Immigration and the origins of regional inequality: Government-sponsored European migration to Southern Brazil before World War I

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Immigration and the Origins of Regional Inequality: Government-Sponsored European Migration to Southern Brazil Before World War I[1]

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Abstract:

This paper studies the long-term consequences of the government-sponsored programs of European immigration to Southern Brazil before the Great War. We find that the municipalities closer to the original sites of nineteenth century government sponsored settlements (*colônias*) have higher per capita income, less poverty and dependence on *Bolsa Família* cash transfers, better health and education outcomes; and for the areas close to German colonies, also less inequality of income and educational outcomes than otherwise. Since that is a reduced form relationship, we then attempt to identify the relative importance of more egalitarian landholdings and higher initial human capital in determining those outcomes. Our findings are suggestive that more egalitarian land distribution played a more important role than higher initial human capital in achieving the good outcomes associated with closeness to a *colônia*.

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[1] A preliminary version of this paper was presented at the 3rd "Migration and Development" Conference at the Paris School of Economics on September 10 and 11, 2010, with the title "How Bodo Became Brazilian: European Migration to Southern Brazil Before World War I." The original title of this paper is a reference to Riegelhaupf and Forman (1970) "*Bodo Was Never Brazilian*..." about the historical absence of the small holder in the Brazilian rural areas.

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I. INTRODUCTION

During Brazil's first 100 years as an independent country, both government and wealthy private citizens struggled to attract immigrants to populate the vast unoccupied lands in the subtropical areas in Southern Brazil. Between 1824 and 1918, the Brazilian government subsidized the settlement of non-Iberian European immigrants (colonists) in the rural areas of that region, in particular to the southernmost province/state of Rio Grande do Sul. In this paper, we contribute to the literature on the relationship between immigration and development by identifying the long-term consequences of Brazil's government sponsored programs for settlement of European immigrants.

It has long been argued that the local economies and societies that emerged from those colonization programs were different in many dimensions from those in other parts of Brazil: the areas of government-sponsored settlement (official colonies) colonies had more equitable land distribution, received larger transfers from the central government, and the colonists in general had a higher level of human capital than the typical backlander Brazilian (usually referred as the *caboclo*).[3] Almost two hundred years after the first group of German immigrants settled in Colônia São Leopoldo in 1824, the state of Rio Grande do Sul (henceforth, RS) is one of the most prosperous in the Brazilian federation and one of the most developed areas in Latin America. While its per capita income has fluctuated in a range between 13 and 46 percent higher than the Brazilian average[4] for the recent period for which a consistent series of annual state GDP series is available (from 1985 to 2007), in many welfare indicators (e.g. life expectancy) it holds the lead amongst all Brazil states (PNUD, 2003). Moreover, within the state of Rio Grande do Sul (exclusive of the state capital), there is a 19 percent gap in log relative incomes between the counties (*municípios*) that were sites of government sponsored colonies and the ones that were not, or a gap of 7¼ percentage points after we control for population size (in a linear regression). The relative success of those local economies holds clues to understanding the process of economic development, the factors that have held back other parts of Brazil and the developing world, and the long-term consequences of immigration.

In this paper, we contrast the experience of counties (*municípios*) where official colonies were installed with those without them; and whether there were differences between the colonies populated by Germans, Italians and other Europeans (mostly Poles, Austrians, Frenchmen and Russians). We identified and located 49 official settlements (*colônias*) in that state, established between 1824 and 1918, of which some bore fruit and laid the ground work for prosperous middle sized towns, while others failed miserably, surviving only in the

[3] Age-heaping patterns suggest that the 19th century immigrants have better numeracy skills than those of their contemporaneous native Brazilians (Stolz, Baten and Botelho 2010).

[4] In 2009, Brazil's GDP per capita was about US$10,500 (PPP in current dollars, source: IMF/WEO).

historical records (for details on our database of colonies, see the appendix). Of those official colonies, 18 were settled exclusively by German colonists, 21 by a combination of colonists of German and other nationalities; and 10 without the German element.

While the settlers in the areas around the official colonies had to live under the Brazilian laws and institutions, their success or failure relative to other areas and the differences among different colonies inform us about the importance of the features that made them different. First, the government sponsorship may have given an initial advantage that set in motion cumulative processes, perhaps related to agglomeration economies, which made those locations more productive even in the long-run. Second, colonists may have started off with more human capital and been more exposed to the idea of public instruction and formal education than other peoples in 19th century Brazil. The evidence on age heaping patterns implies immigrants had better numeracy skills than native Brazilians (Stolz, Baten and Botelho, 2010). Enrollment rates of children age 5-14 were more than 70 percent in Germany as early as the 1860s (as early as the 1830s for Prussia for which earlier data is available); about 30 percent in Italy in 1870 when the first Italian colonies were settled in RS (Lindert 2004, pp. 91-93). The same source has enrollment rates of 10 percent for Brazil in 1900.[6] Third, the land grants may have generated a more equitable distribution of land property or a different agrarian structure more conducive to development than the one found in other parts of the country. Data from the Census of 1920 shows a marked difference in land concentration between municipalities with official colonies and those without. The (unweighted) average land gini for the 30 municipalities with official colonies was 0.57 (and as low was 0.25 in the municipality of São Leopoldo, the first German colony); and 0.67 for the 41 municipalities without an official colony. Finally, colonists may have brought to Brazil different civic traditions (Putnam, 1993, Knack and Keefer, 1997), culture (Guiso, Sapienza and Zingales, 2006), or preferences or opinions about the importance of a formal education (Kreutz 2000).

This study relates to the literature attempting to identify the long-term, slow-moving determinants of economic and social outcomes, and how they are shaped by endogenous processes and historical accidents (e.g. Engerman and Sokoloff 1997; Acemoglu, Johnson and Robinson 2001, 2002; Nunn 2007; Banerjee and Iyer 2010). It also relates to a growing literature on the historical determinants of local institutions and economic performance in Brazil. Naritomi, Soares and Assunção (2007) study the colonial origins of institutions in Brazil looking back to the sugar-cane and gold cycles of the seventeenth and eighteenth

[6] Easterly and Levine (2009) argue in favor of an important role for human capital in long-term development of former colonies. De Carvalho Filho and Colistete (2010) find that in the state of São Paulo, immigrant farm-laborers from countries where public schooling was already established may have played an important role in the early development of locally-funded public instruction, with long-lasting consequences for human capital and income levels.

centuries. Martínez-Fritscher, Musacchio and Viarengo (2010) study the political economy of education in Brazil during the period of increased decentralization of revenues after the proclamation of the Republic. De Carvalho Filho and Colistete (2010) study the connections between the coffee cycle, European immigration of farm laborers and the establishment of public instruction institutions in the state of São Paulo. Rocha et al (2010) also analyzed the case of the colonies in São Paulo and found evidence suggesting the role of human capital of immigrants in the long term development of such areas.

We will proceed as follows. In the next section, we will introduce the history behind the official settlements in RS; in section II, we present the data underlying our empirical work; in section III, we discuss our empirical strategy and reduced form results relating a wide array of outcomes to proximity to an official colony; in section IV, we attempt to disentangle the roles played by two distinctive characteristics of official colonies: a more egalitarian land distribution; and greater human capital of the immigrants. Finally in section V we conclude.

II. The History Behind the Official Settlements in the Rio Grande do Sul

> *Twenty or thirty years ago, the life of a German labouring man was not what it now is, or is fast becoming. Small states had stern laws, and, in the larger ones, multitudinous restrictions gave little room for free expansion. Trade, throttled in its medieval swathing-clothes, was often dull, prices and wages low, manufactures, in some states, in something like to infancy; thereto came political dissensions, military service, bad harvests, with hunger-typhus in the rear; so that a poor man might ell come, and that not seldom, to feel pinched. Thus the devil drove; the desire of those who ruled the councils of Brazil to replenish their land opened a way. After the formal denunciation, followed, about 1850, by the practical suppression of the slave trade, this dilettante desire became an imperative necessity; hence forward agents were constantly at hand in Europe, with all their paraphernalia of puffs, placards, and pamphlets, to assist the harassed German in his attempt to escape a bitter present, to allure him with sunny pictures of the future.*
>
> *In sooth it was a real case of needs must, and the two necessities played perfectly into each other. Ship after ship disembarked its human cargo, colony followed colony into the bowers of the Eldorado.*
>
> *(Jacaré-Assú, 1873)*

A. History

In 1808, the province of São Pedro do Rio Grande do Sul (later to become the state of Rio Grande do Sul, with the promulgation of the Republic in 1889) was inhabited by 87,000 people spread in a territory with an area similar to modern day Italy. In 1830, its population

had doubled, and by 1872 it had reached 446,000 people. Behind this fast population growth were active policies by the Portuguese and later Brazilian Imperial court and later Republican government to foster the occupation of those nearly empty lands.

First, the province had strategic importance due to its location in the border between the original Portuguese and Spanish dominions in the Southern Cone (Figure 1). This is highlighted by its recurrent history as a site of military clashes and skirmishes before and after Brazil and its neighboring countries became independent, as well as a history of long and bloody internal conflicts.[8] Second, there was an economic rationale for immigration as RS shared the low labor/land density characteristic of most other parts of nineteenth century Brazil.[9] Last but not the least, government-sponsored European migration may have reflected widespread racist views (Andrews 1988) or the Teutonic sympathies by Emperor Pedro II, himself a fluent German speaker and son of a Viennese princess.

The first official colony in Rio Grande do Sul was established only two years after the Brazilian independence, in 1824, when a first batch of 126 German immigrants settled in the old Royal flax factory in the newly established colony of São Leopoldo in the valley of the Rio Sinos, some fifty miles from the provincial capital of Porto Alegre (for our list of government sponsored colonies in Rio Grande do Sul, see Table 1). In the first experiments with official settlements, immigrants were promised generous support: free transport from a European port to the colony, 77 hectares of land for each family, livestock and cash support for one year (Roche 1969, p.95). The combination of push factors in the origination countries and the rich incentives generated a remarkable flow. Before the Farroupilha Revolution (1835-1845) interrupted immigration for ten years, 4856 colonists had arrived to the São Leopoldo colony alone.[11] And over the years after the resolution of the Farroupilha Revolution through the World War I, Rio Grande do Sul became one of the major immigrant receiving areas in Brazil. Table 2 shows the proportion of foreigners in Rio Grande do Sul and Brazil for 1872 through the present – in 1900, the foreigners accounted for 12% of the population of that state and about 6% of Brazilian population.

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[8] During the 19th century, modern-day Uruguay was invaded twice (1811-12 and 1816-18), and the Cisplatina War (1825-28), the River Plate War (1851-52), and the Paraguay War (1864-1870) were fought. Internal conflicts were not less frequent or deadly. The Farroupilha Revolution (1835-1845), a separatist insurrection, caused thousands of deaths and split the province for a decade. In the first years after the proclamation of the Republic, violent conflict again erupted with the Federalist Revolution (1893-1895) as groups jockeyed for greater state autonomy.

[9] Holloway (1974) studies the problem of lack of arms in the coffee plantations of Southeast Brazil; for a contemporaneous account, see Grossi (1905).

[11] To bring some perspective, total immigration to Brazil between 1820 and 1929 was 4.5 million while the United States received during the same period 37.5 millions. In terms of ethnic composition, Germans accounted for 205,000 immigrants, less than 5 percent of total migration to Brazil, but almost 6 million or more than 15 percent of the total to the United States (Luebke 1990).

Between 1824 and 1848, official settlement was financed by the Empire and coordinated erratically. After the end of the Farroupilha Revolution, the provincial government started to take part in the settlement project and there was a gradual reduction in the incentives. In 1851, provincial legislation established that land grants would be reduced to 48 ha lots; in 1854, incentives were further weakened by legislation determining that lots would not be granted anymore, but sold to the settlers with subsidized credit, while the transportation from the port of Rio Grande to the *colônia* remained free (Roche 1969, p.102).

For the first 50 years since the establishment of Colônia São Leopoldo, each one of the official settlements was occupied by German colonists. The first official colony with non-Germans was only established in 1870 in present-day Bento Gonçalves with Italians, Austrians and Frenchmen. From that date on, the flow of Italian settlers came to outnumber that of German settlers, and other Europeans (mostly Poles, but also Frenchmen and Austrians) started to become more common (Korndörfer 2009).

The typical German agricultural settlement in southern Brazil was organized around a *Schneiss* or *Pikade* (*picada* in Portuguese). That is a long, straight cut through the virgin forest along which individual settlers would receive long, narrow plots of land of one to two hundred acres at right angles of the road (James 1940; Luebke 1990). The typical colony settlers would have to spend the first one or two years clearing the land before they could farm it (thus the need for a government stipend). Many those farmers soon adopted the native agricultural technique of slash and burn and planting of indigenous crops such as manioc and maize (James 1940; Waibel 1950; Luebke 1990).

In the Republican period, starting in 1889, there was a diversification of the sources of migrants beyond the traditional source countries of Germany and Italy. As a matter of rhetoric, the state government advocated spontaneous voluntary migration, but its deeds heavily subsidized immigration. The state government would generally pay for the trip from the European port to the final destination (Roche 1969, p. 122). In 1865, Brazilian consulates in Europe would offer to cover the additional maritime transport cost to Brazil to attract immigrants that otherwise would have gone to the United States (Roche 1969, p. 101).[12] Subsidies to other services such as hostelling, feeding the settlers while in transit and financing the acquisition of seeds were introduced and phased out every few years probably highlighting a combination of some hesitancy by policymakers and the vagaries of the budget process (Roche 1969, p. 123). The legal and de facto instability of the system of subsidies may have played a role in limiting the flow of migrants to RS to a fraction of the contingents

[12] Timmer and Williamson (1996, 1998) construct an index of immigration policy with the goal of measuring immigration policy stance, covering the period from 1860 to 1930, which highlights a very favorable policy stance in Brazil from the 1890s to World War I.

that flowed to Argentina or the United States, but other factors were at play – contemporaneous observers seemed to agree about Brazil's lack of attractiveness relative to the United States (Jacaré-Assu 1873) and immigration to Brazil was actively opposed by some European governments on the grounds of alleged previous poor treatment to immigrants (e.g. Grossi 1905; Holloway 1980, pp.37).

B. Exogenous variation in the location of official colonies

What were the criteria to determine where official colonies would be located? According to Roche (1969 p. 112), the European settlements were expected to be "seeds" of development, examples of prosperity to the locals. So, in the less populated areas, the expectation was that scattered agricultural nuclei would attract the settlement of Brazilians. Rio Grande do Sul can be subdivided into four geographical regions: the *Campanha* (Prairie), the *Planalto* (Plateau), the *Serra* (Mountain) and the Littoral and atypical areas - Figure 2 shows the main regions of Rio Grande do Sul (Fonseca, 1983). The first settlements were established in the Serra region and were located in forested areas (Amstad 1999). Many of those settlements were created in the lower parts of the Serra as an *entrepôt* for the occupation of the region of the Plateau and to connect preexisting urban centers. There were also settlements which Roche (1969 p.177) calls *islands*, that were established in isolated areas as beachheads to occupy a surrounding region. Table 3 lists the distribution of official settlements according to the regional classification. With the exception of the Campanha region, which was mostly settled by extensive cattle ranching before the 19th century and received only 3 official colonies, official colonies appear to be distributed uniformly on the map of Rio Grande do Sul. The historiography also posits that while some colonies were located in areas of easy transportation cost, others were established in less favorable settings.[13]

The identifying assumption in our empirical analysis is that once one controls for a host of time-invariant characteristics (maximum temperature, temperature range, soil quality, altitude, rain patterns and distance to the capital for each municipality), we can treat the assignment of colonies to municipalities as random.

It is also the case that immigrants were not required to stay in the official colonies and they and their offspring often migrated. Roche (1954, 1969) analyzed this phenomenon and pointed to the depletion of land productivity and the parceling out of plots among heirs.[15] In

[13] Some anecdotal evidence suggests that the settlements were not located in the best possible settings. Amstad (1924 p. 87) tells that migrants to the Santo Ângelo colony (created in 1855) were taken by boat to the vicinity of the site of the colony. Upon disembarking, they felt disappointed with the quality of the land and decided to return. To their surprise, the boat had departed leaving behind their belongings. Hence they settled there.

[15] For some authors, this loss of productivity was inherent to the system of cultivation based on 'land rotation' – instead of crop rotation combined with stock raising, e.g. Waibel (1950).

search of new land, the offspring of the first settlers moved first to the west of the state and later to the Plateau. Hence while some characteristics of official colonies do not migrate with the colonists (e.g. land ownership concentration), human and social capital features were portable and followed the immigrants and their offspring where they relocated.

III. DATA

The sources for locating the colonies are the publications by Mulhall (1873), Amstad (1924), Roche (1969), Iotti (2001) and Korndörfer (2009). The first author was a contemporaneous observer; the works by Amstad and Roche provide an extensive list of names of the official settlements and their municipalities at their inception; Iotti (2001) is a compilation of laws and regulations on immigration and colonization from mid 18th century to the beginning of the Great War; and Korndörfer (2009) is a database developed with the help of researchers interested in genealogy and provides further information about the ethnic composition of each colony.

The matching of official colonies to meaningful political units was a challenge. In 1872, the first year of a reliable census in Brazil, there were only 33 municipalities in RS; in 2007, there were 496. Some of the official colonies blossomed and originated their own municipalities; others failed and their colonists dispersed. From a total of 52 official colonies, we could identify their present day municipality and ethnic composition of colonists for all but 3. The list of official colonies, with their establishment dates, current municipalities and ethnic composition is in Table 1.

IV. EMPIRICAL STRATEGY AND REDUCED FORM RESULTS

To begin with, we construct for each municipality, measures of closeness to an official (or German, Italian or other European official) colony, given by the function $close_i$:

$$close_i^A = \begin{cases} \exp\left(-\alpha \min_{j|I_j^A=1} \langle i, j \rangle\right) & \text{if } I_i^A = 0 \\ 1 & \text{if } I_i^A = 1 \end{cases}$$

where the function $\langle i, j \rangle$ denotes the distance in miles between the centers of the municipalities i and j; I_j^A is an indicator function equal to 1 if municipality j was the site of a colony of type A; and α is a spatial discount factor, similar to a non-parametric kernel. For instance, the municipality of São Leopoldo, site of the first official German colony, has $close^{German} = close^{Any} = 1$, but $close^{Italian} = 0.19$ and $close^{Italian} = 0.17$ when the parameter α is set equal to 1/25 (See Figures 4-5 for the geographical distribution of the municipalities with

official colonies and the values of the closeness function for $\alpha = 1/25$).[17] The results in this paper were obtained using α equal to 1/25 but qualitative similar results could be obtained for a range of different choices of the spatial discount factor.[18]

The building block of our analysis is a simple linear econometric model relating an outcome of our interest *Y* to closeness to an official colony and a set of exogenous time-invariant controls, using data at the local level:

$$Y = closeness\ \beta + Z\ \gamma + u \qquad (1)$$

where *Y* is the outcome of interest; *closeness* stand for measures of closeness to an official colony; *Z* includes time-invariant controls (such as soil quality, rain and temperature patterns, altitude and distance from the state capital) and *u* is an error orthogonal to closeness variables and *Z*. That is the regression specification reported in column (1) of Table 4. [19]

We also compare the results of regression (1) above with a specification where we introduce additional controls (population, population density, per capita income levels) to examine whether the association between official colonies and the variables of interest are robust (results reported in column 2 of Table 4).

Finally, we estimate a regression where we differentiate between closeness to German, Italian and other European colonies (results reported in column 3 of Table 4):

$$Y = closeGerman\ \beta_1 + closeItalian\ \beta_2 + closeOther\ \beta_3 + Z\ \gamma + u \qquad (1a)$$

A. Does the location of official colonies matter for the present day distribution of cultural and ethnical attributes?

The premise behind this paper is that the location of colonies of immigrants from different ethnic or cultural backgrounds matters for the present day distribution of ethnic or national origin groups in Rio Grande do Sul. That is not a moot question because colonists were very

[17] When α is set to infinity, the function closeness equals to an indicator function for the municipalities with official colonies.

[18] In the Appendix we provide a table presenting a summary of results for different values of α.

[19] Notice that those results rely on the assumption that the original location of official settlements and ethnic distribution of immigrants was exogenous to the outcomes of interest, conditional on the vector of natural characteristics *Z*.

mobile, their fertility rate was very high, and their offspring often left their original plots behind to settle somewhere else in the agricultural frontier.[20]

To measure the persistence of the cultural and ethnical composition of the areas nearby official colonies, the ideal would be to use some direct measure of ethnic heritage (such as in the U.S. Census). However, the Brazilian census does not collect information on ethnic heritage, so we have to take the shortcut of proxying ethnic heritage through religion affiliation. There are sharp differences in religion between the two major ethnic groups of colonists: while Germans were either Catholic or Protestant, Italian settlers were in almost totality Catholic. Since the original populations of RS were in almost totality Catholic, one would expect that persistence of cultural and ethnical composition would manifest through a higher prevalence of mainline Protestantism in the areas around German colonies, but not in the areas around Italian ones and away from any colonies.

The results are promising. We find no evidence that closeness to a generic colony increases the proportion of Catholics (Table 4, row 1, columns 1-2), but we find that a significant negative (positive) effect of closeness to a German (Italian) colony on the prevalence of Catholicism, as one would expect if the prevalent religion among the 19th and early 20th century immigrants when the colonies were established still persisted nowadays. In quantitative terms, a municipality that hosted a German colony has about 10 percent less Catholics than one away from any such colony; on the other hand, presence of an Italian colony increases the proportion of Catholics by almost 20 percentage points. We could not find evidence of difference between "other Europeans" and German colonies.

The effect on prevalence of mainline Protestants (defined as Lutherans, Presbyterians, Methodists, Baptists, Congregationalists, Evangelicals, Adventists, Anglicans and Mennonites) confirms the general pattern. Since Protestants typically settled in Rio Grande do Sul in official colonies, we find a marginally significant positive association of closeness to any colony on the proportion of Protestants; but a strongly significant one for German colonies, while closeness to Italian colonies is negatively correlated with Protestantism (row 2). Moreover, the effects of closeness to a German colony on prevalence of Protestantism are statistically different from Italian and other European colonies.

Thus we have established that while European migrants to Rio Grande do Sul were undeniably footloose and their offspring dispersed in the agricultural frontier, the colonists left their footprints behind: the closer a municipality is from an official colony settled by Germans during the hundred years before the First World War, the greater the prevalence of mainline Protestantism today.

[20] Roche (1954) documents the rural-to-rural migration among settlers in RS.

B. Effects of official colonies on present-day macroeconomic variables

Proximity to a colony site is correlated with **population density** in 2000 (row 4), the more so for German colonies. This indicates that colonies actually played the role of seeds for regional economic development (Roche 1969). We also find a stronger effect of closeness to a German colony, which we may attribute to German colonies being on average older than non-German ones or to differences in long-term development.

The **Human Development Index (HDI)** is also higher nearby official colonies (row 5). The magnitude of the effect is such that if that if the Brazilian average HDI (78^{th} in the 2009 UNDP rank) increased by the magnitude of the effect on HDI of maximum closeness to a colony, it would climb 9 positions in the HDI ranking of countries. The effect of the colonies on the HDI index vanishes once we control for population, population density and per capita income, but that is likely due to the direct effect of per capita income on the HDI. We also find a stronger effect of proximity to colonies with non-Germans, non-Italians relative to proximity to German or Italian colonies.

Per capita income is significantly higher nearby official colonies (row 6). Municipalities that were the site of colonies are 19 percent richer than those away from a colony. This effect is significantly stronger for the sites of colonies with non-German, non-Italian colonists (as in the effect on HDI). In line with the findings on per capita income, **poverty rates** (row 7) are also lower the closer a municipality is from an official colony – while the average unweighted municipal poverty rate is 26 percent, sites of colonies have poverty rates almost 10 percentage points lower than municipalities away from official colonies.

The lower poverty rate in the neighborhood of colonies, however, is not only due to higher income levels, but a more equitable **income distribution** plays a role (row 8). While the average unweighted municipal Gini index is 0.52, the colony effect reduces the Gini by 0.032 (column 1). Interestingly, even after we add 'endogenous controls' such as per capita income and population density, we still find an effect of colonies on income distribution, suggesting that causality may directly stem from the presence of immigrant colonies.

In summary, the areas closer to official colonies have higher per capita income, more dense population and less poverty than other areas of the state. Moreover, the evidence points to a direct effect from the existence of a colony to a more equitable income distribution in the present.

C. Effects on health, education and other social indicators

Effects on **health outcomes and inputs** are reported in rows 9-12. Closeness to a colony has a significant effect reducing child mortality, increasing life expectancy and increasing the availability of physicians (column 1) – but no effect on the proportion of nurses with a higher degree, which is an alternative indicator of quality of health providers. However, the effects

on child mortality and life expectancy are not robust to including controls for population, population density and income, which suggests that those variables may be the proximate causes of the better health indicators (while not denying the possibility that population, population density and income levels are themselves influenced by proximity to a colony). As regards differences between colonies across ethnic origins, we could find no significant difference.

The **effects on education** are also strongly significant and favorable to the areas close to colonies (rows 13-18). Closeness to an official colony is negatively correlated to **illiteracy** rates for persons older than 15 years (the average illiteracy rate is over 9 percent in the sample). This effect is robust to inclusion of controls for population, population density, and per capita income. When assessing separately the effects of colonies of different origins, we find a marginally significant difference between German and Italian colonies, whereas the former is associated with 4½ percentage points lower illiteracy rates than the latter.

The effect on **high school test scores (ENEM)** shows a large significant effect of closeness to an official colony (row 14).[21] While the (unweighted) standard deviation of average scores by municipality is 0.07, the effect of a colony site is 0.057 without controls for population, population density and income, and 0.036 when those controls are added. When separating the effects by origin of colonists, closeness to German colonies is associated with significantly better test scores than the non-German colonies.

We next examine whether there is any effect on the intra-municipality dispersion of test scores. If one of the distinguishing consequences of official colonies is to bequeath a more equitable society, one would expect a smaller dispersion of test scores, just as well as we found smaller income Gini coefficients around the colonies. The results are reported in row 15, which shows a negative but not statistically significant effect of closeness to a colony on the dispersion of scores. Looking into the breakdown of colonies by national origins, we find a smaller dispersion of test scores in the municipalities closer to a German colony.

We then look at two measures of **school enrollment** we built from the microdata of the Brazilian Census of 2000: the net enrollment rate ages 10-14 and the private school enrollment ages 7-17 (rows 16-17). The choice of the age range for the net enrollment rate follows the literature on child labor and school enrollment in Brazil (the minimum legal age for working in Brazil is 14). We find no effect on 10-14 enrollment rates for colonies in general, but a small positive effect from Italian colonies.

[21] ENEM is a nationwide exam for concluding high school students with a very high take-up rate. To construct mean scores, we run a regression of individual Z-scores on interactions of age, gender and latest degree concluded; save the residuals; and aggregate them by municipality or minimal comparable area.

As regards **enrollment in private schools**, our prior is that the ethnic homogeneity and isolation that characterized some of the official colonies would generate a fertile ground for private institutions of learning that would preserve the colonists' cultural or religious heritages. To our surprise, although we find a relatively large effect of closeness to colonies, this effect all but vanishes once controls for population, population density and income are included in the regression, which suggests that while children living close to colonies are more likely to attend a private school, that might be related to them being richer or living in a more densely populated municipality.

The findings of lower illiteracy rates, higher average and lower dispersion of test scores in the areas around German colonies may be explained as a long-term effect of early introduction of rural primary instruction and a higher initial human capital in the nineteenth century. Since the early years of immigration, European immigrants demanded public instruction (Kreutz 2000, pp. 161). Even when the government did not provide it, they often organized community schools along confessional lines. Among all immigrant groups, the importance of community school was more salient for German-Brazilians, who organized a network of rural schools to maintain their links with *Deutschtum* and *Gospel* (Willems 1955), and even to this day some of the towns with the highest education indicators in Brazil were originally sites of German settlements – 33 of the 50 municipalities with the highest literacy rates in 1991 were located in RS (Kreutz 2000, 2005).[23]

The **proportion of Bolsa Família recipients** is both a measure of dependence from federal government transfers and also incidence of poverty – the Bolsa Família is a means tested cash transfer aimed at poor families with children.[24] As one would expect considering the higher income and lower inequality in the surroundings of the official colonies, there is a significant negative effect of closeness to colonies on the incidence of Bolsa Família (row 18). This effect is about 1/3 of the baseline average.

Finally, one of the most important policy problems in Brazil are high levels of violence, not only in the large urban centers, but also more recently even in small and medium-sized towns, such as most of the municipalities in our sample. We find a negative but insignificant effect of proximity to colonies on **homicide rates**.

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[23] In a study of the early years of public instruction in the state of São Paulo, de Carvalho Filho and Colistete (2010) found a positive relationship between the proportion of farm hands that were foreign-born and locally-financed educational expenditures in the first decade of the twentieth century; and that those variables are also correlated with test scores today. Bezerra (2001) studies the history of a German rural school in the state of São Paulo.

[24] For details of Bolsa Família, see Hall (2006).

In summary, closeness to an official colony is associated with better health indicators, illiteracy and educational outcomes, perhaps in large part because the areas close to colonies have greater population density and are richer than elsewhere in the state. They are also less dependent on transfers to families from the federal government and may have lower homicide rates. Finally, German colonies are associated with higher mean and lower dispersion of high school test scores.

D. Effects on local fiscal policy

We have found that closeness to official colonies is associated with some better educational outcomes. We now explore whether this might reflect different **patterns of municipal expenditure** (in Brazil, municipalities are usually responsible for elementary education, while secondary education falls under the wings of the state government). In rows 20-22 we report the results for per capita education expenditures, the share of the municipal budget dedicated to education and the share of the municipal budget allocated to overhead costs (a proxy for waste or inefficiency). Our results show no evidence that the municipalities close to official colonies have different expenditure patterns.

E. Effects on culture

The literature on cultural differences across ethnic groups has focused on different attitudes towards families that are persistent across generations and that European immigrants seem to have carried to the New World (e.g. Alesina and Giuliano, 2007; Giuliano, 2007). We focus on two variables: the **fertility rate**,[25] and the **share of adults of age 20-29 that are not heads of their own household or head spouses, and are related to the head of the household** (henceforth, housing dependency).

We find a negative significant effect of closeness to colonies on fertility rates, but the effect seems to be intermediated by the additional controls, not a direct effect of the official colonies (in other words, fertility rates may be lower because areas closer to colonies are richer). As regards housing dependency, we find significant positive effects of closeness to colonies on housing dependency. The effect is mitigated once we use additional controls, but remains strongly significant. Somewhat in line with the literature on living arrangements across European ethnic groups (Giuliano 2007), we find a higher point estimate of housing dependency associated with the municipalities close to Italian colonies than elsewhere in the state (but the difference is not significant).

V. UNBUNDLING THE *COLÔNIAS*

[25] That is the total fertility rate of women over 30.

Recapitulating the results from the previous section, we have found that closeness to an official colony is associated with higher per capita income, less poverty and dependence on Bolsa Família transfers, better health and education outcomes, and less homicides; and less inequality of income and educational outcomes for areas close to German colonies. Those are reduced-form relationships and the point of departure of this section.

The differences in outcomes between the areas near the official colonies from the others may be explained by a variety of factors. First, those communities may have benefited from an initial heads-up from the government subsidies. Second, the immigrants brought with them a tradition of education that was unprecedented to nineteenth century Brazil. Third, the egalitarian land distribution of the official colonies differed from the landholding patterns of other regions of Brazil and the state (for an overview of land policy in nineteenth century Brazil, see Dean 1971).

We would like to unbundle the effects of more egalitarian distribution of land ownership and greater initial human capital, taking advantage of the wide dispersion we find in those variables within Rio Grande do Sul state in 1920 (See Figure 6).[26] By that time, the state had only 71 municipalities and it was necessary an approximation to include the data of the Census of 1920 in our database. The overlay of the 1920 and 2000 municipal boundaries maps provided a way to reconstruct the former based on the latter. The data on literacy and the land ownership by 1920's municipalities were then ascribed to the contemporary ones.[27] Across 71 municipalities, the mean land gini is 0.62 with a standard deviation of 0.19.[28] For a comparison, the Colombian municipalities studied in Acemoglu et al. (2008) have a mean land gini of 0.65 with a standard deviation of 0.10. For literacy rates of those 15 and older, the mean is 0.52 with a standard deviation of 0.12 and they range from 0.274 to 0.837.

With the goal of uncovering the relative importance of human capital and landholding patterns, we identify a first-stage relationship between official colonies and land gini and literacy rates in 1920. We estimate the equations:

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[26] Acemoglu and Johnson (2005) unbundled the "property rights" and "contracting" institutions by exploiting exogenous variation that plausibly affected each one of the types of institution separately.

[27] We have not used Minimum Comparable Areas 1920-2000 (Reis et al., 2007) because then we would have only 27 spatial units. These areas are comparable over time because they are an aggregation of all the emancipated municipalities in the period. For example, if municipalities A and B have just a portion of their territories assigned to a new municipal unit C, the corresponding MCA will be the union of the whole territories of A and B.

[28] Land ginis for municipalities in Rio Grande do Sul in 1920 range from 0.201 to 0.840 (the 25th and 75th percentiles are respectively 0.492 and 0.751).

$$\text{land\_}gini_{1920} = AnyColony\ \alpha_{11} + v_1$$
$$literacy_{1920} = AnyColony\ \alpha_{21} + GermanColony\ \alpha_{22} + v_2$$

where $AnyColony$ is the measure of closeness to any official colony, and $GermanColony$ is the measure of closeness to a German colony. The results are presented in Table 5. We find a strong negative relationship between land ginis and closeness to official colonies and that this relationship is not conditional on the national origin of the settlers (columns I-II). For literacy rates, the results in column III show that the areas nearby German colonies were remarkably different in their literacy rates than other areas.

Then for the second-stage regression, we estimate the following specification, using $AnyColony$ and $GermanColony$ as instruments for land gini and literacy rates:

$$Y = \text{land\_}gini_{1920}\beta_1 + literacy_{1920}\ \beta_2 + \mu \quad (2)$$

where Y is the outcome of interest; the land gini and literacy rates were taken from the Census of 1920 and μ is an orthogonal error term.[29]

We present the reduced form regressions on Table 6. We find a negative effect of 1920 land ginis on population density, HDI, life expectancy and school enrollment 10-14; and a positive effect for poverty rates, income inequality, child mortality and incidence of *Bolsa Família* families. With the exception of the school enrollment measure, a more egalitarian land distribution in 1920 due to proximity to colonies is for all other significant specifications associated with good outcomes.

The results for the effect of 1920 literacy rates are statistically insignificant except a negative effect of literacy rates on present day fertility rates, in line with the known regularity that fertility rates tend to be lower for more educated societies. Somewhat surprisingly, literacy rates in 1920 do not seem to have caused test scores today, but the estimated coefficient at least have the expected sign (a higher literacy rate in 1920 being associated with higher test scores today).

In short, areas close to official colonies had less concentrated landholdings in 1920, and this may have resulted in greater population density, HDI and lower poverty rates and income inequality today. For the health and education outcomes, past land inequality again seems to dominate the human capital channel, but for the education outcomes standard errors are very

[29] Instead of using minimal comparable areas (MCA), we decided to rebuild the 1920 map of the state using the 1997 municipal boundaries. This technique is not as rigorous as the MCA procedure. Nevertheless, it was necessary to use it in order to obtain a more detailed and meaningful map of the state.

wide and we cannot establish statistical significance. There is also a highly significant connection between past land inequality and the incidence of *Bolsa Família* transfers, but no connection to past literacy rates. Finally, the only contemporaneous variable that is significantly related to past literacy rates, conditional on past land inequality, is the fertility rate – the higher the literacy rate in 1920, the lower the fertility rate in 2000.

VI. CONCLUSION

The study of the mechanisms behind the long-term processes that determined the development successes or failures of countries and regions has spurred research drawing lessons from history for a better understanding of the long-term forces driving economic development (Engerman and Sokoloff 1997; Acemoglu, Johnson and Robinson 2001, 2002; Naritomi, Soares and Assunção 2007; Nunn 2007, 2010; Banerjee and Iyer 2010).

This paper draws from the historical natural experiment of government sponsored European immigration to the southern state of Rio Grande do Sul in Brazil. We have assembled a unique database of official colonies in that state and matched their original sites to present-day municipalities. We found that municipalities in that state that were close to the site of a government subsidized settlement of European immigrants are different in several dimensions from the ones that are not: closeness to an official colony is associated with higher per capita income, less poverty and dependence on *Bolsa Família* transfers, better health and education outcomes, less homicides; and for the areas close to German colonies, also less inequality of income and educational outcomes.

Those differences may be explained by a variety of factors. First, those communities may have benefited from an initial heads-up from the government subsidies. Second, the immigrants may have brought with them a tradition of education that was unprecedented to nineteenth century Brazil. Third, the egalitarian land distribution of the official colonies differed from the landholding patterns of other regions of Brazil and the state.

We attempt to sort out the relative importance of those different mechanisms by estimating, using two-stage least squares, a model relating present-day development outcomes to land inequality and literacy in 1920, using the measure of closeness to a colony and to a German colony as instruments. We find that 1920 egalitarian landholdings appear in general more strongly associated with good outcomes today than the 1920 literacy measure. This result indicates an important role for government policy (how land was distributed to immigrants) that is more long-lasting than the effects of the immigrants' own human capital characteristics.

Finally, our findings of a positive effect of egalitarian landholdinds on future economic performance at a first glance appear at odds with Acemoglu et al. (2008), an influential paper

on a Colombian setting. That paper finds that a higher concentration of landholdings in the past is associated with greater development, calling into question the near consensus in the profession that blames economic inequality for some development maladies (North 1959; Ferreira 1999). Nevertheless the comparison may be inappropriate due to the much wider range of observed land inequality in our sample if the long-run benefits from a more egalitarian landholding distribution accrue only when inequality is below a certain threshold.

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Table 1. List of government sponsored (official) colonies in Rio Grande do Sul (1824-1918)

Name of colony	Year of establishment	Name of current municipality	Germans	Italians	Other Europeans
São Leopoldo	1824	São Leopoldo	Yes		
São João das Missões	1825	N/A	Yes		
São Pedro das Torres	1826	Torres	Yes		
Sao Pedro de Alcantara	1826	Torres	Yes		
Três Forquilhas	1826	Três Forquilhas	Yes		
São José do Hortêncio	1827	São José do Hortêncio	Yes		
Feliz	1846	Feliz	Yes		
Santa Cruz	1849	Santa Cruz do Sul	Yes		
Santo Ângelo	1857	Agudo	Yes		
Nova Petrópolis	1858	Nova Petrópolis	Yes		
Monte Alverne	1859	Santa Cruz do Sul	Yes		
Dona Isabel	1870	Bento Gonçalves		Yes	Austrian, Frenchmen
Conde D'eu	1870	Garibaldi	Yes	Yes	Austrian, Frenchmen
São Feliciano	1874	Dom Feliciano			Poles, Frenchmen
Fundos de nova Palmira	1875	Caxias do Sul		Yes	
Silveira Martins	1877	Silveira Martins		Yes	
Col. Mil. Alto Uruguai	1879	Três Passos			
Municipal (Pelotas)	1882	Pelotas	Yes	Yes	Poles
Alfredo Chaves	1884	Veranópolis	Yes	Yes	Prussians, Poles
Antônio Prado	1885	Antônio Prado		Yes	Poles
Barão do Triunfo	1888	Barão do Triunfo	Yes		
Mariana Pimental	1888	Mariana Pimentel	Yes	Yes	Poles
Maciel	1888	Pelotas		Yes	Poles
Vila Nova de Santo Antônio	1888	Santo Antonio da Patrulha		Yes	
Vila Nova	1888	Turuçu	Yes		
Jaguari	1889	Jaguari	Yes	Yes	
São Vicente	1889	Jaguari	Yes		
São Xavier	1889	Porto Xavier	Yes		
Botucaraí	1890	Cachoeira do Sul	Yes		
Dona Francisca	1890	Dona Francisca	Yes	Yes	
Ijuí	1890	Ijuí	Yes	Yes	(*)
Ernesto Alves	1890	Santiago	Yes	Yes	
Toroqua	1890	São Francisco de Assis	Yes	Yes	
Toropi	1890	Toropi	Yes		
Marquês do Herval	1891	Maquiné	Yes	Yes	Poles
Guarani	1891	Guarani das Missões	Yes	Yes	Poles
Cerro Pelado	1891	Porto Xavier	Yes	Yes	Russians, Poles
Cascata	1892	N/A			
Guaporé	1892	Guaporé	Yes	Yes	Poles, Russians, Austrians
São Marcos	1892	São Marcos		Yes	Poles
Cerro Cadeado	1895	Augusto Pestana		Yes	
Chimarrão	1897	N/A			
Anta Gorda	1898	Anta Gorda	Yes	Yes	
Itapuca	1900	Itapuca		Yes	Austrians
Sobradinho	1901	Sobradinho	Yes	Yes	
Erechim	1908	Getúlio Vargas	Yes	Yes	Russians
São Bráz	1909	Chuvisca	Yes		Poles
Pontão do Ijuizinho	1910	Jóia	Yes	Yes	
São João Batista	1912	Santo Ângelo	Yes		
Santa Rosa	1915	Santa Rosa	Yes	Yes	Poles
Guarita	1917	Sarandi	Yes	Yes	
Forquilha	1918	Lagoa Vermelha	Yes	Yes	Poles

(*) Poles, Latvians, Austrians, Dutchmen, Swedes, Spaniards, Lebaneses, Arabs, Lithuanians, Rutenians, Czechs, Finns and Greeks

Source: Mulhall (1873), Amstad (1999), Roche (1954, 1969), Korndörfer (2009) and our own annotations.

Table 2- Population of Rio Grande do Sul per nationality in selected years.

Year	Rio Grande do Sul			Brazil		
	Total	Foreigners	% Foreigners	Total	Foreigners	% Foreigners
1872	434813	41725	9.60%	9930478	388459	3.76%
1890	897455	34765	3.87%	14333915	351545	2.39%
1900	1149070	135099	11.76%	17438434	1074511	5.80%
1920	2182713	151025	6.92%	30635605	1565961	4.86%
1950	4164821	78138	1.88%	51944397	1214184	2.28%
1970	6755458	51079	0.76%	94508583	1229128	1.28%
2000	10181749	26348	0.26%	169590693	510067	0.30%
Growth 1872-1920	3.4%	2.7%		2.4%	2.9%	
Growth 1872-2000	2.5%	-0.4%		2.2%	0.2%	

Source: Levy (1974) for 1872-1970; IBGE (2010, Banco de Dados Agregado – SIDRA. http://www.sidra.ibge.gov.br/) for 2000 figures. There is a small discrepancy between Levy (1974) and IBGE numbers for the previous years.

Table 3 – Distribution of municipalities with official settlements according to the regions of Rio Grande do Sul and year of settlement.

		Campanha	Planalto	Serra	Heterogeneous
Year of settlement	<= 1840	0	0	2	2
	1841 - 1870	0	0	5	1
	1871 - 1889	2	2	4	4
	1890 - 1900	1	6	1	5
	1901+	0	6	1	1

Note: The “Heterogeneous” region refers to municipalities that do not fit clearly in the previous regions because they are peculiar and/or are located in transition areas between regions. The difference between the total number of municipalities and official settlements occurs because there were municipalities that had more than one “colônia”.

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Table 4. OLS Reduced Form Regression Results

		Dependent variable		(1)		(2)	(3)				
		Name	Mean / S.D.	Closeness to colony Coeff. [S.E.]	R^2	Closeness to colony Coeff. [S.E.]	Closeness to colony German	Italian	Other	P-value Italian vs German	P-value Others vs German
Religion	1	% Catholic	0.818 [0.146]	0 [0.0242]	0.24	-0.003 [0.0248]	-0.105 [0.0402]	0.183 [0.0478]	-0.064 [0.037]	0.00	0.45
	2	% Mainline Protestant	0.092 [0.132]	0.044 [0.0233]	0.15	0.055 [0.0241]	0.156 [0.0388]	-0.172 [0.0461]	0.041 [0.0357]	0.00	0.03
	3	% Atheist	0.018 [0.036]	-0.014 [0.0046]	0.54	-0.019 [0.0045]	-0.025 [0.0077]	0.005 [0.0092]	0.01 [0.0071]	0.06	0.00
Macroeconomics	4	Population density, in logs	3.377 [1.09]	0.637 [0.1461]	0.49	N/A	0.725 [0.2473]	-0.369 [0.294]	0.197 [0.2274]	0.03	0.11
	5	HDI 2000	0.785 [0.035]	0.025 [0.006]	0.20	0.005 [0.0028]	0.002 [0.0099]	0.01 [0.0118]	0.029 [0.0091]	0.67	0.05
	6	Per capita income, in logs	5.478 [0.308]	0.192 [0.0491]	0.29	N/A	-0.007 [0.0809]	0.077 [0.0962]	0.259 [0.0744]	0.61	0.02
	7	% Poor	25.728 [12.812]	-9.017 [1.8378]	0.44	-3.434 [0.9862]	-2.97 [3.0403]	-1.196 [3.6142]	-9.618 [2.796]	0.77	0.11
	8	Gini	0.523 [0.057]	-0.032 [0.0084]	0.41	-0.04 [0.0082]	-0.028 [0.0142]	0.006 [0.0169]	-0.006 [0.0131]	0.24	0.25
Health	9	Child mortality under 5	16.623 [5.303]	-2.216 [0.9258]	0.17	-1.093 [0.8548]	0.687 [1.5562]	-2.678 [1.85]	-0.869 [1.4312]	0.28	0.46
	10	Life expectancy	72.507 [2.502]	1.055 [0.4353]	0.17	0.559 [0.4023]	-0.198 [0.7325]	1.171 [0.8707]	0.31 [0.6736]	0.35	0.61
	11	Physicians/'000 people	0.421 [0.606]	0.422 [0.1023]	0.06	0.207 [0.09]	0.371 [0.1719]	-0.195 [0.2044]	0.35 [0.1581]	0.10	0.93
	12	% Nurses with higher degree	15.238 [14.324]	-0.467 [2.6274]	0.07	-0.918 [2.6844]	3.189 [4.4277]	-0.583 [5.2635]	-2.625 [4.072]	0.67	0.33
Education	13	Illiteracy	9.063 [4.109]	-3.239 [0.7044]	0.19	-1.295 [0.5032]	-3.311 [1.1688]	1.277 [1.3894]	-2.818 [1.0749]	0.05	0.76
	14	Mean Score ENEM	-0.035 [0.076]	0.057 [0.0128]	0.23	0.036 [0.0117]	0.083 [0.0213]	-0.018 [0.0254]	-0.007 [0.0197]	0.02	0.00
	15	SD Score ENEM	0.264 [0.037]	-0.01 [0.0068]	0.08	-0.01 [0.007]	-0.039 [0.0113]	0.005 [0.0134]	0.03 [0.0104]	0.06	0.00
	16	% Enrollment 10-14	0.971 [0.026]	0.009 [0.0046]	0.12	0.004 [0.0045]	-0.012 [0.0077]	0.024 [0.0092]	0 [0.0071]	0.02	0.24
	17	% Enroll 7-17, private	0.043 [0.047]	0.022 [0.0084]	0.09	0 [0.0061]	0.006 [0.0139]	-0.018 [0.0166]	0.054 [0.0128]	0.41	0.01
Social	18	# Bolsa Familia/Pop	0.147 [0.074]	-0.05 [0.0104]	0.46	-0.024 [0.0077]	-0.024 [0.0176]	-0.014 [0.0209]	-0.019 [0.0162]	0.77	0.83
	19	Homicide rate	2.944 [1.744]	-0.357 [0.3143]	0.11	-0.507 [0.2896]	-0.932 [0.5278]	0.175 [0.6274]	0.749 [0.4854]	0.30	0.02
Fiscal	20	Education Exp, per capita	6.246 [0.384]	0.015 [0.0672]	0.16	0.049 [0.0554]	0.034 [0.1126]	0.15 [0.1338]	-0.259 [0.1035]	0.61	0.05
	21	% Mun. Exp. In education	0.288 [0.046]	-0.003 [0.0077]	0.23	0.006 [0.0077]	-0.021 [0.013]	0.023 [0.0154]	-0.011 [0.0119]	0.10	0.57
	22	% Mun. Exp. In overhead	0.231 [0.079]	-0.012 [0.0144]	0.09	-0.004 [0.0145]	-0.015 [0.0243]	-0.01 [0.0289]	0.025 [0.0224]	0.91	0.21
Culture	23	Fertility rate	3.296 [0.481]	-0.28 [0.0762]	0.31	-0.098 [0.06]	-0.129 [0.1272]	-0.129 [0.1512]	-0.165 [0.1169]	1.00	0.83
	24	% Living with relatives, 20-29	0.494 [0.094]	0.059 [0.0155]	0.25	0.045 [0.0147]	0.015 [0.0259]	0.059 [0.0308]	0.005 [0.0239]	0.41	0.76
		Exogenous controls		Yes		Yes		Yes			
		Additional controls?		No		Yes		No			

Note: All the regressions have 494 observations and are unweighted. Exogenous controls include functions of temperature (max, range), soil quality, altitude, rain patterns and distance to the capital for each municipality. Additional controls include per capita income, population and population density.

Table 5. Reduced Form Estimates of the Effects of Official Colonies on Land Inequality and Literacy Ratio in 1920

	I	II	III
	Gini 1920	Gini 1920	Literacy 1920
Closeness to:			
Any Colony	-0.00512	-.171**	-.175**
German Colony	-0.178		.32***
Number of Observations	495	495	495
R-squared	0.0567	0.0491	0.113
F-stat	2.97	6.1	4.03

Note: Regressions have 495 observations and are weighted by population in 2000 and standard errors are clustered by 1920 municipality (71 clusters).

Table 6. IV Estimates of the Long-Run Effects of Land Inequality and Literacy Ratio in 1920.

				(1)	(2)
		Dependent variable		**Gini 1920**	**Literacy 1920**
		Name	Mean / S.D.	Coeff. [S.E.]	Coeff. [S.E.]
Macroeconomics	4	Population density, in logs	3.377 [1.09]	-11.442 [5.6354] *	-5.293 [6.5511]
	5	HDI 2000	0.785 [0.035]	-0.254 [0.12] *	-0.05 [0.1056]
	6	Per capita income, in logs	5.478 [0.308]	-1.27 [0.7936]	0.422 [0.8241]
	7	% Poor	25.728 [12.812]	85.698 [41.5435] *	-6.682 [41.5434]
	8	Income gini 2000	0.523 [0.057]	0.592 [0.3235] *	0.262 [0.3337]
Health	9	Child mortality under 5	16.623 [5.303]	35.939 [18.3821] *	13.565 [17.3414]
	10	Life expectancy	72.507 [2.502]	-17.73 [9.0458] *	-7.2 [8.5354]
	11	Physicians/'000 people	0.421 [0.606]	-2.306 [1.7031]	-0.742 [1.5207]
	12	% Nurses with higher degree	15.238 [14.324]	50.877 [61.3444]	58.048 [55.2124]
Education	13	Illiteracy	9.063 [4.109]	24.43 [16.0097]	-3.548 [16.8765]
	14	Mean Score ENEM	-0.035 [0.076]	-0.315 [0.2537]	0.225 [0.2603]
	15	SD Score ENEM	0.264 [0.037]	-0.045 [0.126]	-0.217 [0.1592]
	16	% Enrollment 10-14	0.971 [0.026]	-0.148 [0.0858] *	-0.129 [0.0809]
	17	% Enroll 7-17, private	0.043 [0.047]	-0.254 [0.1652]	-0.108 [0.1553]
Social	18	# Bolsa Familia/Pop	0.147 [0.074]	0.671 [0.3038] *	0.197 [0.3177]
	19	Homicide rate	2.944 [1.744]	3.594 [5.242]	2.02 [5.2531]
Fiscal	20	Education Exp, per capita	6.246 [0.384]	-0.303 [1.0644]	0.048 [1.0082]
	21	% Mun. Exp. In education	0.288 [0.046]	0.065 [0.1154]	0.076 [0.1036]
	22	% Mun. Exp. In overhead	0.231 [0.079]	0.184 [0.2451]	0.247 [0.2395]
Culture	23	Fertility rate	3.296 [0.481]	-0.358 [0.9636]	-3.039 [0.7236] *
	24	% Living with relatives, 20-29	0.494 [0.094]	-0.363 [0.3235]	-0.135 [0.3288]
RHS variables		Mean		0.6249	0.519
		Standard Deviation		0.193	0.121
		Min - Max		0.201-0.840	0.274-0.837

Note: Regressions have 494 observations and are weighted by population in 2000 and standard errors are clustered by 1920 municipality (71 clusters). They were estimated by two-stage least squares using measures of closeness to any colony and closeness to German colonies are instruments for the land gini and literacy rates in 1920.

The homicide rate is transformed by f(x) = ln(1+x) to deal with zeros.

Data Appendix

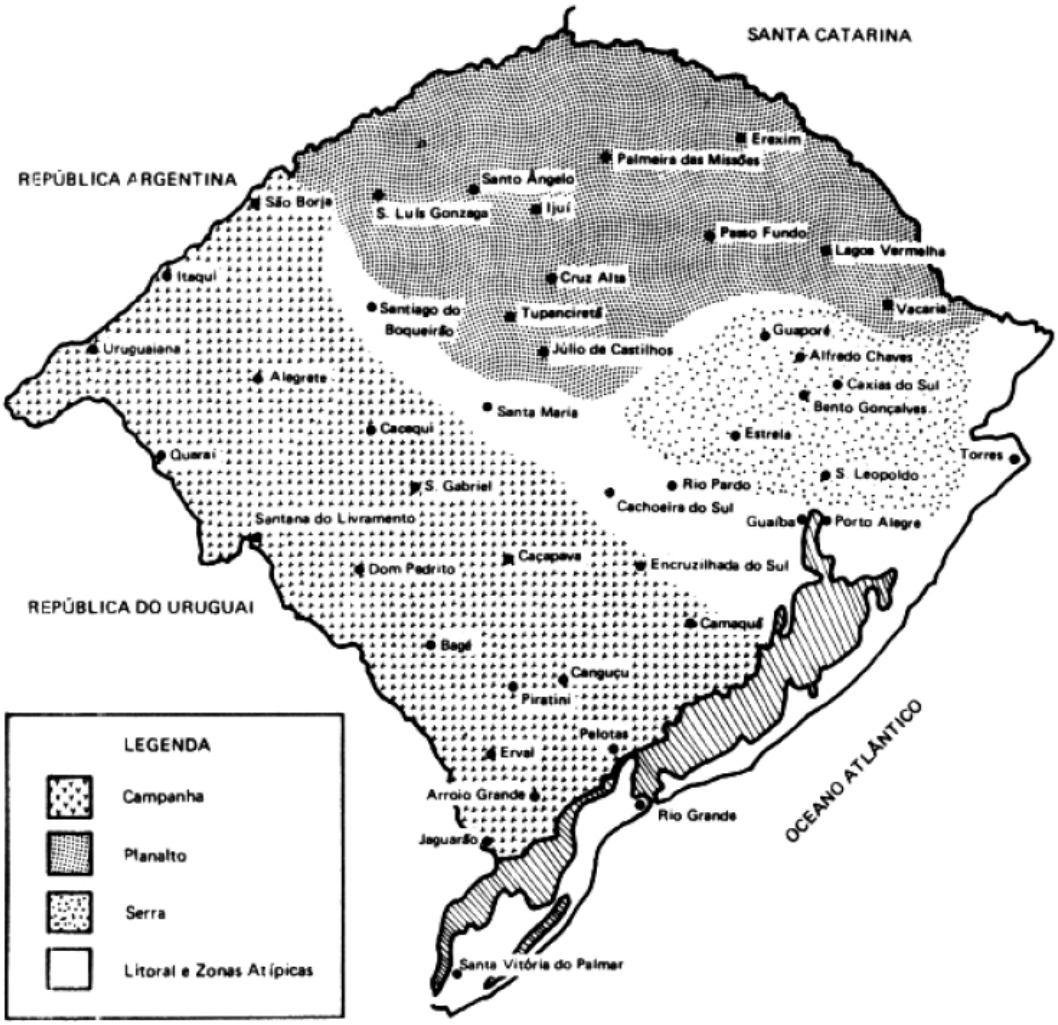
Variables	Description
Rain (mm per month)	Trimester averages of rain, in millimeters per month (December to February; March to May; June to August; September to November) over a 30 year period (1961-1990). These estimates were built based on the database CRU CL 2.0 10' of the Climate Research Unit at University of East Anglia (CRU-UEA) in the UK (New et al. 2002 and http://www.cru.uea.ac.uk). Downloaded from www.ipeadata.gov.br
Temperature (°C)	Trimester averages of temperature, in Celsius, per month (December to February; March to May; June to August; September to November) over a 30 year period (1961-1990). These estimates were built based on the database CRU CL 2.0 10' of the Climate Research Unit at University of East Anglia (CRU-UEA) in the UK (New et al. 2002 and http://www.cru.uea.ac.uk). Downloaded from www.ipeadata.gov.br
Quality of soil	"Quality of Soil" is an ordered categorical variable made up of information of on topography, soil fertility, and physical constraints to agriculture (such as risk of floods, or occurrence of rocks or sand). It has been built through the overlapping of a map of quality of soil (IBGE, 2010b) and the grid of current municipalities. The shares of each ten types of soil in each municipality were then calculated using GIS tools. We thank Vanessa Nadalin (IPEA) for her help on this task.
Religion	
% Catholic % Mainline Protestant % Atheist	Calculated by the authors based on the Census of 2000. The percentages are calculated among the adult (older than 18) population. Catholic refers to codes 110-199; mainline protestant to codes 210-289 and atheist to codes 0 for the religion variable.
Macroeconomics	
Population density, in logs	Calculated by the authors, based on population and area data from IPEADATA.
Human Development Index (HDI 2000)	The HDI is the arithmetic average of three sub-indices, referring to longevity (HDI Longevity), education (HDI Education) and Income (HDI Income). To obtain more methodological informations about this índex, access www.undp.org.br .
Per capita income, in logs	That is the log of the average per capita household income in a municipality, monthly and measured in Reais of August 1st, 2000.
% Poor	Percent of persons with household per capita income below R$75.50, which is equivalent to ½ minimum wage in August 2000. The universe of individuals is limited to those living in permanent households. Source: IPEADATA. To obtain more methodological information, access www.undp.org.br

Gini	Source: IPEADATA
Health	
Child mortality under 5	Frequency of mortality before 5 years of age, per 1000 live births. Source: IPEADATA
Life expectancy	Life expectancy at birth, assuming constant mortality rates in future years. Primary source: Atlas do Desenvolvimento Humano no Brasil 2000. Source: IPEADATA
Number of physicians per 1000 inhabitants	Ratio between the number of physicians residing in a municipality and its total population, including resident physicians, times 1000. Source: www.undp.org.br
Proportion of nurses with a higher degree (%)	Proportion of nurses with a higher degree working as nurses in the municipality. Source: www.undp.org.br
Education	
Illiteracy	Percent of illiterate persons within the population over 15 years old that cannot read. Source: IPEADATA
ENEM Scores (mean, standard deviation)	ENEM is a nationwide exam for concluding high schoolers with a very high take-up rate. To construct mean scores, we run a regression of individual Z-scores on interactions of age, gender and latest degree concluded; save the residuals; and aggregate them by municipality or minimal comparable area.
% Enrollment 10-14	Calculated by the authors based on the Census of 2000. The percentages are calculated for children ages 10-14, enrollment is denoted by codes 1-2 in the variable V0429.
% Enrollment 7-17, private school	Calculated by the authors based on the Census of 2000. The percentages are calculated for children ages 10-14, enrollment is denoted by code 1 in the variable V0429
Social	
Bolsa Família program- number of families receiving benefits in December	Number of families receiving Bolsa Família benefits in December, downloaded from www.ipeadata.gov.br
Number of homicides per capita	Original data comes from SIM-DATASUS (see http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obtbr.def and http://tabnet.datasus.gov.br/cgi/sim/obtdescr.htm), but we downloaded the data from www.ipeadata.gov.br The homicide rate is calculated based on the average yearly homicide count in 1998-2002 for each minimal comparable area, divided by the population of the minimal comparable area in 2000. Since we take logs, we deal with the zeros by adding 1 to the homicide rate before taking logs.

Fiscal	
Municipal education Expenditure, per capita % Municipal Expenditure in Education % Municipal Expenditure in Overhead	Source: IPEADATA
Culture	
Fertility rate	Source: IPEADATA
% Living with relatives, 20-29	Calculated by the authors, from the micro data from Census of 2000,

Figure 1. Rio Grande do Sul and Brazil

Figure 2. Regions of Rio Grande do Sul



Source: Fonseca (2003, p. 28)

Figure 3. Creation of Official Settlements by decade (Rio Grande do Sul 1820-1920)

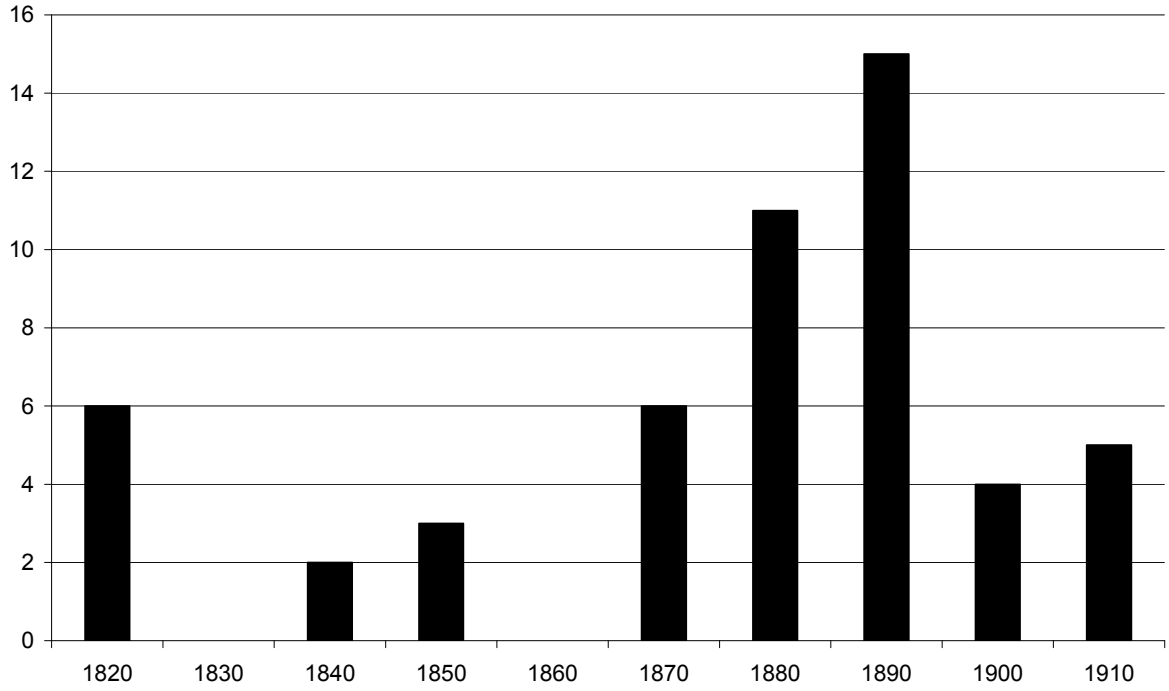


Figure 4

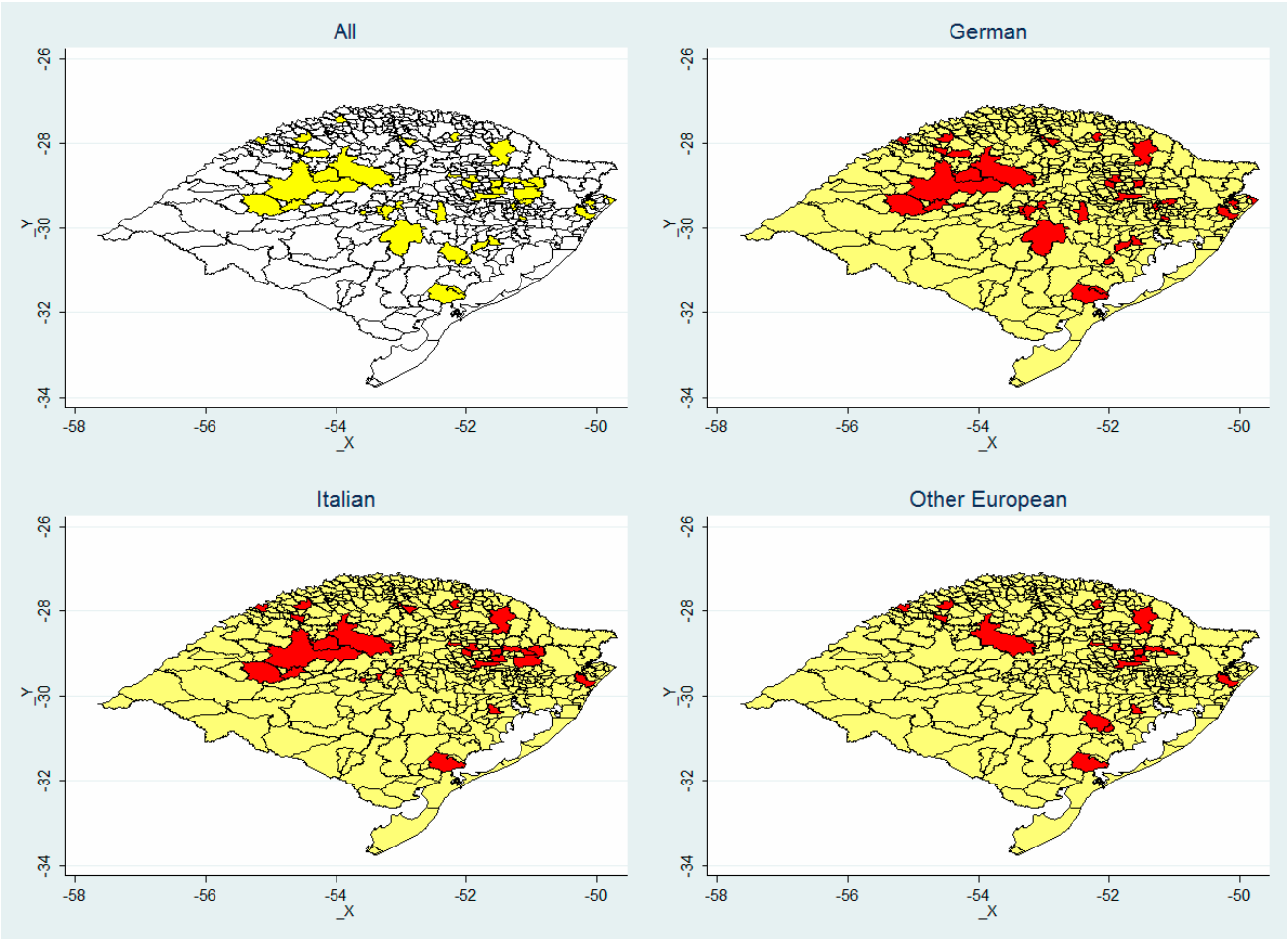

All
German
Italian
Other European
-26
-28
-30
-32
-34
Y
-58
-56
-54
-52
-50
_X

Figure 5. Closeness to Official Colonies

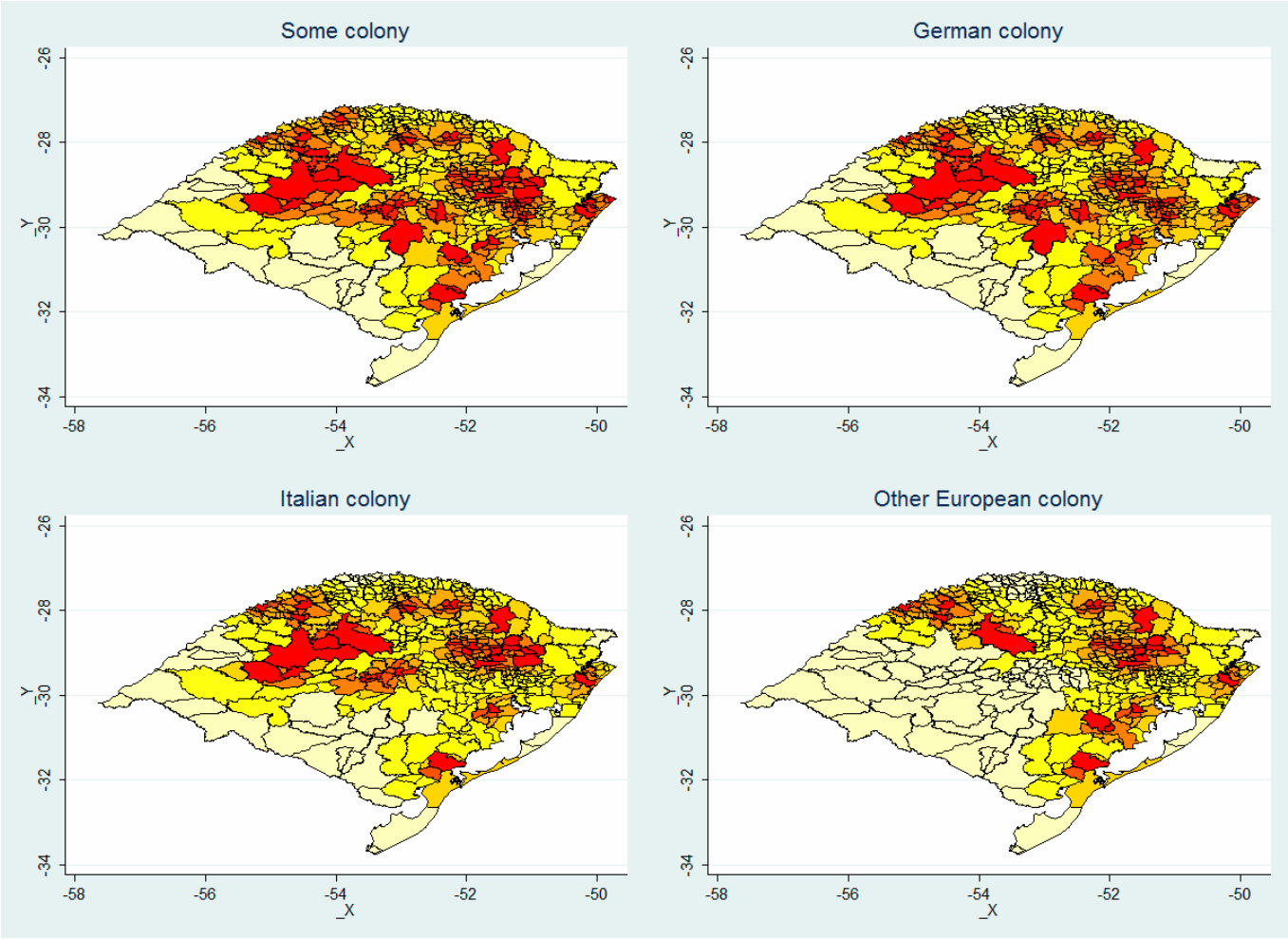
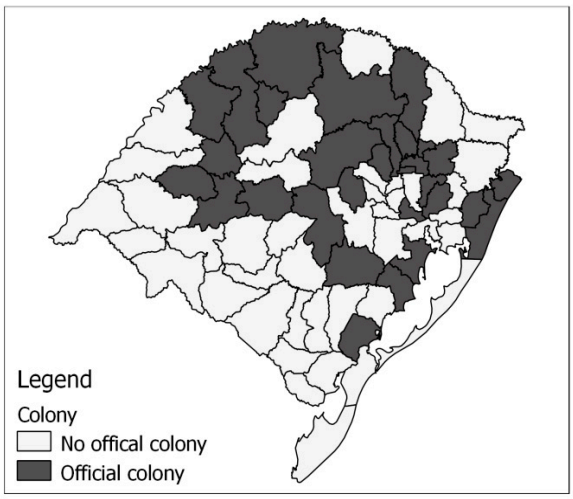
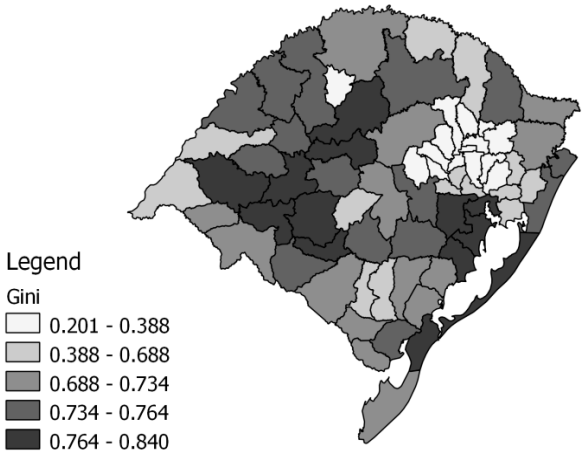


Figure 6

I. Rio Grande do Sul: 1920 Municipalities with an Official Colony



II. Rio Grande do Sul: Land Gini 1920



III. Rio Grande do Sul: Literacy Ratio, 15 and Older in 1920