, and positive and significant in one. Considering these aspects, we thus proceed with this model in the next section[17].

Variable	Pooled Cross-Section	Fixed Effects	First Differences
Constant a_{0ij}	-13.70* (1.89)	-	-2.37* (1.43)
Y_i	0.64* (0.10)	0.41* (0.09)	0.36* (0.09)
Y_j	0.79* (0.05)	0.61* (0.03)	0.62* (0.04)
N_i	0.91* (0.11)	0.85* (0.12)	0.89* (0.12)
N_j	0.06 (0.10)	0.01 (0.13)	0.05 (0.12)
$Dist_{ij}$	- 0.72* (0.16)	-	-
Mercosul	1.75* (0.28)	2.21* (0.25)	1.93* (0.22)
NAFTA	0.12* (0.21)	0.17 (0.16)	0.02 (0.19)
EU	1.14* (0.22)	1.05* (0.19)	0.39* (0.13)
FTAA	-0.10* (0.24)	0.01 (0.15)	- 0.07 (0.17)
MercoEuro	- 1.01 (0.28)	0.05* (0.19)	- 0.49* (0.24)
1994	0.11 (0.13)	-0.01 (0.09)	0.11 (0.11)
1998	- 0.24 (0.13)	-0.17 (0.09)	0.00 (0.10)
2002	0.15 (0.12)	0.06 (0.13)	- 0.02 (0.13)
Interregional	-5.24* (2.19)	-	-
International	4.69* (1.87)	-	-

[17] Following Cheng and Wall (2004)

Competitiveness	2.79* (0.20)	-	-
R^2	0.57	0.44	0.40
Number of observations	1,961	1,961	1,961

Table 1 - Gravity Equation Coefficients Estimates for the Trade Flows between Brazilian States and Brazil's Major Trading Partners, PCS, FE and FD models, 1990 – 2008

***** Significant at the 5% level, one-tail test. The trade pair intercepts were omitted for space reasons. X_{ij} is the dependent variable. Standard errors are given in parentheses. All variables except dummies are expressed in natural logarithms for the PCS and FE models, and in first differences for the FD model. Estimation by OLS.

3.2 Introducing Port-country bloc pair specificities

The objective of this section is to evaluate whether there are specific effects on Brazilian states' exports that can be explained by factors related to the port of exit of that trade flow toward the states' main destination country blocs. If, for example, a dummy $Port_i$-$Bloc_j$ is defined for the trade passing through the port of Santos (in the state São Paulo) towards one of the countries of Mercosur, for example, that dummy equals to 1 if the trade flow comes from any state that exports to Mercosur via the port of Santos, and 0 if that is not the case. The country blocs used in this section are: Mercosur; Nafta; European Union (EU); Free Trade Area of the Americas (FTAA); and the Mercosur-European Union Free Trade Area (Mercoeuro). We chose the Mercoeuro bloc as the reference region, since it was the only country bloc that was insignificant in the results of section 3.1. We use Brazil's twelve main ports: Santos, Rio de Janeiro, Vitória/Tubarão, Paranaguá, Itajaí, Rio Grande, Salvador, Recife/Suape, Manaus, São Luís/Itaqui, Fortaleza/Pecém and Sepetiba. These twelve ports account for over 95% of Brazil's maritime exports (see Table 2). As a result, we have 4 x 12 = 48 of these dummies. We have eliminated the intercept-dummy for blocs to avoid multicolinearity problems, and the time-dummies, for they were not significant in the previous models.

Port/state location		Exports (US$ Million)
Santos	São Paulo	26,265
Rio de Janeiro	Rio de Janeiro	3,753
Vitória	Espírito Santo	8,964
Paranaguá	Paraná	8,582
Itajaí	Santa Catarina	2,877
Rio Grande	Rio Grande do Sul	7,067
Salvador	Bahia	1,900
Recife (Suape)	Pernambuco	548
Manaus	Amazonas	961
São Luis (Itaqui)	Maranhão	4,209
Pecém (Fortaleza)	Ceará	802
Sepetiba	Rio de Janeiro	6,116

Table 2 – Brazil's Main Ports, Total Exports, 2009
From January to August.

The general results are similar to the ones previously presented in terms of values, signs and significance of the coefficients for GDP, population, distance, time dummies, and the openness and competitiveness variables. We can thus concentrate on the analysis of the coefficients of the port-destination bloc pairs. Table 3 presents only the statistically significant coefficients. It can be seen that only 21 out of 48 coefficients were not significant, indicating that port specificities are important in explaining export flows of Brazilian states towards their main trade blocs partners. In terms of exports to Mercosur countries, the only flows significantly different from the ones of the reference region are those coming out of the ports of Itajaí, Rio Grande, Salvador, São Luis and Pecém. Itajaí and Rio Grande are the main ports of the states of Santa Catarina and Rio Grande do Sul, respectively, which are two states neighbour to all Mercosur countries, and are responsible for the exports of poultry meat, textiles, paper and machinery (in the case of Santa Catarina), and the exports of vehicles, machinery, fuels and plastics (in the case of Rio Grande do Sul).

Exports towards Nafta coutries (Mexico and Unites States in this sample) are significant for a few ports, but they all have negative signs, meaning that the exports through these ports to Nafta countries are less significant than exports to the reference region (Mercoeuro), controlling for the other variables in the model. The estimates for the other coefficients are not significant, meaning that, in the case of exports to Nafta countries, port is a less important factor other than the other factors present in the gravity model that explain state exports. On

the other hand, if one looks at exports towards FTAA countries, which includes South American countries (Chile, Venezuela and the Mercosur countries) besides the United States and Mexico, it can be noticed that in this case the export flows through the ports of Santos, Itajaí, Rio Grande and Manaus are significant. Santos are the main way which exports of manufacturing goods go to the other developing countries of the Americas. And Itajaí and Rio Grande are competitive ports, where labor costs are less than the larger, older ports of Rio de Janeiro and Santos, thus being able to export to the rest of South America the same goods they export to Mercosur countries. Manaus port export basically foodstuff to the more developed FTAA countries, and electrical appliances, motocycles and machinery to the less developed FTAA countries.

Finally, in the case of the exports to the European Union (EU), we notice that exports from the ports of Santos, Vitória and Manaus are all significant, indicating higher intensity of trade flows towards EU countries through these ports, controlling for the other variables in the model. This is compatible with the increasing share of agricultural and resource intensive exports to these countries, and these exports maimly go through Brazil's two largest ports (Santos and Vitória). Finally, the estimates for all of the coefficients for other export flows are not significant, meaning that in these cases port is not a significant explanatory variable and there are no other factors explaining exports but the ones present in the gravity model.

Port/state location	**Bloc**			
	Mercosur	**Nafta**	**EU**	**FTAA**
Santos	-	-	0.47	0.60
Rio de Janeiro	-	-1.32	-0.91	-
Vitória	-	-0.48	0.91	-0,79
Paranaguá	-	-	-	-
Itajaí	0.68	-0,72	-	1.55
Rio Grande	1.70	-0.76	-	0.84
Salvador	0.73	-0.98	-	-
Recife (Suape)	-	-	-1.15	-
Manaus	-	-	0.80	0.75
São Luis (Itaqui)	0.61	-	-	-
Pecém (Fortaleza)	1.81	-0,96	-	-
Sepetiba	-	-	-	-

Table 3 - Gravity Equation Coefficients Estimates for the Trade Flows between Brazilian States and Brazil's Major Trading Partners including a Port-Bloc Interaction Dummy, PCS model, 1990 – 2008
MercoEuro is the reference region

4 Conclusions

In this paper we presented a model that shows the aggregate impacts of international commercial integration on the export flows of Brazilian states. The model controls for income and distance effects and concentrates on the economic integration, openness, competitiveness and specificities of region-country pair effects on the Brazilian states' trading patterns. The signs and significance of the traditional gravity model variables resulted as expected. We showed that the degree of openness (share of interregional and international trade) and competitiveness of the states were important in order to explain their export patterns. We showed that states that account for larger shares of total interregional trade tend to trade less internationally, while the opposite holds for those that are more competitive. These variables added considerably explanatory power to the model.

The results on the specific port–coutry bloc trade pairs indicate that there are things left unexplained by the gravity model variables. This indicates that, over and above the influence of GDP, population, economic integration bloc dummies, openness and competitiveness variables, for some specific port-country bloc trade pairs, there are specificities that make trade more intense. For example, in the case of Mercosur, we saw that southern ports such as Itajaí and Rio Grande are important gateways of exports to those countries, but the northeastern port of Salvador, São Luis and Pecém also have some trade specificities to Mercosur countries.

We also note that there are important specificities to the export flows towards European countries (EU and non-EU), especially trade flows coming from the ports of the largest ports of Santos and Vitória (besides the northern port of Manaus), gateways of Brazil's main flows of commodity exports towards the EU. We noticed that, in the case exports to FTAA countries, the ports of Santos, Itajaí and Rio Grande are important gateways of manufacturing exports towards developing countries of the FTAA area and resource oriented and agricultural products towards the developed countries of the FTAA. Moreover, Manaus is the gateway of foodstuff, electrical appliances, motocycles and machinery to FTAA countries.

Finally, we have thus extended out knowledge of the factors behind the effects of international commercial integration on the export ability of Brazilian states, including the role of the port as a gateway to international trade of Brazilian states. It is clear that the

economic variables behind the gravity model are important in general, but it is also clear that it lefts aside important specificities present in international trade.

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