Responsible Land Governance:
Towards an Evidence Based Approach
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ARE RURAL AREAS TAKING ADVANTAGE OF PROXIMITY TO CITIES?

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Abstract

In this paper, we identify the positive and negative effects from proximity to cities on the economic development of rural areas in Chile. This work characterizes the changes in population and employment in rural areas as the partial adjustments on the location of households and firms due to the spatial variations in agglomeration economies, amenities, and public provision of services of nearby cities. In order to observe how rural areas are influenced by the scope and intensity of the linkages with urban areas, we estimate the effect of travel time to cities and market potential variables, over the change of population and employment for 22,161 rural areas in Chile, using the two last Chilean national censuses of 1992 and 2002, rural travel time estimates, and stable satellite light night.

Key Words: Labor Productivity, Agglomeration Economies, Developing Countries.

1 INTRODUCTION

Despite the widely recognized importance of big cities as a source of national economic growth and the increasing academic interest to the role of medium and small-sized cities to local economic growth, the effects of the urban hierarchy on economic development have been scarcely studied in developing countries. Even considering this limited evidence regarding the topic, policies that are applied and promoted continue to be spatially blind, leading to reinforce persistent spatial inequalities, while ignoring the heterogeneity of the effects of public policies across the urban hierarchy. Probably, the main argument ignored is the fact that medium and small-sized cities eventually have a greater potential on employment generation, and poverty and income inequality reduction in their local environment (Berdegué, Carriazo, Jara, Modrego and Soloaga, 2015). However, in the last 20 years, the discussion is still concentrated in big cities and their role as engines of economic growth (Jacobs, 1969; Fujita and Thisse, 2002; Quigley, 1998; World Bank, 2009; Glaeser, 2011). Meanwhile, for example, has been shown that despite the growing urban bias of policies, the extreme poverty is still concentrated in rural areas.[1] Therefore, foster a development strategy focused exclusively on big agglomerations, that reallocate an important quantity of resources, workers and investment, ignores the objective of promote a spatially inclusive development.

The success of many public policies depends on the regional and local context (Olfert, Partridge, Berdegué, Escobal, Jara & Modrego, 2014). However, spatially blind approaches of development policies that have been applying in the developing world enforce the primacy of the main agglomeration, assuming that the development on the rest of the places it happens under the same conditions. This promote spatial inequalities and reveals the necessity to identify those factors more relevant for the specific places and accordingly to their economic development. As an example, the Fig. 1 shows a particular pattern of developing economies for Latin America. The Latin America urbanization processes follow the global trend of rural population decline and, the unprecedented increase in urban population, but this has happened incredibly fast (Latin America reach the urbanization rates of Europe and USA in the half of time). The growth rates of urban population have remained positive but falling in magnitude, and the growth rate of rural population began to turn negative in the 1990s. This has meant a rapid urban growth in small and medium size cities, as we show in the right side graphic, while the urban population accommodated in larger cities has remained stable.

The particular case of Chile is one of the interesting cases of study in Latin America, by its economic geography; with 4,270 km large and 445 km width; a higher spatial concentration in the Capital Region of Santiago that represents the 40% of the population in the 2% of the national territory; and two remote poles of economic development based on the extraction of natural resources. In that particular physical and economic geography, the proximity to urban cores of different sizes may have a very heterogeneous impact on the economic development of rural areas. In particular, on the incentives of localization of households and firms. In Fig. 2, we make a zoom to Santiago and some small and medium-sized cities in Chile. The figure shows the intensity of the night lights, where the blue regions denote the density of rural population, and the most intense colors are higher density. The gray regions are the light's intensity of urban areas.

[1] Approximately, 70% of poor people in the world live in medium and small-sized cities or nearby rural areas to those places (Ferré, Ferreira and Lanjouw, 2012

Santiago is on white region, since it's saturated of lights and displays the greatest possible value. The figure describe a significant trend in the relationship between contemporary urban and rural areas: denser rural localities in Chile, are closer to the medium and small-sized cities, while larger urban areas, tend to drain rural population, reaching very low densities. In this context, we develop an estimate a model using a spatial equilibrium approach from Roback (1982) and Casetti (1971) to explain localization incentives of rural population and employment in Chile.

There are many ways through population and employment growth in rural areas are influenced by urban progress. In the first place the agglomeration economies, because affects the localization choice of firms, and population movements between spatial units. That is urban and economic expansion are caused by agglomeration economies. But these are limited by congestion costs and high level of housing prices. On the other hand, rural areas has properties that configurate the relationship with urban areas: (1) low cost of land, but high transportation cost, (2) low congestion cost, (3) low cost of labor force or in other words low wages, and (4) a lot of natural amenities. Our framework is part of a long standing discussion in economy and specially in regional science, describing how development in rural areas is influenced by proximity to cities. We could remark different concepts of classical authors as Myrdal (1957), Hirschman (1957), and Hoselitz (1955), talking about the same process, that is: *centripetal* and *centrifugal forces*, *generative* and *parasitic cities*, *spread* and *backwash effects*, among others. All of these focusing in identifying positive and negative influences of cities or regions over it's hinterland or rural areas. There are a lot of empirical works exploring these topics, specially by developed world. But also there is a remarkable opportunity to identify the main trends of rural societies in developing world.

Using the two last Chilean national censuses of 1992 and 2002 (INE), and Stable Satellite Night Lights (DMSP) for the same years, we estimate the effect of the distance and market potential variables from nearby cities over the change of population and employment for 22,221 rural areas between 1992 and 2002. To observe how these areas are influenced by the scope and intensity of the linkages with nearby urban areas of different size. The population growth is used as a proxy of the spatial adjustments of utility levels of households in the space, and the employment growth is used to capture spatial variations in the localization incentives of firms due to differences in costs. We use a cross section approach to explore how population and employment growth of rural areas are affected by their closeness to and urban center, and consider the simultaneity relationship between population and employment growth estimating by 3SLS. We found that to be near to a city, makes the population grows and its negative with regard to employment, which means that although these people do not live in the city tend to work on it. In addition, our results tell us about the increasing importance of medium and small cities by rural development, the people is drain by urban areas, especially when the proximate city its and urban giant as Santiago. But if city is medium and small, their attract population by labor reasons, but did not cause its delocalization.

The rest of the paper is organized as follows: section 2 revise the literature regarding the debate about the positive and negative effects of cities over rural areas, section 3 illustrates the model of the influence of cities in rural areas, section 4 detail the econometric specification derived from the model, section 5 describes the data and estimation issues, section 6 shows the results, and finally section 7 summarize main results and concludes with policy implications and further empirical and theoretical research.

2 Theoretical Framework

This work is part of an extensive literature describing how development in rural areas is influenced by proximity to cities. Despite Smith's (1776) thinking reach this topic, with his contribution of the commerce of the towns to the wealth of the country[2]. This theoretical debate began with the description of the different intensities in agricultural land use across space, due to the competition for land and proximity to a central city, an idea published on "Der Isolierte Staat" of Johann Heinrich von Thünen (1826) and influenced by Ricardo's (1817) theory of rent. Notwithstanding, these concepts were also alluded and debated by Marx and Engels (n.d.), who focused on the necessity to improve rural population wellbeing taking advantages of the interactions between the town and the countryside, in fact, explicit spatially inclusive policies were proposed in order to reduce differences between the town and the countryside (Gaile, 1980). The objective it was to achieve a harmonious development of productive forces, a more equal distribution of population and industry across space, the end of the isolation of the villages and the "unnatural concentration of gigantic masses of population in large cities" (Khodzhayev and Khorev, 1972, p. 74).

Despite this initial classical debate, main ideas on the positive and negative effects of cities on rural areas were explicit in Colby's (1933) work on *centrifugal and centripetal forces* in urban geography, which give some hints about the mechanisms involved in the delocalization of people from a central zone and a periphery. Those concepts were reinforced by Hoselitz (1955) with the seminal idea of *generative and parasitic cities*. Hoselitz claims that a *generative city* impacts positively on the economic growth of its region through diffusion of ideas, trade and commerce, migration, and the potential demand. On the other hand, *parasitic cities* are mainly places of 'excessive' exploitation of natural resources without positive spillovers over the territory. This idea of positive externalities of certain places over space was also marked by Perroux (1950), with the concept of *growth poles*, as places that led economic development of the territory. However, the most recognized work was made by Myrdal (1957), who makes an effort in establish the conceptual basis of the positive and negative effects of certain places over their hinterland, introducing the popular concept of *spread* and *backwash effects*, in the context of it's very distinguish idea of *circular and cumulative causation*.

The mechanisms under the positive or *spread effects* stated by Myrdal was related with agricultural demand, and technology improvements, while the negative or *backwash effects* were related with capital movements, selective migration, and trade. The ideas of Myrdal (1957) also was recognized in the work of Hirschman (1957), which introduces the concepts of *trickling down* and *polarization* to explain its theory of *unbalanced growth*. The concept of *trickling down* is very near to the concept of *spread effects*, and its mechanisms are mainly explained by the positive effects that economic growth in one region can produce reducing unemployment in other areas, increasing the marginal productivity of labor. On the other hand, the concept of *polarization* is similar to Myrdal's *backwash effects*, and its explained as the unfavorable effects that causes the migration of workers with high human capital to more richer places (*brain drain*), and the competition of similar economic activities (*market crowding effect*). Those authors led to similar conceptualizations of the positive and negative effects of a city or a region over their hinterland or nearby areas, as *spread-backwash*, *generative-parasitic*, or *trickling-down-polarization*.

[2] According to Gaile (1980), the word "country" here is sometimes used to refer to a nation and others to refer to rural areas.

Other contribution of Myrdal (1957) was propose that the scope and magnitude of the positive spatial effects are limited by the state of development of the country, due that lower the development of a country lower the provision of transportation and communication services, lower the quality of infrastructure, lower the average education level, and less spread of ideas and innovations. Thus, rarely *spread* is going to neutralize *backwash effects* in those contexts (Gaile, 1980). This reference to the scope of *spread effects* is also considered in the work of Williamson (1965), which also refer to the potential implications of labor and capital migration, the role of central government policies, and more important, the lack of inter-regional linkages at early stages of national development, which tends to minimize the *spread effects* of technological and social change, and income multipliers. Kuznets (1966) also refer to the advantage of *spread effects* of developed countries related with the power of technology in transport and communications, and negative effects or costs associated with migration from the countryside to the cities. Those limitations to *spread effects* are much stronger for rural areas than for urban areas. Rural localities are more vulnerable to be influenced strongly by *backwash effects*, that increase rapidly with the distance to an urban center. Due that small settlements and rural areas does not have a such strong opposite positive *centripetal force* which is agglomeration.

More recently, agglomeration economies, housing prices, and amenities, are positioned in the economic literature as the main economic factors behind observed differences in the economic development of spatial units. Main contemporary economic theories to approach to these causal explanations are; the New Economic Geography (Krugman, 1991), the Spatial Equilibrium Model (Roback, 1982), and the theories of Endogenous Growth. These theories takes some elements of the classical *spread-backwash* debate and coincide in the existence of agglomeration effects derived from the spatial concentration of workers and firms, which tends to increase the local and national economic growth (Henderson, 2003; Brülhart & Sbergami, 2009). Agglomeration economies are understood as scale economies derived from the spatial concentration of the economic activity, and can be divided into *localization* and *urbanization economies* (Marshall, 1890). *Localization economies* are the within industry agglomeration economies derived mainly of the geographical specialization, while *urbanization economies* are those that are across industries derived from the indivisibilities (e.g. infrastructure investment), and from the interaction of workers (e.g. *knowledge spillovers*). Thus, while *localization economies* lead to the geographical specialization, *urbanization economies* lead to the diversification of the economic activity in the agglomeration. Nonetheless, both of them act as *centripetal forces* that lead to the spatial concentration of the economic activity in a *circular cumulative causation* process, influencing the economic development of nearby areas (Krugman, 1991).

On the one hand, the New Economic Geography (NEG) postulate a different development between spatial units derived from a different economic structure. Therefore, two regions that could start with the same initial conditions, could reach different levels of economic development due to: transport costs, preferences by a diversity of goods and services, a *market crowding effect*, and differences in cost of living. However, the underlying economic mechanism behind these forces operating in the Krugman model is the different levels of increasing returns derived from agglomeration economies. Models of the NEG has been widely studied by economists and geographers, and there is a debate about the assumptions and applicability of these theories, overall to the developing and less developed countries. By other way, the Spatial Equilibrium

Model (SEM), derived from the works of Roback (1982) and Rosen (1987), explain the different economic performance across regions due to different levels of *amenities* endowment. According to these models, wages and rents differences across spatial units capitalize differences in *amenities*, such as a large number of restaurants and theaters, or a better provision of public services. From this point of view, some workers could be dispossed to receive a less wage with the purpose to enjoy for some *amenities*. On the firm side, they could be disspose to pay more for inputs in order to achieve some *amenities* that increase the level of productivity such as a warm weather.

On the third place, endogenous growth models proposes that human capital externalities plays a crucial role explaining differences in economic performance across spatial units. Areas with a higher concentration of high skill workers, which usually are bigger cities, tends to growth more than areas with a lower endowments of this type of workers. These type of theories are directly related with agglomeration economies of *sharing*, such as *knowledge spillovers* effects, and influence the development of nearby areas though selective migration from the hinterland to the urban center, and the level of agglomeration effects concentrated in the urban center due to this *spatial labor sorting*, which have important implications on the wage offered in the urban center. Due that workers who moves to higher order cities tends to receive higher wages, and also tends to increase it's wages in the time due to the learning proportioned by the interaction with others high skill workers (Glaeser and Mare, 2001).

All previous literature indicates that the agglomeration economies seems to be the principal argument to potentiate not only the growth of cities but also the growth in its hinterland or nearby areas. However, all those previous theories also tends to underestimate or neglect the heterogeneity across the urban hierarchy, like the different levels of technology of cities, the state of development of subnational units, and the different quality of institutions across the country, between other factors more than population size (Soto and Paredes, 2016). Some of these elements are more well developed in the literature of Central Place Theory (Christaller, 1933). The Central Place Theory (CPT) proposes that a hierarchical urban system arises due to the competition of cities, the different levels of services that they offer, and the economic structure of those places. The urban growth effects are not limited to the city itself, but have spillover effects to nearby rural and urban areas, with effects that are not equal on magnitude and extension (Partridge and Rickman, 2008). In this context, there is widely evidence for the U.S., some European and others developed countries. But for developing countries, the evidence on the extension and intensity of those linkages is scarce (with some exceptions as: Chen and Partridge, 2013; Duranton, 2016; and Soto and Paredes, 2016).

Most of the empirical work relating the growth of rural areas nearby cities, are generalizations of the empirical Carlino-Mills models (Carlino and Mills, 1987), which, to the opinion of authors, are a particular case of the SEM. In the sense that the implications of different impacts of urban growth on proximate rural and urban areas, are an implication of the assumption that wages and rents differences between spatial units, represents differences in amenities between those areas, due that workers equalize utility levels across space, and firms face equal costs across space. Empirical models that derived from the work of Carlino and Mills (1987) are not explicitly microfounded, including the work of Carlino and Mill. Thus, in line with the work of Partridge and Rickman (2003), this paper is also an effort to present the microeconomic foundations of the important amount of empirical works of those patterns observed on population and employment at subnational levels. References to some of this work are: Carlino and Mills (1987); Hughes and Holland (1994); Barkley, Henry, and Bao (1996); Henry, Schmitt, Kristensen, Barkley and Bao (1999); Carruthers and Vias (2005); and Hoogstra, van Dik and Florax (2011).

3 THE MODEL

We develop a simple model for rural development lead by the proximity to a city. We assume that exist a CBD positively influencing nearby rural areas through potential demand. Therefore, we define the market access of a jth rural area located at s distance from a city with Y income, as $g_j = \sum_j Y_k e^{-cs_{j,k}}$ (Krugman 1991; Hanson 2005). Therefore, from the utility maximization problem for rural households, assuming a Cobb-Douglass utility function, we have that:

$$\begin{aligned} \max_{x,l_c} \quad & U(x,l_c;s) = x^{\alpha} l_c^{\beta} g(s) \\ \text{s.t.} \quad & w + I = x + l_c r(s) \end{aligned} \tag{1}$$

where $0 < \alpha, \beta < 1$, $x \succeq 0, l_c \succeq 0$, x is the amount of commodity consumed, l_c the residential land used, s is the distance from a city, w the wage, I the income derived from secondary activities[3], r the rent. With $\frac{\partial U}{\partial g} > 0$, which means that the utility of rural households is bigger if they are located near of big urban areas due to access to services. Thus, from the previous maximization problem, the Marshallian demands of x and l_c are obtained as $\bar{x} = \frac{\alpha w}{a}$, $\bar{l}_c = \frac{\beta w}{ar(s)}$, where $a = \alpha + \beta$. Therefore, the indirect utility function for an individual in a location i is given by

$$v(s) = \left(\frac{\beta}{ar(s)}\right)^{\beta} H^{\alpha} w^{a} g(s) \tag{2}$$

where $H = (\frac{\alpha}{a})^{\alpha}$. Thus, solving Eq. 3 for $r(s)$, we obtain the rent value required to maximize the utility, as:

$$\bar{r}(s) = \frac{\beta}{a}\left(\frac{H}{v} w^{a} g(s)\right)^{\frac{1}{\beta}} \tag{3}$$

And the Hicksian demand of l_c is obtained replacing Eq. 4 in Eq. 2:

$$\bar{l}_c^h = \left(\frac{v}{H} w^{-a} g(s)\right)^{\frac{1}{\beta}} \tag{4}$$

Assuming that households are uniform in composition with a size m, the equilibrium population density in a rural area i at a distance s from a city, is given by $\overline{D} = m/\bar{l}_c^h$. Consequently, the equilibrium population in a rural area i within a distance s from the CBD to the rural locality center, is obtained as:

$$\overline{P}_j = \sum_i \left(\frac{H}{v_i} w_i^{a} g_j(s)\right)^{\frac{1}{\beta}} \tag{5}$$

[3]It is important for rural households the differentiation between farm and non-farm employment.

Hence, the equilibrium population of a rural area is a function of the distance to other urban centers, the income of those urban areas, and the wages of the rural locality. On the other hand, the equilibrium condition for firms derive from the cost minimization problem:

$$\min_{w,r} \quad C(k, p_k; s) = wLg(s) + r(s)l_p \tag{6}$$

$$\text{s.t.} \quad Y = AL^{\alpha} l_p^{\beta} \tag{7}$$

where L is the amount of labor, l_p the land used for production , w the wage, $r(s)$ the land rent, and $g(s)$ is the market access to the urban areas, and its means that higher the market access higher wages and rents. A is a Hicks neutral technology shifter, and constant returns to scale are assumed, and $k \succeq 0$. Then, firms chose an optimal amount of land used for production $\bar{l}^p$, and assuming transportation costs as given, the equilibrium amounts of labor and land are:

$$\overline{l_p} = Q\left(\frac{\beta w}{\alpha r(s)}\right)^{\frac{\alpha}{\alpha+\beta}} \tag{8}$$

$$\overline{L} = Q\left(\frac{\alpha r(s)}{\beta w}\right)^{\frac{\beta}{\alpha+\beta}} \tag{9}$$

where $Q = \left(\frac{Y}{A}\right)^{\frac{1}{\alpha+\beta}}$ .Hence, the equilibrium level of employment per land unit in a rural area j is obtained as follows

$$\overline{E}_j = \frac{\alpha}{\beta} \sum_i \frac{r_i(s)}{w_i g_j(s)} \tag{10}$$

where $g_j = \sum_j Y_k e^{-cs_{j,k}}$.Therefore the effect of proximity to cities over the population and employment levels of a rural locality is given by the sign and magnitude of derivatives $\frac{\partial \overline{P}}{\partial s}$, $\frac{\partial \overline{P}}{\partial Y}$, $\frac{\partial \overline{E}}{\partial s}$ and $\frac{\partial \overline{E}}{\partial Y}$. Let us assume a spatial equilibrium for rural households. This means that households utility levels are equalize across locations $v = \bar{v}$, and implies that the effect of a change in the distance and a change in the income of the urban system over the rural population of an area j, is given by:

$$\frac{\partial \overline{P_j}}{\partial s} = -cZ\left(Y_u e^{-cs} w_j^a\right)^{\frac{1}{\beta}} < 0 \tag{11}$$

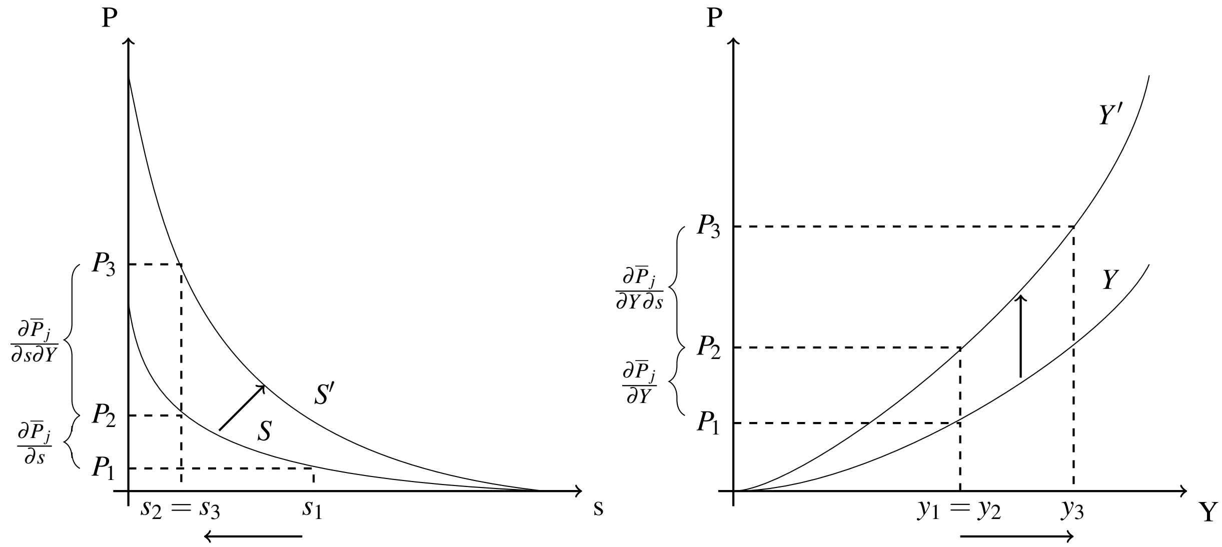
$$\frac{\partial \overline{P_j}}{\partial Y} = Z\left(Y_u^{1-\beta} e^{-cs} w_j^a\right)^{\frac{1}{\beta}} > 0 \tag{12}$$

where $Y_u = \sum_k Y_k$ and $Z = H/\bar{v}$. Thus, the combine effect of g_j on population always is going to be negative. The effect of a change in s and Y in employment is:

$$\frac{\partial \overline{E_j}}{\partial s} = \frac{c\alpha e^{cs}}{\beta w_j Y_u} \frac{\partial r_i(s)}{\partial s} < 0 \tag{13}$$

$$\frac{\partial \overline{E_j}}{\partial Y} = -\frac{\alpha e^{cs}}{\beta w_j Y_u} \frac{\partial r_i(s)}{\partial Y} > 0 \tag{14}$$

with $\frac{\partial r_i(s)}{\partial s} = -\frac{c}{\alpha}\left(\frac{Hw}{\bar{v}}Y_u e^{-cs}\right)^{1/\beta} < 0$, and $\frac{\partial r_i(s)}{\partial Y} = \frac{1}{\alpha}\left(\frac{Hw_i Y^{1-\beta}e^{-cs}}{\bar{v}}\right)^{1/\beta} > 0$. These relations are represented in Fig 3. For a i-th rural locality located at the same distance of three different size urban areas, the potential effect of a reduction in travel time to any of those areas over rural population is greater if that change happen related to the biggest city. The reduction in travel time of a rural locality near of a big city have a greater positive impact in population than if that rural locality was located near of a small or medium-size city. Any change in transportation is represented by the parameter c, due that is the proportion of distance discount that the individual or the firm have to face. If $c = 1$ it means that the individual or the firm have to face all the distance discount, on the other hand, if c is nearest to 0, the individual or the firm have to face only a small proportion of the distance discount.



There are going to be simultaneous effects of a change in s and y over the population and employment levels. As an example, in the graph of the left side in Fig. 3, if we compare a rural locality which is at a distance s_1 of a urban center, with another locality at a distance s_2 of the same city, we are going to observe a difference in population levels given $P_2 - P_1$. However, if that urban center were bigger, then the influence of that city over rural localities in terms of distance is given by another function (S'). Therefore, the difference between two rural localities located at the same distance of two different size urban center it would be given by $P_3 - P_2$. The same happens in relation to the wealth of those cities (Y), in the right side graph. For example, rural localities are being differently influenced by different cities in terms of wealth, If we take, two rural localities being nearby of two similar cities in terms of wealth (y_1 and y_2), they could be influenced differently by those cities, despite having the same wealth, but a different discount distance given by the function Y and the function Y'. Therefore, despite those rural localities are near of the same wealth city, they are going to have different populations levels, given by P_1 and P_2. Moreover, if we compare a rural locality influenced by two different cities in terms of wealth (supose y_2 and y_3), but having the same distance discount function, the differences in population levels are going to be given by $\Delta P_2 = P_3 - P_2$. Therefore, we are going to have direct and indirect influences of s and y over the employment and population levels. This could be help us to understand and disentangling spread and backwash effects. Direct influences of s and y are represented by the previous Eq. 11, 12, 13, and 14. I.e. the partial derivatives of $\frac{\partial \bar{P}_j}{\partial s}$, $\frac{\partial \bar{P}_j}{\partial Y}$, $\frac{\partial \bar{E}_j}{\partial s}$, and $\frac{\partial \bar{E}_j}{\partial Y}$. But the indirect effects are given by mixed partial derivatives: the indirect effect of s over P and E through Y is given by $\frac{\partial \overline{P}_j}{\partial s \partial Y}$, and $\frac{\partial \overline{E}_j}{\partial s \partial Y}$. Or in a similar way, the indirect influence of y over P and E through S, is given by $\frac{\partial \overline{P}_j}{\partial Y \partial s}$, and $\frac{\partial \overline{E}_j}{\partial Y \partial s}$. Being the total effect, a combination of direct and indirect effects.

4 Model Specification

We found in Eq. 5 and 6 the equilibrium of population and employment levels in a rural locality in a spatial model framework. Taking the logarithms of Eq. 5 and Eq. 10, the population and employment equilibrium levels of a rural area j can be expressed as

$$\log(P_j) = \alpha_0 + \alpha_1 \log(w_j) + \alpha_2 \log(g_j) + \varepsilon_j \tag{15}$$

$$\log(E_j) = \beta_0 + \beta_1 \log(w_j) + \beta_2 \log(g_j) + \eta_j \tag{16}$$

where $\alpha_0 = \frac{1}{\beta}\left(\alpha \log(\alpha) - \log(\overline{v})\right)$, $\alpha_2 = \frac{1}{\beta}$, $log(\alpha) + \frac{1}{\beta} log(\frac{H}{\overline{v}})$, $\beta_1 = \frac{\alpha}{\beta}$, $\beta_2 = \frac{1-\beta}{\beta}$. We are interested in analyze the change in that levels understood as temporal deviations to the equilibrium, that happen in specific cases of demographic facts as migration, productive structural transformations that motivate changes in location decisions. Any temporal difference in the utility levels is adjusted through changes in population and employment. The long-term equilibrium condition establishes that the migration of labor is a partial adjustment process. Then, the population and employment levels in a rural area i in a time t represents the well-being of a representative household in a *steady-state*, as well as the employment level represents the optimal production levels of a representative firm to the minimization cost problem in a *steady-state*. The population and employment changes follow a partial adjustment process to the equilibrium levels in i-th rural locality, and suppose that it is initially in a *steady-state*:

$$\log(P_{jt}) = \log(P_{jt-1}) - \lambda_P(\log(P^*_{jt}) - \log(P_{jt-1})) \tag{17}$$

$$\log(E_{jt}) = \log(E_{jt-1}) - \lambda_E(\log(E^*_{jt}) - \log(E_{jt-1})) \tag{18}$$

where λ is a measure of velocity of transition to the equilibrium, and $\log(P^*_{jt})$ and $\log(E^*_{jt})$ represents the logarithms of the equilibrium population and employment levels in a i-th rural area. Expressing (12) and (13) in linear form, substituting on equations (14) and (15), and rearranging terms, we obtained the following equations

$$\Delta \log(P_j) = \gamma_0 + \gamma_1 \log(w_j) + \gamma_2 \log(g_j) - \lambda_P \log(P_{jt-1}) + \varepsilon_j \tag{19}$$

$$\Delta \log(E_j) = \tau_0 + \tau_1 \log(w_j) + \tau_2 \log(g_j) - \tau_P \log(P_{jt-1}) + \eta_j \tag{20}$$

where $\gamma_0 = \lambda_P \alpha_0$, $\gamma_1 = \lambda_P \alpha_1$, $\gamma_2 = \lambda_P \alpha_2$, $\gamma_3 = \lambda_P$, $\eta_0 = \lambda_E \beta_0$, $\tau_1 = \lambda_E \beta_1$, $\tau_2 = \lambda_E \beta_2$, $\tau_3 = \lambda_E$.

5 Data and Estimation

5.1 Data sources

We use the Chilean national censuses of population and housing of 1992 and 2002, from the National Institute of Statistics (INE)[4]. The national statistics office at 1992 distinguish a rural area as any spatial entity with less than 3,000 inhabitants[5]. There are 36,053 rural localities identified by the national census. In addition, we select all those rural areas that are available and can be identified in both census of 1992 and 2002. Which led a total of 22,161 observations in each year. In addition, we use stable satellite night lights data information from the Defense Meteorological Satellite Program (DMSP), as a proxy of the economic activity of cities.[6] We process the night lights satellite images for Chile in 1992 and 2002. We take the sum of night lights for the census perimeter of each city in 1992 and 2002.

5.2 Estimation issues

We estimate the model in changes, as is expressed in Equations (17) and (18). Thus, the change on population and employment, between 1992 and 2002 is explained by the initial population level, plus other geographical, demographics and economics characteristics in 1992. We estimate first using the travel time and after that we estimate using the market potential variable. However, population and employment are simultaneously determined. Therefore we also estimate by 3SLS. This is because in the long term equilibrium the equalization of utility and costs across spatial units leads to consider any difference in rural population and employment as a compensation effect for the differences in the level of amenities, variations on agglomeration economies from nearby cities, or in the access to goods and services. Then, the percent change on population and employment between a time 0 and a time t explained through the characteristics of the location (the level of amenities), represents the effect of those attributes over the welfare of a representative agent (Partridge, Olfert & Alasia, 2007). Thus, it is assumed that population flows show geographical differences on utility, in the same way that variations on employment shows the partial adjustment of firms to achieve its equilibrium condition (Partridge, et al. 2007).

6 Results

Table 1 reported a result based on a travel time as influence variable of urban centers over rural areas. The negative effect of travel time to the nearest urban center on the rural population is consistent in sign and significant in both OLS and 3SLS estimations, it's means, when increase distance from the city center, is greatest the loss of jobs and population. The size of the effect of the time to the nearby city is bigger in the 3SLS estimation, revealing that population in rural areas decrease in approximately 6% for each hour

[4]Regrettably we do not have an updated version of the national census, due to methodological problems, the next Chilean census of 2017 it is expected to be available at 2019.

[5]There is another classification at 2002 that in addition distinguish as a rural locality a spatial entity with less than 5,000 inhabitants but that have a significant proportion of agricultural workers. However, we choose the definition of 1992 to make the comparison in time, and in order to avoid endogeneity problems in the definition of rural areas with some economic variables.

[6]Chile, as many of developing countries, does not account with economic information at city level.

of distance to the urban center, and also the employment decrease by almost 2% by each hour. However, in both population and employment estimations, there is a positive quadratic and significant effect of the travel time in the 3SLS estimation. I.e. population and employment in rural areas decrease while higher is the distance to an urban center, but until certain point in which the remoteness of the locality is very high, and the effects of the travel time to an urban center almost does not have an effect on the population and employment levels in those rural areas.

For other control variables, we found that the population and employment levels in 1992 are related negatively with growth rates, this is usually interpreted as a convergence. On the other hand, the greatest composition of indigenous population in rural areas, causes a higher growth rate of population, this tell about the effect of greater attachment to the territory of ethnic people. About the educational level, the higher educational levels in the population equation are significant in the second estimation by population growth, showing that migration effect is selective respect to educational level, being the people with better endowment of skills those that leaving rural areas, generating a lost for the locality. The average schooling of rural areas in employment equation shows that higher levels of education at the initial moment, causing the fall in employment in rural areas, which means that their are unable to retain through employment their best educated people. The average age of the rural areas in 1992 shows a positive sign, then if average ages increases the rural locality reported more population growth. On the other hand, a greater composition of employment in mining, has a negative and significant effect on employment equation, although very small in magnitude, this it is related to the economic cycle. The average number of workers in agriculture at 1992, affecting positively the employment growth.

On Table 2 we focused in market potential variable as a proxy of urban influences over rural areas. Regarding the market potential of the nearest town. It has a positive sign with the population growth in rural areas. The size of the coefficient is very high for the 3SLS in comparison to the OLS estimation. Population in rural areas growth approximately 0.31% by each increment of 1% in the market potential. To be near to a big city, makes the population grows and its negative with regard to employment, which means that although these people do not live in the city tend to work on it. The employment in rural areas decrease to almost 0.007% for each increment in 1% of the market potential. But those effects of the market potential on population and employment growth changes when the market potential is small, as reveals the sign of the coefficients for the square of the market potential. The interesting fact, is the change of sign in the population equation using the market potential, in comparison when only travel time is used. This result can be tell us about the increasing importance of medium and small cities by rural development, the people is drain by urban areas, especially because of isolation and, when the proximate city its and urban giant as Santiago. But if city is medium and small, their attract population by labor reasons, but did not cause its delocalization. The coefficients of control variables also behaves as travel time model: The majority have the same sign and significance than the first model.

The Fig. 3 describes the marginal effects (linear) of the market potential variable of the nearest city over the population and employment growth. For the greatest values of the market potential variable the confidence intervals shows that there are no significance differences between population and employment growth. However, in terms of population it is possible to say that those rural areas that are influenced by those high values of the market potential variable are not increasing in terms of population. But also we can say that they are benefiting more of employment opportunities that those rural areas with low values of market potential. Moreover, despite rural areas with low values of the market potential variable does not show positive employment growth rates, they show positive population growth rates, that decays as higher the market potential. Thus, the potential explanation to this is that as more remote the rural locality is, the less delocalization incentives its population have, even when the employment is less than for rural localities near of big cities. However, the more near the rural locality is of a big urban center the more incentives the rural population have to move to those areas. Probably, this incentives are created in the first place due to rural non-farm employment localized mostly in the city. Thus, rural inhabitants near big cities commutes to work in the city and with the time they move to those areas. Instead, when that population is far away of those urban areas, the cost of moving is so big, that they prefer to stay living in those areas, despite experienced low employment levels.

7 Conclusions

This work may have important policy implications in Chile because Chile's growth model has been for a long time driven by cities, but not any city, the largest city (Santiago), the levels of concentration of population in Santiago exceed 40% of the total population. But its clear by these results that smaller and intermediate cities in the urban hierarchy may generate more virtuous dynamics with the rural world, where is concentrated the largest percent of poor people in the country. We found that rural population decrease almost 6% for each hour of travel time to the nearby city, and employment decrease by almost 2% for each hour. However, when the wealth of those cities is considered with the incorporation of the market potential in the estimations, our results indicate that as higher the market potential, higher the employment in rural areas, but lower the population. Thus, probably population nearby big cities is moving to urban areas due to the incentives to delocalization that are generated by those big cities. However, for low values of the market potential (i.e. more remote rural localities), the population growth rate is higher, despite having negative growth rates in terms of employment. Therefore, for those remote rural localities the cost of moving to urban areas is higher than for rural areas nearby big cities, and for that reason there are not much incentives to delocalization, even more with conditions of informal and precarious employment. Notwithstanding, our empirical analysis requires incorporate natural amenities variables (such as climate and other geographical variables) and other variables of agricultural land use at locality level.

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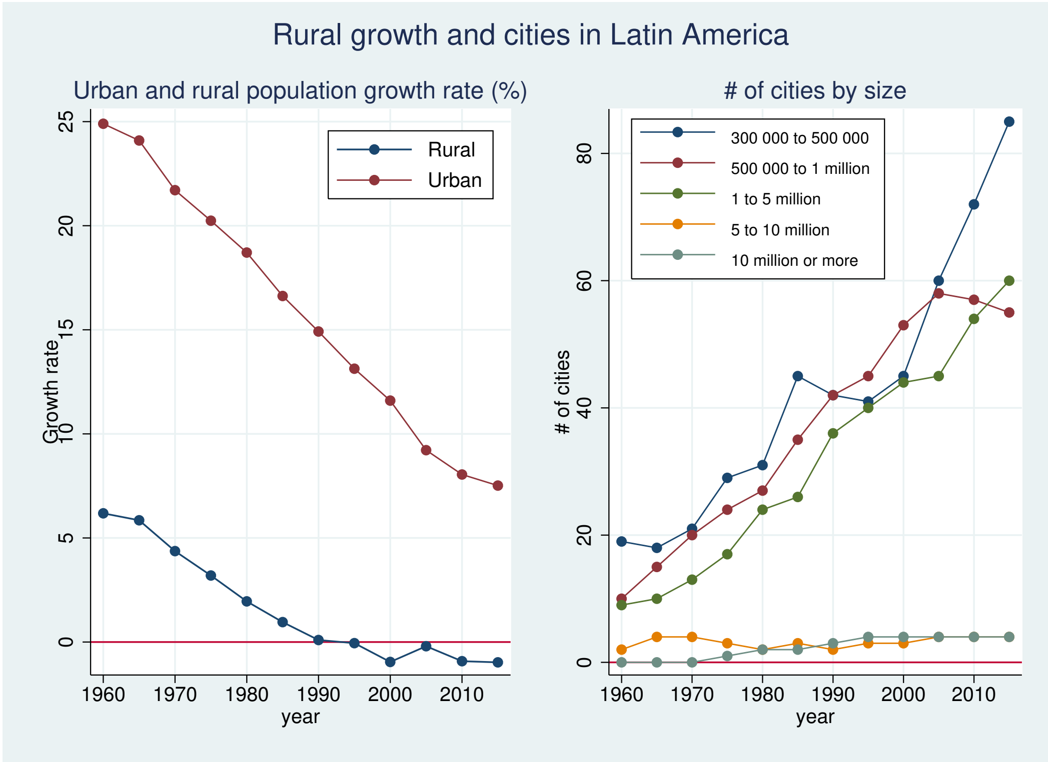

FIGURE 1: Rural growth and cities in Latin America.

Source: Own elaboration based on data from the World Urbanization Prospects.

Cities and Rural Areas

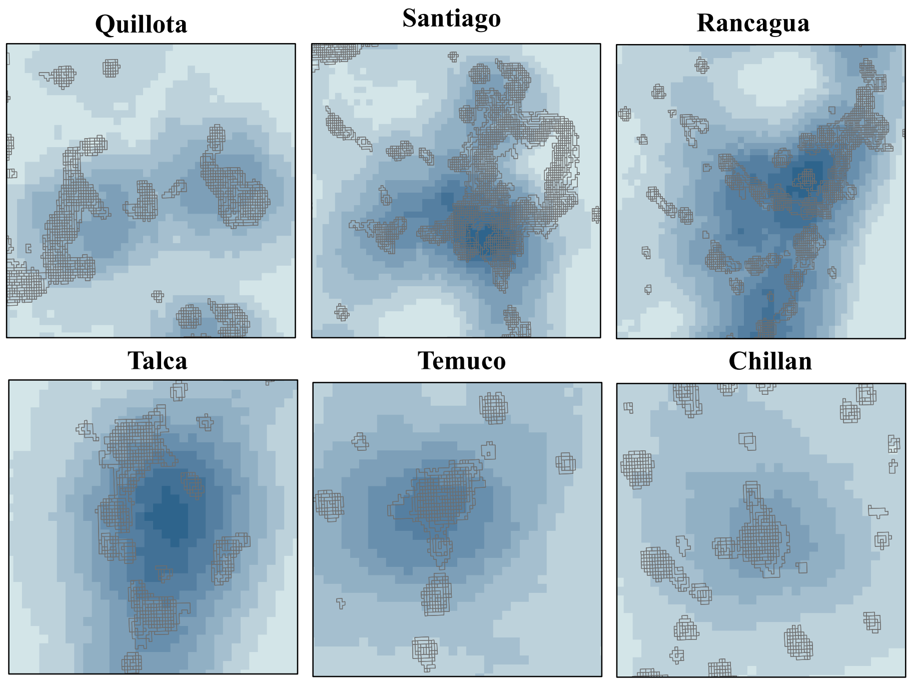

FIGURE 2: The Rural-Urban Interface in Chile

Source: Own elaboration based on data from the 2002 census of population of the Chilean National Institute of Statistics (INE).

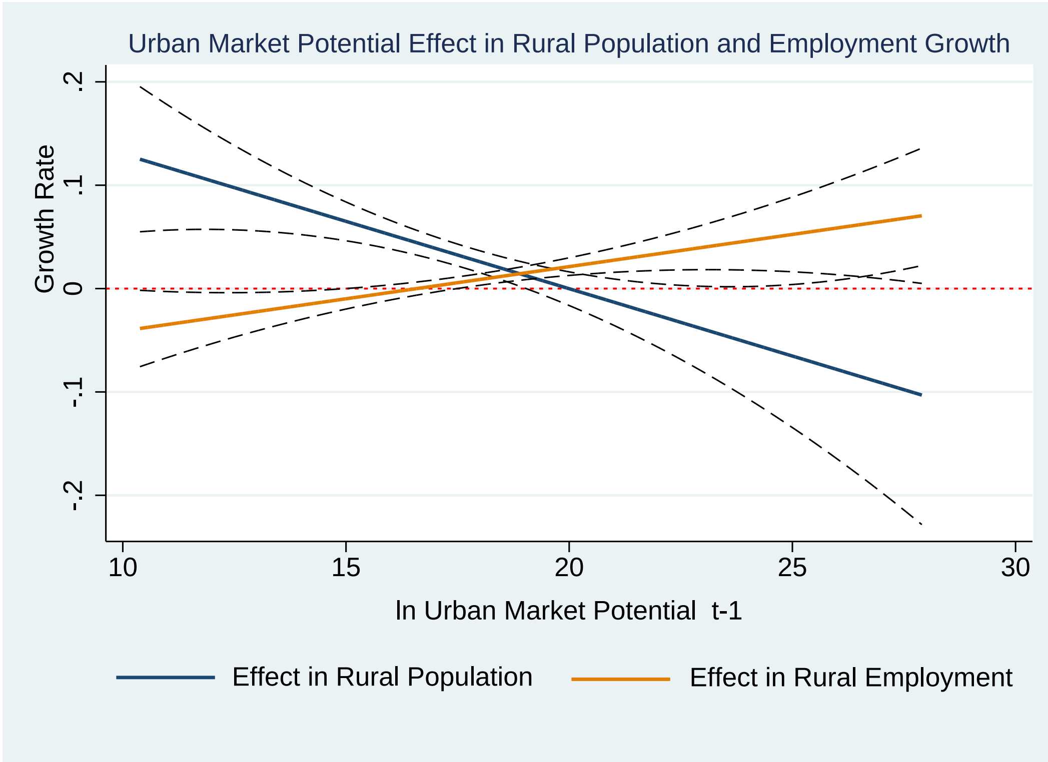

FIGURE 3: Marginal effects of the market potential in rural population and employment growth.

Source: Own elaboration.

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TABLE 1: Travel time to the nearby city effect in rural population and employment growth

	OLS		3SLS	
	Δ ln Pop	Δ ln Emp	Δ ln Pop	Δ ln Emp
ln Population t-1	-0.093***		-0.432***	
ln Employment t-1		-0.166***		3.17e-05**
Δ ln Employment	0.896***		0.400***	
Δ ln Population		0.844***		0.922***
Time to the nearby city	**-0.021****	**-0.024*****	**-0.061*****	**-0.017****
Time to the nearby city-sqrt	**-2.46e-04**	**0.003*****	**0.002***	**0.002****
ln Men t-1	0.989***		-0.182	
ln indigenous inhabitants t-1	0.159***		0.133***	
ln people with higher education t-1	5.27e-08		-1.2e-04***	
Literacy rate	0.182***		-0.024	
Average age t-1	0.012***	-0.017***	0.010***	-0.016***
Average schooling years t-1		-0.068***		-0.074***
ln mining workers t-1		-0.001***		-0.001*
ln farm workers in t-1		0.001***		0.001***
Constant	-0.696***	1.080***	1.308***	0.708***
N	22,161	22,161	22,161	22,161
R-squared	0.8778	0.8752	0.7210	0.8678

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Own elaboration.

TABLE 2: Urban Market Potential effect in rural population and employment growth

	OLS		3SLS	
	Δ ln Pop	Δ ln Emp	Δ ln Pop	Δ ln Emp
ln Population t-1	-0.093***		-0.735***	
ln Employment t-1		-0.166***		-0.410***
Δ ln Employment	0.896***		4.65e-4***	
Δ ln Population		0.844***		0.491***
ln Urban Market Potential t-1	**0.187*****	**-0.093*****	**0.305*****	**-0.070****
ln Urban Market Potential-sqrt t-1	**-0.005*****	**0.003*****	**-0.007*****	**0.003****
ln Men t-1	0.989***		0.560***	
ln indigenous inhabitants t-1	0.157***		0.294***	
ln people with higher education t-1	7.39e-08		0.001***	
Literacy rate	0.186***		-0.232***	
Average age t-1	0.012***	-0.017***	-0.001	-0.011***
Average schooling years t-1		-0.069***		-0.051***
ln mining workers t-1		-0.001***		-0.002***
ln farm workers in t-1		0.001***		2.71e-04**
Constant	-2.316***	1.775***	-0.733	1.760***
N	22,161	22,161	22,161	22,161
R-squared	0.8778	0.8753	0.3847	0.7889

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Own elaboration.