Salarios y Acceso de Mercado: Un enfoque espacialmente heterogéneo

Market Access and wages: A spatially heterogeneous approach

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Abstract:

We empirically test the positive relationship between market access and wages stated by New Economic Geography. Contrary to most estimation in other countries, we find evidence of significant spatial heterogeneity of this elasticity across Chilean communities. Moreover, the estimated elasticity is negative for some spatial units, especially in those far away from large urban concentrations and in communities highly dependent on natural resources intensive production. This result suggests new directions for the development of the New Economic Geography, especially for those countries with high dependency of natural resources.

Keywords: New Economic Geography, wages, market access, Geographically Weighted regression.

JEL classification: J3, R1

1. Introduction

From the seminal contribution of Krugman (1991), the literature tests the empirical relationship between market access (MA) and wages. As the New Economic Geography (NEG) states, firms prefer locate close to large markets saving transport costs and getting benefits from increasing returns to scale. The firms reward their production factors with higher wages, but also they face congestion costs such as high land rents (Niebuhr, 2006). In many developed countries the MA-wage elasticity is found to be positive and significant (Brakman et. al. 2004, 2009, Garcia 2006, Mion 2004, Niebuhr 2006). Nevertheless, few

papers have proved this hypothesis for countries with high dependency of natural resources. For the Chilean case, natural resources endowments are clustered on the extremes of the country (copper on north and salmon on south) far away from the main MA; namely the Metropolitan Region (MR) of Santiago (see Figure 1). Given the benefits derived from high prices of cooper during the last years of the twentieth century (Lagos and Blanco, 2010) and the entry of salmon industry in the foreign markets, the extreme areas also present high wages even when they do not enjoy a large MA. This scenario contemplates a situation ignored by NEG: the higher wages could not be positively correlated with higher MA, but rather by absolute advantages of some regions over, even, those large urban concentrations as the metropolitan areas. Remotes areas, with advantages on initial endowments can also get benefits from the favorable cycles of natural resources prices.

We test our hypothesis by estimating the relationship between wages and MA for Chilean communities (the smallest administrative region), but allowing MA-wage elasticity varying across space. This strategy allows us to evaluate whether this elasticity is more important in the MR than in the extreme northern and southern regions of the country. In order to assure a robust proxy for regional wages, we must isolate the effect of human capital on wages. Spatial sorting of skills (Combes et al. 2008) or urban productivities (Glaeser et. al. 2001) affects the wage differentials even with similar MA. Consequently, this paper controls by human capital using two different techniques. The first one runs a regression *à la Mincer* and fixed effects are estimated for each community, while the second technique uses a multilevel regression to generate a random wage effect attributable for each community, but also controlling by human capital. We also use the communal average wage as a third measurement of wages differences just to show its high instability for our empirical strategy. These three measurements are used as proxy for aggregated wage in a second stage where the MA-wages elasticity is estimated. The spatial variation is obtained by using geographically weighted regression.

Chile does not follow the theoretical positive relationship suggested by NEG for the whole country. In fact, when we only consider the MA-wage elasticity, it is possible to find three types of spatial units. First, a set of communities, especially those located near to the MR, show a positive, but low elasticity. For a second set of communities, the relationship is not significant for any specification of aggregated wages. Finally, the third set of spatial units shows a negative relationship between MA and wages. These results support our hypothesis that MA, grounded on NEG, is not sufficient to understand spatial wage variations. We also consider the negative externalities associated with large concentrations, mainly the role played by housing price. We expect that negative externalities diminish the elasticity between MA and wages. Our results, confirm our expectation, and the MA-wage elasticity is even lower than in the previous result. Moreover, a large set of communities does not follow the theoretical condition of a positive elasticity. Consequently, we conclude that NEG is not sufficient for understanding the wage distribution of countries with high natural resource dependency. For this cases, the increasing return derived from absolute advantages also play a role for explaining regional inequalities in wages. This exercise suggests new branches for theoretical

research in the NEG discipline and a new avenue of discussion for applied economists, especially for countries where there are multiple sources of wage inequalities.

2. Methodology

Geographically weighted regression (GWR), proposed by Fotheringham, Brunsdon and Chartlon (2002), is a methodology that allows spatial variability on estimated parameters across space. That is to say, it does not assume that relationships in the model are constant over the space (a non-stationary process). As Deller (2011) pointed out, GRW has been widely used to analyze spatial phenomena such as hedonic modeling of houses prices, rural poverty patterns, migration patterns and the role of entrepreneurship in economic growth. In this research, a GWR model will be used to analyze the spatial variation of the relationship between MA and wage differences across Chilean communities. Formally:

$$y_i = \beta_0(u_i, v_i) + \sum_k \beta_k (u_i, v_i) x_{ik} + \varepsilon_i, \quad (1)$$

where k is the number of exogenous parameters, (u_i, v_i) denotes the coordinates of the ith point in space and $\beta_k(u_i, v_i)$ is a realization of the continuous function $\beta_k(u, v)$ at point i. The dependent variable y_i is a $N\ x\ 1$ vector of one of our three measures of aggregate wages and x_{ik} represents a $N\ x\ k$ matrix with different independent variables, namely MA and average of housing prices. According to NEG, we should find a positive relationship between y_i and MA, that is to say, wages should be higher in those places with higher MA. The parameters for each point ith are estimated by:

$$\hat{\beta}(i) = (X'W_iX)^{-1}X'W_iY, \quad (2)$$

where W_i is an nxn spatial diagonal weighting matrix, with zero for all others elements. Data from observation close to i are weighted more heavily than data from observations further away. The spatial weighting function s_{ij} is defined as:

$$s_{ij} = exp\left[-\left(\frac{d_{ij}}{b}\right)^2\right], \quad (3)$$

where d_{ij} is the distance (Kms.) between communities i and j and b is the spatial bandwidth. If $i = j$, the weighting of data at that point will be unity and the weighting scheme of other data will decrease according to Gaussian curve as the distance between i and j increases.

3. Data

The data were obtained from the 2009 National Socioeconomic Characterization Survey (CASEN) with statistical representation for 334 Chilean communities. First, the communal wages differences were estimated using three approaches: 1) Regression *à la Mincer* where the fixed effects are interpreted as communal wages, 2) Multilevel model where

the random effect is the proxy for communal wages and 3) Communal average wage. The first and second approaches control by workers characteristics such as years of education, years of experience, sex and economic sectors dummies[1]. In order to represent congestion costs, we use the average of housing rent for each community. The NEG suggest that MA increases the nominal wages, but price levels also affect them. High concentrations generate a push on housing price, getting down the real wages. Moreover, according to Roback (1982), the urban density is capitalized by housing prices and a proper control is needed. Under this scenario, the housing prices must be considered on the econometric specification of NEG. On the second step the communal wages are used to build the wage equation sustained by NEG.:

$$w_i = \beta_{0i}(u_i, v_i) + \beta_{1i}(u_i, v_i)MA_i + \beta_{2i}(u_i, v_i)HP_i + \varepsilon_i, \qquad (4)$$

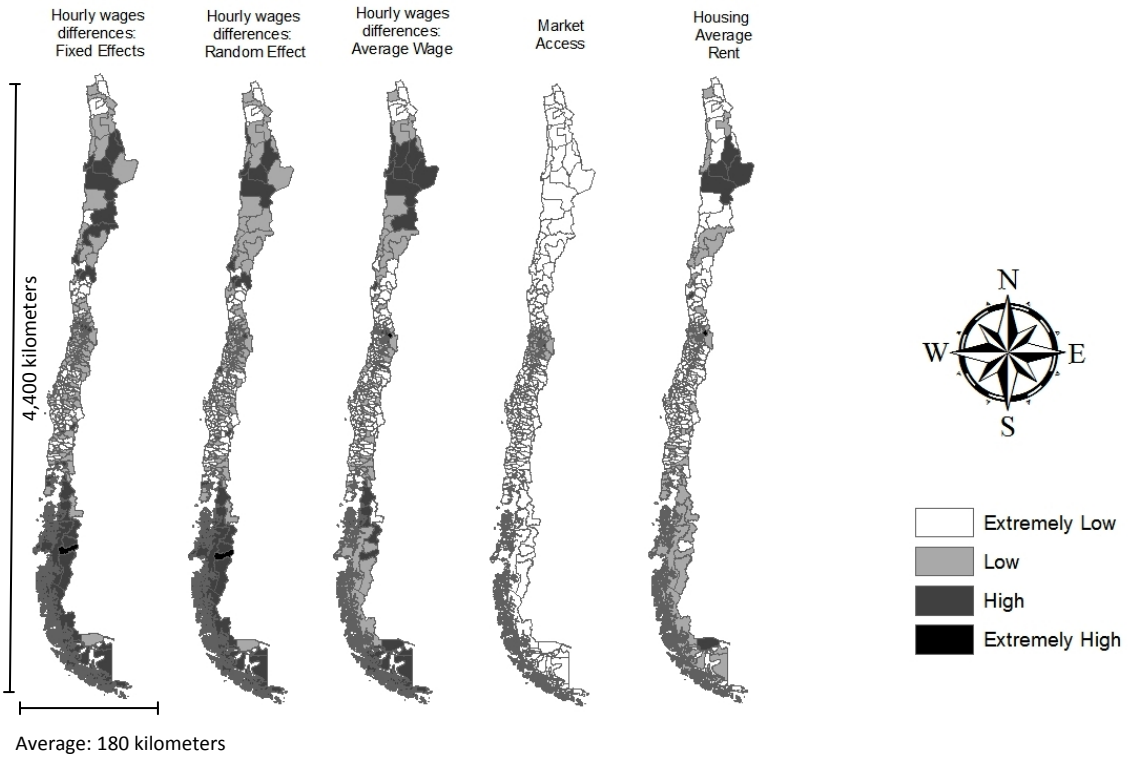
where w_i are wages, MA_i is the Market Access, HP_i is the average of housing rent. All these variables are measured for each spatial unit i. The spatial distributions of these variables are shown on Figure 1. Thus, the wage equation (4) requires two inputs: MA and HP. The first one is estimated such as a weighted average of population as a proxy of MA:

$$MA_i = \sum_j \frac{P_j}{d_{ij}}, \qquad (5)$$

where P_j is the population of jth commune and d_{ij} is the centroid distance between commune i and j. For d_{ii} an often-used convention is used that $d_{ii} = (2/3)\sqrt{A_i/\pi}$ in which A_i is region's area in squares kilometers (Head and Mayer, 2003). In order to provide a descriptive idea of the Chilean case, Figure 1 shows the spatial distribution of communal wages (for both specifications), communal average wages, MA and HP. As can be seen, we found a similar spatial pattern using the three measures of communal wages differences: the highest wages are located in the middle (MR) and the extreme communities of the country. In contrast, MA follows a rather different pattern, that is to say, the highest values of the country are located in the middle of the country, whereas the lowest values are in the extremes. HP spatial distribution is similar to wages differences pattern, that is, the highest values are concentrated in the extremes and in the middle of the country.

[1] The data set and Stata ® code are available from the authors upon request.

Figure 1: Spatial distribution of the wages differences, MA, and HP.



Source: Authors

4. **Results**

Our results are reported in Table 1. We show the robustness of our results with the use of three dependent variables. We expect that Fixed Effects (FE) and Random Effects (RE) (namely the first and second row) show a better behavior than the wage average due to the role of spatial sorting of skills. Simultaneously, we set the spatial neighborhood for three different rings or bandwidths: 100, 300 and 500 kilometers. We follow this strategy in order to avoid the problem known as Modifiable Areal Unit Problem (MAUP). By using these bandwidths, the data will indicate which the correct geographical scale is, where the MA-wage elasticity is revealed. Finally, we test the NEG model by including negative externalities of dense areas, captured through the housing prices.

We split the estimation in two approaches. The first approach only considers the spatial interaction between wages and MA (namely the market access column in the table 1). For this approach, the results show that the minimum elasticity is below zero when any ring is considered. For example, when the spatial neighborhood is considered up to 100 kilometers, we find a minimum elasticity of -0.463 when FE is used as a dependent variable. This number implies that Chile presents some spatial units with high/low wages, but where the MA is low/high, indicating an opposite relationship compared with the NEG

statements. This unusual relationship is stable for wider rings, namely 300 and 500 kilometers, where the number of spatial units with negative elasticities are between 19% and 5% of the total sample. Regarding the maximum elasticity, it is extremely high for the smallest ring, which indicates that spillovers effects are locally clustered. When the neighborhood is extended beyond 100 kilometers, the spatial interaction between wages and MA is reduced. The average shows a representative case for the whole country, and the elasticity is extremely low, around 3%. This magnitude is low compared to other countries, where the wage-MA elasticity is around 20%-30%. The significant and positive magnitudes are only identified around the MR, but its range is low for rings larger than 100 kilometers.

Previous results are consistent when the RE is considered. Again, some spatial unit shows negative elasticity. In order to assess whether the NEG could explain at least the case of the spatial units with higher density, namely the MR's communities, we provide the range of elasticities for those communities. We see that the range is low and only the smallest ring presents MA-wage elasticity slightly over 20% while for the other estimations this measurement is well below 20%. The proportion of communities with negative elasticity is between 6% and 22% of the total sample. The ranges of elasticity for alternative rings are consistent with the FE estimation and the complete set of estimations support our hypothesis about how the NEG does not properly explain the case of Chile and how the NEG performance is weakened by the absolute advantages. Again, the elasticity range is low for the total country, and its magnitude is low even for the MR. Finally, the estimations with average wages confirm our hypothesis about the poor quality of this variable, since results are distorted due to the lack of controls by human capital, therefore unexpected elasticities appear. The maximum and minimum levels of the elasticity are outside the theoretical expectations and the average elasticity is clearly overestimated. This result supports our hypothesis about the relevance of considering the spatial sorting of human capital, which could largely explain the wage differentials. Summarizing, this exercise shows that a consistent proportion of spatial units present negative wage-MA elasticity, but this proportion is higher for low rings of spatial interaction. These results would support that spatial spillovers derived from MA are highly clustered in small functional areas. Moreover, the average range is low in Chile compared to other experiences.

In order to properly test the role of the benefits derived from spatial concentration, we also incorporate the role of congestion costs (Helpman, 1998 and Brakman et al., 2004) in the second approach. Our hypothesis establishes that MA-wage elasticity is overestimated when congestions costs are not incorporated, specially housing prices. These results are presented on the right side of table 1. With respect to the FE, the proportion of negative elasticity is similar to the previous model, but the range of estimations is slightly different. The maximum values are lower than the previous estimations, and the average is also reduced. The new total elasticity is about 1 percent. A similar conclusion is obtained for RE and average wages. These set of results give support to our hypothesis. First, some spatial units do not follow the theoretical implications derived by the NEG. Chile presents regions where the wage and MA are not

positively correlated and this measurement is robust for several specifications of wages and. Second, the nature of spillovers generated by MA would seem to be locally clustered and its extent decrease for rings larger than 100 kilometers. Finally, the role of congestions costs is relevant for evaluation the NEG. The incorporation of housing price reduces the majority of the elasticity estimations.

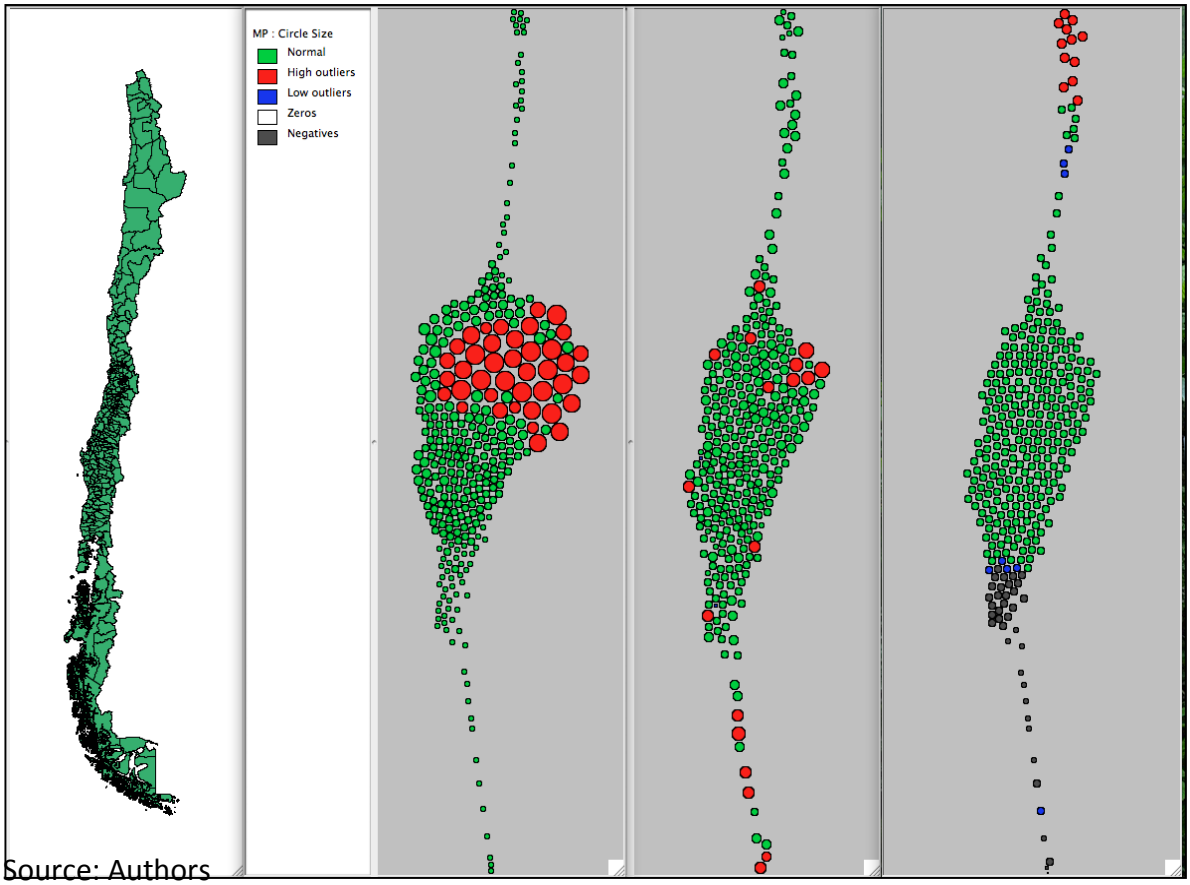
The second set of hypothesis to be contrasted is related with the geographical distribution of the elasticity. As can be seen in figure 2, there are three groups of communities. First, in the extreme north of the country, there is a group of communities, which show low MA and low wages, thus elasticity is positive and high (red circles on right map). By contrast, in the extreme south of the country a group of communities show a negative elasticity this is explained by low MA and high wages (gray circles). Finally in the middle of the country there is an important group of communities that belong to RM that show high MA and high wages, thus a positive elasticity appears. This result shows how the absolute advantage also generates higher wages, for example for the south side of the country, but where the MA is not able to catch this process. Moreover, the NEG seems to be useful for understanding only a portion of the country, specially where exist the large urban agglomerations.

Table 1: MA elasticity for different wages specifications and bandwidth distances

Dependent variable	Market Access Elasticity Measurements	Independent variables					
		Market Access			Market Access +Average Rent Price		
		Bandwidth Distance (Kms.)			Bandwidth Distance (Kms.)		
		100	300	500	100	300	500
Fixed Effects	Min	-0.463	-0.233	-0.081	-0.413	-0.141	-0.089
	Max	0.679	0.116	0.036	0.27	0.089	0.019
	Average	0.022	0.028	0.027	0.007	0.012	0.011
	% negative	19%	11%	5%	39%	9%	5%
	R.M range	[0.006-0.21]	[0.007-0.058]	[0.029-0.036]	[-0.099-0.017]	[-0.086-0.012]	[0.007-0.014]
Random Effects	Min	-0.543	-0.243	-0.099	-0.523	-0.162	-0.109
	Max	0.538	0.149	0.039	0.232	0.123	0.019
	Average	0.023	0.03	0.028	0.001	0.009	0.008
	% negative	22%	13%	6%	55%	12%	7%
	R.M range	[0.003-0.141]	[0.005-0.076]	[0.031-0.039]	[-0.364-0.006]	[-0.102-0.009]	[0.005-0.013]
Average Wages	Min	-2.142	-1.784	-0.546	-3.636	-2.376	-0.548
	Max	1.989	1.2	0.241	1.629	0.821	0.096
	Average	0.198	0.177	0.155	0.021	0.028	0.033
	% negative	16%	12%	4%	45%	9%	6%
	R.M range	[0.031-0.614]	[0.055-0.472]	[0.161-0.241]	[-2.925-0.069]	[-1.077-0.035]	[0.004-0.046]

Source: Authors

Figure 2: Spatial distribution of MA, wages fixed effects and MA-wage elasticity



Source: Authors

5. Conclusion

We test the explicative power of the NEG framework in a country where the MA does not coincide with the natural resource endowment high dependency of natural resource production. While the NEG has been widely tested in the literature, we do not have enough evidence about its explicative power for developing countries. We show how heterogeneous this measurement is across space, even more reflecting that some spatial units present a negative elasticity. We show the robustness of our estimations by using different dependent variables and controlling by additional factors such as housing price. The main result of this research shows that there is an evident MA-wage elasticity heterogeneity through Chilean communities. The geographical scope of the positive externalities derived from spatial agglomeration seems not to be further than 100 kilometers. Inside these rings there are both, communities with positive and negative elasticity which provides evidence regarding the need to go further NEG framework to understand the spatial distribution of wages when the spatial units also present absolute advantages. Moreover, the theoretical models of NEG should move toward the representation of this type of stylized facts in the future.

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