Trade Shocks in Brazil:
An Investigation of Effects on Regional Manufacturing Wages

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Abstract

When increasing returns to scale are taken into account in a theoretical background, employment concentrates closer to the market. As a consequence, regional wages are a decreasing function of transport cost to markets, since firms tend to compensate this cost by paying less to its employees. Moreover, trade shocks can transform foreign market more attractive for firms than internal market. This paper test these hypothesis by using regional data from Brazil. The results show that transport cost is important to understand differences in wages between Brazilian regions and trade shocks have influenced in some sense these disparities, but not so consistently as transport costs can.

Keywords: Economic Geography, Trade Shocks, Brazilian manufacturing, Wages.

JEL Classification: F12, F14, R12, R30.

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1. Introduction

Access to the market plays an important role to explain where economic activity takes place. A firm close to the market faces a smaller transport cost to ship its products to consumers compared to another located not so close. So, firms far from the market need to offer lower wages to its employees (compared with the closer ones) in order to compensate transport cost. This trade-off promotes regional disparities in wages in any economy, specially in a closed one, where one single place can be the market, therefore called: industry center. However, it is important to mention that not all models salaries are greater in the core, such as (Krugman 1980), where salaries are assumed to be the same. On the other hand, whenever salaries are endogenous, they are higher in larger markets.

Considering that industry center is not close to the external market[1], whenever a country experiences a reduction in trade cost, the link of the regions with the industry center is reduced and regions closer to the external market become more attractive to some firms and less to others. Exporting firms see this reduction of transport cost as a possibility to export even more and, therefore, these regions closer to the external market are more attractive to be located. Firms facing a higher competition with imports look this reduction of transport cost as a threat of its survival performance in the market. So, these firms tend to locate even farer to the external market. Taking into consideration both cases, regional wages should be reduced after the movements of firms, since exporting firms locating closer to external market tend raise salaries in these regions compared to the industry center. On the other hand, firms facing a higher competition may try to locate far from the external market, but not in the industry center, since these firms couldn't survive in the industry center before the reduction of trade cost. So, regions far from both industry center and external market can be the destiny of the firms facing higher competition.

Brazil is a good example to investigate these phenomena. First, this country was a very closed economy until the late 80's, which explains the existence of a industry center as pointed out theoretically by (Elizondo and Krugman 1995). During the 90's, it has experienced two trade shocks, which have reduced the trade cost: unilateral liberalization, which weighted average nominal tariff reduced from 37.7% in 1988 to 10.2% in 1994; and a drastically real devaluation of 47% in the exchange rate in 1999[2]. As a consequence of this trade shock, the trade balance changed from a annual deficit of US$ 6 billion on average from 1996-98 to a surplus of US$ 25 billion in 2003, where exports raised from US$ 50 billion on average from 1996-98 to US$ 73 billion in 2003. These two effects have influenced the location of industry in Brazil, since the industry center of Brazil, Sao Paulo State,

[1] This problem was found in Krugman, P. (1996) by Henderson, J. V. (1996).
[2] The exchange rate has never returned to the level before the shock.

reduced its participation in the industry sector from 52% in 1985 to 43% in 2002. This represents that dispersion forces have overcame the agglomeration ones.

The main dispersion force evidenced by the literature is the increase of competition among firms, when an introduction of a new good into the market expel enterprises to elsewhere. This increase in competition has two different channels: one is direct by offering the consumer a new product, which in the Brazilian case will be represented by a imported good after the openness to trade in the 90's; and the other indirect, where a firm should hire extra labor force in order to produce another good (or even more of the same), demand of labor raises and therefore, wages. Taking into consideration both effects, enterprises tend to produce at places different of industry center, since the equilibrium of zero profit was already achieved there before this increase in competition.

In a trade agreement, these two different channels occurs simultaneously, since the reduction of trade cost raises the competition with imports and firms trying to sell to the external market search extra labor force to increase production focusing to export. Thus, the result could be neutral. In the Brazilian case, it is possible to distinguish between these two channels: the direct one, which is competition with the imported goods (first shock); the indirect one, which is in the labor market (second shock). One way to evaluate these effects is by investigating the effectiveness of transport cost to understand the regional differences in wages and if it has reduced (or increased) its explanation power after the trade shock.

This paper contains five sections apart from this introduction to explore these ideas. Section 2 points out the theoretical framework of regional disparities of wages and how they can be influenced by trade shocks. Data description is made in Section 3 and some descriptive analysis is carried on Section 4. Section 5 outlines the econometric specification to test the hypotheses in this paper, followed by Section 6 which show empirical results. Finally, the last section concludes.

2. Theoretical Background

In the trade literature, effects of trade shocks in the economy are investigated theoretically throughout the years. Differences in wages between regions is one of the issues of interest in this literature. According to models with increasing return to scales, there are agglomeration and dispersion forces which drives where the economic activity takes place. For this literature, wages should be higher in these locations closer to the industry center and as transport cost increases, wages should be lower to compensate this new cost. So, the closer a firm is to the market, the higher the salary paid to its employees will be. However, the change of trade costs can influence the location of economic activity by increasing competition with imports and making some new markets more attractive to firms. So, trade shocks can increase the dispersion or agglomeration forces which may explain part of the location process of economic activity.

One example was the case of Mexico after signing the North America Free Trade Agreement (NAFTA) with USA and Canada in 1985. This trade agreement has weaken the importance of Mexico City, the industry center of this country, and increased the agglomeration forces in regions closed to the border with the USA. In this case, the reduction of trade cost made the external market (USA) more appealing for many Mexican firms. And because of that market effect, firms located close to the border have increased the competition in the labor market searching for employees, then raising the salaries. On the other hand, the expanded competition with imports could lead firms to locate not so close to the border with the USA. Therefore, regional disparities in Mexico could have been changed after this trade shock.

This was the subject studied in (Hanson 1996) and (Hanson 1997), he argues that transport cost to industry center or to external market is important to determine the regional differences in industry's wages, confirming the increasing returns to scale theoretical models. And even more, he investigated if the trade shock, NAFTA, has influenced the regional disparities in wages. In (Hanson 1997), he finds no evidence that trade shock affected regional relative wages.

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3. Data

One major issue is to define which geographical unit could better capture these effects. Even though (Hanson 1997) analyzed this effect using Mexican states data, he argues that a more disaggregated data, for example split by cities, could be more suitable for this investigation. His justification to use state-level data resides on the fact that manufacturing employment is concentrated in one single city at each Mexican state. Although this could be the case of Mexico, this is not the Brazilian case. There are many important cities within states which can not be neglected by pooling all of them together in one single unit (states). Brazil has two other geographical classification between states and cities, where they call mesoregion and microregion[3]. The former divides the territory into 137 parts and the latter into 558. City level data is not the most appropriate for this period, since there were created more than 1,000 cities during the nineties through emancipation of some counties.

One problem to be considered in selecting the geographical scale is that political division can not be an economic one. For example, one problem is that any regional disparity within any larger scale cannot be captured by the data. So movements to poor regions in the same geographical unit will not be captured by data in a higher geographical scale. In order to minimize problems of this nature,

[3] These two classification uses the social e economical linkages between cities to evaluate which were more connected, but respecting the political division (states and cities). So, it is a nested classification between states and cities.

heterogeneous spaces, the more disaggregated geographical scale data will be used in this study, which is by microregion.

The main data will come from the Statistic and Geography Brazilian Institute (*Instituto Brasileiro de Geografia e Estatística* – IBGE). There will be used two types of publication: Annual Industry Research (*Pesquisa Industrial Anual* – PIA) from 1996 until 2002; and Industrial Census from 1985[4]. The former has annually information from all establishments over 30 employees and the latter has information of all manufacturing firms.

Salaries per worker will be measured by total remuneration divided by the number of employees in each microregion. The transport cost will be calculated by the distance between the main city of the microregion and the industry center (Sao Paulo) or to the next port. The distance will be given by the great circle formula using the latitude and longitude of each location (city or port). Brazil has a large number of ports at its extensive coast, but the 14 main Brazilian ports[5] represents almost 90% of the total exports and imports of this country trough ports. These ports were selected according to (Goebel 2002) and (Lacerda 2004), not only by their historical data, but also by their capacity to be an important port in the future.

Since regions with higher educational level tend to have greater wages, it is necessary to control for education. The percentage of literate people in each location will be used as a measure of this issue. Brazil has also experienced a dispute between states to attract manufacturing sector in the 90's, called Fiscal War, where states offered exemption of taxes and other subsidies to achieve this goal (Rodriguez-Pose and Arbix 2001). Therefore, it is important to control for this government intervention. The variable used for this reason will be the sum of expenditures in industry and regional development over the total budget of each state.

4. Descriptive Analysis

Before making an econometric analysis, some descriptive analysis could give us some insights about the evolution of the variables used in this paper. The most important variable is the ratio between salaries in one microregion to the salaries in the industry center. Taking into consideration the period and the shocks mentioned before, a summary of this ratio form the period analyzed is shown in Table 1a.

[4] I am stil wating to receive this data, thus some parts of the paper are incomplete.
[5] The ports are: Santos (SP), Rio de Janeiro (RJ), Sepetiba (RJ), Vitória (ES), Paranaguá (PR), São Francisco do Sul (SC), Itajaí (SC), Rio Grande (RS), Salvador (BA), Suape (PE), Fortaleza (CE), Pecém(CE), Belém (PA) and Manaus (AM).

First, the number of observations increases over time, which could represent the appearance of new firms or the enlargement of existent smaller ones in some remote parts of Brazil. It should be noticed that even though there are 557 microregions in Brazil, some don't have manufacturing plants, such as microregions in the Amazon. From 1996 to 2002, there were 35 microregions which started to have some manufacturing production reported by the survey. In other words, this could be a sing of some firms could have decided to locate in remote areas where the salary are lower because of the two dispersion forces.

Table 1a

Descriptive Summary	**Before Shock**	**After the 1st Shock**	**After the 2nd Shock**
Wages in region i / Wages SP	**1985**	**1996-1998**	**1999-2003**
Average	To be completed	0.41	0.40
Standard Deviation	To be completed	0.23	0.21
Minimum	To be completed	0.08	0.10
Maximum	To be completed	2.14	1.63
Number of years	To be completed	3	5
Number of observations	To be completed	1203	2105
Average of obs. per year	To be completed	401	421

Looking at the average, it is not possible to conclude that the trade shock has had any impact of the distribution of manufacturing wages regionally. Nevertheless, there is a slight reduction of standard deviation and the maximum value as well as an increase in the minimum value. These two evolutions could be an indication that microregions in Brazil have become more homogenous during this period.

Table 1b show a summary of the independent variable, which is distance.

Table 1b

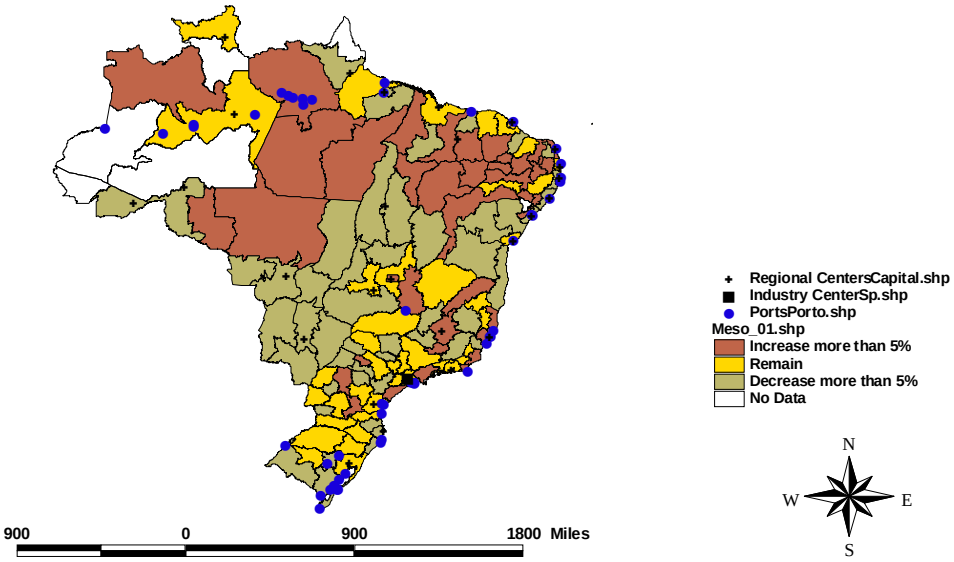
Distance	SP	Port	After Sepetiba	After Pecem
Average	1,289	398	396	394
Standard Deviation	832	303	303	304
Minimum	14	22	22	22
Maximum	3,317	1,488	1,488	1,488
Number of Observations	557	6,684	7,241	7,241
Regions changed after infrastructure improvements			35	72

It could be seen that, on average, microregions are closer to the external market (nearest port) than to the industry center (Sao Paulo). This is because most of the microregions are located closer to the coast, but far from Sao Paulo. Regarding the transport cost to the external market, two ports were inaugurated seeking to improve the access to foreign market, one in the Southeast (Sepetiba) in 1999 and the second in the Northeast (Pecem) in 2001. The appearance of these ports makes the distance to the external market to vary over time. It is possible to notice the improvements in infrastructure

(inauguration of ports), the distance to foreign market has reduced slightly, but 72 microregions have become closer to the nearest port after the inauguration of these two new ones[6].

In order to have an overview of the geographical change, the Figure 1 shows how manufacturing wages have changed over the period analyzed. First, the map was drawn according to the mesoregion geographical classification, since this division of Brazil into 137 parts could be better seen rather than by microregions (558 parts). This map shows how the average salary of a mesoregion changed after the trade shock. So, the average of the ratio of manufacturing wage in mesoregion *i* over from the industry center was compared with the average of the same ratio from the years after the trade shock.

Figure 1: After the 2nd Shock
Wages in Mesoregion / Wages in Industry Center



First, it is important to mention that after the trade shock, regional disparities of manufacturing wages have changed There were 39 mesoregions, representing 28% of the total mesoregions, which have increased this ratio after the trade shock. Moreover, most of these regions are far from the industry center and on the north. Being more precisely, 70% are in regions considered non core, which are not in the south or in the southeast regions. Therefore, these regions are closer to where some improvements in infrastructure have made some of these regions closer to the external market, which is representing here as the inauguration of Pecem port in the northeast. In other words, the inauguration of Pecem port has reduced the transport cost to foreign market and this could have already influenced in the reduction of regional disparities in the manufacturing sector.

[6] Where for these 72, the total reduction to the external market was 2,334 kilometers.

5. Empirical Specification

This paper investigates the effects of trade shocks into the disparities of regional wages in the Brazilian manufacturing sector. Brazil experienced a reduction on import tariffs from 1988 to 1994 and exchange rate devaluation in 1999. Some papers addressed already this question, such as (Hanson 1996) and (Hanson 1997), where it was analyzed how regional wages are distributed across Mexican states and how these disparities were affected by NAFTA. This paper follows his methodology, yet with some changes.

First, Hanson uses state level data (31 states) whereas this paper has a more disaggregated regional data (microregion, which divides Brazil into more than 500 parts). This more disaggregated division improves the economical meaning of each place as was pointed out earlier.

Second, Hanson mentioned three exogenous amenities: (i) exogenous natural-resource supplies; (ii) exogenous levels of amenities; and (iii) location bias in government spending or tax policies. Even though the first two are also exogenous in the Brazilian case, the last one can not be considered fixed for this country. First, Brazil eliminated illiteracy from young children recently by government policies since the 50's and remote areas benefited most with this government spending policies, where manufacturing wages are lower. Therefore, improvement in education should be addressed into the estimation process and I used the percentage of literate people from each region. Second, improvement in infrastructure to external market by government spending should also to be included in this estimation process. Thus, this was included by changing the distance to the external market, as it was said previously by the inauguration of ports. Third, government spending to attract manufacturing plants were also considered in this paper, since these government interventions played a important role in the nineties, as it was mentioned before.

There is another reason which makes this paper different from (Hanson 1997), it is based on geographical terms. In the Mexican case, there was a common border with its main trade partner, USA. In the Brazilian case, there isn't a main trade pattern that could explain the access to the foreign market, which is in its boundary. (Overman and Winters 2003) solve this problem by using the distance to the ports in the UK case as a proxy of distance to the international market. Since more than 60% of Brazilian international trade (export plus import) was done through these ports, then distance to port is the best proxy of transport cost to foreign market.

As was proposed in a previous section, differences in regional industry wages can be explained by transport costs. Using it in an econometric view, we can write the following equation:

$$\ln(W_{it}/W_{ct}) = \beta_0 + \beta_1 \ln(IC_{it}) + \beta_2 \ln(PORT_{it}) + \delta_t\theta \ln(IC_{it}) + \delta_t\phi \ln(PORT_{it}) + \gamma_t\varphi \ln(SP_{it}) + \gamma_t\rho \ln(PORT_{it}) + \alpha_k \ln(CV_{it}) + \varepsilon_{ijt} \quad (1)$$

where

- W_{it} is the average nominal wage per worker for region *i* from industry *j* at time *t*;
- W_{jt} is the average nominal wage per worker from the industry center in Brazil, Sao Paulo Metropolitan Area[7], at time *t*;
- IC_{it} is the unit of transport cost from region *i* to industry center at time *t*;
- $PORT_{it}$ is the unit of transport cost from region *i* to the foreign market at time *t*;
- CV_{it} is the control variable[8] *k* from region *i* at time *t*.
- δ_t is a dummy variable which takes a value of one if year *t* falls after the trade liberalization;
- γ_t is a dummy variable which takes a value of one if year *t* falls after the exchange rate devaluation;
- ε_{ijt} is the error term, which will be discussed latter;
- And the rest not mentioned are parameters to be estimated.

According to increasing returns to scale, it is expected a negative value in the estimation of β_1 and β_2, since an increase in transport costs reduces the value of (W_{ijt}/W_{cjt}), which means that salary of a region far from the center or from the nearest port becomes lower relative to the market. In summary, parameters β_1 and β_2 will be testing the following hypothesis:

a) If β_1 and β_2 are negative, transport costs matters for difference in regional wage;
b) If β_1 and β_2 are not significant, transport costs are insignificant to understand regional wages disparities.

If β_1 and/or β_2 changed after a trade shock, then liberalization and/or exchange rate devaluation have impacted regionally the Brazilian economy. In order to test this, it is possible to check if equation 1 is stable over time, which is equivalent to the joint test that θ and ϕ are equal to zero for the first shock and φ and ρ for the second shock.

To answer the question of which channel of the dispersion force (increase in competition) was higher in the Brazilian case, this could be seen by comparing the θ with φ and ϕ with ρ. If

[7] This is the microregion of Sao Paulo and not the state or city of Sao Paulo.
[8] The controls variables are educational level and government local taxes;

$|\theta| > |\varphi|$ and $|\phi| > |\rho|$, then the direct effect (competition with a new product – imports) has influenced more the reduction of disparities of wages than the indirect effect (competition in the labor market).

To control for exogenous natural-resource supplies and amenities, which could influence the regional relative wages, it is assumed the error has an specific form. This specific form is based on the fixed-effect approach, where the error will have the following form:

$$\varepsilon_{it} = c_i + v_t + \eta_{it} \qquad (2)$$

where c_i is the fixed effect for microregion *i*, v_t is the fixed effect for year *t*, and η_{it} is an i.i.d. term with mean zero and finite variance σ^2.

The estimation by fixed-effects presents a problem. The transport costs used in equation (1) does not vary over time, but rather within regions, since it is the distance from a region to the industry center or to a port. The distance to the external market was solved by the introduction of improvements in infrastructure (inauguration of ports). The remaining problem is on the distance to industry center. First-differencing the data would eliminate the distance variables from the regression. Therefore, the price paid was assuming that error term c_i is not correlated to the explanatory variables, then estimated by random effects. Or using the fixed-effect method, but interacting the distance with the percentage of GDP from the industry center in the Brazilian economy.

6. Results

Table 2 gives the first results on equation (1), where three different measures of distance to the external market were tested: minimum, average to the main 7 and 12 ports[9]. First, distance to Sao Paulo has the expected value showing that transport cost really matters to understand regional differences in wages.

The results also show that only the minimum distance to the external market has the expected value, which means that transport cost really matters to explain differences in wages between localities in Brazil. Average, with 7 or 12 ports, didn't show the expected sign. One possible reason resides on the fact that this measure could be not the best to explain access to foreign market. One example is the following: consider a straight line with three localities and two ports in each extreme. The foreign market access will be the same for any of the three regions, since the average will be the same for all of

[9] Representing more than 60% of Brazilian international trade and more than 80% of Brazilian international trade by ports.

them. However, it is clear that the port regions has a better access to the external market than the inside region.

Table 2

Distance Results	(i)	(ii)	(iii)
Sao Paulo (SP)	-13.4*	-15.7*	-21.7*
	0.68	0.92	1.19
Port	-2.98***	3.46*	21.7*
	1.82	0.93	2.27
Sao Paulo after 1st Shock	To be completed	To be completed	To be completed
Port after 1st Shock	To be completed	To be completed	To be completed
Sao Paulo after 2nd Shock	0.401	1.38	1.51
	0.81	1.26	1.22
Port after 2nd Shock	0.174	-1.2	-1.22
	2.18	1.23	1.3
R2	0.219	0.222	0.242
Number of Observations	3308	3308	3308

(i) minimum distance to the port

(ii) average of 7 main ports

(iii) average of 12 main ports

* means significant at 1% and *** significant at 10%

At this stage, the second shock didn't change the slope of the transport cost coefficients, since they have not significant estimates. Therefore, the equation is stable over time. This means that exchange rate devaluation has not impacted the disparities of wages across microregions in Brazil.

The problem of fixed-effects mentioned in the previous section is reduced in this case, since there were some changes in the infrastructure during the period analyzed. So, the problem of constant regressor remains in the distance to the industry center, as mentioned before. In order to solve this, there are two possible approaches. The first will be to estimate the equation by random effects instead of fixed effects, the price of this approach is the strong assumption that regressors are not correlated to the error term. The second approach is to interact the distance with the size of the industry center (% of this region in the Brazilian GDP). Using both approaches, the results didn't change so much.

Using the minimum distance to the ports, the results on Table 3 show the estimates controlled by education, infrastructure improvements an government subsidies. At this time, three possible ways were used to estimate. The columns (i) and (ii) shows the estimation by random effects and the others show the estimation of fixed effects, where the distance to Sao Paulo was interacted with its share in GDP. In all cases, it can be seen that transport cost to Sao Paulo and to the nearest port has the expectative negative value, showing that distance to the markets really matters to explain regional disparities in manufacturing sector. Moreover, after controlling for the others variables, trade shock of exchange rate seems to have made some impact at the regional disparities. It looks like the importance

of Sao Paulo has reduced its explanation power after the trade shock, and that the transport cost to the external market has become more important. However, it is not so consistent as the transport cost results.

If subsidies can not be represented by percentage of expenditures in industry and regional development in states' budget and if there is any other type of state effect interfering in the difference between regions, then another regression was done with dummies for states. The results remain practically the same as before, with the transport cost having the correct sign and the effects of trade shock reducing the importance of Sao Paulo. The only difference is that trade shock now does not increase the explanation power of external market.

Table 3

Transport Cost Results	**(i)**	**(ii)**	**(iii)**	**(iv)**	**(v)**	**(vi)**
Sao Paulo	-5.5*	-1.07*	-37.02*	-9.58*	-1.7*	-58.8*
	0.8	0.15	5.1	0.16	0.3	9.5
Port	-5.2*	-6.9*	-7.0*	-12.8*	-14.1*	-14.1*
	1.7	1.9	1.9	2.3	2.4	2.4
Sao Paulo after 1st Shock	To be completed	To be completed	To be completed	To be completed	To be completed	To be completed
Port after 1st Shock	To be completed	To be completed	To be completed	To be completed	To be completed	To be completed
Sao Paulo after 2nd Shock	0.64	0.29*	5.3	0.46	0.51*	5.3
	0.71	0.14	5.7	0.64	0.14	5.6
Port after 2nd Shock	-3.6	-0.79	-0.79	-1.2	0.8	0.8
	1.9	2.3	2.3	1.8	0.2	2.1
Education	0.565*	0.557*	0.558*	0.68*	0.681*	0.682*
	0.042	0.042	0.042	0.061	0.06	0.06
Subsidies	-0.011*	-0.014*	-0.014*	-	-	-
	0.002	0.002	0.002			
R2	0.305	0.297	0.298	0.403	0.400	0.403
Number of Observations	3308	3308	3308	3308	3308	3308

(i) is with RE
(ii)is with FE and SP divided by % in GDP
(iii) is with FE and SP multiplied by % in GDP
(iv) is with RE and dummies for States
(v) is with FE, SP divided by % in GDP and dummies for States
(vi) is with FE, SP multiplied by % in GDP and dummies for States
* means significant at 1%, ** at 5% and *** at 10%

Another way to verify this phenomena is looking how much market size can explain differences in wages. In order to check if these results according to distance are robust, I estimated a similar model, but using market potential for each region, instead of distance. Using GDP from each region, a variable of internal market was created by calculating the market potential of each region. The external market was created by adding the export and import value of each port. Using the distances, foreign market potential was calculated. So, instead of using the distance to the industry center, the market potential of each region was calculated. And, at the place of the distance to the next port, the trade information was used to act as a proxy to the external market potential.

Table 4 shows the results. As it could be seen, either internal or external market plays an important role in explaining regional differences in the manufacturing wages in Brazil. The question switches to whether these markets have became more important after the trade shock. Only the internal market seems to have been impacted by the trade shock, since the external market doesn't show a change in the slope.

Table 4

Demand Results	I	Ii	iii	Iv
Internal Market (IM)	11.4*	9.09*	5.99*	4.64*
	0.64	0.95	0.84	0.80
External Market (EM)	21.7*	21.2*	16.4*	14.9*
	2.27	3.69	3.25	3.04
IM after 1st Shock	-	To be completed	To be completed	To be completed
EM after 1st Shock	-	To be completed	To be completed	To be completed
IM after 2nd Shock	-	4.3*	3.22*	2.05***
		1.28	1.13	1.05
EM after 2nd Shock	-	0.54	0.67	0.58
		4.68	4.11	3.83
Education	-	-	0.69	0.63*
		-	0.03	0.06
Subsidies	-	-	-0.011*	-
		-	0.002	
R2	0.130	0.132	0.323	0.421
Number of Observations	3308	3308	3308	3308

i) Only with Internal and External Markets

ii) IM and EM with trade shocks

iii) IM, EM, Education and Subsidies

iv) IM, EM, Education and States dummies

* means significant at 1% and *** at 10%

In all cases, looking at transport costs or market potential, it is important to observe two facts. First, education plays an important role to explain differences in wages, since all estimation results show the expected sign (positive) significant. The other control variable, subsidies, is not so consistent. First, it seems that it has a negative impact, contradictory to the expected. So, regions with higher subsidies to industry in their budget had lower wages. This finding is consistent with (Sousa 2002), which also found that States with higher subsidies didn't attract more manufacturing production, but contrary to (Volpe 2004). When states dummies were included, the huge majority was not significant, showing that any state characteristic is not important to explain differences in regional manufacturing salaries. This result about subsidies shows that more work should be done to address the question of to what extend the Fiscal War has really played a role in the location of manufacturing sector in Brazil.

7. Conclusion

Regional manufacturing wages are not homogenous across Brazilian territory. They are higher closer to the markets, which corroborates the hypothesis of agglomeration from models with increasing returns to scale. Moreover, trade shocks have changed the distribution of regional manufacturing wages, where regions far from the industry center increased its value relatively to the core region.

Using an econometric approach, the results show that transport costs to internal and external market are important to understand differences in wages between Brazilian microregions. Additionally, trade shocks have influenced in some sense these disparities, reducing the explanation power of the industry center and raising the importance of the external market. However, these results were not so consistent as transport costs.

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TO BE COMPLETED