

Three studies on the economic development of  
Argentina. The role of inequality and institutions in  
human capital formation.

by

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# **Chapter 1: Introduction**

## **1.1. The question**

The thesis studies the economic development of the Argentine from a historical comparative development perspective. More specifically, the dissertation assesses the relationship between inequality and development in Argentina, focusing on the influence of inequality on the historical evolution of human capital.

In an attempt to address this topic the thesis is structured in 3 main chapters. Chapter 2 evaluates the impact of wealth inequality at the local level on various indicators of primary education in the years 1883 and 1909, that is, before and after a process of centralization of the educational budget took place. In addition, various mechanisms that could have operated as linkages are analyzed. Chapter 3 tests the influence that agricultural colonization projects in the province of Santa Fé had on

the provision of primary schooling at the end of the 19th century. Because of its close link with this institution, inequality in this case is proposed as one of the channels through which the causal relationship could have taken place. Finally, Chapter 4, co-authored with Antonella Bonacina and Alejandro Danón, analyzes the effects that inequality at the local level could have had on the different levels of development. Institutions and human capital are proposed and tested as mechanisms in this last chapter.

## **1.2. Background**

The Argentine case is of special interest in the literature on comparative historical development as a case of development failure. In particular, Argentina is often mentioned as a typical example of reversal of fortunes since, in the late 19th and early 20th centuries, it experienced a period of rapid growth and modernization of its economy, becoming one of the richest countries in the world in the first decades of the 20th century.

Numerous studies have addressed the question of why -and when- Argentina reversed its fortune. There are explanations based on the productive structure -both from the structuralist perspective and from the international trade perspective-, as well as interpretations that attribute the failure to a low institutional quality and/or "bad" economic policies. It is not the intention of this thesis to address these debates, which are intense and still unresolved. On the contrary, the thesis aims to contribute to the understanding of the phenomenon of development in the Argentine case by investigating the influence of inequality in the development process, a question that does not compete with the aforementioned debates.

Although it is very popular in the discipline, studying the role of inequality in hampering development is not novel. In fact, the relationship between inequality and development has called the attention of the discipline since its beginnings up to the present (Lewis, 1954; Kaldor, 1956; Kuznets, 1955; World Bank, 2006; Piketty, 2014; Milanovic, 2016). These contributions can be classified into



those that analyze the effects of growth on inequality and those that evaluate the reverse causality: how inequality limits the growth potential of an economy.

Regarding the effects of inequality on development, classical economists advocate the hypothesis that inequality fosters growth and it is beneficial for economic development. Kaldor (1956) suggests that marginal propensity to save increases with income, thus a transfer from a poor person to a rich one may increase aggregate saving and generate economic growth through capital accumulation.

With the development of endogenous growth and unified growth theories, there has been a revival to study the impact of inequality on growth and development. From that literature, the idea emerges that improvements in productivity must be explained endogenously in any plausible growth model. Within this popular benchmark inequality, human capital formation, and productivity growth are closely connected: the more egalitarian the economy, the higher the educational attainment and the faster the economic growth.

More contemporary scholars have proposed other theoretical linkages between income distribution and growth and/or development that can be classified into three different channels: a fiscal one, an institutional one, and a human capital one. Within each of these groups we can find a heterogeneous set of explanations. Briefly, scholars advocating the *fiscal channel* argue that unequal economies have poorer median voters who, with the aim of producing redistribution, vote for inefficient policies -mostly higher taxes- that might hurt growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1994). Acemoglu (2005), Bourguignon and Verdier (2000), and Engerman and Sokoloff (1997) explore the *institutional channel*. In short, they hold that elites in highly unequal societies might prevent growth by enhancing growth-limiting policies that preserve their privileges. Among the pioneer papers that study the *human capital channel*, Galor and Zeira (1993) build a model to show that inequality may produce underinvestment in human capital which in turn results in a less developed - low income - and unequal long run economy.

From the empirical approaches to this question there are also diverse results, both across

countries (Deininger and Squire, 1998; Easterly, 2007; Birdsall et al., 1995, Perotti, 1996; Barro, 2000; Banerjee and Duflo, 2003) and within countries (Acemoglu et al., 2007; Dell, 2010; Summerhill, 2010; Banerjee and Iyer, 2005; Galor et al., 2009). Within the set of within countries studies, it is notable that those analyzing Latin American countries find positive effects of inequality on development while the remaining findings endorse a negative effect of inequality. This fact makes the evaluation of this question even more attractive in the Argentine case.

Goldin and Katz (2010) argue that the 20th century was the human capital century for the United States and the world, and that the United States exceptional leadership in investing in the skills of its workforce was a major driver of economic growth. In this regard, Lindert (2010) conducts a cross-country analysis in which he attributes the Latin American backwardness in terms of education throughout the 20th century to the high level of inequality present in the region, suggesting as a mechanism an insufficient investment in human capital by these countries.

This thesis explores the influence of inequality on the early development of the Argentinean educational system. During this period, between 1870 and 1914, Argentina experienced substantial growth due to its increasing insertion in international trade. Consequently, a great process of modernization of society began to take shape in the country, both in the political and economic spheres. Modernization implied for Argentina a notable rise in the levels of primary education during the period. The historiography points to the process of Nation-state consolidation (Tedesco, 2003) and the increasing demand for non-tradables linked to the growth model (Galiani et al., 2008) as the main motivations of the country's ruling elites to extend the elementary education system.

Those motivations resulted in a process of centralization of the budget for primary education with the Láinez Act of 1905, which meant the convergence in primary education levels. Thus, by around 1910, although Argentina's educational performance was relatively successful in the international context, the most backward regions of the national territory tended to get closer in terms of primary schooling to the most dynamic areas of the Litoral near to the port of Buenos Aires, which were integrated into world markets. But this convergence in education had its limitations. In

particular, by the end of the period relevant for this research, considerable spatial disparities in educational outcomes still persisted. Then, it is worth asking whether the different levels of inequality present throughout the territory had any impact on the spatial heterogeneity in educational performance.

All social relations involve inequalities. They can be transient and fluctuating or long-lasting and systematic. The former, which we call conjunctural inequality or market inequality, are traversed by market forces and lead to asymmetries only because success in free markets is different in different individuals, cities, regions, firms, and industries (Tilly, 2000: 20). On the other hand, structural inequality endures from one social interaction to the next, with particular attention to disparities that persist throughout a career, a lifetime, and an organizational and institutional history. In Easterly's words, "*(s)tructural inequality reflects historical events such as conquest, colonization, slavery, land distribution by the state or colonial power; that is, structural inequality shapes an elite through mechanisms that are not associated with the market*" (Easterly, 2007: 756).

Even though it has been subject to numerous ups and downs (Bértola and Ocampo, 2010; Arroyo-Abad, 2013; Frankema, 2009; Bértola, Prados de la Escosura and Williamson, 2010; Williamson, 2009, 2015), many authors consider that inequality in Latin America has a high component of structural inequality and that this component is higher than in other countries and regions of the planet (Gasparini and Lustig, 2011; Morley, 2001; Chenery et al. 1974; DeFerranti et al. 2004; Baten et al, 2010). Engerman and Sokoloff (2012) argue that inequality is persistently high in the region because government policies and other institutions reproduce it over time. In extremely unequal societies, elites can establish a legal framework that benefits their political power and maintains their advantage by hindering public policies that promote development and the equitable distribution of resources. The authors exemplify elite political power with the scope of electoral participation and voting rights legislation, among others.

Although both types of inequality manifest themselves simultaneously in societies, it is necessary to distinguish between them when assessing their impact. In this dissertation, the inequality

whose impact is intended to study refers to structural or persistent inequality, as reflected in the spatial heterogeneity of inequality levels throughout the Argentine territory.

The New Institutional Economics closely links the concepts of structural inequality and institutions (North, 2009; Acemoglu et al., 2005). This view emphasizes that differences in long-term performance among societies can be explained by differences in the institutions that relate with the distribution of income, wealth and political power. Thus, highly unequal societies - *extractive* in the jargon of Acemoglu, Johnson and Robinson - are characterized by elites that hinder the provision of public goods for the masses, as opposed to more egalitarian societies with *inclusive* institutions. These relationships are also tested in chapters 3 and 4 of this dissertation.

### **1.3. Brief consideration on the methodological strategy**

Argentina is a vast country with considerable heterogeneity within it in many development dimensions. In this respect, in *The Other Argentina* (1996) Larry Sawers warns about the importance of contemplating the enormous diversity present in this country in order to understand its growth and development trajectory. He describes the provinces of the interior as having worse resource endowments, more extractivist local elites, higher levels of poverty, and low institutional quality. In addition, he argues, there is enormous variability among the interior regions (Patagonia has higher levels of economic development than the regions of Northern Argentina), as well as heterogeneity within regions. For example, in Northwestern Argentina, historically specialized in the sugar industry, two production models coexist: the *latifundia* in a highly concentrated and integrated agroindustry in the provinces of Salta and Jujuy, and the predominance of smallholdings in the case of Tucumán.

Similarly, historiography describes the variability within the Pampean region (Scobie, 1963; Gallo, 1977, 1986; Rock, 1986; Bulmer Thomas, 1994; among many others). Although with higher levels of development than the economies of the interior and fully integrated into international

markets since the boom of the first globalization, the "pampa gringa" (with a high proportion of immigrant population of European origin, an agricultural productive structure and higher levels of modernization of economic activities) coexisted historically with the "pampa criolla" (characterized by a higher participation of natives, a productive structure based on the traditional model of extensive cattle raising, and a more incipient development of economic activities).

The great heterogeneity described above makes the development of each of the chapters in this dissertation feasible since all of them exploit local variability. This type of study has the advantage over cross-country studies of being able to disentangle the analyzed effects in a more consistent manner. Firstly, there is a greater probability that the unobservables are identical - or at least stable - for all observations in this kind of approach. Secondly, measurement errors may also be smaller because the sources for recording the information for the different observations are usually the same and, consequently, present the same methodology and quality.

## **1.4. The findings**

Overall, the results in this dissertation suggest that inequality did indeed constitute an obstacle to economic development in the Argentine case. In particular, the most unequal areas seem to have faced greater difficulties in investing in the human capital of their inhabitants at the beginning of the development of the national educational system. Moreover, its effects lasted once the process of centralization of primary education budgets began and had long-lasting effects on long-term development.

Chapter 2 tests the influence of wealth inequality on various indicators of primary education and finds that the negative effect found is reduced once the process of centralization of budgets took place. These results are interpreted as a loss of power of local elites to hinder mass schooling. However, the impact of inequality - although reduced - still persists. For this reason, various demand mechanisms that could have played a role in the persistence of this influence are explored. In this way,

the possibility that the productive structure as a conditioning factor of the demand for child labor had been part of the explanation is rejected. The results suggest that urbanization - used as a proxy for the degree of modernization of economic activities - has promoted the demand for education via its relationship with inequality. Chapter 3 explores this mechanism in greater depth.

A third mechanism explored in Chapter 2 is that of European immigration. In this regard, it should be noted that during the period of analysis Argentina experienced a huge influx of European immigrants. Droller (2018) finds a positive impact of the arrival of these immigrants on education and long-term development. The idea behind this hypothesis is that European immigrants, with a relatively higher level of human capital, also had a higher demand for schooling. Although a positive effect is also found in this chapter, it seems to be of low magnitude. Following Sánchez Alonso (2019), Chapter 2 argues that whereas immigration on average increased the demand for education, the heterogeneity in the degree of success of the various nationalities is also remarkable. This mechanism is also further explored in Chapter 3.

Chapter 3 evaluates the impact of agricultural colonization in the province of Santa Fé on the provision of primary schooling at the end of the 19th century. Since the assignment of colonies was not random, the historiography is assessed in order to find explanatory variables for the location of the colonies that allow us to analyze their causal relationship on schooling indicators. The results suggest that the presence of colonies improved educational outcomes via higher attendance rates, expenditures, schools and teachers.

Various mechanisms proposed in the literature are tested in this chapter to explain this causal relationship. The influence of urbanization is also evaluated in this case. According to historiography, agricultural activity - particularly cereal crops -, by stimulating the establishment in the countryside of a series of economic activities related to industry, commerce and transportation, contributed significantly to the diversification of economic life in the region and, at the same time, gave a strong impetus to the creation of hundreds of small urban centers. The results suggest that the degree of urbanization could have been part of the explanation, thereby giving support to evidence of similar

studies for the Chilean and the Brazilian cases (González, 2020; Rocha, Ferraz, and Soares, 2017). At this point it is worth asking whether the influence of urbanization is via demand as in the aforementioned cases, or via supply as Montalbo (2020) finds for France in the 19th century.

Second, while it is true that the Europeans in the province of Santa Fé had a higher stock of human capital than the natives, there is no evidence that the higher relative incidence of Europeans in the colonies had been part of the explanation for the colonies' relative success as providers of primary education - at least until 1887 -. This finding challenges the research of Droller (2018) on the European effect in the Pampas and, again, the interpretation can be found in Sánchez Alonso (2019). These findings claim for further research in this topic.

In this chapter the relative equality in land ownership - measured as the percentage of owners - is found to be a mechanism by which the colonies performed better in educational terms. Although it is not possible to distinguish between demand or supply drivers of the inequality channel, the fact that the *Contribución Directa* - a wealth tax - constituted an important part of the financing for primary education indicates that at least in this period - that is, prior to the centralization of budgets for primary education - the supply side of the effects of inequality would have played a role.

Finally, Chapter 4 - co-authored with Antonella Bonacina and Alejandro Danón - studies the long-term effects of inequality at the local level on development using the instrumental variables method. Following Easterly (2007), an instrument is constructed based on the land suitability ratio for sugarcane and cereal crops, due to the link of each of these crops with more unequal and more egalitarian societies, respectively. This instrument is useful for understanding the causal relationship between inequality and development at the local level in Argentina. The results of the chapter suggest a negative effect of "structural" inequality on long-term development and provide evidence that human capital and institutions were the mechanisms that reproduced the relationship over time.

Taken together, all these results suggest that "structural" inequality in Argentina could be part of the explanation for its development failure. Specifically, spatial heterogeneity in Argentina's historical inequality levels caused different development paths that, taken together, hindered the

aggregate's growth and development trajectory. Moreover, within this explanation, human capital could have played an important role as a driver of the relative Argentine failure.

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## **Chapter 2: Wealth inequality and primary education in Argentina (1870-1914)**

### **2.1. Introduction**

Between 1870 and 1914, during its stage of Nation-state consolidation, Argentina experienced substantial growth due to its increasing insertion in international trade. Consequently, a great process of modernization of society began to take shape in the country, both in the political and economic spheres. Modernization implied for Argentina a notable rise in the levels of primary education during the period. The historiography points to the process of Nation-state consolidation (Tedesco, 2003) and

the increasing demand for non-tradables linked to the growth model (Galiani et al., 2008) as the main motivations of the country's ruling elites to extend the elementary education system.

Those motivations resulted in a process of centralization of the budget for primary education with the Láinez Act of 1905, which meant the convergence in primary education levels. Thus, by around 1910, the most backward regions of the national territory tended to get closer in terms of primary schooling to the most dynamic areas of the Litoral nearest to the port of Buenos Aires, which were integrated into world markets. But this convergence in education had its limitations. In particular, by the end of the period relevant for this research, considerable spatial disparities in educational outcomes still persisted.

This chapter explores the influence of wealth inequality in the origins of Argentine primary education development. To do so, Wealth Ginis at departmental level estimated in Gelman (2011) for the 1860s - the beginning of the period studied in this research - and census data on a series of educational indicators are used. In particular, literacy, primary school attendance, number of teachers, number of schools, and spending per school-age child published in school censuses of 1883 and 1909 and in the national population censuses are assessed. The units of observation are the departments of 6 Argentine provinces: Buenos Aires and Santa Fé in the Litoral Region, Mendoza in Cuyo, and Tucumán, Salta, and Jujuy in the Northwestern part of the country.<sup>1</sup>

Two hypotheses about how inequality might have negatively affected primary education allocation have been suggested. On the supply side, a high level of inequality is associated with the presence of local elites hindering the provision of education for the masses. This hypothesis is confirmed for the first part of the period - end of the 19th century - in which the allocation of the budget to primary education was decentralized. On the demand side, high inequality is associated with a lack of interest in education on the part of the masses. This hypothesis is also validated by the end of the period (1909 and 1914), once the centralization of the budget in primary education had already taken place. Indeed, the results indicate that the wealth inequality coefficient loses significance for the

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<sup>1</sup> For the time period relevant to this thesis, the Argentine state was made up of 14 provinces, 9 national territories that later became provinces, and the federal capital. The national territories and the federal capital are not studied in this thesis because they constituted jurisdictions that depended entirely on the national government.

variables linked to the education inputs (teachers and schools) but not for the outputs (literacy and school attendance). Overall, these results suggest that inequality did affect the allocation of primary education, but that this effect decreased over time, with the supply-side effect disappearing with budget centralization.

Finally, the mechanisms by which inequality would have affected the demand for education at the beginning of the 20th century are explored. While the productive structure does not seem to have constituted a channel of demand for primary education, the results provide evidence that the proportion of the European population in each department and urbanization did.

The relationship between inequality and economic development has called the attention of the discipline since its beginnings up to the present (Lewis, 1954; Kaldor, 1956; Kuznets, 1955; Piketty, 2014; Smith, 1776; World Bank, 2006). Furthermore, in Latin America this phenomenon deserves particular consideration since the region has been characterized not only as the world most unequal (Bourguignon and Morrison, 2002; Morley, 2001) but also with “excess inequality” given its level of development (Londoño and Székely, 2000, Frankema, 2005, 2009). Thus, the Argentine case may constitute an interesting laboratory for analyzing this relationship. In general terms, this research contributes to the debate on the effects of inequality on economic development with emphasis on one of the channels that explain this relationship: human capital.

The pervasive effects of inequality on human capital investment found in this research are consistent with the findings about the inverse relationship between land inequality (across landowners) and human-capital formation across countries (Deiningen and Squire, 1998; Easterly, 2007) and within countries (Galor, Moav, and Vollrath, 2009; Cinnirella and Hornung, 2016; Beltrán Tapia and Martínez-Galarraga, 2018). Therefore, a second contribution of this chapter is to provide empirical evidence to evaluate the relationship between land inequality and education within the Argentine case.<sup>2</sup>

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<sup>2</sup> Strictly speaking, the Ginis used in this study correspond to wealth inequality, which includes assets other than land. However, it could be argued that in Argentina, a land-abundant country, the Wealth Gini will surely approximate the value of the Land Gini quite well during the period studied in this research.

The chapter has the following structure. In the next section, a review of the literature is carried out in two large sets of publications. On the one hand, the main interpretations on the development of educational systems in their origins are presented. After that, the literature regarding the influence of inequality in primary education in particular and in economic development in general during this period is discussed. In section 3, a description of the development process of the primary education system between 1870 and 1914 is made. Section 4 describes data sources used in this research, and sections 5 and 6 present the descriptive statistics and the regression results, respectively. Section 7 concludes.

## **2.2. Literature review**

Two sets of studies are relevant for this research. On the one hand, the literature on the origins of educational systems within the framework of human capital theories (Lindert, 2004; Goldin and Katz, 2010) and, on the other hand, research specifically focused on testing the influence of past land inequality in the development process.

### **2.2.1. On the origins of educational systems**

The first set of relevant research aims to explore the causes of the development of educational systems in their origins. Among them, institutional, political, and economic interpretations can be identified.

For example, Go and Lindert (2010) explain the uneven early growth of public education in the United States on the basis of the degree of autonomy by local governments and the local distribution of political voice. These influences are highlighted by their wide contrasts between the northern and southern states. Along the same lines, Capelli (2016) finds that an initially decentralized primary school system in Italy had negative effects on the convergence of the long-term development



paths of the different regions through its impact on the supply of human capital, which even a subsequent process of centralization could not fully reverse.

Another political force less explored within the new institutional literature and more emphasized among historians and political theorists is the process of Nation building. This hypothesis is not new. Weber (1976) for the case of France and Wright (2003) for the United States assign a high explanatory power to the process of building a national identity in economic development under the idea of modernization. Peres Cajías (2013) also analyzed the impact of the Bolivian revolution on the provision of public education. Lankina and Getachew (2013) studied the effects of institutions on development before and after the revolutions, exploiting local variability in the cases of Russia and India. The idea behind all these studies is that the presence of changes - in some cases relatively fast changes - in social consciousness, mentalities and identities implied alterations in the rules of the game, thus counteracting the influence of negative institutional forces and historical legacies, and/ or revitalizing the positive impacts of shocks.

Specifically for the Argentine case, Elis (2011) argues that the origins of public education in Argentina had their roots in the formation and consolidation of the Nation-State. His argument is that the oligarchic regime had an interest in promoting primary education and consequently committed to free public education as part of a broader liberal project in which liberal elites made a deliberate attempt to reshape political and economic Argentinean institutions, as well as its social composition, so that they could resemble those of the United States and Europe. In this interpretation, the liberal project is understood as a strategy of the oligarchic regime to eliminate *caudillismo* in the provinces and modernize the Nation.<sup>3</sup> In this way, public education served the positive function of sustaining the emerging national coalition of liberal oligarchs. The objective was to modify the relationship between the citizens and the provinces towards the citizens and the national government.<sup>4</sup>

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<sup>3</sup> *Caudillismo* was a political and social phenomenon that emerged during the 19th century in Latin America. It consisted of the presence of local charismatic leaders whose way of accessing power and reaching the government was based on informal and diffuse mechanisms of recognition of leadership by the multitudes, who deposited in the "caudillo" the expression of the interests of the masses and the ability to solve common problems.

<sup>4</sup> Elis' finding endorses the works of Zimmerman (1996) and Botana (1977). In *Los liberales reformistas* (1996), Zimmerman argues that the great social transformations experienced in Argentina between 1880 and 1916 were the product of the ruling elite's political motivations to consolidate the Nation-State. On the other hand, Botana characterizes the enormous political competition experienced by the oligarchic regime between the elites of the interior and the national government, which resulted in a process of increasing centralization.

The development of Western primary education systems is contemporaneous to the first globalization boom. Then, there are also interpretations from an international trade perspective within the literature. An important work in this line is that of Musacchio, Martínez-Fritscher and Viarengo (2014), who analyze the role of trade shocks - changes in commodities prices - in the proliferation of primary education supply in the states of Brazil during the 1889-1930 period. During this stage, subnational states had autonomy to collect taxes on exports and to spend on public goods. Their argument is based on the fact that trade shocks asymmetrically affected the subnational states' fiscal revenues and, therefore, they also had a heterogeneous impact on their primary education expenditures, based on the mix of crops predominant in each state. Their results suggest that states with more egalitarian and democratic institutions use positive shocks from foreign trade to invest in education, while the opposite occurs in states with more extractive institutions. The authors argue that extractive institutions became binding and slowed-down the impact of terms of trade on the educational supply in areas where the population descended from slaves was the majority, so that it was not convenient for authorities that they participated electorally. Similarly, egalitarian institutions magnified the effect of positive trade shocks. Furthermore, the resulting distribution of human capital between states persists up to this day, suggesting that education would have been an important channel on the path of development.

Although in the Argentine case a study of this type is not feasible since there was no collection of foreign trade by subnational governments, some authors have proposed an interpretation linked to the influence of international trade on the development of the national education system. Specifically, Galiani et al. (2008) propose a model of education provision in land-rich economies that is mainly based on the growing demand for non-tradable goods that would have arisen from the wealthiest elites during the first globalization boom.

Finally, González (2020) links Chilean educational growth between 1882 and 1904 with the need for modernization of economic activities that arose from European immigration. The author explores the relationship between European immigration and human capital of the natives through the study of a colonization policy implemented by the Chilean government between 1882 and 1904 and

finds a strong, positive and robust correlation between recruited Europeans and natives' human capital. This finding does not seem to be driven by increases in the provision of public goods but by a modernization of the local economy: Europeans became landowners, production became increasingly technical, with physical capital being complementary to skilled labor, and with changes towards a modern crop productive structure.

In summary, the literature explaining the origin of the educational systems of the second half of the 19th century and early 20th century emphasizes the shocks that generated incentives for modernization of economic activities and institutions.

### **2.2.2. On the influence of inequality in primary education**

Regarding the second set of relevant research, the main theoretical exponents are the pioneering contributions of Engerman and Sokoloff (1997, 2002) and Acemoglu, Johnson and Robinson (2001, 2005). Their contributions suggest that the initial configuration of institutions persists over time, thus affecting the path of the economic development process. In particular, the idea is that initial institutions are linked to the distribution of wealth and political power, thereby determining the contemporary and future level of development. The channels proposed to affect the path of future development are inequality, the distribution of political power (generally measured by participation in elections) and the provision of public goods. This last channel will then be important to reflect the influence of agrarian institutions (in general) and inequality (in particular) on the development of educational systems, as a determinant.

The theoretical model in Galor et al. (2009) suggests that an unequal distribution of land for a given population could delay the implementation of educational institutions and indirectly affect growth. In this model, the delay in the expansion of formal education is explained by the presence of large landowners - potential contributors to the provision of education - opposing educational reforms in order to reduce the mobility of the rural labor force toward the cities to work in their farms. The main difference between this theoretical proposal and the institutionalist contributions mentioned

above lies in the fact that these authors assume the existence of two elites competing for labor: a rural landowner elite vs. an industrial elite.

In recent years, a growing body of research began to test the hypothesis of the impact of institutions and land inequality on economic development. In particular, these studies focus on the effect of inequality and institutions on the provision of public goods.<sup>5</sup> In this sense, the supply of primary education has been extensively studied insofar as Nation-State education systems developed in the late 19th and early 20th centuries. Moreover, the 20th century has been described as the century of human capital (Goldin and Katz, 2010). According to this literature, extractive institutions can be linked to the existence of a powerful elite capable of hindering the provision of public goods and, consequently, also of slowing down the process of economic development.

In this line of research, Cinnirella and Hornung (2016) analyze the impact of land ownership concentration on the expansion of mass education in Prussia throughout the 19th century. Cross-sectional estimates show a negative association between land ownership concentration and enrollment rates suggesting that inequality in land ownership hampered the development of the educational system. This negative relationship decreases over time due to an increase in private demand for education driven by the gradual implementation of agricultural reforms.

Beltrán Tapia and Martínez-Galarraga (2018) examine the historical link between inequality in access to land and education in mid-19th century Spain. They also find a causal negative relationship between the fraction of non-owner agricultural workers - a proxy for inequality in land ownership - and male literacy rates. Regarding the mechanisms behind the observed negative relationship, they argue that inequality influences education not only through supply factors but that demand effects also played a prominent role. Then, as in Cinnirella and Hornung (2016), a significant part of the effect of inequality on education can be linked to demand factors. Their explanation lies in the fact that given an income, more unequal societies have lower median income. In poor economies,

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<sup>5</sup> It should be noted that within this literature institutions and inequality are both thought to be closely linked, that is, extractive institutions are associated with a greater concentration of wealth while inclusive institutions are associated with a more egalitarian distribution of wealth.

such as pre-industrial Spain, this constraint prevented large segments of the population from investing in education.

Similarly, Ramcharan (2010) studies the relationship between land inequality - measured as the Gini coefficient of the farm size distribution - and education expenditures using county-level census data in the United States for the 1890-1930 period. By using different specifications and instruments to account for potential endogeneity, the author finds that inequality negatively affected education expenditures.

Summerhill (2010) assesses the role of a potential coercive institution of forced labor, the *aldeamento*<sup>6</sup>, agricultural inequality, concentration of political power, and slavery intensity - all measured in the year 1905 - on long-run development in São Paulo counties, assessing public goods and land inequality as channels. Although the author finds a relationship between *aldeamento* in 1905 and income in 2000, neither the intensity of slavery nor the pattern of inequality had a discernible negative economic impact in the long run. The author also dismisses land inequality as a persistent factor and a channel to promote development but finds evidence of public goods as a mechanism. In particular, the provision of local public goods in the early 20th century, as measured by local public education expenditures, has a positive impact on long-term development, and it is negatively related to contemporary economic or political inequality.

Banerjee and Iyer (2005) find that different colonial systems of land tax collection explain different growth paths in different regions of India. In particular, the authors find that after India's independence, districts where *landlords* had historically functioned as intermediaries to collect the land tax paid by cultivators (*landlord districts*) had lower productivity and investment in public goods than districts where the incidence fell directly on cultivators (*non-landlord districts*), so that areas with more extractive institutions and higher levels of inequality experienced less dynamic schooling systems.

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<sup>6</sup> *Aldeamentos* were settlements of semi-nomadic indigenous populations that the Portuguese created to convert them to Christianity, provide continuous religious instruction and defend against less cooperative invading Indians (Perrone-Moisés; 1992).

Dell (2010), finds that the *mita* - a colonial institution of forced labor in mining that was practiced in Peru and Potosí - is associated with less provision of public goods but also with less inequality. The author interprets this counter-theoretical finding by suggesting that in contexts such as Latin America during the colony, theoretical propositions such as those of Engerman and Sokoloff or Acemoglu, Johnson and Robinson are not valid since the configuration of well-established property rights at these junctures operated only through large extensions of property. That is, extractive institutions according to this article hinder the development process but rule out inequality as a channel or mechanism.<sup>7</sup>

In summary, this set of research provides empirical evidence that extractive institutions and/or land inequality in the past operated as obstacles to the provision of primary education at the stage of the origin of primary schooling systems, suggesting that human capital would have been the mechanism linking their influence on the development process. In addition, this literature also emphasizes the importance of demand mechanisms rather than elites hindering the development of education systems as channels through which inequality may have had an impact. Finally, unlike other explanatory hypotheses of the development of Argentine primary education systems, the influence on inequality has not been tested yet.

## **2.3. Primary education in Argentina (1870-1914)**

### **2.3.1. The Argentine primary education system in the international context**

Figure 2.1 presents the levels of enrollment and public spending on primary education<sup>8</sup> in years surrounding 1910 for a sample of 24 countries. First, these data show that by the end of the first decade of the 20th century, Argentine spending on primary education was among the highest of the world, comparable to those of Germany or Sweden and only slightly below those from the two richest

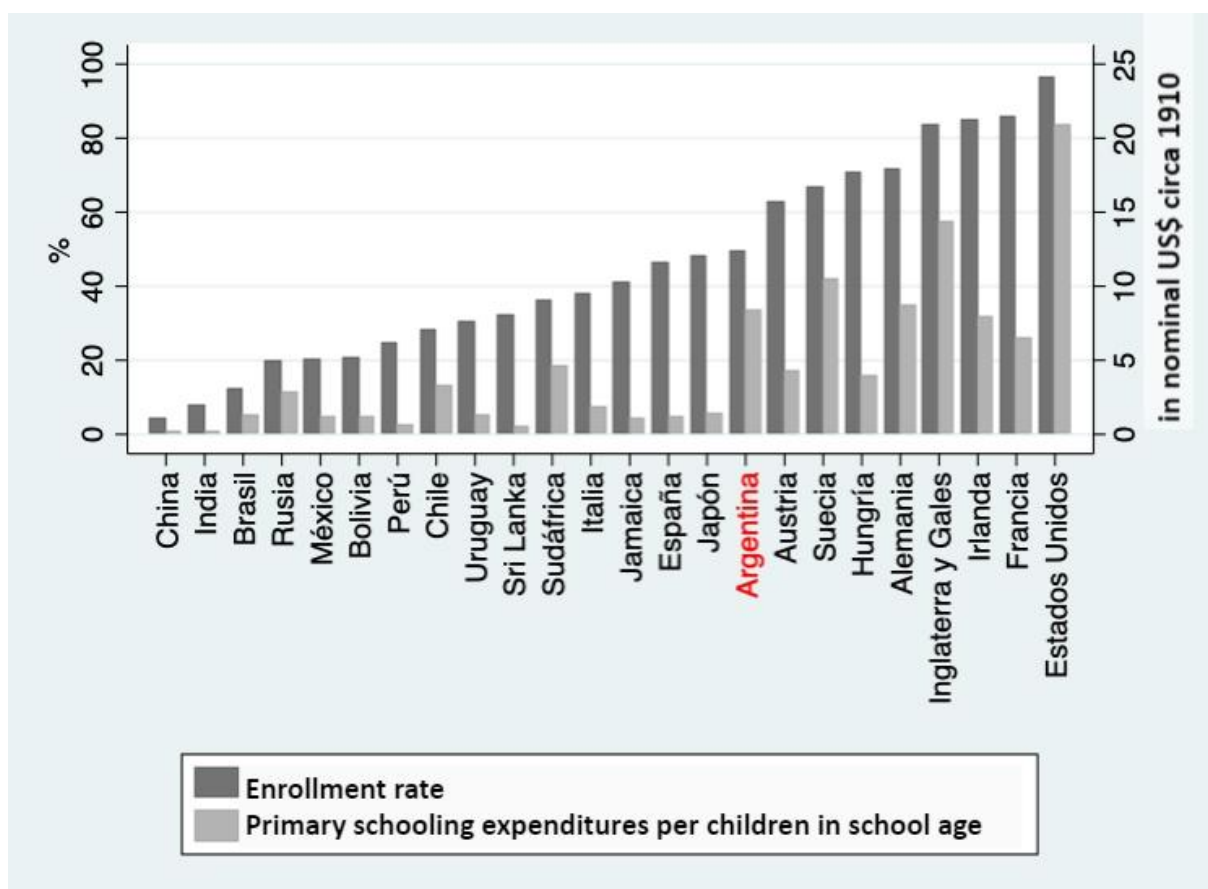
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<sup>7</sup> Obviously the *mita* was not an agrarian institution, but one of forced labor in mining. Dell's paper was included in the literature review due to its close relationship with the aforementioned empirical research, especially for the Latin American case.

<sup>8</sup> Primary education spending in Argentina is the sum of municipal, provincial, and national expenditures.

economies of the time: USA and Great Britain. On the other hand, the enrollment rate - which reached almost half of the school-age population in the country - was considerably lower than those from the most advanced economies. In fact, the Argentine educational system can be considered only moderately successful since the level of school enrollment was well above that of any country in Latin America and the Caribbean, but it was also quite similar to that of the less dynamic societies in southern Europe, such as Italy or Spain, that had poor educational performances.

**Figure 2.1: Enrollment rate (in %) and expenditures on primary education per school-age child (5 to 14 years of age) ca. 1910**

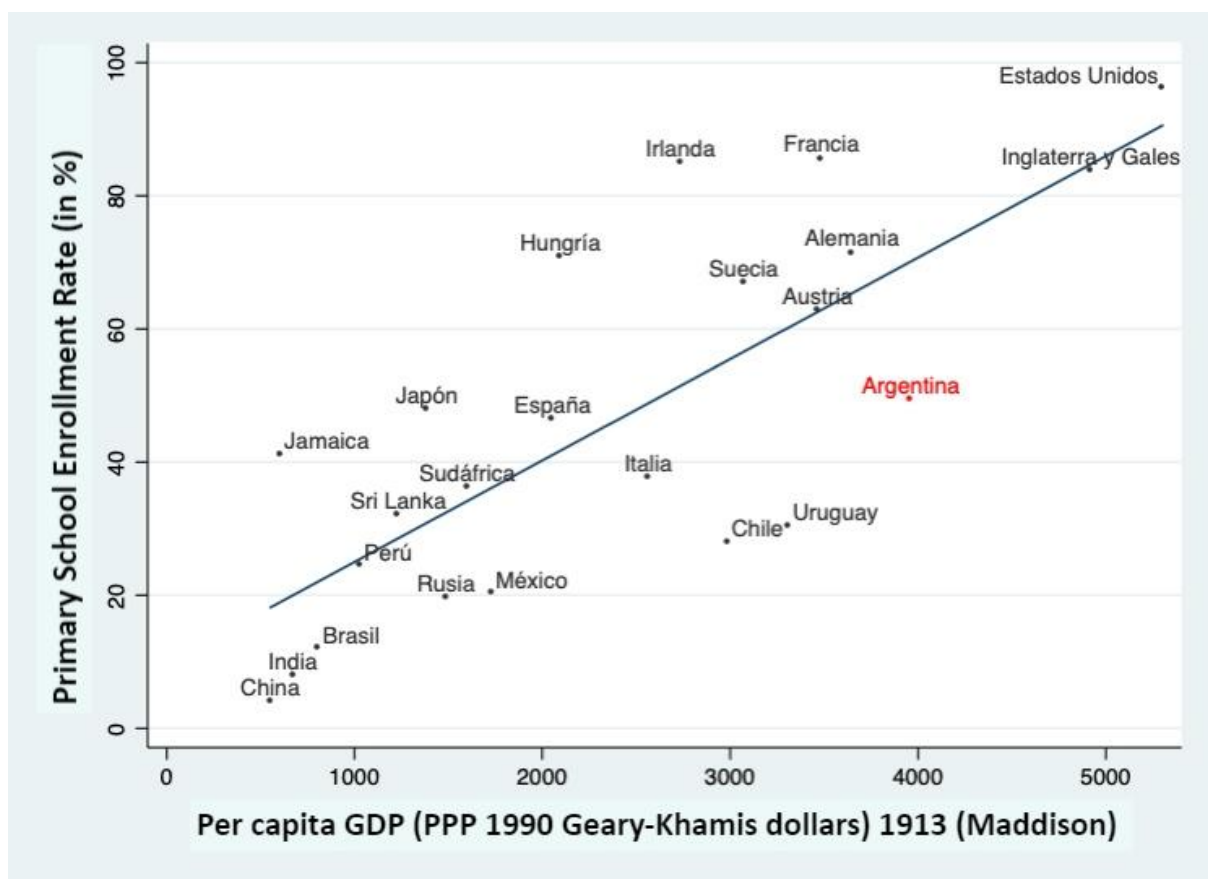


Sources: Chaudhary et al. (2011) and General Census of Education in the Argentine Republic (1909)

Therefore, Argentina’s primary education spending was high, but the results of that high spending, as measured by the corresponding level of enrollment, were mediocre. The latter might be the indication of a certain degree of elitism in the provision of primary education; that is, the state

could have spent a lot but not on the entire population. Figure 2.2<sup>9</sup> reinforces this suspicion; it pictures the enrollment rate with respect to per capita income. Given its per capita GDP, Argentina should have achieved an average enrollment rate of 70%, similar to those achieved by Hungary, Sweden and Germany with even lower per capita income. However, Argentina's enrollment rate was 49.3%, 20 percentage points below.

**Figure 2.2: Primary school enrollment rate (in %) c. 1910**



Sources: Chaudhary et al. (2011), General Census of Education in the Argentine Republic (1909), and MOxLAD

<sup>9</sup> Figure 2.2 does not include Bolivia in the sample because GDP per capita data is not available.



### **2.3.2. The development of the Argentine primary education system in its origins**

Between 1850 and 1880, primary education had large regional imbalances in both coverage and quality, since its founding was decentralized. During this period, primary school enrollment increased from 5% to 20% nationally, albeit at varying paces in different regions (Newland, 1991).

Added to local conditions, the uneven economic development of the country led some provinces to lack resources to promote education at a constant and systematic rate. For this reason, the central government developed some mechanisms to help the provinces meet their primary education provision goal. So, the first national subsidies appeared in 1864. These subsidies were subsequently signed into law. Thus, the National Subsidies Act (463 Act) passed in 1871 was created to regulate such contributions that appeared in the form of subsidies. In reality, these regulated subsidies were not binding because they were determined on the basis of political clientelism, the support of the port elite, and fiscal agreements. According to Vedoya (1973), these subsidies were small and ineffective because they were administered by provincial elites, who in many cases allocated the budget based on their own preferences. For others, such as Tedesco (2003), during the presidencies of Mitre, Sarmiento and Avellaneda, the national government played an active role in promoting education, given the general belief that the provincial governments were not expanding access to schools, because of low literacy rates among natives and inlanders.

Between 1880 and 1914, the importance of the federal government in the provision of education increased. In 1881, the Education Council began to have the authority over schools of the Buenos Aires city and the national territories, while the rest of the country was covered by local and provincial authorities. During this period, Argentina experienced considerable educational achievements. A very common indicator of schooling progress in this period is the gender gap in literacy rate, usually associated with poor educational systems. The literate male population in Argentina in 1869 was 38% higher than the female, and in 1895 this gap was reduced to 19%. These data are remarkable if we consider that by 1900, Mexico, Brazil, and Bolivia had a literate male population almost double that of the female. These improvements also have an explanation in terms of

European immigration which, as stated by numerous authors, had a higher proportion of literate population.<sup>10</sup>

The 1420 Act of 1884 established that attendance at primary school should be free, secular and compulsory for all children between 6 and 14 years of age. In addition, this act limited the distance that children had to travel to attend schools and established the mandatory existence of one educational building for every 1,500 inhabitants. These standards were not met uniformly across the country, between Interior and Litoral regions, natives and foreigners, and between urban and rural sectors. Between 1875 and 1896, almost all the provinces significantly increased per capita expenditures on primary education. However, by 1896 the province of Buenos Aires was still well ahead of the rest (Vedoya, 1973:89).

The central government strengthened during this period. It participated in the efforts to obtain loans, in the expansion of the productive lands available through the anti-indigenous campaigns, and in the growth of foreign trade. Overall, this meant the consolidation of Litoral landowners as a national elite, since the implemented policies aimed to favor this sector. According to Tedesco (2003), there was a strong state centralization process in the primary education budget reflected both in the acts related to national subsidies and in the Láinez Act of 1905. This Act established that the central government could create primary schools in provinces that proved to be backwarded in their educational performances.

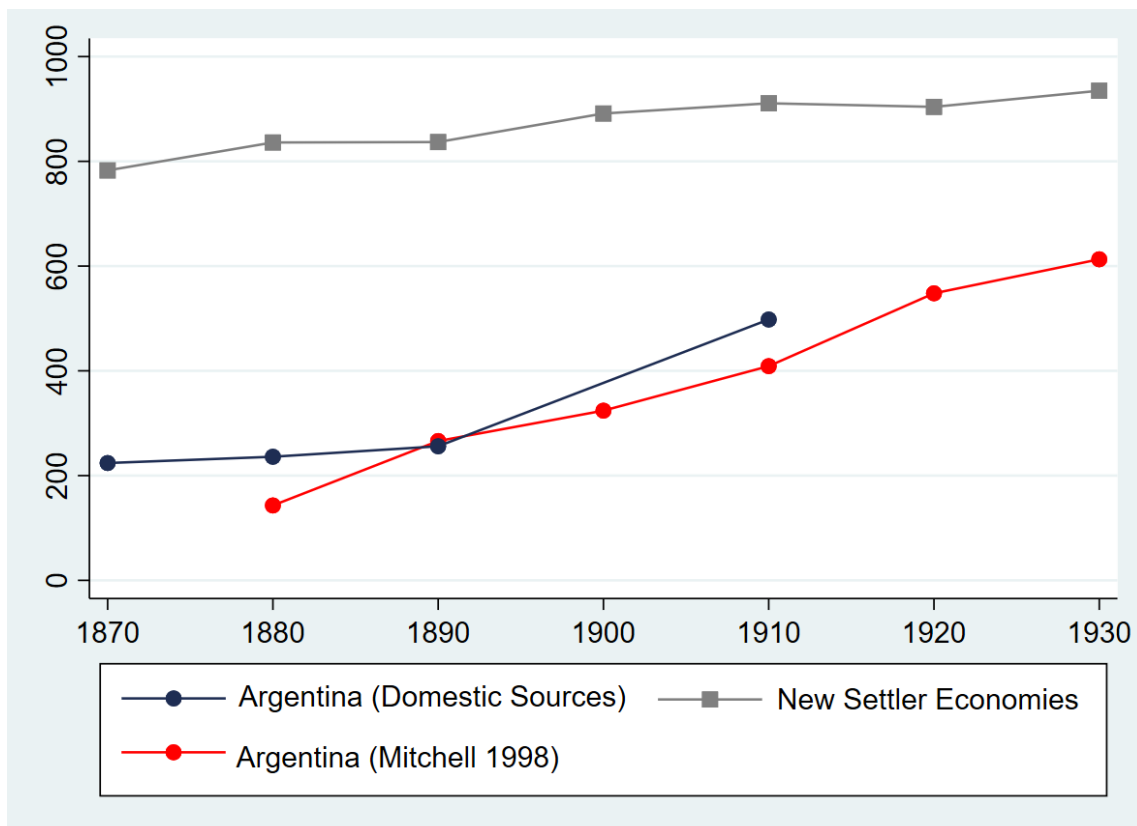
But the average proportion of schools provided by the central government in the provinces did not increase over the period. In the same way, there is no evidence that National subsidies have increased at the end of the period. Then, provinces were the main providers of primary education throughout the period. However, it is worth noting that the laws that intended to strengthen the primary education system required the provinces to maintain negotiations with the central government.

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<sup>10</sup> See for example Moya (1998), Devoto (2003), or Sánchez Alonso (2010)

Figure 2.3 refers to Mitchell (2007) and to domestic information corresponding to the national censuses due the latter offer a somewhat different picture. In particular, the figure adds the enrollment data in primary school for Argentina corresponding to the *Memoria del Ministerio de Justicia e Instrucción Pública* (1872); General Education Census (1883; 1909); and National Population Census (1895). Both series - Mitchel (2007) and the one generated by adding domestic sources - suggest a significant increase in primary schooling enrollment rates for Argentina but at different points in time. According to domestic sources, educational progress in the Argentine primary school took a leap in the first decade of the 1900s, while according to the Mitchell series (2003) the rise in primary education enrollment was continuous. This distinction is important for the analysis since after 1905, with the Láinez Act, an important centralization of the budgets for primary schooling took place. This does not necessarily imply that local conditions lost all their role in explaining primary education indicators, but it can be assured that if they had any influence, it would had begun to be less direct.

**Figure 2.3: Number of students enrolled in primary school per 1,000 children between 5 and 14 years of age.**



Source: Own elaboration based on Mitchell (2007), *Memoria del Ministerio de Justicia e Instrucción Pública* (1872); General Education Census (1883; 1909); and National Population Census (1895).

### 2.3.3. The evolution of regional differences in primary schooling

Although unevenly, the levels of primary education rose during the analyzed period. This tendency towards convergence in the levels of primary education was the result of a process of increasing intervention by the central government nuanced by the hegemony of Buenos Aires - and to a lesser extent of the rest of the Litoral or Pampean Region -, and it took place due to a particular configuration of the budget. The configuration of primary education budget was mainly based on a combination of three key aspects: 1) national and provincial budgets in primary education were early isolated from the rest of the items; 2) provincial education budgets were the most important source of financing of primary schooling during the period and were formed mainly by direct taxes, which were not sacrificed after the Nation took over the provincial debts in 1889; and 3) a constant monitoring by the central government on the provincial budgets to endow them with resources through the National Subsidies Act first and through the Láinez Act later.

Table 2.1 shows enrollment rates - expressed in % - for the 14 provinces that initially made up the national territory in various years throughout the period 1870-1914 for which information is available.<sup>11</sup> According to domestic sources, the enrollment rate in primary education doubled between 1872 and 1914 in Argentina. In addition, a strong convergence process can be detected: the coefficient of variation of school enrollment among the 14 provinces went from being 50% to 13% at the end of the period. This means that the provinces with the lowest initial coverage (located in greater proportion in the Central and Northern regions) presented a more significant improvement than the rest. It should be noted at this point that those provinces with the best primary school enrollment indicators did not necessarily constitute the most dynamic economies in the country. Although Buenos Aires and Santa Fé belong to the Pampean Region - that led the strong economic growth of those years -, and that they had the highest primary school enrollment rates in 1872 and/or 1883, it is also true that the Andean region, much less dynamic, also presented a relative good educational performance.

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<sup>11</sup> The National Territories, the Federal Capital and the Martín García Island were excluded from the analysis because they were exclusively founded by the national government.

**Table 2.1: Primary school enrollment rate, by province**

	Primary school enrollment rate (in %)				
	1872	1883	1895	1909	1914
<b>National Average</b>	22.4	23.6	25.6	49.8	44
<b>Coef. of Variation</b>	50%	26%	34%	13%	13%
<i>Litoral Region</i>					
<b>Buenos Aires</b>	27	30.5	31	50.3	42.9
<b>Corrientes</b>	13.4	22.3	16.1	46.5	42
<b>Entre Ríos</b>	13.8	19.6	24.5	52.4	38.6
<b>Santa Fé</b>	18.2	30.4	26.9	50.2	44.3
<i>Center Region</i>					
<b>Córdoba</b>	8.3	16.7	20.8	44.9	40
<b>San Luis</b>	23.2	24.4	24.8	47.9	53.5
<b>Santiago</b>	10.7	6.9	13.4	38.1	37.9
<i>Andean Region</i>					
<b>Catamarca</b>	32.9	17	27.3	50.8	56.8
<b>La Rioja</b>	28.7	24.1	19.3	48.6	50.6
<b>Mendoza</b>	41.1	26.6	31.7	55.8	45.3
<b>San Juan</b>	44.9	26.1	50	67.1	50.3
<i>Northwestern Region</i>					
<b>Jujuy</b>	15.3	18.2	22.1	53.4	43.7
<b>Salta</b>	16.9	21.1	20.3	50	43.8
<b>Tucumán</b>	19.8	19.3	24.5	54.9	50.3

Sources: Memoria del Ministerio de Justicia e Instrucción Pública (1872); General Education Census (1883; 1909); National Population Census (1895, 1914).

A second aspect to highlight from Table 2.1 is that the growth in enrollment rates and the aforementioned convergence were not consistent until after the turn of the century. In a second sub-period, taking 1895 as the baseline year, it can be seen that the Northern and Central provinces grew more than the Andean or Litoral provinces, either measuring the final year as 1909 or as 1914.

Table 2.2 shows the distribution of expenditures on primary education (measured in 1909 National \$) by province and for the Nation throughout the period 1872-1909. On average, these expenditures tripled. In terms of this variable, convergence is already observed from the first sub-period: the coefficient of variation fell 20 percentage points (33%) between 1872 and 1895. The latter occurred because the provinces of the Central and Northern regions increased their efforts more than those of the Andean and Litoral regions. In the second sub-period, while expenditures in the Center and the North continued to increase, it rose even more on the Litoral.

**Table 2.2: Expenditures per school-aged child, by province**

	Expenditures per school-age child (in 1909 national currency \$)			
	1872	1883	1895	1909
<b>National Average</b>	5.1	8.9	10.1	14.6
<b>Coef. of Variation</b>	61%	58%	41%	57%
<i>Litoral Region</i>				
<b>Buenos Aires</b>	12.1	19.7	17	26.4
<b>Corrientes</b>	5	7.1	5.2	5.6
<b>Entre Ríos</b>	5	2.8	6.8	15.3
<b>Santa Fé</b>	10.5	6.8	11.6	8.6
<i>Center Region</i>				
<b>Córdoba</b>	1.3	2.7	4.8	9.8
<b>San Luis</b>	3.6	7.5	6.1	7
<b>Santiago</b>	1.4	1.5	4.1	8.8
<i>Andean Region</i>				
<b>Catamarca</b>	2.8	3.3	5.6	23
<b>La Rioja</b>	4.4	6	3.6	1.4
<b>Mendoza</b>	7.4	11.1	15.1	8.5
<b>San Juan</b>	5.2	6.3	10.7	4.9
<i>Northwestern Region</i>				
<b>Jujuy</b>	5.9	6.5	6.9	28
<b>Salta</b>	3.2	15.3	10.3	2.1
<b>Tucumán</b>	3.6	2.5	7.2	14.5

Sources: Memoria del Ministerio de Justicia e Instrucción Pública (1872); General Education Census (1883; 1909); National Population Census (1895, 1914).

Note: for the homogenization of the currencies in constant 1909 national currency \$, the price series of Cortés Conde (1979) was used.

Despite the strong process of convergence in the enrollment rate - much lower in the case of primary education expenditures -, spatial disparities in primary education indicators among different regions were similar to those of the less advanced economies such as Brazil, Russia, India or China (Table 2.3).<sup>12</sup>

**Table 2.3: Variation in primary schooling indicators c. 1910**

<i>Country</i>	Primary school attendance rate (in %)		Expenditures per school-age child (in US\$ 2010)	
	Average	CV	Average	CV
Argentina	43.3%	33%	4.6	82%
Brazil	11.9%	50%	1.32	89%
European Russia	19.3%	30%	2.8	69%
British India	7.8%	50%	0.1	72%
China	4%	30%	0.16	65%

Sources: Chaudhary et al. (2011), General Census of Education in the Argentine Republic (1909) and MOxLAD.  
Note: expenditures are measured in US\$ ca. 2010. For the Argentine case, it corresponds to 1909.

In summary, although the Argentine primary education system underwent a process of convergence in the period 1870-1914, it was limited in scope, so that by the early years of the 20th century spatial differences were still considerably large. This chapter explores whether the different levels of wealth inequality at the local level had any incidence on the heterogeneity present in the educational levels of the country.

## 2.4. The model and the data

To assess how inequality affected - if it did - primary education, the following model is estimated:

$$educ_i = \beta ineq_i + \gamma X'_i + \varepsilon_i$$

where  $educ_i$  refers to some outcome variable associated with primary education in 1883, 1895, 1909, or 1914 (literacy rate, attendance rate, number of schools per 1,000 school-age children, and number

<sup>12</sup> The coefficients of variation of Table 2.3 for the case of Argentina differ from those of tables 2.1 and 2.2 because they were calculated on the basis of departments, not provinces.

of teachers per 1,000 school-age children), and  $ineq_i$  is the variable associated with the wealth Gini in some department  $i$  of the 6 Argentine provinces considered.<sup>13</sup>  $\epsilon_i$  is the error term and  $X'_i$  is a vector of covariates used to control for a set of factors that could affect the identification strategy. In particular, this set of variables captures other dimensions of the supply and demand for primary education that could also affect inequality or at least be linked to it. Among them, population density might be a potential driver for schooling demand. The department's altitude - measured in meters above sea level - and the minimum distance to the port of the city of Buenos Aires are included to capture access to markets. Finally, a land quality index aims to approximate a likely wealth effect.<sup>14</sup>

*Sources on primary education indicators at departmental level in Argentina*

- First School Census of the Argentine Republic. It was carried out between December 1883 and January 1884. This census provides a systematic count about the population characterized as schooling children, that is, boys and girls between 5 and 14 years of age, and of the characteristics of the schools. It identifies variables such as literacy, attendance, number of schools, teachers, school expenditures, and types of schools (national, provincial, local, religious, and private).
- Second Census of the Population of the Argentine Republic, corresponding to the year 1895. This census is not specifically a school census and, consequently, its scope is limited. It only provides information on literacy and attendance of the population between 5 and 14 years of age.
- Second School Census of the Argentine Republic. It was carried out in 1909. This census provides a systematic count of the population characterized as schooling children, that is, boys and girls between 5 and 14 years of age, and of the characteristics of the schools. It identifies variables such as literacy, attendance, number of schools, teachers, school expenditures, and types of schools (national, provincial, local, religious, and private).

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<sup>13</sup> Buenos Aires, Santa Fé, Mendoza, Tucumán, Salta, and Jujuy.

<sup>14</sup> The methodology applied to generate Land Quality Index by department is explained in Appendix 2.A.



- Third Population Census of the Argentine Republic, corresponding to the year 1914. This census is not specifically a school census and, consequently, its scope is limited. It only provides information on literacy and attendance of the population between 5 and 14 years of age.

*Sources and methodology for measuring inequality at the local level in Argentina.*

Due to the availability and to the sources' degree of reliability, the quantification of welfare at the local level is currently a difficult task in developing economies, a group to which Argentina belongs. The difficulties to achieve robust estimations of welfare distribution are obviously accentuated to study these phenomena in the past. However, and with limited scope, some indicators have been built within the historiography. Next, these indicators along with sources that make it possible to generate other indicators will be mentioned below.

An important methodological discussion concerns the measure of well-being on which to inquire into the distribution: income or wealth. Although both distributions are correlated, wealth, being a stock, tends to reflect more accurately the structural side of the distribution, while the degree of income concentration is more sensitive to the economic juncture. The available sources only provide information on wealth inequality at departmental level.<sup>15</sup>

The sources available for quantifying wealth inequality at the local level are<sup>16</sup> :

- 1) Wealth Ginis by department for a series of provinces in the period 1860-1870, calculated in Gelman (2011), from *Contribución Directa* data. These estimations arise from a collective project to measure the distribution of personal assets from the payment of a property tax on land and other assets. This tax was levied by the province but local governments also participated in its collection. In particular, the *Contribución Directa* was of great relevance for the allocation of budgets for primary education. Unfortunately, of the 14 provinces already

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<sup>15</sup> For methodological discussions on available sources see Alvarez (2011) and Santilli (2021).

<sup>16</sup> It could also have been measured with inventories, but the amount available at departmental level is insufficient to generate a representative sample.

established during the relevant period of this thesis, only 6 have Gini coefficients estimated at departmental level for a total of 152 observations.

- 2) Farm size distribution by department/partido for all provinces and territories in 1914 can be estimated from the Third National Population census. This indicator does not take into account neither land value nor farm ownership. This last fact is important due to the non-negligible presence of settlers in the historiography of the Pampean economy of the period. The second important limitation for the use of this indicator is its temporality subsequent to most of the analyzed data.
- 3) Percentage of owners over the total number of farms and percentage of owners over the total number of potential owners - the latter measured as the total population aged 14 years and older -. These data come from population censuses of 1895 and 1914 and correspond, consequently, to those years.

For this research, the relevant measure to use in order to identify wealth inequality is the Wealth Gini estimated from the *Contribución Directa* records, reported in Gelman (2011). Note that these Ginis were estimated for the 1860s decade, that is, prior to the years in which the primary schooling indicators are measured. The reason for this choice lies in the fact that these Ginis attempt to capture the variation in inequality that is structural - as opposed to market - at the departmental level. In the words of Easterly (2007): “*Structural inequality reflects such historical events as conquest, colonization, slavery, and land distribution by the state or colonial power; it creates elite by means of these non-market mechanisms. Market forces also lead to inequality, but just because success in free markets is always very uneven across different individuals, cities, regions, firms, and industries*” (Easterly, 2007: 756). Important to the argument, Latin America has been characterized by this kind of inequality (Gasparini and Lustig, 2011 and Morley, 2001). Engerman and Sokoloff (2002) hold that inequality persists because government policies and other institutions reproduce it through time. In extremely unequal societies, elites are able to establish a legal framework that benefits their

political power and maintains their advantage by hampering public policies that promote development.

Moreover, the correlation coefficient between the Wealth Gini in the 1860s and 1914 farm size Gini is 0.1952 and statistically significant (with a *p-value* of 0.01), thereby implying a certain degree of stability in spatial variation. In addition, Santilli (2016) suggests that farm size distribution did not vary in the province of Buenos Aires in the period throughout the first three national population censuses (1869 and 1914). His argument is supported by data from Cortés Conde (1979) and Adelman (1994). From cadastre data, Cortés Conde (1979) analyzes the evolution of farm size distribution in 3 districts of the province of Buenos Aires at 3 points in time (1864, 1890 and 1920). On the other hand, Adelman (1994) uses a sample of census forms to study the distribution of land size in 1895 for 3 zones comprising 12 districts of the province of Buenos Aires.

Last, notice that local estimations of inequality, in contrast to cross-country studies, might have less measurement errors since they belong to the same surveys. Poor data quality on inequality comes from different methodologies across countries' surveys: individual vs. households, income vs. expenditure, pre-tax vs post-tax, or national vs. urban (Deininger and Squire, 1996, 1998; Atkinson and Brandolini, 2001).

## **2.5. Descriptive statistics**

Table 2.4 shows descriptive statistics of the main educational variables to be used as dependent variables in the regressions to test the influence of inequality in the allocation of primary education in six Argentine provinces for which wealth inequality data are recorded at the departmental level: Buenos Aires, Santa Fé, Mendoza, Tucumán, Salta and Jujuy.

All primary education indicators at the department level for these six provinces increased by the turn of the century. In the case of literacy and attendance, changes were not observed until the beginning of the 20th century. Moreover, for these two indicators, the available information suggests a

certain setback in 1914 compared to 1909, which may be the result of different methodologies in data compilation or, as historiography suggests, of advances and setbacks experienced in the primary education system during the period under study (Tedesco, 2003).

**Table 2.4: Primary education indicators for six Argentine provinces (1883-1914)**

<i>Primary education indicator</i>		1883	1895	1909	1914
<b><i>Literacy rate (in %)</i></b>	average	34.6	40.6	51.7	46.0
	standard deviation	15.1	17.7	12.3	12.5
	# observations	183	211	213	213
<b><i>Attendance rate (in %)</i></b>	average	28.0	25.7	47.4	46.2
	standard deviation	15.2	13.0	12.0	14.9
	# observations	183	211	213	213
<b><i>Expenditures per school-age child (in 1909 national currency \$)</i></b>	average	0.23	nd	0.98	nd
	standard deviation	0.83	nd	0.74	nd
	# observations	153	nd	211	nd
<b><i>Schools per 1,000 school-age children</i></b>	average	3.9	nd	5.1	nd
	standard deviation	1.9	nd	1.6	nd
	# observations	171	nd	211	nd
<b><i>Teachers per 1,000 school-age children</i></b>	average	5.9	nd	10.5	nd
	standard deviation	2.1	nd	2.0	nd
	# observations	171	nd	211	nd

Source: Own elaboration based on Education Censuses of 1883 and 1909 and National Population Censuses of 1895 and 1914.

Table 2.5 presents the linear correlation coefficients of the educational variables with inequality at departmental level, measured by the Gini estimated from the *Contribución Directa* tax in the period 1860-1870, for the six provinces mentioned above. The correlation between inequality and education outputs - literacy and primary school attendance rates - is negative and significant and remains relatively stable throughout the analyzed period. The lowest and least significant values for the coefficient appear only at the end of the period, indicating a negative but less robust correlation.

In the case of variables most closely linked to educational supply - expenditures, schools and teachers -, the negative and significant linear correlation with inequality is present at the beginning of

the period but disappears once the 20th century begins, probably due to the centralization process that the primary education budget experienced after 1905, when the Láinez Act was passed. In the case of primary education expenditures, the correlation is even weaker, probably suggesting that supply factors weighed less than demand factors.

**Table 2.5: Linear correlation coefficient of educational variables and inequality**

<i>Primary education indicator</i>		1883	1895	1909	1914
<b><i>Literacy rate among school-aged children (in %)</i></b>	coefficient	-0.2363***	-0.2321***	-0.1639**	-0.2575***
	#obs	143	152	152	152
<b><i>Attendance rate to primary school (in %)</i></b>	coefficient	-0.2885***	-0.2927***	-0.3070***	-0.0996
	#obs	143	152	152	152
<b><i>Expenditures per school-age child (in log)</i></b>	coefficient	-0.0939	n/d	0.415	n/d
	#obs	123		152	
<b><i>Schools per 1,000 school-age children (in log)</i></b>	coefficient	-0.2423***	n/d	0.0052	n/d
	#obs	138		152	
<b><i>Teachers per 1,000 school-age children (in log)</i></b>	coefficient	-0.1864**	n/d	-0.0204	n/d
	#obs	138		152	

Source: Own elaboration based on Gelman (2011), Education Censuses of 1883 and 1909 and National Population Censuses of 1895 and 1914.

One could speculate that the demand mechanisms persisted throughout the period while the supply side weakened among the channels through which wealth inequality might have affected primary education in early stages of the primary education system. Specifically, greater wealth concentration is likely to have initially affected the allocation of primary education via supply - elites hindering the provision of primary education - and through demand - majorities not finding their children's schooling and literacy useful -. Once the centralization process began, the supply mechanisms were weakened but not the demand channels, since the negative correlation persisted in the outputs: literacy and attendance.

## **2.6. Regressions**

### **2.6.1. Baseline regressions and results**

Tables 2.6 and 2.7 show baseline specifications for the model presented in section 2.4. The results suggest that inequality negatively affected both outputs and inputs of primary education in 1883. By 1909, once the centralization process had already begun, the effect of inequality was reduced in literacy and attendance rates, though it remained consistent. On the other hand, the statistical significance disappeared for the variables linked to educational inputs (teachers and schools). Therefore, it could be hypothesized that centralization reduced the power of local elites to hinder the literacy process of the masses, but that this power had a certain persistence or lag that manifested itself through a lower demand of the general population.

**Table 2.6: Baseline output regressions: literacy and attendance rates, 1883 and 1909**

	<i>Literacy rate (in %)</i>								<i>Attendance rate (in %)</i>							
	1883				1909				1883				1909			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Wealth Gini	-0.55*** (0.17)	-0.47*** (0.12)	-0.35** (0.15)	-0.42** (0.17)	-0.28** (0.13)	-0.19 (0.13)	-0.21* (0.13)	-0.23* (0.13)	-0.67*** (0.16)	-0.52*** (0.16)	-0.36** (0.17)	-0.43** (0.20)	-0.52*** (0.13)	-0.37** (0.16)	-0.35*** (0.15)	-0.37*** (0.14)
Population density		0.02 (0.02)	0.03 (0.02)	0.05* (0.03)		0.01 (0.01)	0.01 (0.01)	0.01 (0.01)		0.06* (0.04)	0.07* (0.04)	0.09* (0.05)		0.02*** (0.01)	0.01** (0.01)	0.02** (0.01)
Land Quality Index		-0.27* (0.17)	-0.32* (0.17)	-0.26 (0.18)		-0.03 (0.09)	-0.04 (0.09)	-0.00 (0.10)		-0.30* (0.19)	-0.39** (0.18)	-0.33* (0.18)		-0.15 (0.15)	-0.10 (0.13)	-0.07 (0.13)
Altitude (in logs) (m.a.s.l.)		1.23 (1.37)	2.52* (1.56)	-0.09 (1.29)		0.37 (0.99)	-0.04 (1.04)	-1.51 (0.88)		1.03 (1.56)	2.88* (1.68)	-0.00 (1.44)		0.82 (1.14)	-0.47 (1.32)	-2.19** (1.08)
Minimum distance to a railroad station				-0.04 (0.03)				-0.08 (0.06)				-0.04 (0.04)				-0.13* (0.07)
Distance to the port		-0.03*** (0.01)	-0.06*** (0.02)			-0.02*** (0.00)	-0.03*** (0.01)			-0.02*** (0.01)	-0.06*** (0.02)			-0.00 (0.01)	-0.03** (0.01)	
Provincial dummies	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.06	0.50	0.56	0.51	0.03	0.49	0.55	0.52	0.08	0.31	0.40	0.33	0.09	0.16	0.30	0.28
Observations	143	143	143	143	152	152	152	152	143	143	143	143	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported

**Table 2.7: Baseline input regressions: schools and teachers, 1883 and 1909**

	<i>Schools per 1,000 school-age children (in logs)</i>								<i>Teachers per 1,000 school-age children (in logs)</i>							
	1883				1909				1883				1909			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Wealth Gini	-0.02***	-0.02***	-0.02**	-0.02***	0.00	-0.00	-0.01	-0.01	-0.02***	-0.01*	-0.01	-0.01	-0.00	0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Population density		-0.00	-0.00	-0.00		-0.00**	-0.00***	-0.00***		0.00*	0.00*	0.00*		0.00**	0.00	0.00
		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
Land Quality Index		-0.02	-0.01	-0.01		0.00	0.01	0.01		-0.02	-0.02*	-0.02		-0.01	0.00	0.00
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)		(0.08)	(0.01)	(0.01)
Altitude (in logs) (m.a.s.l.)		0.06	0.04	-0.05		0.03	-0.08*	-0.12***		0.02	0.13	0.00		0.10*	-0.03	-0.09*
		(0.07)	(0.08)	(0.08)		(0.04)	(0.04)	(0.04)		(0.08)	(0.09)	(0.08)		(0.05)	(0.05)	(0.05)
Minimum distance to a railroad station				0.00				-0.00				-0.00				-0.00
				(0.00)				(0.00)				(0.00)				(0.00)
Distance to the port		-0.00*	-0.00***			-0.00**	-0.00**			-0.00**	-0.003***			-0.00***	-0.00*	
		(0.00)	(0.00)			(0.00)	(0.00)			(0.00)	(0.00)			(0.00)	(0.00)	
Provincial dummies	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Adj. R sq.	0.06	0.10	0.19	0.13	0.00	0.08	0.36	0.35	0.03	0.18	0.28	0.21	0.00	0.13	0.46	0.44
Observations	138	138	138	138	152	152	152	152	138	138	138	138	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported



## 2.6.2. Economic relevance and statistical significance

Table 2.8 describes the magnitude, based on the results, of the effect of inequality on educational outcomes. According to estimates, one standard deviation in wealth inequality (6.5 percentage points) reduced a) literacy and attendance rates in 1883 by a value between 0.15 and 0.24 and between 0.15 and 0.29 standard deviations, respectively; and b) literacy and attendance rates in 1909 between 0.12 and 0.21 and between 0.21 and 0.35 standard deviations, respectively. Therefore, these findings on inequality hindering the development of the primary education system in Argentina are statistically significant and, to a lower extent, economically relevant.

**Table 2.8: Economic significance. Effect of 1 standard deviation in the Gini Coefficient on the literacy rate and on the primary school attendance rate, years 1883 and 1909.**

Model	SD Gini	SD of Education Output	Gini Coefficient in the model	Change in the output of education in response to a 1 SD change in the Gini Coefficient	(4) to (2) Ratio
	(1)	(2)	(3)	(4)	(5)
<b>1883 Literacy</b>					
Table 2.6, col.1			-0.55	-3.60	-0.24
Table 2.6, col.2	6.55	15.18	-0.37	-2.42	-0.16
Table 2.6, col.3			-0.45	-2.95	-0.19
Table 2.6, col.4			-0.42	-2.75	-0.18
<b>1909 Literacy</b>					
Table 2.6, col.5			-0.28	-1.82	-0.17
Table 2.6, col.6	6.49	11.01	-0.19	-1.23	-0.11
Table 2.6, col.7			-0.21	-1.36	-0.12
Table 2.6, col.8			-0.23	-1.49	-0.14
<b>1883 Attendance</b>					
Table 2.6, col.9			-0.67	-4.39	-0.29
Table 2.6, col.10	6.55	15.29	-0.52	-3.41	-0.22
Table 2.6, col.11			-0.36	-2.36	-0.15
Table 2.6, col.12			-0.43	-2.82	-0.18
<b>1909 Attendance</b>					
Table 2.6, col.13			-0.52	-3.37	-0.31
Table 2.6, col.14	6.49	10.89	-0.37	-2.40	-0.22
Table 2.6, col.15			-0.35	-2.27	-0.21
Table 2.6, col.16			-0.37	-2.40	-0.22

### 2.6.3. Checking for demand mechanisms in 1909

The results of the regressions in Tables 2.6 and 2.7 suggest that inequality negatively affected the development of the primary education system in its origins, both via inputs and outputs. However, the ability of the elites to hinder the schooling of the masses almost disappeared by 1909, as can be seen from the loss of significance of the Wealth Gini coefficient in the regressions of schools and teachers (Table 2.7). The fact that inequality continued to affect educational outputs in 1909 is suggestive that certain demand mechanisms by which inequality slowed down the development of the primary schooling system would have persisted, even after the centralization process - when elites could no longer hinder financing and the most unequal departments had a population that was not interested in schooling -.

In order to identify the mechanisms through which inequality could have affected the demand for education in 1909, a series of variables that could have affected the demand for primary education at the same time being correlated with inequality are included in regressions.

First, the department's predominant production could have affected the demand for primary education through its incidence in child labor and, at the same time, have been correlated with the distribution of wealth. Specifically, agriculture, due to the fact that it was more intensive in the use of the labor factor than livestock, could also have been associated with a lower demand for primary education. For this reason, the percentage of productive land in agriculture, as opposed to that dedicated to livestock, is incorporated as a control variable. In this regard, Wegenast (2009) explores the relationship between the agricultural production system and educational attainment via its influence on land distribution.<sup>17</sup> Table 2.9 presents the results of 1909 attendance rate<sup>18</sup> regressions for various specifications and suggests that production would not have been a relevant factor in the demand for primary education since it hardly alters the incidence of inequality on education.<sup>19</sup>

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<sup>17</sup> For the available sample, the linear correlation coefficient between the share of agriculture in 1909 and the Gini of wealth is -0.10, significant at the 5% level. The scatterplot of this relationship is available in Figure 2.B.1 of Appendix 2.B.

<sup>18</sup> The results of these same specifications for the literacy rate regression in 1909 are available in Table 2.C.1 in Appendix 2.C.

<sup>19</sup> The agricultural participation variable was generated from data from the 1908 National Agricultural Census. The census is available at: <https://deje.mendoza.gov.ar/#!/censos-productivos/1908-censo-agropecuario-nacional-37> . Last date of consultation: February 4, 2023.

**Table 2.9: The effect of inequality in 1909 attendance rate. Controlling for agricultural share.<sup>20</sup>**

	Dependent variable: <i>1909 Attendance rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.52***	-0.49***	-0.59***	-0.56***	-0.37**	-0.37**	-0.35***	-0.35***
	(0.13)	(0.14)	(0.13)	(0.13)	(0.16)	(0.16)	(0.15)	(0.15)
<i>Agricultural share (in %)</i>		0.03		0.07		0.00		0.04
		(0.04)		(0.04)		(0.04)		(0.04)
<i>Population density</i>					0.02***	0.02***	0.01**	0.01*
					(0.01)	(0.01)	(0.01)	(0.01)
<i>Land Quality Index</i>					-0.15	-0.15	-0.10	-0.06
					(0.15)	(0.15)	(0.13)	(0.14)
<i>Altitude (m.a.s.l.)</i>					0.82	0.82	-0.47	-0.64
					(1.14)	(1.15)	(1.32)	(1.32)
<i>Distance to the port</i>					-0.00	-0.00	-0.03**	-0.03***
					(0.01)	(0.01)	(0.01)	(0.010)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.09	0.10	0.19	0.21	0.16	0.16	0.30	0.31
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported

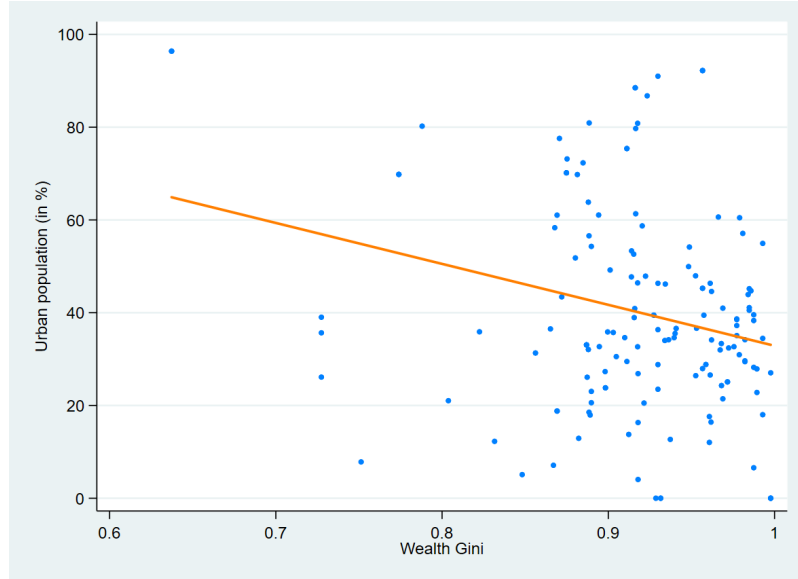
Second, urbanization could have been a channel through which inequality would have influenced the demand for education. In particular, as stated by Galiani et al. (2008) for the Argentine case, it is likely that the greater the degree of urbanization, the greater the demand for education. But also, a higher level of structural inequality might have contributed to a lower level of urbanization (Figure 2.4)<sup>21</sup>. Table 2.10 tests this hypothesis and shows that the degree of urbanization seems to have been an important factor in the demand for primary education. Moreover, when this variable is accounted for in the regressions, both the magnitude and significance of the Gini coefficient of wealth is lowered. However, it does not completely eliminate its effect, so there could have been other demand channels operating.<sup>22</sup>

<sup>20</sup> The variable Minimum distance to a railroad station has been excluded from specifications because Distance to the port had better adjustment in all baseline specifications.

<sup>21</sup> For the available sample, the linear correlation coefficient between the share of urban population in 1909 and the Gini of wealth is -0.20, significant at the 1% level.

<sup>22</sup> The results of these same specifications for the literacy rate regression in 1909 are available in Table 2.C.2 in Appendix 2.C.

**Figure 2.4: Wealth Gini and 1909 urbanization, departmental level**



**Table 2.10: The effect of inequality in 1909 attendance rate. Controlling for urbanization<sup>23</sup>**

	Dependent variable: <i>1909 Attendance rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.52*** (0.13)	-0.38*** (0.13)	-0.59*** (0.13)	-0.38*** (0.14)	-0.37** (0.16)	-0.32** (0.15)	-0.35*** (0.15)	-0.29** (0.14)
<i>Urbanization (in %)</i>		0.15*** (0.04)		0.22*** (0.04)		0.20*** (0.04)		0.20*** (0.04)
<i>Population density</i>					0.02*** (0.01)	0.01 (0.01)	0.01** (0.01)	-0.00 (0.01)
<i>Land Quality Index</i>					-0.15 (0.15)	-0.17 (0.14)	-0.10 (0.13)	-0.11 (0.12)
<i>Altitude (m.a.s.l.)</i>					0.82 (1.14)	1.83* (1.00)	-0.47 (1.32)	0.37 (1.03)
<i>Distance to the port</i>					-0.00 (0.01)	-0.00 (0.01)	-0.03** (0.01)	-0.03*** (0.01)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.09	0.18	0.19	0.34	0.16	0.25	0.30	0.40
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

<sup>23</sup> Departmental data on urbanization were obtained from the Third National Census of the Argentine Republic and, consequently, correspond to the year 1914. This census is available at: <https://deie.mendoza.gov.ar/#!/censos-nacionales-de-poblacion/1914-tercer-censo-nacional-38> . Last date of consultation: February 4, 2023.

Finally, a variable through which inequality could have affected the demand for education is the percentage of the European population. Traditional historiography has pointed to the relatively higher human capital of the European immigrant population (Cortés Conde, 1979), although this has been refuted from the most current historiography (Djenderedjian, Bearzotti, and Martirén, 2010; Moya, 1998; Sánchez Alonso, 2010). The idea behind this hypothesis is that European immigrants, with a relatively higher level of human capital, also had a higher demand for schooling. In a recent paper, Droller (2018) finds positive effects of the mass immigration era on Argentinian long-run development. However, Sánchez Alonso (2019) argues that the research does not contemplate all the complexities and nuances of the Argentine case in the era of mass immigration. Although the author acknowledges that immigration meant a demand mechanism for education, she also suggests that Argentine immigration policy was much less restrictive in terms of human capital than that of the rest of Latin America, and that the heterogeneity in the degree of success of the various nationalities was carried out according to different settlement patterns and different levels of human capital.

Given that in this period the European immigration flows reached a peak (Vázquez Presedo, 1976: vol. III, p.17) and that the location of the immigrants was not random, it is also worth testing this hypothesis as a mechanism. Table 2.11 presents the results of these regressions and suggests that the pattern of settlement of European immigration in relatively more egalitarian areas<sup>24</sup> would have reduced the negative effects of inequality on the demand for education in a certain degree.<sup>25</sup>

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<sup>24</sup> For the available sample, the linear correlation coefficient between the share of the European population in 1909 and the Gini of wealth is -0.24, significant at the 1% level. The scatterplot of this relationship is available in Figure 2.B.2 of Appendix 2.B.

<sup>25</sup> The results of these same specifications for the literacy rate regression in 1909 are available in Table 2.C.3 in Appendix 2.C.

**Table 2.11: The effect of inequality in 1909 attendance rate.  
Controlling for the percentage of the European population.<sup>26</sup>**

	Dependent variable: <i>1909 Attendance rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.52*** (0.13)	-0.50*** (0.13)	-0.59*** (0.13)	-0.47*** (0.14)	-0.37** (0.16)	-0.36** (0.16)	-0.35*** (0.15)	-0.29* (0.15)
<i>Europeans share (in %)</i>		0.03 (0.07)		0.35*** (0.10)		0.05 (0.01)		0.39*** (0.10)
<i>Population density</i>					0.02*** (0.01)	0.02*** (0.01)	0.01** (0.01)	0.00 (0.01)
<i>Land Quality Index</i>					-0.15 (0.15)	-0.13 (0.15)	-0.10 (0.13)	0.05 (0.12)
<i>Altitude (m.a.s.l.)</i>					0.82 (1.14)	0.84 (1.12)	-0.47 (1.32)	-1.47 (1.13)
<i>Distance to the port</i>					-0.00 (0.01)	-0.00 (0.01)	-0.03** (0.01)	-0.03** (0.01)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.09	0.18	0.19	0.27	0.16	0.16	0.30	0.37
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

## 2.7. Concluding Remarks

In the Argentine case, historiography points to the modernization process experienced by the national economy as the main determinant of the origin and development of the primary education system in its beginnings. Some authors suggest that elites had political motivations stemming from the consolidation process of the Argentine national State (Tedesco, 2003; Elis, 2011), or economic incentives (Galiani et al., 2008) to develop the school system. For other countries there is also a body of literature that highlights the modernization of economic activities and institutions as a trigger for the development of educational systems (see, for example, the work from Felipe González for the Chilean case quoted above).

<sup>26</sup> Departmental data on Europeans share were calculated from the Third National Census of the Argentine Republic and, consequently, correspond to the year 1914. This census is available at: <https://deie.mendoza.gov.ar/#!/censos-nacionales-de-poblacion/1914-tercer-censo-nacional-38> . Last date of consultation: February 4, 2023.

A recent body of research addresses the influence of institutions on development. This literature - which begins with the theoretical contributions of Acemoglu, Johnson, and Robinson (2001, 2005) and Engerman and Sokoloff (1997, 2002) - suggests that institutions present a certain degree of persistence, manifest themselves through inequality, and act on the processes of growth and development via the allocation of public goods. In particular, the authors suggest that political and economic institutions in a society can be extractive, linking this concept to the presence of elites that hinder the provision of public goods.

In line with this literature, this chapter explores the influence of inequality, linked to extractive institutions, in the origins and initial development of the Argentine primary education system. To do so, the relationship is explored at a departmental level in 6 provinces that were part of the national territory between 1884 and 1914. Using data from the national population, agricultural, and school censuses and the Gini of wealth estimated from the tax called *Contribución Directa*, it is found that inequality could have slowed down the development of the primary education system in its beginnings and that its influence has been weakened once the centralization of budgets for primary education began. Furthermore, these findings are not only statistically significant but economically relevant.

Finally, results suggest that the influence of inequality was manifested mainly via demand mechanisms and not so much by elites hindering the allocation of schooling. These findings endorse other empirical research addressing this relationship (Beltrán Tapia and Martínez-Galarraga, 2018; Cinnirella and Hornung, 2016). The main channels found are linked to the increased demand resulting from urbanization and, to a lesser extent, European immigration. This last channel might have affected different areas of the country in different ways because of the heterogeneity in settlement patterns among nationalities. Last, the productive structure does not seem to have affected the impact of inequality.

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## **Appendix Chapter 2**

### **Appendix 2.A.: Land Quality Index Methodology**

The formula for generating the Land Quality Index variable was taken from Brady and Weil (2008), and consists of an average of 5 top-soil properties: a) available water holding capacity, b) reference bulk density, c) the percentage of clay, d) the percentage of organic carbon; and e) the PH level. In particular, the different kinds of soils that the Harmonized World Soil Database provides were compiled for every geographic observation; that is, departments. Then, for each observation (department) an average of the five soil properties was computed. Finally, the average value calculated for each soil property in every observation has been normalized following Andrews et al. (2004). These authors propose scoring algorithms -that is, reference functions- for each indicator associated to a soil property. Whereas these authors provide the scoring algorithms of 12 soil indicators, the data only gives information on the 5 top soil properties mentioned above. Nevertheless, this index is comprehensive enough to represent land quality as the 5 properties it accounts - cover soil texture, structure, fertility, and chemical reaction or soil environment - can be considered the main land quality properties. Salinity, for example, is a very important property though it is absent in this index. However, this is not troublesome as it is usually closely correlated to the PH level.

## Appendix 2.B.: 1909 Demand channels and wealth inequality

Figure 2.B.1.: Wealth inequality and 1909 agricultural share (in %), departmental level

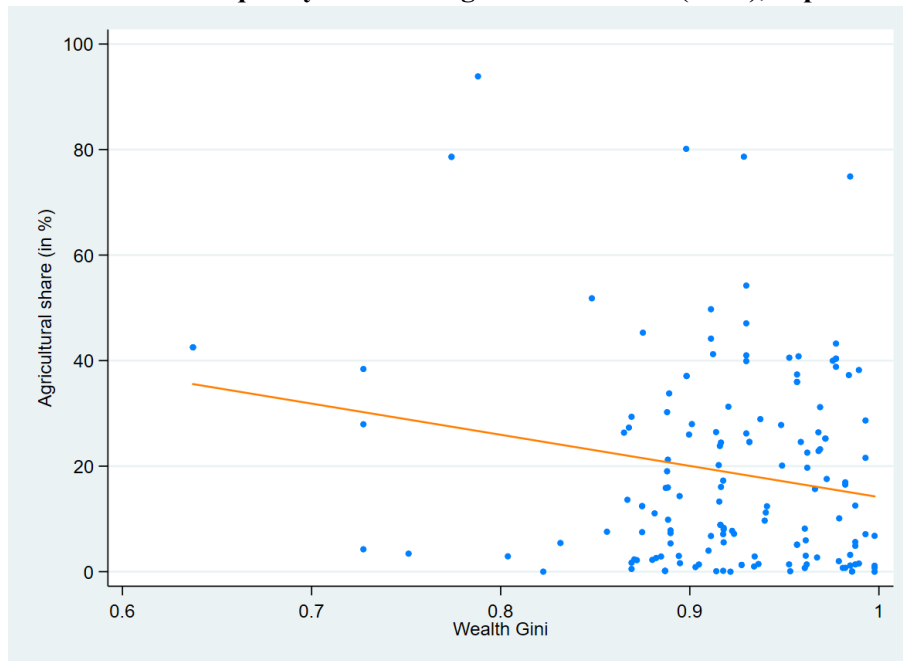
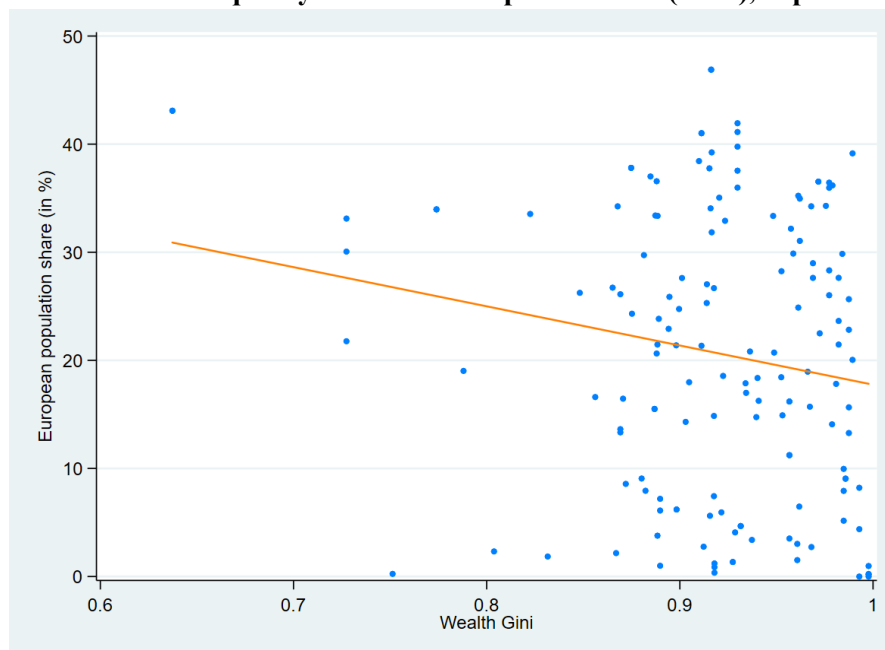


Figure 2.B.2.: Wealth inequality and 1909 Europeans' share (in %), departmental level





## Appendix 2.C.: Checking for demand mechanisms in 1909 literacy rate

**Table 2.C.1.: The effect of inequality in 1909 literacy rate. Controlling for agricultural share.**

	Dependent variable: <i>1909 Literacy rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.28**	-0.25*	-0.36***	-0.34***	-0.19	-0.18	-0.21*	-0.21
	(0.14)	(0.15)	(0.11)	(0.12)	(0.13)	(0.14)	(0.13)	(0.14)
<i>Agricultural share (in %)</i>		0.05		0.04		0.02		0.03
		(0.05)		(0.03)		(0.03)		(0.03)
<i>Population density</i>					0.01	0.01	0.01	0.00
					(0.01)	(0.01)	(0.01)	(0.01)
<i>Land Quality Index</i>					-0.03	-0.02	-0.04	-0.01
					(0.09)	(0.10)	(0.09)	(0.10)
<i>Altitude (m.a.s.l.)</i>					-0.37	-0.36	-0.04	-0.14
					(0.99)	(0.99)	(1.04)	(1.04)
<i>Distance to the port</i>					-0.02***	-0.02***	-0.03***	-0.03***
					(0.00)	(0.00)	(0.01)	(0.01)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.03	0.03	0.49	0.49	0.49	0.49	0.55	0.55
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported

**Table 2.C.2.: The effect of inequality in 1909 literacy rate. Controlling for urbanization**

	Dependent variable: <i>1909 Literacy rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.28**	-0.02	-0.36***	-0.19	-0.19	-0.14	-0.21*	-0.15
	(0.14)	(0.14)	(0.11)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
<i>Urbanization (in %)</i>		0.29***		0.17***		0.18***		0.18***
		(0.03)		(0.03)		(0.03)		(0.03)
<i>Population density</i>					0.01	-0.00	0.01	-0.01
					(0.01)	(0.01)	(0.01)	(0.01)
<i>Land Quality Index</i>					-0.03	-0.05	-0.04	-0.05
					(0.09)	(0.09)	(0.09)	(0.08)
<i>Altitude (m.a.s.l.)</i>					-0.37	0.60	-0.04	0.69
					(0.99)	(0.83)	(1.04)	(0.81)
<i>Distance to the port</i>					-0.02***	-0.02***	-0.03***	-0.03***
					(0.00)	(0.00)	(0.01)	(0.01)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.03	0.35	0.49	0.57	0.49	0.57	0.55	0.62
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

**Table 2.C.3.: The effect of inequality in 1909 literacy rate.  
Controlling for the percentage of the European population.**

	Dependent variable: <i>1909 Literacy rate (in %)</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Wealth Gini</i>	-0.28**	-0.10	-0.36***	-0.28**	-0.19	-0.16	-0.21*	-0.16
	(0.14)	(0.12)	(0.11)	(0.12)	(0.13)	(0.14)	(0.13)	(0.14)
<i>Europeans share (in %)</i>		0.47***		0.23***		0.15**		0.28***
		(0.06)		(0.07)		(0.07)		(0.08)
<i>Population density</i>					0.01	0.01	0.01	0.00
					(0.01)	(0.01)	(0.01)	(0.01)
<i>Land Quality Index</i>					-0.03	0.01	-0.04	0.07
					(0.09)	(0.10)	(0.09)	(0.09)
<i>Altitude (m.a.s.l.)</i>					-0.37	-0.23	-0.04	-0.74
					(0.99)	(0.89)	(1.04)	(0.94)
<i>Distance to the port</i>					-0.02***	-0.01***	-0.03***	-0.03***
					(0.00)	(0.00)	(0.01)	(0.01)
<i>Provincial dummies</i>	NO	NO	YES	YES	NO	NO	YES	YES
R sq.	0.03	0.33	0.49	0.52	0.49	0.51	0.55	0.58
Observations	152	152	152	152	152	152	152	152

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

## Appendix 2.D.: Descriptive statistics for control variables

**Tabla 2.D.1.: Descriptive statistics**

<i>Variable</i>	Period / Year	Mean	Standard Deviation	Min	Max	Obs
<i>Wealth Gini</i>	1860-1870	91.81	6.47	63.73	99.77	152
<i>Population density</i>	1883-1895	16.07	44.34	0.24	425.95	152
	1909-1914	39.07	126.65	0.29	752.19	152
<i>Land Quality Index</i>	-	60.38	6.82	49.29	87.73	152
<i>Altitude (m.a.s.l.)</i>	-	574.44	1050.45	4.13	4393.66	152
<i>Minimum distance to a railroad station (in km)</i>	1883-1895	14.63	40.30	0	374.03	152
	1909-1914	4.89	14.97	0	67.77	152
<i>Distance to the port (in km)</i>	-	425.15	377.42	7.67	1229.27	152
<i>Agricultural share (in %)</i>	1908-1909	18.97	19.38	0	93.86	152
<i>Urbanization (in %)</i>	1909-1914	40.09	22.38	0	96.39	152
<i>Europeans share (in %)</i>	1909-1914	20.71	13.13	0	46.89	152

## **Chapter 3: The impact of agricultural colonization on primary education. Santa Fé, 1887**

### **3.1. Introduction**

In the second half of the 19th century, Argentina experienced a spectacular process of economic growth as the result of its insertion in international trade through the exportation of agricultural products, becoming this way the *barn of the world*. This process meant a shift from a productive structure originally based on livestock specialization towards a more diversified productive structure which involved agriculture as a key aspect. Labor scarcity and the relative abundance of land, along with favorable international prices for grains and an active participation of the State, explain why a large part of this transformation was channeled through immigration and agricultural colonization.

During this period, the Pampean region became the main laboratory for agricultural colonization. The aims of increasing provincial tax revenues in Pampean provinces - due mainly by the loss of some trade taxes that used to be collected before unification took place -, relatively low

transportation costs, low population density and the presence of available land, made the provinces of this region prone to get involved in land settlement projects. The province of Santa Fé led this process.

In line with the literature emphasizing the effects of institutions on economic development (Acemoglu et al., 2001; Acemoglu et al., 2005; North, 1991), an extensive body of research has inquired into the role of public goods and human capital as mechanisms connecting both phenomena (Gennaioli et al., 2014; Glaeser et al., 2004; Acemoglu, Gallego, and Robinson, 2014; Banerjee and Iyer, 2005; among others). Moreover, some researchers have pointed to the twentieth century as the century of human capital to suggest the importance of investment in human capital as a key determinant of growth and development in the economies of the last century (Goldin and Katz, 2010).

Within this benchmark, the objective of this chapter is to explore the effects of agricultural colonization on primary education in the province of Santa Fé during the process of expansion of the agricultural frontier in the second half of the 19th century. Therefore, agricultural colonies in Santa Fé are thought of as a case study of egalitarian institutions that might have impacted on primary schooling provision. In order to assess the aforementioned relationship, data from the 1887 provincial census corresponding to 362 districts (communes and municipalities) that make up the province are used. The results of the OLS and ATE estimations suggest that the presence of colonies positively affected investment in human capital. In addition, several hypotheses are tested regarding the mechanisms by which the presence of colonies could have promoted the expansion of primary schooling. The results are as follows.

First, there is no evidence that the greater predominance of the population of European origin in Santa Fé colonies constituted a demand channel despite the fact that Europeans in the province had higher levels of human capital. In addition, despite the population of French origin does seem to have had a positive influence in primary education, its incidence can be considered negligible as its relative abundance was small (an average of 2% of the population).

Second, while traditional historiography argues that the colonies represented ethnically homogeneous communities, recent research among historians and statistical evidence in this chapter

suggest that these settlements were relatively diverse in terms of the nationalities residing in them. In addition, estimations' results point to the relative high heterogeneity in terms of nationalities as part of the explanation regarding the relative success of colonies' primary education indicators. This finding also contributes to the social sciences' debate on the degree of cultural heterogeneity as a channel of public goods provision.

Third, given that the colonies represented relatively egalitarian distributions of ownership, the hypothesis that (in)equality measured as the proportion of owners could have been part of the explanation is also assessed. The results of these tests suggest that the relatively high proportion of owners among the colonies propelled primary schooling. This finding is consistent with much of the evidence published, such as Banerjee and Iyer (2005), Galor, Moav and Vollrath (2009), Cinnirella and Hornung (2016), and Beltrán Tapia and Martínez Galarraga ( 2018), among others.

Finally, there is the possibility that agricultural colonization - as opposed to the rest of the districts where the traditional cattle ranch predominated - may have fostered a commercialization chain promoted by its relationship with international trade and thus urban concentration that implied a greater demand for human capital. In accordance with recent research on the effects of colonies (González, 2020; Rocha, Ferraz, and Soares, 2017), the results of the specifications suggest that this might have been the case.

The structure of the chapter is as follows. Section 2 discusses the main theoretical and empirical contributions of the literature relevant to this research. Section 3 analyzes the historical context in which the agricultural colonies of the province of Santa Fé were created and evolved during the second half of the 19th century. Section 4 presents the data and descriptive statistics that guide the estimates made in section 5. Section 6 concludes.

### 3.2. Literature review

Institutions and their effects on economic conditions have become a key topic in economic history as linked to past and present economic outcomes (Acemoglu et al., 2001; Acemoglu et al., 2005; Angeles and Elizalde, 2016; Bértola et al., 2010; Engerman and Sokoloff, 2000; Gennaioli and Rainer, 2007; Maloney and Valencia Caicedo, 2016; North, 1991). Specifically, there is much written about how coercive institutions (generally forced labor institutions), as extractive, shaped contemporary and future economic development. In this line, the works of Banerjee and Iyer (2005), Dell (2009), Cinnirella and Hornung (2016), Nunn (2007), Buggle and Nafziger (2021), among others, are notable.

But the economic effects of institutions can also be positive. Most of these works are focused on the missions or religious orders during colonization that had among their objectives the literacy of the aboriginal population. Thus, Valencia Caicedo (2019) reports the positive and persistent consequences for the economic development of the Jesuit missions in the Guarani communities established in what would today be Paraguayan, Argentine and Brazilian territory. The transmission of human capital via literacy was the basis of the Jesuit missions and, consequently, the argument of this author regarding the positive influence of this institution. This literature extends to other parts of the globe. Thus, Gallego and Woodberry (2010) and Nunn (2014) show a positive effect on educational attainment of Protestant missions in Africa. For India, Mantovanelli (2014) and Castello-Climent, Chaudhary, and Mukhopadhyay (2015) document a positive effect of missions on Indian literacy and tertiary education.

Specifically on the cases of agricultural colonies, the studies made by de Carvalho Filho and Monasterio (2012) and Rocha, Ferraz, and Soares (2017) for the case of Brazil stand out. The former find that municipalities closer to the original sites of nineteenth century government sponsored settlements (*colônias*) have more egalitarian landholdings and higher initial human capital. Their findings also suggest that more egalitarian land distribution played a more important role than higher initial human capital in achieving the good future outcomes associated with closeness to a *colônia*.



With a more sophisticated empirical strategy, Rocha, Ferraz, and Soares (2017) find that immediately after the initial establishment of the settlements, state-sponsored settlements areas had populations with literacy rates 8 percentage points higher than elsewhere, despite having only marginally higher shares of immigrants. Their evidence suggests that local communities that developed from historical settlements demanded higher educational investments.

Within this literature, various mechanisms are proposed by which institutions would have affected economic results in general and the allocation of public goods in particular. Among the most explored mechanisms are inequality as a proxy for institutional arrangements, the relative level of human capital of different communities, the degree of ethnic homogeneity that in principle could facilitate collective action, as well as urbanization or agglomeration as a reflection of the degree of modernization of economic activities.

In relation to inequality, the study of de Carvalho Filho and Monasterio (2012) is particularly important. The authors find that the land grants have generated a more equitable distribution of land property and 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. These results are in line with most of the works in this literature, such as the studies by Engerman and Sokoloff (2002), Galor, Moav, and Vollrath (2009), Banerjee and Iyer (2005), Beltrán Tapia and Martínez Galarraga (2018), or Cinnirella and Hornung (2016).

Another body of relevant studies for this research are the works that investigate the relatively high level of human capital by the immigrant population of European origin as a determinant. For the case of Brazil the evidence suggests that local communities that developed from historical settlements demanded higher educational investments and, through time, shifted economic activity to skill-intensive sectors. The pattern they uncover is consistent with the idea that state-sponsored settlements brought more skilled foreigners—along educational and possibly other unobservable

dimensions—to localities (de Carvalho Filho and Monasterio, 2012; Rocha, Ferraz, and Soares, 2017). The same results are found by González (2020) for the Chilean case.

Droller (2018) shows that Argentinian departments with historically higher shares of European immigrants during the mass immigration stage (1880-1930) had higher per capita GDP and a greater proportion of skilled workers in 2001. This long-run effect is linked to the higher level of human capital of immigrants and to the fact that Europeans also provided skilled labor for industry and services. However, as stated by Sánchez Alonso (2019), the era of mass immigration in the Argentine case was much more complex. Although Sánchez Alonso acknowledges that immigration pushed the Argentine government to invest in education, she also suggests that Argentine immigration policy was much less restrictive than that of the rest of Latin America and that the heterogeneity in the degree of success of the various nationalities was carried out according to different settlement patterns and different levels of human capital.

Regarding the degree of homogeneity between the nationalities of migrants, there has been a longstanding consensus in the social sciences that heterogeneity – ethnic, linguistic, religious, genetic, or social – undermines public goods provision and weakens overall economic performance because it hampers collective action. In this setting, cooperative norms do not apply to all, as weak social ties prevent the identification and punishment of uncooperative individuals. Within this literature, the studies from Alesina, Baqir, and Easterly (1999), Miguel and Gugerty (2005), Ashraf and Galor (2013), and Baldwin and Huber (2010) are notable.

More recent publications within this literature suggest the opposite of the works mentioned above. Thus, Charnysh (2019), Dincecco, (2017), or Besley and Persson (2014) find that greater heterogeneity among the migrant population can increase the provision of public goods and promote better economic results. The argument rests on the fact that the greater the heterogeneity, the lower the probability of creating norms of informal cooperation, and individuals' willingness to engage with the state -a potential third-party enforcer of cooperation- increases.

Finally, González (2020) shows that the arrival of skilled European immigrants to Chile increased the human capital of the natives not due to an increase in the provision of public goods but rather through a growing modernization of local economic activities. Similarly, Rocha, Ferraz and Soares (2017) link the better education results of Brazilian colonies to a process of modernization. While these authors focus on the demand effects of the modernization process, Montalbo (2020) argues that the development of industrial activities in France in the first half of the 19th century promoted primary schooling not through a demand channel but through a supply channel via an income effect.

### **3.3. Historical Background**

During the second half of the 19th century there was a spectacular process of creation of agricultural colonies. The settlement projects in the Pampean lands of the 19th century were carried out with the aim of populating the territory, increasing the value of the land and its profitability, and improving agriculture. The idea behind this purpose had its origin in the scarcity of population faced by the territory once most of the civil conflicts between the provinces of the Río de la Plata had ended. The few creoles or immigrant men who inhabited the country - representing the core of the economically active population - were mostly recruited in the wars against the indigenous population, between the provinces of the Confederation and Buenos Aires, and - once Buenos Aires joined the rest - in the war against Paraguay. In addition, the need to populate the country became increasingly important as Argentina's integration into world markets was consolidated alongside its modernization objectives.

In general, the creation of a colony consisted of bringing together a group of European families (in the first colonies the same nationality also predominated), providing them with land (evenly distributed in the "new community") and other facilities (such as tools and animals to work the land, housing and food, tax and military exemptions, and travel expenses to the colony), on the condition that the settlers would engage in agricultural activities and pay part of their earnings to the creator of the colony (often a company or a sub-national state) for a period of time (usually 5 years) after which they could become owners. The only feature that remained stable in the colonies was the uniform

distribution of farms. Otherwise, various contingencies caused the colonies to have considerable variability in terms of homogeneity in nationalities, levels of human and physical capital, and land ownership.

Sternberg (1972) describes in detail the rural settlement pattern of the humid Pampa:

*"From the very beginning the farm colonies were fitted into the landscape like geometric building blocks. The rectangular or square-shaped colonies were the prevalent arrangement of land subdivision. The level terrain posed no obstacles to these angular shapes, except where a river or provincial boundary served to provide the fourth enclosing side to the colony." (Sternberg, 1972: 69)*

While the central government provided the legal background to secure property rights and expanded the frontier through its "desert campaigns," subnational governments, along with private initiatives, were the main drivers of agricultural colonization. In most cases, the provincial government sold a piece of land for a low price to someone (usually a rancher, an entrepreneur or a company) and guaranteed tax and military exemptions for a period of time. The new owner was in charge of wire fencing, recruiting families and providing them with housing, food and the capital necessary to work the land.

However, land colonization in the 19th century did not take place in all provinces (Figure 3.1).<sup>27</sup> As Djenderedjian, Bearzotti and Martirén (2010) point out, provincial tax revenue targets (accentuated by the loss of some taxes that used to be collected before unification), relatively low transportation costs, low population density and the presence of available land, made some provinces prone to engage in land settlement projects. The northwestern provinces, for example, despite their low levels of fiscal capacity, did not have significant amounts of unpopulated areas, as they had played an active role under the Spanish Crown and land was already distributed. Moreover, this region and the Cuyo region in the west were more interested in the success of their agro-industries and did not face such high levels of labor shortages nor did they have the communication facilities that were present in the Pampean provinces.

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<sup>27</sup> The map of Argentina in Figure 3,1 was extracted from the "Historical Maps" section of the Ministry of Education website ([www.educ.ar/sitios/educar/recursos/ver?id=125215&referente=documentos](http://www.educ.ar/sitios/educar/recursos/ver?id=125215&referente=documentos)). Last date of consultation: January 30, 2023.

**Figure 3.1: Boundaries of Argentina and the provinces in 1895**



The provinces that most systematically applied these colonization projects during the second half of the 19th century were Santa Fé, Entre Ríos and Córdoba. Other provinces and the central government national territories also colonized part of their lands, but did so mainly during the 20th century. Despite the amount of land available, Buenos Aires was not part of these ventures, at least on a large scale, due to a higher population density, deeper cattle pressure on the land and its ideal natural conditions for expanding cattle ranching - the most profitable economic activity until at least the 1880s -. Table 3.1 shows the number of colonies per province or per national territory existing at the end of the 19th century according to the 2nd National Population Census of 1895.

**Table 3.1: Number of colonies by province or territory in 1895**

<i>Provinces and National Territories</i>	<i>Number of colonies</i>
Santa Fé	365
Entre Ríos	184
Córdoba	146
Corrientes	16
Santiago	4
Chaco	6
Formosa	6
Misiones	2
Chubut	2
Santa Cruz	1
Río Negro	3
Total	735

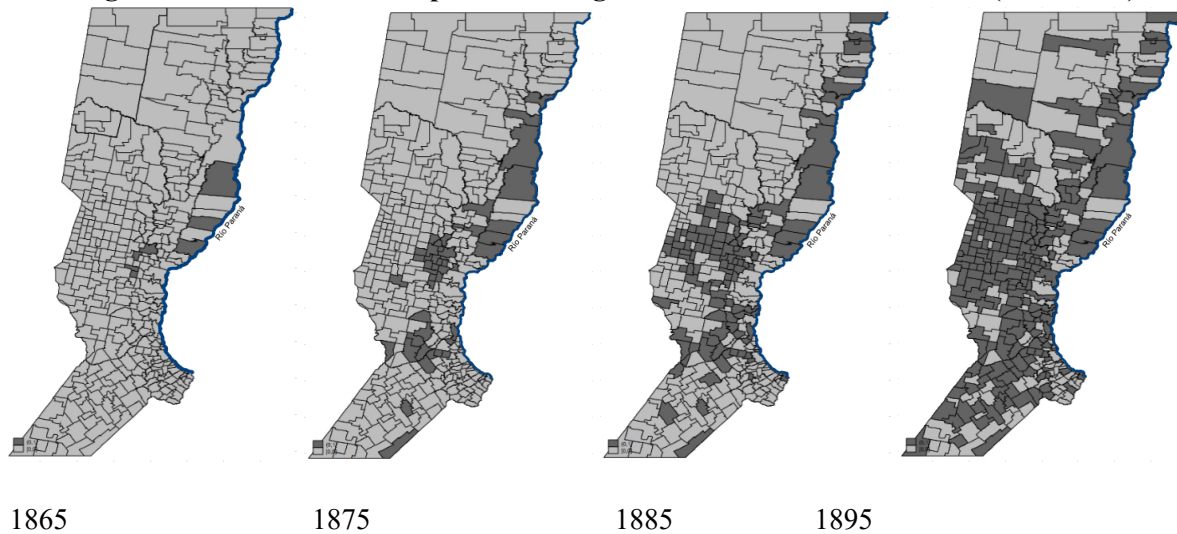
Source: Segundo Censo Nacional de la Población Argentina (1895). Tomo 2. Cap II. Cuadro VII i. p.660.

Colonies' location was initially determined by the proximity to a river and a greater propensity to concentrate in areas of unprofitable ranching, that is, where land was cheaper, such as in central Santa Fé, where higher temperatures made ranching difficult (Gallo, 1969). Success in the early colonies of the 1850s and early 1860s was difficult to achieve. The productive structure within these lands initially had a lot of variability and was dedicated to internal consumption. But with the Paraguayan War (1864-1870), there has been a transformation towards specialization in cereals. In particular, the mobilization of large numbers of men due to the conflict allowed the settlers of the initial colonies of Esperanza, San Carlos and San Gerónimo in Santa Fé, and San José in Entre Ríos, to face a strong increase in the demand for cereals that remained stable for a considerable amount of time. Thus, the war allowed them to learn for the first time the advantages of participating in wider consumer markets through agricultural specialization (Djenderedjian et al., 2010: 37).

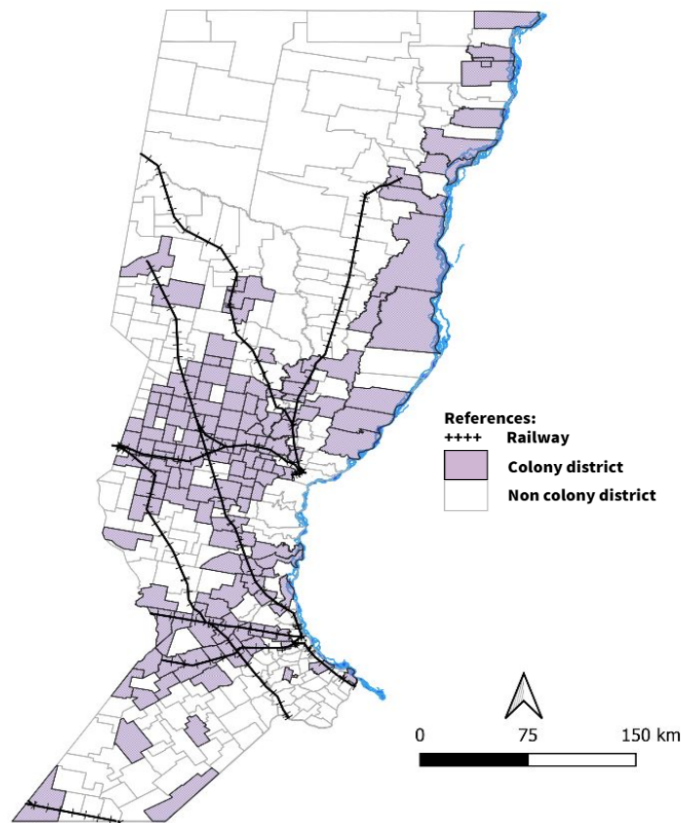
Once the business proved to be profitable, new initiatives began to proliferate. Many colonization companies were created during the 1870s. In addition, some colonists initiated new projects by taking advantage of their networks with potential new settlers in their home countries.

Although by 1880 there was still no general colonization plan, a location pattern can be identified based on proximity to the Paraná River (for the Santa Fé colonies). Figure 3.2 shows this colonization pattern for Santa Fé during the first decades. Beginning in the 1880s, proximity to railroads was added to proximity to rivers in determining the location of colonies. In fact, railroad companies began to demand portions of land on both sides of their railroad constructions to undertake their own colonization projects. In particular, Figure 3.3 shows how the presence of colonias was closely linked to the railroad network in 1887. By 1895, the south of the province, historically a cattle ranching land area, joined the colonization projects given its high profitability (Gallo, 1977). The price of land in northern Santa Fé was still low but its high temperatures made this land more suitable for other crops, such as flax. In fact, soil hydration was particularly important in this rain-dependent technological state.

**Figure 3.2: Evolution of the presence of agricultural colonies in Santa Fé (1865-1895).**



**Figure 3.3: Presence of agricultural colonies and railroad network in 1887.**



Immigration and colonization were closely associated. Since the 1850s, most of the immigrants arriving in the country were men.<sup>28</sup> Due to the type of economic development generated during the wool export cycle (1850-1880), cities (particularly the city of Buenos Aires) proved to be more attractive to these immigrants. As Jefferson (1926) states, in the 1870s "only one-sixth of the immigrants of that golden age of Argentine colonization settled in rural areas" (Jefferson, 1926: 98). Moreover, they did not necessarily arrive with a permanent status. Both their mobility within the country and their rate of return to their countries of origin were high. Consequently, and because during this period the country was still importing grains, the national authorities faced the opportunity to enhance agriculture by colonizing the land. Therefore, since the mid-1870s, colonization efforts took on an increasingly systematic character.

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<sup>28</sup> According to the 1st National Population Census (1869), 71.7% of the immigrants were male. In contrast, the male population among the natives represented 48.7% pp. 159-160.



Most of the "imported" families were northern Italians, Swiss and Germans. Despite being the second most important migratory flow of the period, Spaniards were not included in these projects, probably due to their previous arrival to the country. These different types of immigration based on nationality are the result of the particular context faced by each country of origin during those years. Thus, the *pogroms* and the existence of the Jewish Colonization Association meant that Russian Jews were an important community among the settlers. As a second example, Spanish land inheritance laws made individual immigration more feasible for this group (Moya, 1998: 30). But domestic prejudices regarding nationalities also influenced different patterns followed by colonization and general immigration. The idea was that Creoles and Spaniards had the same blood, and thus, were not good enough to cultivate the land, at least as much as the northern Europeans, who supposedly had more knowledge about agricultural tasks and were more willing to work. Although economic rationality prevailed over these prejudices over time, the early settlers created networks with their countries of origin that made the initial pattern persist until the end of the century.

The initial development of the colonies was characterized by an initial conquest of the domestic market and a progressive entry into the international market. According to Djenderedian, Bearzotti and Martirén (2010), this process was the result of important investments made by all the members of the business chain (colonial entrepreneurs, colonists, intermediaries and exporters), taking into account that both the international context (at least at the beginning) and the domestic context (due to the stability provided by the consolidation of the National Government, the climate of greater security of property rights in the provinces and the lowering of transportation costs), encouraged the acceleration of these investments.

Despite the shortcomings of any "new" commercial enterprise,<sup>29</sup> expansion also involved quantitative and qualitative improvements that were undertaken to meet international standards and some degree of uniformity among the colonies. More specifically, mills progressively increased their productivity, numerous research experiments in land and seeds quality were accomplished,

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<sup>29</sup> These difficulties were mainly based on decreasing international prices.

improvements in storage capacity and in the process of separating wheat from straw were brought about, as well as there were advances in many areas of the dense commercial network of this activity.

By the 1880s, the hurdles of modernization - present in the previous decade - had been already overcome. Therefore, the agricultural expansion, along with the speculation fever in every link of the cereals productive chain and its by-products, was accentuated during this period and it even transcended colonization areas. Noticeably, some big colonization companies became much more visible and projects began to acquire larger scales (it was common to observe a same enterprise carrying out the creation and organization of several colonies). In addition, two large communal trading companies were strengthened: the Volga Germans and the Jewish Colonization Association. Both operated in more than one province and on a large scale, making them comparable to large private companies. Whereas the authors emphasize the more relevant communal characteristic of colonies established by these companies that could have benefited them by the possibility of reducing risks and costs in their operations (Djenderedjian et al., 2010: 592-593), they also highlight the different paths followed by these homogeneous groups, even when they were of the same origin (Djenderedjian et al., 2010: 718).

Grain prices continued to fall during the 1890s. As a result, expansion decelerated. In addition, by this time cereal monoculture became less popular due to the results of research on soil depletion and deterioration. The high price of land was also an obstacle to cereal cultivation because it required large tracts of land. Finally, other activities linked to agriculture, such as the cultivation of oilseeds, or more commercial activities in the rural world, became more attractive. In the words of Djenderedjian, Bearzotti and Martirén (2010) "*(without) having concluded (since there remained much open space for colonization in the new lands), it can be said that the phenomenon of traditional colonization had thus fulfilled its original mission of land valorization, and that the ways to continue with this objective did not necessarily include it as its main protagonist*" (Djenderedjian et al., 2010: 693).<sup>30</sup> Either way, the cultivated surface continued to expand due to a combination of three simultaneous factors: 1) the capitalization of past investments (railways, equipment, productive infrastructure installation, wire

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<sup>30</sup> Djenderedjian, Bearzotti, and Martirén, 2010, *Historia* Vol.2, p. 693. Own translation.

fence), 2) a reorganization of the productive space based on decreasing costs (immigration meant lower wages and then lower production costs), and 3) a significant portion of the credit destined to agricultural activities (which meant that after 1890's devaluation, exporters received their profits in gold and paid their debts in low-valued *pesos papel*).

### **3.4. Data and descriptive statistics**

#### **3.4.1. Primary education in Santa Fé colonies**

Table 3.2 presents descriptive statistics on primary education indicators in 1887 for all the districts in the province of Santa Fé and for those districts that were colonies up to 1880. Data on colonies' location and their date of creation were obtained from Djenderedjian, Bearzotti, and Martirén (2010).<sup>31</sup> On the other hand, primary education indicators were generated from the information provided by the First Census of the Province of Santa Fé, surveyed in 1887.<sup>32</sup>

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<sup>31</sup> Djenderedjian, Bearzotti, and Martirén (2010). *Historia* Vol. 2 pp. 1009-1036

<sup>32</sup> Primer Censo de la Provincia de Santa Fé (1887). Results of this census are available at <https://www.santafe.gob.ar/censo1887/censo.php>. Last date of consultation: January 30, 2023.

**Table 3.2: Primary education indicators in Santa Fé, 1887**

Primary schooling indicator	Total districts			Colony districts		
	Average	Standard deviation	Observations	Average	Standard deviation	Observations
Attendance rate (%)	10%	14%	347	11.98%	15%	143
Attendance or Literacy rate (%)	30.45%	16.90%	347	31.78%	18.08%	143
Expenditures per school-age child	\$2.16	\$3.3	347	\$2.5	\$3.3	143
Teachers per 1,000 school-age children	3.06	4.04	347	3.38	4.33	143
% of foreign teachers	54.66%	44.09%	185	65.09%	41.29%	82
Schools per 1,000 school-age children	2.89	3.72	347	3.23	3.94	143
<i>% Schools</i>						
National schools	6.85%	24.71%	185	7.93%	26.22%	82
Provincial schools	56.59%	40.34%	185	63.85%	39.01%	82
Municipal schools	5.07%	20.68%	185	6.58%	24.16%	82
Private schools	31.49%	36.65%	185	21.65%	30.42%	82
<i>% expenditures financed by</i>						
Nation	7.11%	24.74%	185	7.51%	26.17%	82
Province	61.93%	41.87%	185	66.54%	39.79%	82
Municipality	5.03%	20.57%	185	6.96%	24.18%	82
Private	25.94%	35.99%	185	18.98%	29.53%	82

The first two columns of Table 3.3 present the coefficients of the simple regressions for primary schooling indicators in the presence of colonies. These results suggest that the presence of colonies up to 1880 was positively correlated with primary education indicators in 1887. In addition, the classification by type of school and its funding indicates a greater presence of provincial spending and a lower participation of private spending in the colonies established up to 1880 than in the rest of the districts.

The last two columns show the results of the same regressions but for a restricted sample that only includes departments where colonies were typically located in 1887 (the departments of Las Colonias and Castellanos) and those eminently cattle-raising departments in the south (General López and Constitución). These last results go in the same direction mentioned above but in greater magnitude.

**Table 3.3: Simple regressions of various education indicators in 1887 on the presence of colonies founded up to 1880. Total districts and restricted sample**

Primary schooling indicator	Total districts		Restricted sample	
	Coefficient	Observations	Coefficient	Observations
Attendance rate (%)	10.9***	347	15.0***	133
Attendance or Literacy rate (%)	12.9***	347	19.8***	133
Expenditures per school-age child	\$2.2***	347	\$2.9***	133
Teachers per 1,000 school-age children	2.6***	347	4.2***	133
% of foreign teachers	12.4*	185	27.4***	56
Schools per 1,000 school-age children	2.3***	347	3.4***	133
<i>% Schools</i>				
National schools	0.2	185	2.8***	56
Provincial schools	21.8***	185	25.3***	56
Municipal schools	-1.1	185	-7.1	56
Private schools	-20.9***	185	-21.0***	56
<i>% expenditures financed by</i>				
Nation	-1.1	185	0.9***	56
Province	16.7***	185	14.4***	56
Municipality	0.54	185	-3.9	56
Private	-16.2***	185	-11.4	56

Notes: 1) Robust standard errors; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

### 3.4.2. The demographic pattern

The interprovincial variability in the demographic pattern of the colonies was largely the result of the importance of provincial actions in the design and implementation of agricultural colonization processes. In addition, the availability of data at the departmental level hinders the interpretation of demographic patterns. The 1887 census of Santa Fé province - and to a much lesser extent, the 1869 national population census<sup>33</sup> - allows for a somewhat more detailed analysis of the aforementioned correlations by providing data at the district level. Thus, Table 3.4 presents statistics on various indicators (demographics, occupational and property structure, and other geographic indicators usually associated with access to markets<sup>34</sup>) distinguishing districts which were colonies until 1880 versus districts where colonies had not been established up to that year.

<sup>33</sup> Primer Censo de la República Argentina (1869). Results of this census are available at <https://deie.mendoza.gov.ar/#!/censos-nacionales-de-poblacion/1869-primer-censo-de-la-nacion-argentina-17> . Last date of consultation: January 30, 2023.

<sup>34</sup> Data construction on access to market indicators (Soil Quality Index and Minimum distance to a railroad station in 1879 or to the Paraná River) are explained in Appendix 3.A and 3.B.

**Table 3.4: District-level statistics for the province of Santa Fé, by presence of colonies. Second half of the 19th century**

	Districts with colonies until 1880 (62 observations)		Districts without colonies in 1880 (285 observations)		Difference	
	Average	Sd. dev	Average	Sd. dev	Coefficient	<i>t</i>
<i>Demographic indicators</i>						
Population density 1869	0.96	2.3	1.38	12.1	0.41	0.27
Population density 1887	4.74	4.8	3.82	27.2	-0.93	-0.27
% urban population 1887	25.8	19.6	13.5	18.7	-12.3	-4.65
% European population 1887	44.2	18.3	33.9	22.7	-10.3	-3.34
% Italian population 1887	31.3	19.6	26.7	22.7	-4.6	-1.47
% Swiss population 1887	6.1	7.0	1.4	2.9	-4.7	-8.51
% Spanish population 1887	0.8	0.6	1.4	1.5	0.6	3.07
% French population 1887	2.1	1.8	1.2	1.1	-0.9	-5.14
% German population 1887	1.7	2.5	0.8	1.4	-0.9	-3.94
% English population 1887	0.6	1.5	1.2	2.2	0.6	2.04
% Austrian population 1887	1.2	5.7	0.9	3.7	-0.3	-0.60
Nationalities concentration Index 1887 (HHI 1887)	48.1	13.5	59.9	16.1	11.8	5.34
% literacy	41.1	19.0	28.1	15.5	-12.9	-5.70
% foreign literacy	60.6	13.7	61.3	15.2	0.6	0.30
<i>Occupational structure</i>						
% employers	39.0	13.3	33.8	14.7	-5.2	-2.55
% dependent employees	4.6	3.3	5.3	3.5	0.6	1.26
% officials and artisans	3.4	2.8	4.1	6.7	0.7	0.79
% laborers	53.0	13.2	56.8	14.2	3.9	1.96
<i>Property structure</i>						
% owners	11.9	6.7	9.7	7.1	-2.2	-2.26
<i>Market access indicators</i>						
Soil Quality Index	74.6	20.3	73.7	21.1	-0.9	-0.32
Minimum distance to a railroad station in 1879 or to the Paraná River	27.1	27.7	59.2	49.3	32.1	4.97

Data from the first national census do not reveal a different pattern in population density between colony and non-colony districts throughout the second half of the 19th century. However, population density has grown more until 1887 in districts that were colonies than in the rest of the districts.<sup>35</sup> The colonies were eminently agricultural and specialized in cereal production, while the

<sup>35</sup> If the sample is constrained to departments where colonies were typically located by 1887 (the departments of Las Colonias and Castellanos) versus those eminently cattle-raising departments in the south (General López and Constitución), population density is significantly higher in the districts that were colonies by 1887 than elsewhere.

other districts -more intensively located in the south- belonged to the wool circuit. The difference in population growth between cereal and non-cereal areas is particularly notable, partly due to the greater subdivision of rural property caused by the introduction of cereal cultivation. The major difference between the two activities was mainly the size of the operation. Whereas the average size of sheep ranches in Santa Fé had wide variations among the different wool-producing districts, it can be said that they ranged from 2,000 to 10,000 hectares, with several cases far exceeding the latter figure, such as the properties of Diego de Alvear, in the department of General López, which well exceeded 100,000 hectares. These figures contrast spectacularly with the cereal area, where the farms varied between 33 and 150 hectares, with only a few cases of up to 600 hectares (Gallo, 1977: 333).

The impact caused by the introduction of cereal cultivation can also be seen with reference to the spectacular growth of small rural towns. Of the 62 centers classified by the 1895 census as having more than 500 inhabitants, 56 were located in the cereal-growing zone; and five of the six that had passed the 2,000 threshold, were located in the agricultural colonization zone.<sup>36</sup> Thus, the greater urbanization present in the colonies revealed by the data in Table 3.4 can be explained by the colonization itself. Agricultural activity, particularly cereal crops, by stimulating the establishment in the countryside of a series of economic activities related to industry, commerce and transportation, contributed significantly to the diversification of economic life in the region and, at the same time, gave a strong impetus to the creation of hundreds of small urban centers.

Agricultural colonization in the Pampas kept land prices comparatively low during most of the 19th century, and this allowed various social groups, most of them immigrants, who had become rich through urban or rural commerce, to acquire part of the land (Djenderedjian et al., 2010). This fact, added to the chronic shortage of permanent labor in agriculture in the Pampean region, was reflected in the fact that the European population predominated in the colony districts. These figures illustrate the remarkably diverse composition of the population in the province of Santa Fé, a fact that becomes even more striking if one takes into account that a considerable proportion of the inhabitants who were actually born in Santa Fé were the children of European and internal immigrants who had settled in the

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<sup>36</sup> Segundo Censo de la República Argentina, 1895. Tomo 2. Cuadro Iib. pp. 145-154.

province. In fact, the Report of the Italian Vice Consul Carlo Nagar estimated that of the 135,785 registered as Argentines in the 1887 census, 40% were children of foreign immigrants.<sup>37</sup> These disparities are vividly portrayed in popular literature through the evocative terms "pampa criolla" and "pampa gringa," which serve to differentiate the pastoral lands from the strictly agricultural areas (Gallo, 1977: 330).<sup>38</sup>

The majority of the European population residing in the province of Santa Fé in 1887 was Italian, while the participation of the rest of the nationalities -both in the districts that were colonies and those that were not- was negligible. However, systematic differences can be detected. The Swiss, French and German predominated in colonies, while the Spanish and English tended to establish in the rest of the districts.

A valid point to analyze concerns the homogeneity of nationalities. Traditional historiography suggests that this was the setting in Pampean agricultural colonization projects and highlights cultural or ethnic homogeneity as one of the main reasons for their relative success. However, Djenderedjian, Bearzotti and Martirén (2010) demystify the hypothesis of nationalities' homogeneity in relation to colonization projects with detailed evidence on the configuration of some colonies in the Pampean case. The figures of the provincial census of Santa Fé for 1887 also suggest that the aforementioned hypothesis should be ruled out; in fact, there was a significantly lower concentration of nationalities in colony than in non-colony districts, as suggested by the Herfindahl Index of nationalities created with data in the 1887 census.

Then, in the colonies there was more diversity in terms of nationalities, which, according to traditional literature discussed in the previous section, could have slowed down the provision of public goods or, according to the most recent publications, would have promoted them due to the greater demands for public goods on the provincial state by heterogeneous communities. As it has been shown

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<sup>37</sup> *Emigrazione e colonie* (Rome, 1893).

<sup>38</sup> If the sample is restricted to the departments where colonies were typically located by 1887 (the departments of Las Colonias and Castellanos) versus those eminently cattle-raising departments in the south (General López and Constitución), the figures show the marked contrast between the cereal region, with 52% of foreigners, and the rest of the rural areas, where only 15% of the inhabitants were born outside the country.



in Table 3.3, colonies had a higher share of provincial schools and a lower proportion of private schools than the rest of the districts, thereby showing evidence prone to the more recent literature.

On the other hand, literacy was higher for colony districts than for non-colony districts. This variable is important to look at since it suggests that there might have been demand mechanisms driven by the settlers' higher level of human capital. However, foreigners in colonies did not tend to be more literate than foreigners in non-colony districts. These differences hold even if the sample is constrained to typical departments with colonies (Castellanos and Las Colonias) versus typical ones without colonies in the south (Constitución and General López).<sup>39</sup> However, foreigners' rate of literacy was considerably higher than the one for locals so that the relative abundance of the European population might have meant a higher demand for education in colony districts than in non-colony districts.

The 1887 census data also show information on occupational structure. More specifically, census authorities asked people to place themselves in one of four social and occupational categories: employer, employee or dependent, official or artisan, and laborer or worker. Given the lack of precision in the two intermediate categories, the results should be interpreted with caution. However, it is interesting to see how Santa Fé residents placed themselves in the different categories suggested to them by the census authorities.<sup>40</sup> In particular, there was a lower proportion of laborers and a higher percentage of employers in colony districts than in non-colony districts. These results show a more egalitarian occupational structure, which agrees with the historiography in the sense that the production in the colonies, eminently agricultural, implied a more modern and sophisticated economic structure than that generated by sheep farming. Furthermore, it also implied a greater subdivision of property, which is also consistent with a greater participation of landowners<sup>41</sup>.

Finally, colonies had significantly lower transportation costs than the rest of the provincial districts. However, the correlation between the presence of colonies and land quality is not linear. As previously explained, the ranches in the south were clearly more suitable for livestock production

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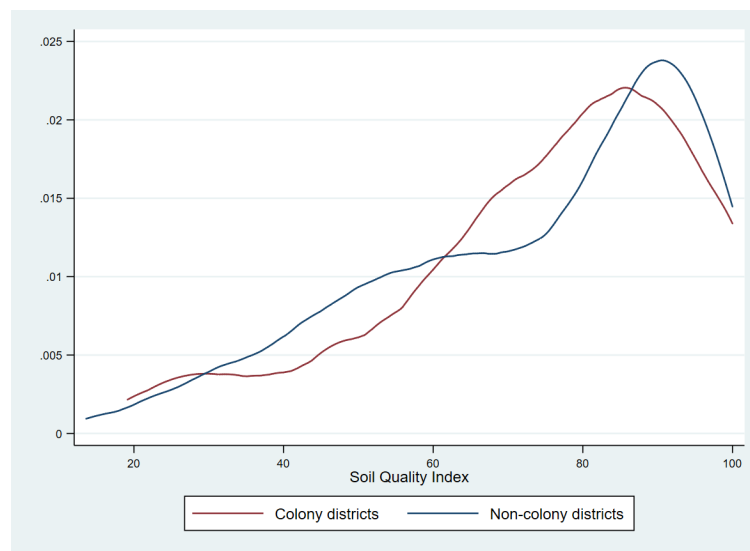
<sup>39</sup> When the sample is restricted to these four departments the mean difference test for literacy and foreign literacy between non-colony districts vs. colony districts reach -19.8% ( $t=-7.06$ ) and -4.1% ( $t=-1.26$ ), respectively.

<sup>40</sup> It is worth noting that the percentage of laborers, therefore, included not only agricultural workers (a minority in this category) but also factory workers in the cities, and especially those who were engaged in the construction of railroads.

<sup>41</sup> The percentage of owners is calculated on the total population aged 14 or over.

precisely because of their high level of fertility. Within the remaining lands of the province, the less fertile ones to the north and west were also not preferred to locate colonization projects whose main productive destination was cereal production for export. These characteristics are clearly observed in Figure 3.4., which presents the estimated density function for colony districts and for non-colony districts.

**Figure 3.4: Soil Quality Index in colony and non-colony districts.**



### 3.5. Estimation strategy and results

#### 3.5.1. The colony effect on primary education. Baseline regressions.

The presence of colonies positively affected primary education in the province of Santa Fé. To see how, I estimate the following model:

$$educ_i = \beta * colony_i + \gamma * X'_i + \varepsilon_i$$

where  $educ_i$  refers to some outcome variable associated with primary education in 1887 (attendance rate, expenditures per school-age child, number of schools per 1,000 school-age children and number of teachers per 1000 school-age children) and  $colony_i$  is the variable associated with the presence of a colony up to 1880 in some district  $i$ .  $X'_i$  is a vector of covariates to control for a set of factors that could

affect the identification strategy, and  $\epsilon_i$  is the error term. The vector of covariates captures other dimensions of education supply and/or demand that could also affect the presence of colonies or at least be linked to it. This set of variables include 1869 population density, a soil quality index<sup>42</sup>, altitude (in meters above sea level), and the minimum distance to a railroad station in 1887 or to the Paraná River.

Table 3.5 shows the results for the estimations regarding the effect of the presence of colonies up to 1880 on the primary school attendance rate. The presence of colonies increases the attendance rate by something between 6.7 and 10.9 percentage points and the effect is reduced when controls capturing socioeconomic factors, geography and market access potential are included.

**Table 3.5: The effect of 1880 colonies on 1887 primary schooling indicators.  
OLS basic specifications.**

	Attendance rate (in %)		Expenditures per school-aged child in \$		Schools per 1,000 school-aged children		Teachers per 1,000 school-aged children	
Colony in 1880	10.93***	6.68***	2.17***	1.14**	2.30***	1.15**	2.64***	1.45**
	(2.20)	(2.29)	(0.52)	(0.52)	(0.57)	(0.59)	(0.66)	(0.68)
1869 Population density		0.11**		0.05***		0.01		0.05***
		(0.05)		(0.002)		(0.01)		(0.02)
Soil Quality Index		1.71		0.29		0.43		0.28
		(1.44)		(0.35)		(0.41)		(0.42)
Altitude (m.a.s.l)		-0.10***		-0.03***		-0.03***		-0.03***
		(0.02)		(0.005)		(0.005)		(0.006)
Min. distance to a railroad station in 1879 or to the Paraná River		-0.06***		-0.01***		-0.01***		-0.02***
		(0.01)		(0.002)		(0.004)		(0.004)
<i>R sq.</i>	0.09	0.22	0.06	0.24	0.06	0.19	0.06	0.21

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347

### 3.5.2. Addressing endogeneity

#### 3.5.2.1. Average treatment effects

The results of OLS regressions may be subject to endogeneity due to measurement error, simultaneity, and/or non-linearities, and thus it is probable that estimations were biased. The measurement error might be present because the relationship is estimated by using historical statistics. Simultaneity may

<sup>42</sup> It is worth noting that, given the estimated density functions in Figure 3.4, the Soil Quality Index variable enters the specifications as a dummy corresponding to the second quartile of the index distribution.

arise because colonies in which higher indicators of primary education were observed probably tended to last longer than in those colonies where schooling was not as fully developed. Finally, there is the possibility that the causal relationship is subject to non-linearities.

Therefore, in order to try to identify the effect of Santa Fé agricultural colonization on the provision of primary education at the end of the 19th century, the impact evaluation approach is applied using the propensity score matching technique. This identification strategy requires a two-stage procedure. First, given that the assignment of the colonies in the Santa Fé area was not random and that the historiography proposes a series of factors (observables) that influenced the selection of districts to be colonies, the probability of being a colony district is estimated on the basis of these observables. In a second stage, the average effects of being a colony (ATE) on primary education indicators are estimated.

*First stage: propensity score estimation*

Colonization decisions during the second half of the 19th century were made by the provinces based on their goals of tax revenues, transportation costs, population density and land availability. Santa Fé was among the pioneer provinces and was the one that most systematically carried out the colonization process. The allocation of colonies throughout the provincial territory was not random, but rather their location was determined, at first, by proximity to the Paraná River and by a greater propensity to areas of unprofitable cattle raising, that is, where land was cheaper, such as in the center of Santa Fé, where higher temperatures made cattle raising difficult (Gallo, 1969). Although by 1880 there was still no general colonization plan, a location pattern can be identified based on the proximity to the Paraná River (for Santa Fé colonies) or to railroad stations. In fact, beginning in the 1880s, railroad companies began to demand portions of land on both sides of their railroad constructions in order to undertake their own colonization projects.

Based on this estimation strategy and the available information, the probability of being a colony in 1880 was estimated in Table 3.6 using a simple logit model with the following equation:

$$Pr(\text{colony} = 1) = \alpha + \beta_1 * 1869 \text{ pop. density} + \beta_2 * \text{land quality} + \beta_3 * \text{altitude} + \beta_4 * \text{distance}$$

where:

1869 *pop. density* refers to 1869 population density, and it is used as a proxy to account for the price of land. The idea is that population pressure increases the price of land; *land quality* and *altitude* (in meters above sea level) were included because there was a deliberate intention of colonization projects to promote agriculture; and *distance* refers to the minimum distance to a railroad station in 1879 or to the Paraná River and it aims to take into account access to markets. Although "new" land was used in settlement projects, nearby areas were preferred to remote areas to minimize transportation costs. It is equal to zero if the district borders the Paraná River or has a railroad station, and otherwise it is equal to the minimum distance in kilometers to the centroid of the nearest district with a railroad station until 1879 or to the Paraná River.

**Table 3.6: Logit regression of the probability of being a colony in 1880.**

Dependent variable: Probability of being a colony in 1880	
<i>Covariates</i>	Marginal effects
1869 population density	-0.004 (0.006)
Soil Quality Index	0.49 (0.31)
Altitude (m.a.s.l)	-0.02*** (0.006)
Minimum distance to a railroad station in 1879 or to the Paraná River	-0.01*** (0.006)
<i>Pseudo R sq.</i>	0.12
<i>Observations</i>	347

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.

### *Second stage: ATE results*

The results of the ATE estimates in Table 3.7 are quite similar to those of the OLS estimates and suggest that the presence of colonies established up to 1880 implied better primary schooling indicators, even when accounting for observable colony selection criteria.

**Table 3.7: ATE results**

<i>Primary schooling indicator</i>		Attendance rate (in %)	Expenditures per school-aged child in \$	Schools per 1,000 school-aged children	Teachers per 1,000 school-aged children
ATE	Coefficient	6.00**	1.08**	1.82***	1.93***
	p-value	0.014	0.036	0.006	0.006

Notes: 1)\*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 2) obs=347

### 3.5.2.2. Other specifications: time and space discontinuities

Another way of trying to address endogeneity is to analyze discontinuities. Two strategies are used. First, a temporal strategy by investigating the effects of the presence of colonies at different points in time, before and after 1880 (Table 3.8). The second strategy is spatial in the sense that we compare districts without colonies up to 1880 but adjacent to those that will become colonies in the future (Table 3.9).

The results in Table 3.8 show that the magnitude and consistency of the effect of a colony on the district's primary education in 1887 is decreasing with time. In addition, after 1885 the coefficients ceased to be significant; that is, in years close to or after the one in which primary education is measured -1887-, the correlation between colonies and education disappears. These findings, then, provide more confidence to talk about a causal effect of the presence of colonies in promoting primary schooling. Although with less robustness, the results of the regressions in Table 3.9 go in the same direction.

**Table 3.8.: The effect of colonies on 1887 primary schooling indicators for different years. OLS.**

<i>Panel A</i>		<i>Dependent variable: Attendance rate (in %)</i>											
		1870 (29 colonies)		1875 (48 colonies)		1880 (62 colonies)		1885 (114 colonies)		1890 (178 colonies)		1895 (219 colonies)	
Colony		12.46***	7.26**	10.57***	6.11**	10.93***	6.68***	5.95***	3.31**	1.70	0.70	0.95	1.03
		(2.88)	(3.00)	(2.27)	(2.40)	(2.20)	(2.29)	(1.71)	(1.63)	(1.51)	(1.40)	(1.55)	(1.44)
<i>R sq.</i>		0.06	0.21	0.07	0.21	0.09	0.22	0.04	0.21	0.004	0.19	0.001	0.20
<i>Panel B</i>		<i>Dependent variable: Expenditures per school-aged child in \$</i>											
		1870 (29 colonies)		1875 (48 colonies)		1880 (62 colonies)		1885 (114 colonies)		1890 (178 colonies)		1895 (219 colonies)	
Colony		2.72***	1.46**	2.22***	1.14**	2.17***	1.14**	1.02***	0.43	0.24	0.07	-0.08	0.004
		(0.62)	(0.64)	(0.50)	(0.52)	(0.52)	(0.52)	(0.38)	(0.37)	(0.35)	(0.33)	(0.38)	(0.35)
<i>R sq.</i>		0.05	0.24	0.06	0.24	0.06	0.24	0.02	0.23	0.001	0.22	0.001	0.22
<i>Panel C</i>		<i>Dependent variable: Schools per 1,000 school-aged children</i>											
		1870 (29 colonies)		1875 (48 colonies)		1880 (62 colonies)		1885 (114 colonies)		1890 (178 colonies)		1895 (219 colonies)	
Colony		3.06***	1.72**	2.66***	1.51**	2.30***	1.15**	1.12**	0.40	0.26	-0.01	0.10	0.10
		(0.77)	(0.80)	(0.61)	(0.64)	(0.57)	(0.60)	(0.44)	(0.44)	(0.40)	(0.39)	(0.42)	(0.40)
<i>R sq.</i>		0.05	0.19	0.06	0.19	0.06	0.19	0.02	0.18	0.001	0.17	0.0002	0.17
<i>Panel D</i>		<i>Dependent variable: Teachers per 1,000 school-aged children</i>											
		1870 (29 colonies)		1875 (48 colonies)		1880 (62 colonies)		1885 (114 colonies)		1890 (178 colonies)		1895 (219 colonies)	
Colony		3.46***	2.02**	3.16***	1.96***	2.64***	1.45**	1.19**	0.47	0.20	-0.04	-0.005	0.07
		(0.96)	(0.98)	(0.73)	(0.76)	(0.66)	(0.68)	(0.49)	(0.48)	(0.43)	(0.41)	(0.45)	(0.42)
<i>R sq.</i>		0.06	0.21	0.07	0.22	0.06	0.21	0.02	0.19	0.001	0.19	0.0000	0.19
<i>Control variables</i>													
1869 Population density		NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Soil Quality Index		NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Altitude (m.a.s.l)		NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Min. distance to a railroad station in 1879 or to the Paraná River		NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347

**Table 3.9: Simple regressions of primary schooling indicators in 1887 on the presence of colonies taking only adjacent districts that will later become colonies. OLS.**

	Attendance rate (in %)	Expenditures per school-aged child in \$	Schools per 1,000 school-aged children	Teachers per 1,000 school-aged children
Coefficient	6.10***	1.18*	0.68	1.13
Standard error	(2.84)	(0.61)	(0.74)	(0.80)
<i>R sq.</i>	0.04	0.03	0.001	0.02

Notes: 1) Robust standard errors in parentheses; 2) \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ ; 3) For simplicity, the constant is not reported; 4) obs=119

### 3.5.3. Exploring mechanisms

#### 3.5.3.1. European population

This subsection aims to address the way the presence of a colony affected primary education. One variable by which the presence of colonies could have affected the demand for education is the percentage of European population in a district. Traditional historiography has pointed to the relatively higher human capital of the European immigrant population (Cortés Conde, 1979), although this hypothesis has been nuanced by more recent historiography (Sánchez Alonso, 2019). The idea behind this hypothesis is that European immigrants - with a relatively higher level of human capital - had higher demands of primary schooling for their children. Given that the agricultural colonies were mainly composed of European immigrants, this hypothesis is also worth testing. Not all European nationalities settled in the Santa Fé colonies. Spanish immigrants, for example, although they were the main component of transatlantic immigration, had a neglectable incidence in agricultural colonization. Therefore, the possibility that the most relevant nationalities in agricultural colonization of Santa Fé - Italians, and to a much lower extent, Swiss, French and Germans - might have influenced the greater demand for schooling is also evaluated. An attempt is made to capture this effect by including variables associated with the participation of these nationalities in the total population of each district. Table 3.10 presents these specifications.



**Table 3.10: The effect of 1880 colonies on 1887 primary school attendance rate. Nationality controls<sup>43</sup>**

	<i>Dependent variable: Attendance rate (in %)</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Colony in 1880	6.68*** (2.29)	7.14*** (2.33)	1.65 (5.00)	4.66** (2.34)	3.63 (3.43)	4.66** (2.34)	3.84 (3.46)
% Europeans 1887		-0.04 (0.03)	-0.06 (0.03)			-0.17 (0.11)	-0.16 (0.11)
Colony in 1880 * % Europeans 1887			0.13 (0.11)				
% Italians 1887				-0.05 (0.03)	-0.05 (0.03)	0.11 (0.11)	0.11 (0.11)
% Swiss 1887				0.17 (0.30)	0.17 (0.30)	0.31 (0.32)	0.31 (0.32)
% French 1887				1.92*** (0.62)	1.71** (0.76)	2.11*** (0.64)	1.94** (0.77)
% Germans 1887				0.14 (0.31)	0.14 (0.30)	0.34 (0.33)	0.33 (0.32)
Colony in 1880 * % French 1887					0.57 (1.18)		0.45 (1.19)
1869 Population density	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES
<i>R sq.</i>	0.22	0.23	0.23	0.27	0.27	0.27	0.27

Notes: 1) Robust standard errors; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347

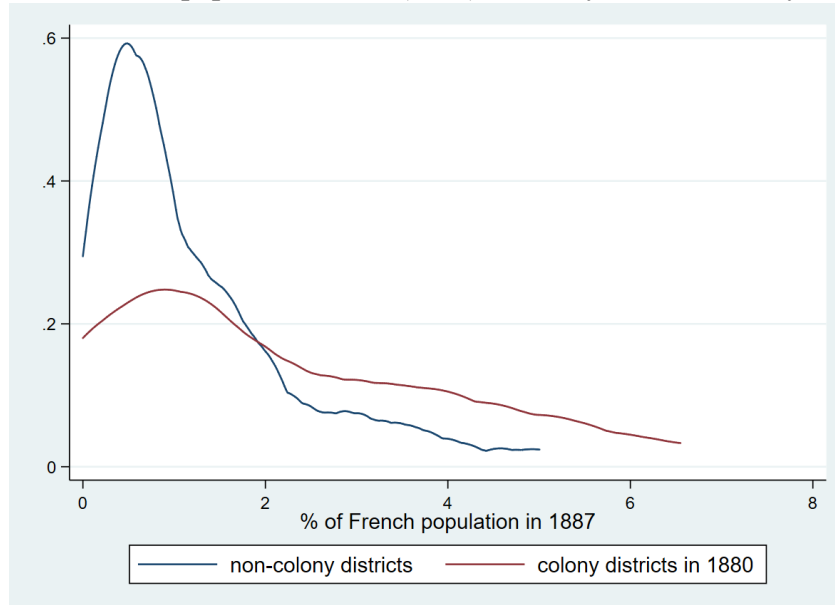
Although European immigrants tended to settle more in Santa Fé colonies than elsewhere in the province, the inclusion of this variable in regressions does not alter much of the magnitude nor the significance of the colony coefficient (columns 1 and 2 in Table 3.10). This does not necessarily mean that the European population was not a determinant of the colonies relative successful educational performance. Therefore, column 3 in Table 3.10 explores a non linear effect interacted with the presence of a colony. Overall these results allow us to reject this hypothesis for the case of Santa Fé province.<sup>44</sup>

<sup>43</sup> The results of these estimates for other indicators of primary schooling are available in Tables 3.C.1., 3.C.2, and 3.C.3. in Appendix 3.C.

<sup>44</sup> Moreover, the linear correlation coefficient between the percentage of Europeans and the attendance rate is -0.01, and not statistically significant.

However, when typical nationalities present in the colonies are included, the value of the coefficient associated with the presence of colonies drops slightly and loses some of its significance. In particular, the population of French origin seems to have played some role in the explanation. Moreover, no colony or district had a particularly large abundance of French to consider this effect to have been relevant enough (Figure 3.5).

**Figure 3.5: French population share (in %) in colony and non-colony districts.**



Therefore, the population of European origin in Santa Fé had a higher proportion of literates in 1887 than the natives and, furthermore, it was relatively more abundant in the colonies than in the rest of the districts of the province. However, they do not seem to have been part of the explanation for the relative success of the Santa Fé colonies in terms of primary education; that is, they did not constitute a special source of demand for primary education, at least until this period.

### 3.5.3.2. Nationalities concentration

As the results in column 2 of Table 3.11 show, the inclusion of the Herfindahl Index of nationalities in the regressions is not significant and does not alter the coefficient of the colony variable. On the other

hand, the interaction with the colony dummy in column 3 magnifies the colony effect considerably because colonies tended to be more heterogeneous in terms of nationalities than the rest of the districts. Overall, these results mean that heterogeneity might have been one of the channels through which colonies had an impact on the provision of primary education.

These findings are consistent with the most recent literature that challenges the traditional view of the positive effects of cohesion for the provision of public goods. This literature also highlights the importance of the role of the state in the provision of public goods due to the greater difficulty of providing them through private informal mechanisms. At this point, it should be noted that the colonies had a greater participation of provincial schools and financing and a lower percentage of private schools and financing than the rest of the provincial districts (Table 3.3).

**Table 3.11: The effect of 1880 colonies on 1887 primary school attendance rate. Nationalities concentration index (1887 HHI) controls<sup>45</sup>**

	<i>Dependent variable: Attendance rate (in %)</i>				
	(1)	(2)	(3)	(4)	(5)
Colony in 1880	6.68*** (2.29)	6.46*** (2.35)	13.49** (6.42)		
1887 HHI		-0.02 (0.03)	0.000 (0.04)	-0.12*** (0.04)	-0.06 (0.04)
Colony in 1880 * 1887 HHI			-0.15 (0.12)		
1869 Population density	YES	YES	YES	NO	YES
Soil Quality Index	YES	YES	YES	NO	YES
Altitude (m.a.s.l.)	YES	YES	YES	NO	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	NO	YES
<i>R sq.</i>	0.22	0.22	0.23	0.02	0.19

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.

### 3.5.3.3. Inequality

Another important hypothesis to be tested refers to the influence of inequality, which can affect education through a supply or a demand mechanism. On the supply side, in line with Engerman and

<sup>45</sup> The results of these estimates for other indicators of primary schooling are available in Appendix 3.D.

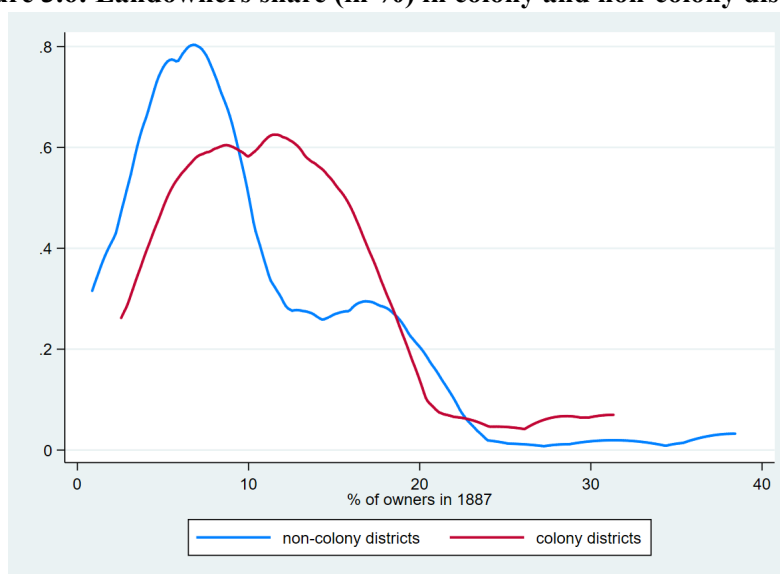
Sokoloff's hypothesis, agricultural colonies, as institutional configurations with less concentration of political and economic power in the hands of local elites, could have had higher levels of investment in human capital. On the other hand, it could have also been plausible that at higher inequality levels, the demand side prevailed and the masses do not wish to invest in human capital. The effect of inequality is attempted to be captured with the percentage of owners over the total adult population -reflecting a more egalitarian distribution of land ownership-. Simple linear correlations of landowners' proportion with the presence of colonies and with the rate of elementary school attendance suggest that this could have been the case.<sup>46</sup>

While the land ownership rate was higher in the colonies (Figure 3.6) and correlates positively with education, its linear inclusion in the regressions is not significant nor does it alter the coefficient on the presence of colonies in the specifications (column 2 in Table 3.12). This would suggest at first that greater equality, measured as the land ownership rate, does not appear to have been the mechanism by which colonies were relatively more successful in terms of education. However, its effect via the interaction with the colony dummy seems to explain some of the primary schooling attendance rate in 1887 while its inclusion nullifies the presence of colony effect; that is, colonies that were more egalitarian in terms of ownership tended to have slightly higher attendance rates, thereby suggesting that relative egalitarian distribution of land ownership might have pushed Santa Fé primary education system.

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<sup>46</sup> The linear correlation coefficient between the percentage of owners in 1887 with the presence of colonies in 1880 is 0.12 (p-value=0.01) and with the primary school attendance rate in 1887 is 0.15 (p-value=0.01).

**Figure 3.6: Landowners share (in %) in colony and non-colony districts.**



**Table 3.12: The effect of 1880 colonies on 1887 primary school attendance rate. Land ownership controls.<sup>47</sup>**

	<i>Dep. variable: Attendance rate (in %)</i>		
	(1)	(2)	(3)
Colony in 1880	6.68*** (2.29)	6.66*** (2.28)	-0.32 (4.91)
1887 % of owners		0.04 (0.12)	-0.07 (0.11)
Colony in 1880 * 1887 % of owners			0.60* (0.34)
1869 Population density	YES	YES	YES
Soil Quality Index	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES
<i>R sq.</i>	0.22	0.22	0.24

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347

### 3.5.3.4. Urbanization

Finally, the greater urbanization in the colonies can be explained by the colonization process itself. According to historiography, agricultural activity -particularly cereal crops-, by stimulating the

<sup>47</sup> The results of these estimates for other indicators of primary schooling are available in Appendix 3.E.

establishment in the countryside of a series of economic activities related to industry, commerce and transportation, contributed significantly to the diversification of economic life in the region and, at the same time, gave a strong impetus to the creation of hundreds of small urban centers. This urbanization may have been a product of agricultural colonization, so it may be an important mechanism by which the presence of colonies could have affected the demand for schooling. This hypothesis is tested in Table 3.13 and the results suggest that the degree of urbanization could have been part of the explanation given that when urbanization is included the coefficient for the presence of a colony in 1880 falls by 2 percentage points.

**Table 3.13: The effect of 1880 colonies on 1887 primary school attendance rate. Urbanization controls<sup>48</sup>**

	<i>Dep: variable: Attendance rate (in %)</i>		
	(1)	(2)	(3)
Colony in 1880	6.68*** (2.29)	4.43** (2.27)	5.15 (3.99)
1887 % of urban population		0.27*** (0.05)	0.28*** (0.05)
Colony in 1880 * 1887 % of urban population			-0.03 (0.11)
1869 Population density	YES	YES	YES
Soil Quality Index	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES
<i>R sq.</i>	0.22	0.33	0.33

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347

### 3.6. Concluding Remarks

Argentina was inserted into the first globalization boom as an exporter of primary products, with a growing participation of cereals in exports. During this process of considerable productive transformation, the province of Santa Fé played a very important role. In addition, Santa Fé was one of

<sup>48</sup> The results of these estimates for other indicators of primary schooling are available in Appendix 3.F.

the jurisdictions of the Pampas with the greatest availability of fertile lands not occupied by livestock during the previous wool cycle, which the provinces of Entre Ríos and Buenos Aires had known how to take advantage of very well.

In this process, a scarcity in the demand for labor coexisted with large tracts of available land belonging to the provincial government. Consequently, the province and the private sector took advantage of the national immigration policy to carry out a large number of colonization projects. Although these projects were also implemented simultaneously in other provinces, they did not have the magnitude of those in the case of Santa Fé.

The results of this research suggest that the districts that became colonies during this period had a positive and significant effect on the primary schooling indicators. In particular, controlling for the observable factors that determined the location of the colonies, the presence of a colony founded up to 1880 increases the primary school attendance rate in 1887 by almost 7 percentage points. This finding is consistent with proposals that highlight the role of institutions in economic development and in the provision of public goods (Acemoglu, Johnson, and Robinson, 2001 and 2005; Engerman and Sokoloff, 2002, 2002).

Various mechanisms proposed in the literature are tested in this chapter to explain this causal relationship. First, while it is true that the Europeans in the province of Santa Fé had a higher stock of human capital than the natives, there is no evidence that the higher relative incidence of Europeans in the colonies was part of the explanation for the colonies' relative success relative in primary education - at least until 1887 -. This finding challenges the research of Droller (2018) on the European effect in the Pampas and is more consistent with the proposal of Sánchez Alonso (2019), who suggests qualifying this vision by recognizing the complexities of the immigration process in the Argentine case.

Secondly, it has been found that the colonies were relatively heterogeneous in terms of nationalities and that this greater diversity could also constitute one of the channels through which the colonies achieved better educational results. These findings challenge the traditional historiography that perceives the colonies as ethnically and culturally homogeneous communities (Gallo, 1977) and are

more in line with the most recent historiographical production (Djenderedjian, Bearzotti, & Martirén, 2010). Furthermore, these findings are also inserted into the discussion about the role of ethnic homogeneity in the provision of public goods, again providing evidence in favor of the most recent proposals (Charnysh, 2019).

A third mechanism by which the colonies performed better in educational terms seems to have been their relatively equal distribution of land ownership. Although it is not possible to distinguish between demand or supply drivers of the inequality channel, the fact that the *Contribución Directa* has constituted an important part of the financing for primary education gives indications that at least in this period - prior to the centralization of budgets for primary education - the supply side would have played a role.

Last, the influence of urbanization has been evaluated. According to historiography, agricultural activity - particularly cereal crops -, by stimulating the establishment in the countryside of a series of economic activities related to industry, commerce and transportation, contributed significantly to the diversification of economic life in the region and, at the same time, gave a strong impetus to the creation of hundreds of small urban centers. The results suggest that the degree of urbanization could have been part of the explanation, thereby giving support to evidence to similar studies of the Chilean, Brazilian and French cases (González, 2020; Rocha, Ferraz, and Soares, 2017; Montalbo, 2020, respectively).

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## **Appendix Chapter 3**

### **Appendix 3.A: Soil Quality Index**

The Soil Quality Index was built from the data provided by Geo Inta following the explanatory document Base Map of Soil Suitability available on the INTA (National Institute of Agricultural Technology) website<sup>49</sup>. The construction of the index for each of the 362 districts in the province of Santa Fé supposed the calculation of a weighted average of the hectares with different degrees of land suitability for agricultural production, an average that penalizes the lands of worse quality.

### **Appendix 3.B: Minimum distance to a railroad station in 1879 or to the Paraná River**

The variable minimum distance to a railway station in 1879 or to the Paraná River tries to capture the access to markets that a district had. Then, it is equal to zero if the district had a railroad station in the year 1879 or if it bordered on the Paraná River. Otherwise, the variable takes the value in kilometers of the minimum distance from the centroid of the district to the centroid of the closest district with a railroad station or bordering the Paraná River. The information corresponding to the existence of a railway station was extracted from the website Crónicas Ferroviarias.<sup>50</sup>

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<sup>49</sup> The data was downloaded from the Soil Map of the Province of Santa Fé. Available on the website: <http://www.geointa.inta.gob.ar/2014/05/22/mapa-de-suelos-de-la-provincia-de-santa-fe/> . Last date of consultation: January 31, 2023.

<sup>50</sup> <https://www.cronicaferroviaria.blogspot.com/> . Last date of consultation: January 31, 2023.

## Appendix 3.C.: The effect of 1880 colonies on 1887 primary schooling indicators.

### Nationality controls

**Table 3.C.1. Expenditures per school-aged child in \$**

	<i>Dependent variable: Expenditures per school-aged child in \$</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Colony in 1880	1.14*** (0.52)	1.21*** (0.51)	0.36 (1.06)	0.87 (0.59)	0.41 (0.95)	0.87 (0.59)	0.43 (0.95)
% Europeans 1887		-0.01 (0.01)	-0.01 (0.01)			-0.02 (0.02)	-0.02 (0.02)
Colony up to 1880 * % Europeans 1887			0.02 (0.03)				
% Italians 1887				-0.01 (0.01)	-0.01 (0.01)	0.01 (0.02)	0.01 (0.02)
% Swiss 1887				0.03 (0.05)	0.03 (0.05)	0.05 (0.05)	0.05 (0.05)
% French 1887				0.24** (0.13)	0.15 (0.13)	0.27*** (0.13)	0.17 (0.13)
% Germans 1887				-0.01 (0.07)	-0.01 (0.06)	0.01 (0.07)	0.01 (0.07)
Colony in 1880 * % French 1887					0.26 (0.30)		0.24 (0.30)
1869 Population density	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES
<i>R sq.</i>	0.24	0.24	0.24	0.26	0.26	0.26	0.26

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported.; 4) obs=347

**Table 3.C.2. Schools per 1,000 school-aged children**

	<i>Dependent variable: Schools per 1,000 school-aged children</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Colony in 1880	1.15** (0.59)	1.40*** (0.60)	-1.03 (1.26)	0.77 (0.65)	0.49 (0.96)	0.77 (0.65)	0.55 (0.96)
% Europeans 1887		-0.02*** (0.01)	-0.03*** (0.01)			-0.05** (0.02)	-0.05** (0.02)
Colony up to 1880 * % Europeans 1887			0.03 (0.03)				
% Italians 1887				-0.02 (0.01)	-0.02*** (0.01)	0.02 (0.02)	0.02 (0.02)
% Swiss 1887				0.09 (0.06)	0.09 (0.06)	0.13** (0.07)	0.13** (0.06)
% French 1887				0.27*** (0.12)	0.21 (0.15)	0.32*** (0.12)	0.27* (0.15)
% Germans 1887				-0.06 (0.08)	-0.06 (0.08)	-0.003 (0.08)	-0.005 (0.08)
Colony in 1880 * % French 1887					0.15 (0.30)		0.12 (0.30)
1869 Population density	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES
<i>R sq.</i>	0.19	0.20	0.21	0.23	0.23	0.23	0.23

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.

**Table 3.C.3. Teachers per 1,000 school-aged children**

	<i>Dependent variable: Teachers per 1,000 school-aged children</i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Colony in 1880	1.45** (0.68)	1.71** (0.68)	-0.33 (1.37)	0.97 (0.68)	0.15 (1.00)	0.97 (0.68)	0.21 (1.00)
% Europeans 1887		-0.02*** (0.01)	-0.03*** (0.01)			-0.04* (0.02)	-0.04 (0.02)
Colony up to 1880 * % Europeans 1887			0.05 (0.03)				
% Italians 1887				-0.02*** (0.01)	-0.02*** (0.01)	0.02 (0.03)	0.01 (0.03)
% Swiss 1887				0.11 (0.08)	0.10 (0.08)	0.14* (0.08)	0.14* (0.08)
% French 1887				0.36** (0.16)	0.20 (0.17)	0.41*** (0.16)	0.25 (0.16)
% Germans 1887				-0.09 (0.09)	-0.09 (0.09)	-0.04 (0.09)	-0.05 (0.09)
Colony in 1880 * % French 1887					0.45 (0.38)		0.42 (0.38)
1869 Population density	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES
<i>R sq.</i>	0.21	0.22	0.23	0.26	0.26	0.26	0.26

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.

**Appendix 3.D.: The effect of 1880 colonies on 1887 primary schooling indicators.**

**Nationalities concentration index (1887 HHI) controls**

**Table 3.D.: The effect of 1880 colonies on 1887 primary schooling indicators.  
Nationalities concentration index (1887 HHI) controls**

	Expenditures per school-aged child in \$			Schools per 1,000 school-aged children			Teachers per 1,000 school-aged children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Colony in 1880	1.14** (0.52)	1.12** (0.54)	1.69 (1.53)	1.15** (0.59)	1.30** (0.61)	2.80 (1.77)	1.45** (0.68)	1.58** (0.68)	4.09* (2.16)
1887 HHI		-0.002 (0.01)	0.000 (0.01)		0.01 (0.01)	0.02* (0.01)		0.01 (0.01)	0.02* (0.01)
Colony in 1880 * 1887 HHI			-0.01 (0.03)			-0.03 (0.04)			-0.05 (0.04)
1869 Population density	YES	YES	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES	YES	YES
R sq.	0.24	0.24	0.24	0.19	0.19	0.19	0.21	0.21	0.22

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.



**Appendix 3.E. The effect of 1880 colonies on 1887 primary schooling indicators. Land ownership controls.**

**Table 3.E.: The effect of 1880 colonies on 1887 primary schooling indicators. Land ownership controls.**

	Expenditures per school-aged child in \$			Schools per 1,000 school-aged children			Teachers per 1,000 school-aged children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Colony in 1880	1.14** (0.52)	1.14** (0.52)	0.49 (1.18)	1.15** (0.59)	1.16* (0.59)	0.48 (1.16)	1.45** (0.68)	1.46** (0.68)	0.55 (1.19)
1887 % of owners		-0.01 (0.03)	-0.02 (0.03)		-0.04 (0.02)	-0.05* (0.03)		0.02 (0.03)	-0.04 (0.03)
Colony in 1880 * 1887 % of owners			0.06 (0.07)			0.06 (0.07)			0.08 (0.08)
1869 Population density	YES	YES	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES	YES	YES
<i>R sq.</i>	0.24	0.24	0.24	0.19	0.19	0.19	0.21	0.21	0.21

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.

**Appendix 3.F.: The effect of 1880 colonies on 1887 primary schooling indicators.**

**Urbanization controls.**

**Table 3.F.. The effect of 1880 colonies on 1887 primary schooling indicators.  
Urbanization controls.**

	Expenditures per school-aged child in \$			Schools per 1,000 school-aged children			Teachers per 1,000 school-aged children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Colony in 1880	1.14** (0.52)	0.70 (0.51)	0.65 (1.03)	1.15** (0.59)	0.59 (0.60)	0.89 (1.13)	1.45** (0.68)	0.72 (0.67)	1.08 (1.30)
1887 % of urban population		0.05*** (0.01)	0.05*** (0.01)		0.07*** (0.01)	0.07*** (0.01)		0.09*** (0.01)	0.09*** (0.01)
Colony in 1880 * 1887 % of urban population			0.002 (0.03)			-0.01 (0.03)			-0.01 (0.04)
1869 Population density	YES	YES	YES	YES	YES	YES	YES	YES	YES
Soil Quality Index	YES	YES	YES	YES	YES	YES	YES	YES	YES
Altitude (m.a.s.l.)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Min. distance to a railroad station in 1879 or to the Paraná River	YES	YES	YES	YES	YES	YES	YES	YES	YES
R sq.	0.24	0.32	0.32	0.19	0.28	0.28	0.21	0.35	0.35

Notes: 1) Robust standard errors in parentheses; 2) \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; 3) For simplicity, the constant is not reported; 4) obs=347.

## **Chapter 4: New evidence on the causation from inequality to development in Latin America: Argentina at the local level<sup>51</sup>**

### **4.1. Introduction**

The goal of this paper is to shed light on the causal relationship between inequality and development at the local level. The empirical relationship between inequality, growth, and development outcomes has been mostly studied at the country level. In this article, we explore this issue in the local context by using a database of Argentine departments - the second level of administrative division below the provinces -<sup>52</sup>. Our results indicate a negative impact of inequality on development, thereby challenging most of the Latin American evidence (Acemoglu et al., 2007; Dell, 2010; Summerhill, 2010), though reinforcing findings for other regions in the world (Banerjee and Iyer, 2005; Galor et al., 2009), thereby reconciling Latin American empirical results with those for other regions.

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<sup>51</sup> This chapter was co-authored with Antonella Bonacina and Alejandro Danón for its presentation at the 20th Annual Meeting of the Latin American and Caribbean Economic Association.

<sup>52</sup> Argentina is divided into 23 provinces and an autonomous city, Buenos Aires. Each province is in turn, except for Buenos Aires Province, divided, for administrative purposes, into departments (*departamentos*) and, at a lower level, municipalities. The Province of Buenos Aires is divided into partidos and the City of Buenos Aires into communes.

In our opinion, the originality of our results is due to the empirical strategy, based on Easterly (2007) and inspired on the hypothesis of Engerman and Sokoloff (1997). We use agricultural endowments - that is, the ratio of land suitable for small scale plantation crops to large scale plantation crops - as an instrument for “structural inequality.”

Additionally, our research controls for a widely accepted causal mechanism alleged in the literature, i.e. the fiscal channel, and endorses human capital and institutions as conduits reproducing the impact of inequality in development. We do not expect the tax redistributive policy channel (Alesina and Rodrik, 1994) to be a strong mechanism operating among Argentine departments since most revenues are collected at the national or provincial levels. Moreover, our results allow us to hypothesize that, as highlighted by empirical studies in other contexts, the Argentine case would endorse the human capital mechanism as one of the main channels through which inequality may affect development. However, Acemoglu and Dell (2010) argue that local institutions vary significantly within countries and states, being a strong candidate to locally reproduce the effect of inequality in economic development. Although we capture institutions in a highly imperfect way - at least in comparison with our human capital variable -, we also find support for institutions being a binding mechanism connecting structural inequality with development at the local level. Taken together, these findings highlight the importance of developing a theoretical model that differentiates channels by levels of government.

The relationship between inequality and economic development has called the attention of the discipline since its beginnings up to the present (Lewis, 1954; Kaldor, 1956; Kuznets, 1955; Piketty, 2014; Smith, 1776; World Bank, 2006). Furthermore, in Latin America this phenomenon deserves particular consideration since the region has been characterized not only as the world most unequal (Bourguignon and Morrison, 2002; Morley, 2001) but also with “excess inequality” given its level of development (Londoño and Székely, 2000). Other important features of Latin America inequality are its persistence and its multidimensionality, with the last one ranging from income measures to other socioeconomic variables such as access to education, land, or basic services (Gasparini and Lustig, 2011). Moreover, within Argentina, inequality and development outcomes show significant spatial

disparities, even at the departmental level.<sup>53</sup>

The remainder of this paper proceeds with the following structure. Section 2 presents a brief literature review. In section 3, we discuss the identification strategy. Section 4 contains data description. In section 5, we highlight our main results at the department level and evaluate different robustness checks. Section 6 concludes.

## 4.2. Literature review

Classical economists advocate the hypothesis that inequality fosters growth and it is beneficial for economic development. Lewis (1954) and Kaldor (1955) suggests that marginal propensity to save increases with income, thus a transfer from a poor person to a rich one may increase aggregate saving and generate economic growth through capital accumulation. More contemporary scholars have proposed other theoretical linkages between income distribution and growth that we classify into three different channels: fiscal, institutional and human capital. Within each of these groups we can find a heterogeneous set of explanations.

Briefly, scholars advocating the *fiscal channel* (Alesina and Rodrik, 1994; Persson and Tabellini, 1994) argue that unequal economies have poorer median voters who, with the aim of producing redistribution, vote for inefficient policies -mostly higher taxes- that might hurt growth. Acemoglu (2005), Bourguignon and Verdier (2000), and Engerman and Sokoloff (1997) explore the *institutional channel*. In short, they hold that elites in highly unequal societies might prevent growth enhancing policies in order to preserve their privileges. Among the pioneer papers that study the *human capital channel*, Galor and Zeira (1993) build a model to show that inequality may produce underinvestment in human capital which in turn results in a less developed - low income - and unequal long run economy.

Our paper takes advantage of variability within provinces. Since most taxes are determined at

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<sup>53</sup> Figure 4.A.1. in the Appendix shows the spatial distribution of inequality and development at the departmental level in 14 out of the 24 Argentine provinces.

the national or provincial levels in Argentina, we only expect institutions and human capital mechanisms to be the operating channels between inequality and development. The maximum share of total revenues achieved by municipalities in the 1961–2002 period was 6%, while provinces collected between 18.5% and 28% in the same period (Cetrángolo and Jiménez, 2004: 122). In terms of expenditures, the distribution among levels of government is not too different. The maximum share of municipalities occurred in 1993, with a 10.8%. For more distant periods, Porto (2003) indicates that municipalities' expenditures in 1916 was 11.7%, with provincial and nation shares amounting 25% and 63.3%, respectively. Then, there has been almost no room for the fiscal channel worked in Argentina at departmental - or local- level.

Up to our knowledge, the only empirical attempt of isolating different theoretical channels at the local level can be found in the work of Acemoglu and Dell (2010). They find that half of the cross-municipality differences in income can be accounted for by differences in human capital, with the remainder due to the residual factor which they interpret as local institutions.<sup>54</sup> One can infer the presence of inner institutional variability on property rights from certain narratives of the Argentine case. For instance, Teruel (2005) states that Argentina lacked national legislation on communal indigenous land property. Thus, discretionality prevailed as every conflict on land was decided locally, based on intrinsic characteristics of each group and historical circumstances. Throughout history, several conflicts regarding property rights were recorded, not only among members of the communities but also with external claimants of the land.<sup>55</sup> Political institutions are also highly heterogeneous among Argentine departments. For instance, 2011 presidential voters' turnout -a proxy for political participation- varied from 37% in the department Mitre of Santiago del Estero province to 90% in General Guido, a *partido* in the Province of Buenos Aires. Other standard measures of political competition, such as the winner's share of votes or the winning margins also show strong variability. Therefore, we can speculate that both economic and political institutions vary considerably within Argentina.

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<sup>54</sup> According to these authors, local institutions can be identified through the enforcement of property rights, the availability of local public goods, the interaction between different levels of government, and how political power is distributed at the local level.

<sup>55</sup> The 26.160 Act was passed in 2011 and it aims to prevent indigenous communal land from expropriation. However, it was only since this date that a national legislation intervened in these disputes.

The empirical field has also addressed the relationship between inequality and development, with dissimilar results. A first group of studies (Alesina and Rodrik, 1994; Persson and Tabellini, 1994) finds a negative relationship between both measures based on cross-country estimations. A second group of scholars exploits the panel dimension of the data made available by Deininger and Squire (1996),<sup>56</sup> and finds a positive (or non-negative) effect of inequality in growth, which is interpreted as a positive relationship but only within the country, not ruling out cross sectional negative results.

At the local level, whereas most empirical studies account for a negative association between inequality and development (Banerjee and Iyer, 2005; Galor, Moav and Vollrath; 2009), other authors find the opposite for Latin American countries. In particular, Summerhill (2010) detects a non-negative relationship between past inequality and long-term income per capita within the state of São Paulo, Brazil. Results in Dell (2010) indicate a negative correlation between the presence of *mita* -a colonial extractive labor institution in Peru- and economic development. However, she also finds that the presence of *mita* meant lower levels of land inequality, which in turn implied a lower development path, i.e. a positive correlation between inequality and development. According to her argument, higher levels of land inequality might have meant more secure property rights and, consequently, more public goods and a higher path of economic development. She suggests that the Peruvian case represents an example of the many ways in which elites can use the state to shape economic development (i.e. at the same time they can use it to coerce labor and lobbying to protect their property rights), which in her words, could provide a particularly useful starting point for modeling Latin America's long-run growth trajectory. Last, according to Acemoglu et al. (2007) there is a positive relationship between 19th century land inequality and current economic development across municipalities within the state of Cundinamarca, Colombia. To our knowledge, there is no empirical evidence on the relationship between these variables at the department level in Argentina.

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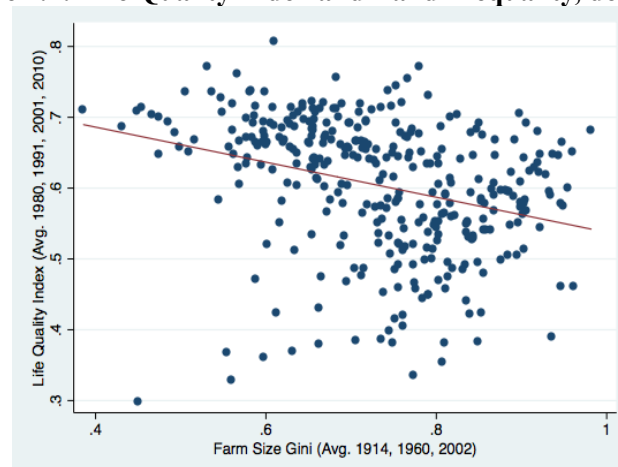
<sup>56</sup> Barro (2000) and Forbes (2000), among others

### 4.3. Identification strategy

A first approximation shows a negative and significant linear relationship<sup>57</sup> between inequality and development measures for Argentine departments (Figure 4.1). Awarding these empirical results to a causal relationship is not straightforward. Banerjee and Duflo (2003) highlight different problems in models and methods of estimation used in previous empirical studies, such as endogeneity, model misspecification (non-linear relationship predicted by theoretical models), and measurement error. Therefore, the challenge of this paper is to build an identification strategy capable of overcoming all potential endogeneity issues.

Easterly (2007) addresses potential endogeneity by proposing an instrument for inequality inspired on the hypothesis of Engerman and Sokoloff (henceforth ES). According to these authors, factor endowments in colonies partially shaped different levels of inequality which persisted over time and affected the course of development. In particular, ES explain that colonies with comparative advantage in large-scale crops plantations<sup>58</sup> -e.g. sugar cane, cotton, or coffee- and mineral resources were prone to have higher levels of inequality of wealth, human capital and political power. Typically, factor endowments with these characteristics were in Central and most countries in South America, contrasting with the experience of North American colonies, with comparative advantage in the production of small farms crops (grains, such as wheat), associated with more egalitarian societies.

**Figure 4.1: Life Quality Index and Land Inequality, department level**



<sup>57</sup> Correlation coefficient is -0.31, significant at 1% level.

<sup>58</sup> These colonies used to import low skill labor, mostly slaves. However, the authors point out that distribution was also highly unequal in free populations



The argument to use this instrument is that agricultural endowments predict inequality and inequality predicts development outcomes. Particularly, the ratio of land suitable for wheat (small-scale crop) to land suitable for sugarcane (large-scale crop) is an instrumental variable of inequality. Easterly (2007) confirms ES hypothesis about inequality causing underdevelopment, and finds evidence supporting institutions and schooling as possible channels; though, he does not test the fiscal channel.

Easterly (2007) claims that the instrument based on factor endowments may capture structural -as opposed to market- inequality variation. In his own words: “*Structural inequality reflects such historical events as conquest, colonization, slavery, and land distribution by the state or colonial power; it creates elite by means of these non-market mechanisms. Market forces also lead to inequality, but just because success in free markets is always very uneven across different individuals, cities, regions, firms, and industries*” (Easterly, 2007: 756). Important to our argument, Latin America has been characterized by this kind of inequality (Gasparini and Lustig, 2011 and Morley, 2001). ES hold that inequality persists because government policies and other institutions reproduce it through time. In extremely unequal societies, elites are able to establish a legal framework that benefits their political power and maintains their advantage by hampering public policies that promote development. The authors exemplified elite political power with the extent of the franchise and voting rights legislation. Although most American countries were nominally democracies, highly unequal societies imposed restrictions based on wealth, literacy, or lack of secrecy in balloting.

### **4.3.1. First stage**

We explore the correlation between factor endowments and farm size distribution in 1914. We construct an index defined as the ratio of cereals suitability (sunflower, maize and soybean) to sugar cane suitability.<sup>59</sup> The index shows a negative relationship with two measures of farm size distribution: Average Farm Size and Farm Size Gini (Table 4.1). These estimations suggest that the ratio of cereals suitability to sugar-cane suitability is a good predictor of the (historical) extension of farms and their

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<sup>59</sup> The index is defined as:  $instrument = \ln[(1 + Index\ of\ cereal\ suitability) / (1 + Index\ of\ sugar\ cane\ suitability)]$ . The index of cereal suitability is an unweighted average of the indexes corresponding to sunflower, maize and soybean.

distribution. Therefore, even though there was a considerable amount of heterogeneity in both, sugar and cereal productive structures -with sugar mostly cultivated in the Northwest part of the country whereas cereals predominated in the Pampas-, statistics still suggest that areas relatively prone to sugar (cereals) configured more (less) concentrated distributions of land. Notice that in Argentine large and small scale sugarcane exploitations coexisted, such as Jujuy and Salta models -large- compared to Tucumán productive structure - where *minifundios* prevailed-. However, Table 4.1 shows that cereals to sugarcane ratio is associated, in average, with smaller average farm size and less unequal distribution. These results hold for past and more contemporary (1914, 1960, and 2002) measures of farm size distribution, as shown in Table 4.A.1 in the Appendix. They also agree with 1996 Larry Sawers's historical depiction of sugar industry in the Northwest as unequal<sup>60</sup> sharply contrasting with the Pampean cereal model described by Ezequiel Gallo (1977) which, according to him, has some features in common with the temperate grasslands of the Western United States, Canada, Australia, and New Zealand.<sup>61</sup>

**Table 4.1: Past farm size distribution regressed on factor endowments, departmental level**

Regressions	Dependent variable	
	Average Farm Size (Year 1914)	Farm Size Gini (Year 1914)
Instrument: Log of cereals to sugarcane suitability	-878.7*** (138.7)	-0.255*** (0.025)
Observations	363	363
R-squared	0.07	0.22

Note: Robust standard errors in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1)

<sup>60</sup> In his words, "(S)ince the inception of the modern sugar-refining industry in the 1870s, most sugar has been grown on large estates. The cultivation and processing of sugar have employed either forced labor or migrant workers who are among the most poorly paid on the continent.[...] Sugar has brought riches to a few and poverty to many, thereby reproducing the skew in the income distribution that goes back to the sixteenth century."(Sawers, 1996: 11).

<sup>61</sup> On behalf of Gallo's work, Duncan and Rutledge stated: "Ezequiel Gallo's paper on cereal- growing in the province of Santa Fé argues that the choice of crop itself played a central role in determining the future social and economic structure of the area, although he also emphasizes that, since this was an area of new settlement, it was completely free from the historically influential social and economic structures and relationships established by, and embodied in, a pre-existing and more archaic mode of production. To this extent the cereal-growing areas of Argentine pampas must be sharply distinguished from the older cereal growing areas of Latin America, such as Chile or Mexico (...). In contrast to the case of Brazilian coffee, in Santa Fe, at least during the period which Gallo analysis, there was practically no landlord control over the land, and great numbers of European immigrants (again, mainly Italian) were able to establish themselves very rapidly as independent farmers, through the system of agricultural colonies, were favored by the provincial authorities. By using a wide variable of census data Gallo underlines the difference between the cereal-growing area of Santa Fe and the sheep-raising zone, and stresses that the characteristic and principal form of agricultural enterprise in the cereal region was the small or medium-sized farm in which the greater part of the agricultural work was carried out by family labour. Even in this case, however, wage labour played an important role at harvest time, when large numbers of seasonal migrant workers were required. Gallo argued that between them the absence of a pre-existing landlord class and the special pattern of land settlement allowed the evolution of a rather more egalitarian class structure than that typically found in most other parts of Latin America" (Duncan and Rutledge, 1977: 300).

Additionally, we need the fulfillment of a second element, persistent inequality, i.e. strong relationship between past and current inequality. Table 4.2 (columns 1 and 2) shows that both 1960 and 2002 Farm Size Ginis are significantly correlated with Farm Size distribution in 1914.

**Table 4.2: 1960 and 2002 land inequality regressed on past farm size distribution, department level**

Regressions	Dependent variable: Farm Size Inequality in			
	1960		2002	
	Model 1	Model 2	Model 3	Model 4
Average Farm Size (year 1914)	0.00004*** (9.88e-06)		0.00002*** (9.82e-06)	
Farm Size Gini (year 1914)		0.548*** (0.0595)		0.587*** (0.0426)
Observations	360	360	350	349
R-squared	0.06	0.2702	0.022	0.393

Note: Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

### 4.3.2. Exclusion restriction

It is worth to note that the difference with ES approach is that we only ask factor endowments to be a “good” instrument, i.e. to be exogenous and correlated with inequality. In contrast, ES propose factor endowments as the main variable that explains development. Therefore, the two theories are mutually inconsistent if factor endowments affect growth through other channels, or directly. In subsection 4.5.2, we explore other determinants of development that may be associated with the instrument causing failure of the exclusion restriction.

One important critique our instrument could receive is that it is correlated with *geographical variables* which could belong to the structural model (Bloom and Sachs, 1998, and Sachs and Warner, 1997). Thus, we control for the main geographical variable suggested in the literature: distance to the equator.

A second concern emerges from the possibility of different human capital intensities involved in the production functions for different crops. Glaeser et al. (2004) argue that the fundamental cause of development is human capital. Then, our instrument could be flawed if their hypothesis is valid. In

order to assess the relevance of this theory, we also control for *initial levels of human capital* in 1883. Notice we do expect human capital to be a channel through which inequality affects development and we test it in subsection 4.5.1.

Other possible exclusion restriction failure is related to the possibility of different degrees of *tradability* between crops used to generate our variable of factor endowments. If levels of tradability differ for cereals (and oil-seeds) and sugar -thus implying differential productivity based on their degree of association with international markets-, we would find that our IV is correlated with growth by a channel independent from inequality, i.e. trade. We add this possibility by accounting for distance to the port of Buenos Aires, a proxy for openness.

A crucial assumption, noticeable omitted by some authors, is that agricultural endowments are part of the production function, then another channel that might be operating is a *wealth effect*, i.e., departments with richer factor endowments achieve higher development outcomes and thus afford less unequal societies. Then, we test the possibility that agricultural endowments might have a direct impact on our measures of development, in subsection 4.5.3, by including land price and land quality in the regressions.

Unfortunately, there are two other confounders that data availability prevent us from testing. First, if -as stated by Acemoglu et al. (2002)- the initial disease environment (their IV for European settlement) was correlated with factor endowments, and, at the same time, shaped the extent to which secure property rights were established thereby affecting growth directly, our instrument would not pass the exclusion restriction. Therefore, whereas it is possible that *initial institutions* drove economic growth while they were merely casually correlated with factor endowments, we lack measures that allow us to test this possibility. However, as suggested by Rodrik et al. (2004), its effect might be captured by conventional measures of geography. Second, there is a possibility that our measure of factor endowments has an effect on economic development not through inequality but by virtue of its impact on agricultural productivity. Briefly, differential suitability for different crops in diverse regions might have led cultivation strategies across the country, thereby influencing the *nutritional carrying*

*capacity* of land, which in turn affected urbanization and economic development. Following this reasoning, Nunn and Qian (2011) found that the introduction of the potato to the Old World, following the discovery of the Americas, explains 22% of the increase in population growth and longevity observed post-1700. Nevertheless, Delacroix and Licandro (2015) reject this hypothesis as they record the improvements for the 1600-1649 cohort.

## **4.4. Data**

### **4.4.1. The instrument**

Data on agricultural endowment suitability for Argentine departments was extracted from Visor GeoINTA.<sup>62</sup> The characterization of land is based on relevant components of climate, soils and topography, which are basic for the supply of water, energy, nutrients and physical plants' support. The model has been applied considering baseline period 1961-1990 average climate. Data is available for 376 departments that constitute 14 out of 24 provinces of Argentina.<sup>63</sup> These 14 provinces represent 62% of national 2005 GDP and cover 75.6% of 2010 total population.<sup>64</sup> To build our instrumental variable, we closely follow Easterly (2007). Although we trust in the same argument, data availability at the local level made us modify it slightly. For Argentine departments, we consider the ratio of cereals suitability (sunflower seed, maize and soybean) to sugarcane suitability. Notice the strong relationship between this factor endowments suitability indicator and farm size distribution described in Figure 4.A.2 in the Appendix.

### **4.4.2. Inequality**

Regarding the inequality measure, we tried to use a variable that captures the structural inequality proposed by Easterly, given data availability at the department level. We estimated the Gini coefficient

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<sup>62</sup> Available at <http://geointa.inta.gov.ar/visor/>. Last consultation: November, 2014

<sup>63</sup> These provinces correspond to the first 14 jurisdictions in which the Argentine territory was divided in at the beginning of the 20th century. These 14 provinces are: Jujuy, Salta, Tucumán, Santiago, Catamarca, La Rioja, San Juan, Mendoza, San Luis, Córdoba, Santa Fé, Entre Ríos, and Buenos Aires.

<sup>64</sup> Source: <http://www.economia.gob.ar/secretarias/politica-economica/planificacion-economica/informacion-regional-y-provincial/>. Consultation date: November, 2015

for the distribution of the sizes of farms based on 1914 National Population Census, and 1960 and 2002 National Agricultural Censuses. We use the average between the three measures as a variable representing *structural* inequality (Land Gini).<sup>65</sup>

One may argue that our measure of inequality (Farm Size Gini) does not represent wealth distribution but only the distribution in the size of firms (farms in our case) that, according to IO scholars, would be naturally correlated with factor endowments, thereby affecting productivity without actually representing the level of inequality in the distribution of land. In order to address this concern, we show in Table 4.3 the correlation of our measure of inequality in different years with other dimensions of inequality more associated, at first, to wealth inequality. Data in the table show a significant and positive association between our measure of structural inequality (Average Farm Size Gini (1914, 1960, 2002)) and the 2001 years of education Gini. Despite the close correlation and same data coverage, we use average farm size Gini instead of 2001 years of education Gini because we believe that the first one reflects better the idea of structural inequality due to its time stability. Second, we also correlate our variable with a more specific measure of land inequality, that is, the wealth Gini among owners calculated by Gelman and Santilli (2011). Even though data coverage is strongly reduced in this second example, results hold its sign and significance. These Ginis were also calculated for other regions in the country but our sample size would be strongly reduced.

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<sup>65</sup> We prefer to use farm size Gini instead of average farm size. Even though both measures of land distribution should be, at first, correlated with factor endowments (if ES are right), evidence suggests that the average might be also capturing differences in productivity (Adamopoulos and Restuccia, 2014). Table A1 in the Annex shows the correlation coefficients for factor endowments and Average Farm Size and Farm Size Gini in 1914, 1960, and 2002. The coefficients show that whereas our instrument is closely associated with farm size inequality with a relatively constant correlation coefficient (near 0.45), its relationship with average farm size is much lower, less significant and decreases with time. This time-invariant characteristic of the association between factor endowments and farm size Gini, we believe, is more closely related to the “structural” feature of inequality that we aim to grab. Besides, average and inequality in farm size do not appear to be strongly correlated. Therefore, by using farm size Gini rather than average farm size, we avoid -at least to a certain degree- taking into account the part of the distribution of farms that is associated with productivity.

**Table 4.3: Correlation coefficients of Farm Size Gini with other dimensions of inequality,**

<b>department level</b>	
Variables	Average Farm Size Gini (1914, 1960, 2002)
2001 Years of Education Gini	0.1714***
Observations	347
1867 Wealth Gini among owners ( <i>partidos</i> of Buenos Aires)	0.1952***
Observations	138

Note: Robust standard errors in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1)

Last, notice that local estimations of inequality, in contrast to cross-country studies, could have less measurement errors since they belong to the same surveys. Poor data quality on inequality comes from different methodologies across countries surveys: individual vs. households, income vs. expenditure, pre tax vs post tax, or national vs. urban (Deininger and Squire, 1996, 1998; Atkinson and Brandolini, 2001).

#### **4.4.3. Development outcomes**

Based on data availability, we use two measures of economic development, i.e. GDP per capita in 1959 and 2001 Life Quality Index (LQI). We use LQI, for the year 2001, from Velázquez (2008), to account for current development at the department level. This index is based on National Census data and includes a combination of socioeconomic variables (education, health and housing) as well as physical environmental indicators (flood risk, earthquakes, volcano, frequency of tornado and land erosion). Unfortunately, data availability prevents us from having an income variable to represent current economic development at this level of analysis. However, we consider LQI a good indicator of development outcomes. Our results remain valid if we use 1980, 1991, and 2010 Life Quality Indexes, which were also constructed by Velázquez (2008) and Velázquez et al. (2014).

GDP per capita for the year 1959 was obtained from an official publication of the *Consejo*

*Federal de Inversiones* (CFI).<sup>66</sup> Again, results hold when we use 1953 and 1958 GDP per capita, which were taken from the same source of information. Last, it is worth noting the close association between 1950s GDP per capita measures and more current LQIs, thereby suggesting certain persistence in economic development, at least in the past 60 years.<sup>67</sup>

#### 4.4.4. Channels of development

As mentioned before, the main mechanisms of development suggested by the literature are fiscal policies, institutions, and human capital. In the context of Argentine departments, the fiscal channel is not feasible since most of public revenues and budgets are decided at provincial and national levels. Therefore, we expect institutions and human capital to be the only prevailing mechanisms reproducing the effects of inequality.

We approximate 2001 human capital with average years of education. This variable was generated with data from the 2001 National Population Census. In order to quantify institutions, we use voter turnout from 2007 presidential elections, based on the electoral results published by the *Dirección Nacional Electoral*. The results obtained in the next section hold for voter turnouts in 2001, 2003, 2005, 2009, and 2011. Additionally, we try to capture the 2007 electoral competition for presidency with the share of votes obtained by the winner, along with its winning margin over the second most elected candidate.<sup>68</sup>

At this point, we can make a digression to discuss the accuracy of our proposed measure of institutions. First, it is incomplete as, at most, we only capture political institutions. Most empirical evidence accounts for institutions by generating indexes including the multiple dimensions comprehended by this concept or, more straightforwardly, by providing many definitions of institutions in order to achieve a certain degree of robustness. Second, it is imperfect because it aims to capture political participation and competition among candidates, in the sense that they represent

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<sup>66</sup> *Relevamiento de la Estructura Regional de la Economía Argentina*, Part II, Tables 53 and 75, (1965)

<sup>67</sup> Figure 4.A.3 in the Appendix shows the dispersion diagram between Average GDP during the 1950s and Average LQI between 1980 and 2010.

<sup>68</sup> All these measures are available at <http://elecciones.gov.ar>. Last consultation: September, 2015



democracy.<sup>69</sup> At first, one can state that voter turnout is not binding in a context of mandatory suffrage, such as the Argentine electoral system. Still, we do believe this is an effective way to measure political participation because the mandatory character has no enforcement in the Argentine case.

## **4.5. Estimation results**

### **4.5.1. Main results**

In this section we estimate the relationship between inequality and development outcomes. Table 4.4 presents the OLS and IV regression results of Land Gini in 2001 LQI (Panel A), and in 1959 GDP pc (Panel B). The estimations indicate a negative and significant causal relationship between land inequality and development. Consistent with results in Easterly (2007), IV estimated coefficients are significantly higher than OLS estimations, thereby suggesting that the latter understate the causal relationship between structural inequality and development. Moreover, when we include regional dummies (columns 3 and 7) and provincial dummies (columns 4 and 8), the coefficients are still negative and significant at 1%, and their values keep considerably higher than OLS beta. Last, all IV specifications in Table 4.4 surpass the Stock-Yogo critical value to test instrument weakness.

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<sup>69</sup> Ideally, rather than analyzing the outcomes of the electoral process, we would prefer to have data describing the conditions under which the elections took place. However, these dimensions of electoral outcomes were already used in other works. See, for instance, Banerjee and Iyer (2010). In particular, these authors use voter turnout, along with other electoral variables (number of candidates, winner vote share, vote margin, and probability of incumbent party winning) in order to assess institutions as a channel.

**Table 4.4: Development outcomes regressed on land inequality, department level.**

		Dependent variable: Land Gini							
Regressions	Panel A: 2001 Life Quality Index				Panel B: 1959 GDP pc (in logs)				
	OLS		IV		OLS		IV		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Land Gini	-0.228*** (0.0506)	-0.777*** (0.0854)	-1.633*** (0.246)	-1.022*** (0.287)	-2.101*** (0.270)	-5.309*** (0.514)	-8.556*** (1.354)	-6.337*** (1.905)	
Control by region	No	No	Yes	No	No	No	Yes	No	
Control by province	No	No	No	Yes	No	No	No	Yes	
Observations	348	348	348	348	347	347	347	347	
R-squared	0.057				0.143				
Weak Identification Test (Cragg-Donald Wald F)		191.846	41.159	17.047		192.248	41.246	17.188	

Note: Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 4.5 describes the magnitude, based on our results, of the effect of inequality on development outcomes. According to IV estimations, a one standard deviation in land inequality (12 percentage points) reduces a) 2001 LQI between 0.8 and 1.7 standard deviations, and b) 1959 ln GDP pc between 1 and 1.5 standard deviations. Therefore, our findings of inequality hampering development in Argentina is not only statistically significant but economically relevant.

**Table 4.5: Economic significance. Effect on development of one standard deviation change in land inequality, department level**

Model	SD Development outcome		Gini Coefficient in the model (3)	Change in development in response to a change in 1 SD of the Gini Coefficient (4)	(4) to (2) Ratio (5)
	SD Gini				
	(1)	(2)			
<i>Dependent variable: 2001 Life Quality Index (LQI)</i>					
Col.2, Table 4.4			-0.78	-0.09	-0.82
Col.3, Table 4.4	0.12	0.11	-1.63	-0.19	-1.71
Col.4, Table 4.4			-1.02	-0.12	-1.07
<i>Dependent variable: 1959 ln GDP pc</i>					
Col.6, Table 4.4			-5.31	-0.62	-0.96
Col.7, Table 4.4	0.12	0.65	-8.56	-1.00	-1.54
Col.8, Table 4.4			-6.34	-0.74	-1.14

As stated before, we do not expect the fiscal channel to be relevant in this case, since most

revenues are collected at national and provincial levels in Argentina. The remaining alleged mechanisms proposed by scholars are human capital and institutions. To test whether structural inequality affects current levels of human capital - that is, whether human capital represents an important channel today -, we use “2001 Average years of formal education.” Regarding local institutions, we gathered information on 2007 presidential voter turnout, winner share, and winning margin. The last two variables aim to capture electoral (lack of) competition. We expect these quantitative measures to represent at least a small part of the wide concept encompassed by (political) *institutions*. Consistent with Easterly (2007), our findings in Table 4.6 support both human capital (Panel A) and institutions (panels B, C, and D) as channels reproducing structural inequality. The only specification for which the IV is not significant is the case of the winning margin (Column 8, Panel D) when we include provincial dummies. Last, all IV specifications exceed Stock and Yogo critical values, thereby supporting our instrument strength.

**Table 4.6:** Potential channels regressed on land inequality, department level

Regressions	Dependent variable:											
	Panel A: 2001 Average Years of Education				Panel B: 2007 voter turnout presidential elections							
	OLS		IV		OLS		IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)				
Land Gini	-1.897*** (0.526)	-6.859*** (0.888)	-12.27*** (2.352)	-5.820** (2.649)	-0.141*** (0.027)	-0.409*** (0.051)	-0.840*** (0.124)	-0.612*** (0.152)				
Control by region	No	No	Yes	No	No	No	Yes	No				
Control by province	No	No	No	Yes	No	No	No	Yes				
Observation	348	348	348	348	348	348	348	348				
R-squared	0.036				0.054							
Weak Identification Test	191.846		41.159		17.047		191.846		41.159		17.047	

Regressions	Dependent variable:											
	Panel C: 2007 winner share on presidential elections				Panel D: 2007 winning margin on presid. elections							
	OLS		IV		OLS		IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)				
Land Gini	-1.897*** (0.526)	-6.859*** (0.888)	-12.27*** (2.352)	-5.820** (2.649)	-0.141*** (0.027)	-0.409*** (0.051)	-0.840*** (0.124)	-0.612*** (0.152)				
Control by region	No	No	Yes	No	No	No	Yes	No				
Control by province	No	No	No	Yes	No	No	No	Yes				
Obs.	348	348	348	348	348	348	348	348				
R-squared	0.036				0.054							
Weak Identification Test	191.846		41.159		17.047		191.846		41.159		17.047	

Notes: 1) Robust standard errors in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1; 2) Weak Identification Test is based on Cragg-Donald Wald F statistic)

## 4.5.2. Robustness Check for the Exclusion Restriction: Competing theories

In this section we test some possible failures of the exclusion restriction. Among the main (testable) sources of potential concerns with our instrumental variable are its correlation with 1) geographical variables that could belong to the structural model (Bloom and Sachs, 1998; Sachs and Warner, 1997), 2) initial levels of human capital which have been claimed to be a strong predictor of current economic development (Glaeser et al., 2004), and 3) trade.

**Geography.** One important critique the instrument can receive is that it is correlated with geography, a compelling cause of development. Indeed, agricultural suitability is closely associated with distance to the equator (Figure 4.A.4). However, our findings in Table 4.7 show that inequality coefficient is still negative and significant at the 1% level when we control for this variable. Overall, IV estimations for structural inequality are larger than its OLS coefficients.

**Table 4.7: Robustness check, effect of inequality on development accounting for distance to the equator**

Regressions	Dependent variable:					
	Panel A: 2001 Life Quality Index			Panel B: 1959 ln GDP pc		
	OLS	IV		OLS	IV	
(1)	(2)	(3)	(4)	(5)	(6)	
Land Gini	-0.252*** (0.068)	-0.777*** (0.086)	-1.240*** (0.144)	-1.833*** (0.324)	-5.309*** (0.514)	-7.034*** (0.816)
Distance to the equator	0.0017 (0.0021)		0.018*** (0.0031)	-0.0188 (0.0114)		0.065*** (0.0186)
Obs.	348	348	348	347	347	347
R-squared	0.059			0.151		
Weak Identification Test	191.846		93.414	192.248		93.099

Notes: 1) Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; 2) Weak Identification Test is based on Cragg-Donald Wald F statistic)

**Initial levels of human capital.** According to Glaeser et al. (2004), the main cause of development must be looked into human capital. The authors find that initial levels of human capital predict growth in a cross-country data set. Even though we expect human capital to be a channel through which inequality affects development, in this subsection we aim to isolate its impact as a fundamental cause to find out whether structural inequality independently causes development. Then, in order to assess the

relevance of this hypothesis at the local level for the Argentine context, we also control for initial levels of human capital in 1883, as measured by literacy rates among school-aged children.<sup>70</sup> Results in Table 4.8 suggest that OLS estimations (columns 1 and 4) would drive us to underestimate, or even discard (as in the case of LQI), the negative effect of land inequality if we account for the initial level of human capital in the regression. In contrast, according to IV estimations there is some room for inequality to affect development even after taking initial human capital level into account.

**Table 4.8: Robustness check, effect of inequality on development accounting for initial levels of human capital**

Regressions	Dependent variable:					
	Panel A: 2001 Life Quality Index			Panel B: 1959 ln GDP pc		
	OLS	IV		OLS	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Land Gini	-0.0321 (0.063)	-0.750*** (0.089)	-0.609*** (0.101)	-1.247*** (0.320)	-4.893*** (0.519)	-4.634*** (0.630)
1883 Literacy rates among school aged children	0.333*** (0.049)		0.153*** (0.058)	1.342*** (0.244)		0.283 (0.332)
Obs.	314	314	314	313	313	313
R-squared	0.196			0.199		
Weak Identification Test	166.378		108.027	166.714		108.219

Notes: 1) Robust standard errors in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1); 2) Weak Identification Test is based on Cragg-Donald Wald F statistic)

**Trade.** It is possible that every crop used to build our instrument differ in their degree of tradability, therefore meaning that each one of them has different levels of productivity based on its respective level of association with international markets. If this is the case, we would find that our IV (factor endowments) is correlated with growth independently from our measure of structural inequality. Then, we proxy openness with distance to the port of Buenos Aires. Despite we find that this variable is correlated with factor endowments,<sup>71</sup> results in Table 4.9 allow us to conclude that inequality remains significant after controlling for this characteristic, and that IV coefficients of inequality are larger than OLS.

<sup>70</sup> Our findings remain valid if we use 1895, 1909, or 1914 literacy rates.

<sup>71</sup> Correlation coefficient between factor endowments and distance to the port of Buenos Aires is -0.6, significant at 1% level.

**Table 4.9: Robustness check, effect of inequality on development accounting for distance to the port of Buenos Aires**

Regressions	Dependent variable:					
	Panel A: 2001 Life Quality Index			Panel B: 1959 ln GDP pc		
	OLS	IV		OLS	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Land Gini	-0.159** (0.078)	-0.777*** (0.086)	-1.468*** (0.219)	-1.383*** (0.343)	-5.309*** (0.514)	-8.292*** (1.273)
Distance to the port of Buenos Aires	-3.89e-05* (2.35e-05)		0.0002*** (4.92e-05)	-0.0004*** (0.0001)		0.0009*** (0.0003)
Obs.	348	348	348	347	347	347
R-squared	0.068			0.176		
Weak Identification Test		191.846	50.833		192.248	51.145

Notes: 1) Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; 2) Weak Identification Test is based on Cragg-Donald Wald F statistic)

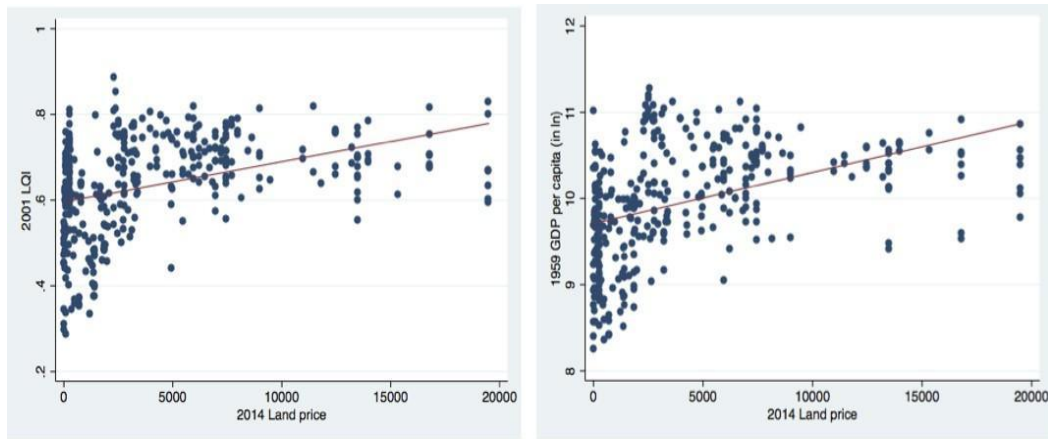
#### 4.5.3. Robustness Check for the Exclusion Restriction: Wealth Effect

The second part of the exclusion restriction requires that the instrument has no effect on outcomes other than through the first stage channel. The fact that factor endowments are part of the production function is one of the most prominent weaknesses of our instrument. Then, another relationship that might be operating in our IV regressions is a wealth effect, i.e. departments with richer factor endowments enjoy higher levels of economic development and, consequently, can “afford” less unequal societies. Therefore, we assess this presumptive limitation by accounting for wealth in the regressions. In particular, we take this hypothesis into account and estimate the model including land value and land quality as controls. Land price data is obtained from *Compañía Argentina de Tierras S.A.*<sup>72</sup> Regarding land quality, we develop a Soil Quality Index by using information from FAO and applying the formula proposed by Brady and Weil (2008), i.e. considering the average of 5 top-soil properties: available water holding capacity, reference bulk density, the percentage of clay, the percentage of organic carbon, and the PH level (see more details in the Appendix 2.A). Notice, Figure 4.2 shows that land price is in fact significantly related to both measures of economic development.<sup>73</sup>

<sup>72</sup> Available at <http://www.cadetierras.com.ar/estadisticas/valor-de-la-tierra-en-argentina> (Last date of consultation: November, 2014).

<sup>73</sup> 2001 LQI, with a linear correlation coefficient of about 38% and 1959 ln GDP pc of 43%, both significant at 1% level.

**Figure 4.2: Development outcomes and land price, department level**



Columns 3 and 6 in Table 4.10 show that inequality coefficient does not change significantly when we include land price as a control variable. Moreover, although land price is significant in OLS regression and it is closely associated with factor endowments (Figure 4.A.5 in the Appendix), when we use IV method only inequality shows a significant correlation. Regarding our land quality indicator, despite the correlations shown in Figure 4.A.6, inequality coefficient is not considerably affected by the inclusion of this variable, as shown in Table 4.11.

**Table 4.10: Robustness check, effect of inequality on development accounting for land price**

Regressions	Dependent variable:					
	Panel A: 2001 Life Quality Index			Panel B: 1959 ln GDP pc		
	OLS	IV		OLS	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Land Gini	-0.106 (0.066)	-0.815*** (0.093)	-0.841*** (0.130)	-1.344*** (0.316)	-5.450*** (0.539)	-5.515*** (0.916)
2014 Land price	7.94e-06*** (1.58e-06)		-7.88e-07 (2.34e-06)	4.77e-05*** (8.08e-06)		-2.04e-06 (1.80e-05)
Obs.	327	327	327	326	326	326
R-squared	0.141			0.238		
Weak Identification Test		186.644	100.551		187.109	100.820

Notes: 1) Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; 2) Weak Identification Test is based on Cragg-Donald Wald F statistic)

**Table 4.11: Robustness check, effect of inequality on development accounting for land quality**

Regressions	Dependent variable:					
	Panel A: 2001 Life Quality Index			Panel B: 1959 ln GDP pc		
	OLS	IV		OLS	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Land Gini	-0.145** (0.06)	-0.753*** (0.083)	-0.757*** (0.09)	-1.577*** (0.294)	-5.173*** (0.491)	-4.975*** (0.548)
Land quality	0.003*** (0.0008)		-8.99e-05 (0.0008)	0.022*** (0.004)		0.004 (0.005)
Obs.	338	338	338	337	337	337
R-squared	0.099			0.209		
Weak Identification Test		210.658	146.689		211.172	146.838

## 4.6. Conclusions

The relationship between inequality and economic development has called the attention of the discipline since its beginnings up to the present. While this relationship has been mostly studied at the country level, the goal of this paper is to shed light on the causal relationship at a lower level of administrative division, using Argentine departments.

Our empirical strategy is based on Easterly (2007) who, inspired on the hypothesis of Engerman and Sokoloff (1997), uses the ratio of agricultural endowments, as an instrument for “structural inequality,” which results in a very good predictor of the historical size distribution of farms and current multidimensional measures of inequality in each department.

Our results suggest an economically significant negative impact of inequality on development outcomes, which contrast with the positive association indicated in recent Latin American empirical evidence focused on the local level (Dell, 2010; Acemoglu et al., 2007; Summerhill, 2010) but consistent with estimations for other regions (Banerjee and Iyer, 2005; Galor et al., 2009).

We test for possible failures of the exclusion restriction of our instrument -in some cases omitted by the literature-, such as correlation with geographical variables, initial levels of human capital, tradability, and a possible wealth effect. The results remain consistent with previous estimations.



Our research challenges further theoretical exploration regarding causal mechanisms between inequality and development by differentiating channels operating at the local and national level; the fiscal channel is not operative in our research since most taxes are determined at the national or provincial levels in Argentina. As highlighted by empirical studies in other contexts, our results would endorse the human capital mechanism as one of the main channels through which inequality may affect development. Moreover, we also find support for institutions as a mechanism connecting structural inequality with development, consistently with Acemoglu and Dell (2010) hypothesis, local institutions vary significantly within countries and states and reproduce the effect of inequality in economic development.

#### **4.7. References**

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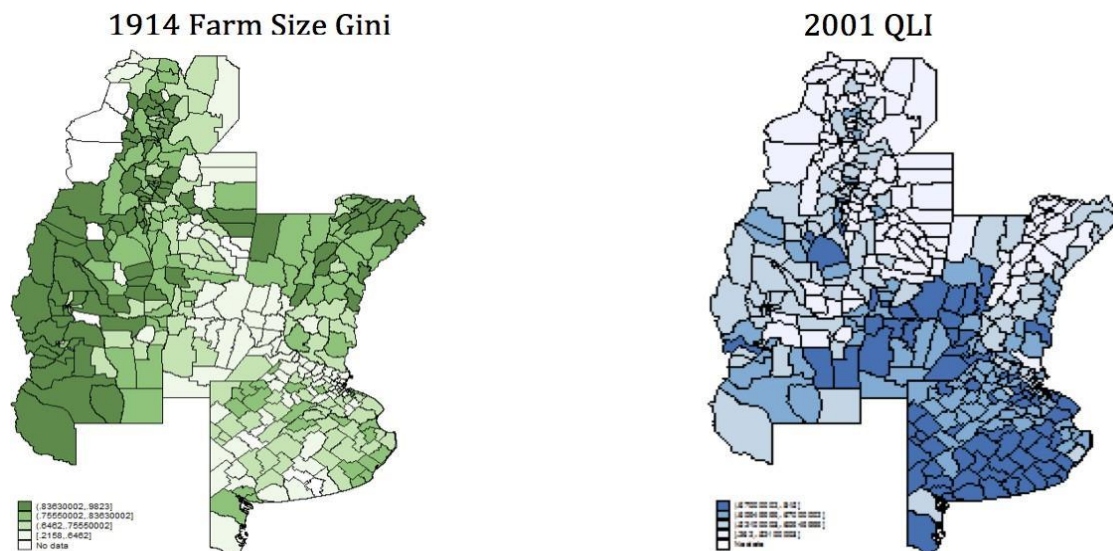
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# Appendix Chapter 4

## Appendix 4.A. Figures and Tables

**Figure 4.A.1: Spatial distribution of land Inequality and Life Quality Index, department level**

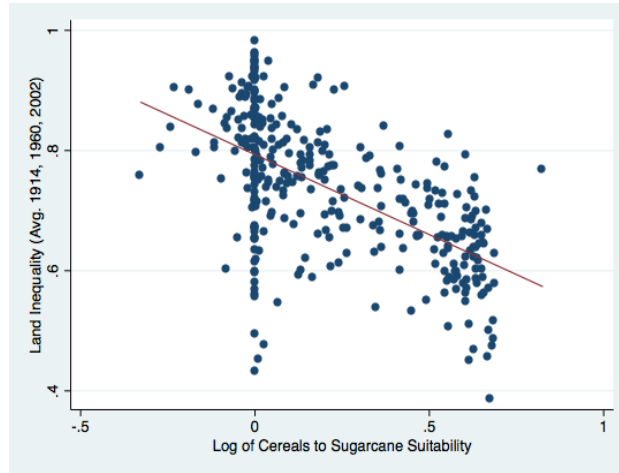


**Table 4.A.1: Correlation coefficients of factor endowments, average farm size, and farm**

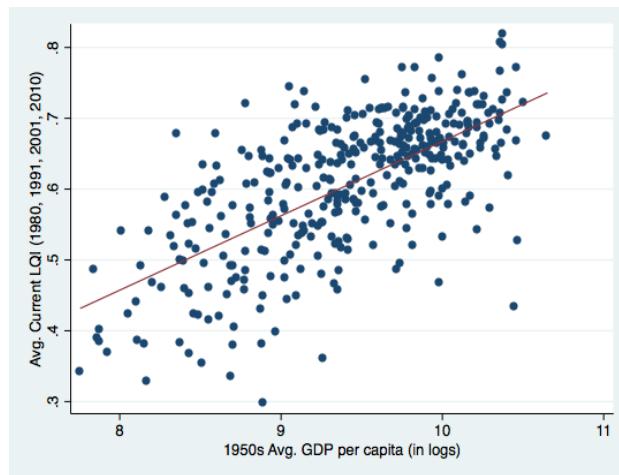
Variables	Average Farm Size			Factor endowments	Farm Size Gini		
	1914	1960	2002		1914	1960	2002
1914 Average Farm Size	1						
1960 Average Farm Size	0.3415***	1					
2002 Average Farm Size	0.4216***	0.5732***	1				
Factor Endowments	-0.2639***	-0.1445**	-0.0778	1			
1914 Farm Size Gini	0.0710	0.1648**	0.0753	-0.4666***	1		
1960 Farm Size Gini	0.2448***	0.1393*	0.0685	-0.4436***	0.5198***	1	
2002 Farm Size Gini	0.1479**	0.0175	-0.0528	-0.4848***	0.6269***	0.5913***	1

(\*\*\* p<0.01, \*\* p<0.05, \* p<0.1)

**Figure 4.A.2: First Stage. Factor endowments and land inequality, department level**

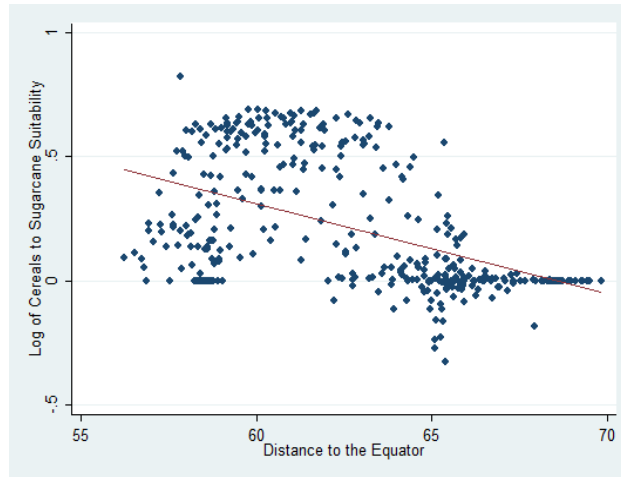


**Figure 4.A.3: Average 1950s GDP per capita (in logs) and average LQI (1980, 1991, 2001, 2010), department level**

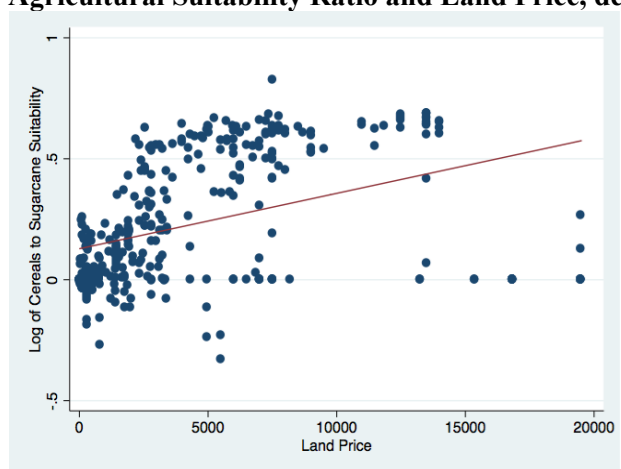




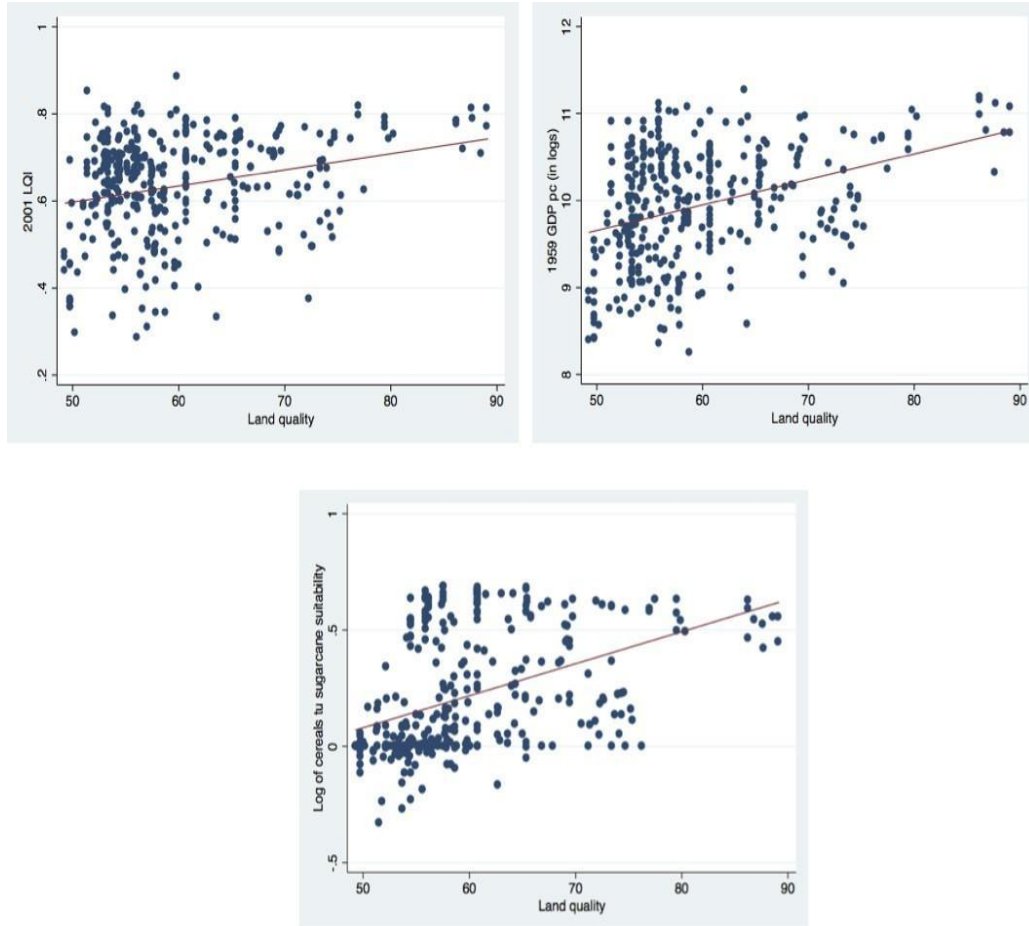
**Figure 4.A.4: Agricultural suitability ratio and distance to the equator, department level**



**Figure 4.A.5: Agricultural Suitability Ratio and Land Price, department level**



**Figure 4.A.6: Development outcomes, land quality and factor endowments, department level**



## **Chapter 5: Conclusions**

Motivated by the debates around the failure of Argentine development, this thesis has explored the incidence of inequality on development via its influence on human capital. Overall, the results provide evidence in favor of a negative impact of structural inequality on long-term economic development paths and suggest that human capital would have been an important driver of this effect.

This general question is addressed throughout the three main chapters of the thesis by using different estimation strategies, with different specific objectives, and limited by the availability of sources. In fact, in the three investigations in this thesis, inequality is measured on different variables and even with different statistical indicators to represent the economic distribution.

However, the three studies also have points in common. On the one hand, they have the same debates as a background and, on the other hand, they share a local level approach

(departments in chapters 2 and 4, and districts in chapter 3). In the Argentine case, local analysis is not only feasible due to the great variability within the territory in terms of inequality, human capital, institutions and development, but it is also necessary given the question to be answered in this dissertation.

Chapter 2 finds that wealth inequality in the 1860s negatively affected subsequent educational performance at the origins of the development of the national primary education system, before and after the process of budget centralization had taken place.

Two hypotheses about how inequality might have negatively affected primary education allocation have been suggested. On the supply side, a high level of inequality is associated with the presence of local elites hindering the provision of education for the masses. This hypothesis is confirmed for the first part of the period - end of the 19th century - in which the allocation of the budget to primary education was decentralized. On the demand side, high inequality is associated with a lack of interest in education on the part of the masses. This hypothesis is also validated by the end of the period (1909 and 1914), once the centralization of the budget in primary education had already taken place.

Moreover, the results indicate that the wealth inequality coefficient loses significance for the variables linked to the education inputs (teachers and schools) but not for the outputs (literacy and school attendance). Overall, these results suggest that inequality did affect the allocation of primary education, but that this effect decreased over time, with the supply-side effect disappearing with budget centralization. These findings endorse other empirical research addressing this relationship (Beltrán Tapia and Martínez-Galarraga, 2018; Cinnirella and Hornung, 2016).

In addition, the mechanisms by which inequality would have affected the demand for education at the beginning of the 20th century are explored. While the productive structure does not seem to have constituted a channel of demand for primary education, the results provide evidence that urbanization and, to a lesser extent, the proportion of the European population did.

Regarding urbanization as a channel connecting the negative effects of inequality on development, the results are in line with other research for the period that suggests that the process of modernization of institutions and economic activities - experienced asymmetrically in different localities in favor of more egalitarian areas - would have been part of the explanation.

On the other hand, the results indicate that while the proportion of the European population was negatively correlated with wealth inequality in the 1860s, it would also have been a driver of the demand for human capital. However, the results are not significant in specifications where spatial heterogeneity is not accounted for. For this reason, although in principle these results endorse the findings of Droller (2018), they also suggest, as does Sánchez Alonso (2019), that there are nuances and complexities in the different settlement patterns of European immigration in the Argentine case that need to be taken into account. The findings in Chapter 3 lend support to this hypothesis.

The main goal of Chapter 3 is to explore the effects of agricultural colonization on primary education in the province of Santa Fé during the process of expansion of the agricultural frontier in the second half of the 19th century. Therefore, agricultural colonies in Santa Fé are thought of as a case study of egalitarian institutions that might have impacted on primary schooling provision. In order to assess the aforementioned relationship, data from the 1887 provincial census corresponding to 362 districts (communes and municipalities) that make up the province are used. The results of the OLS and ATE estimations suggest that the presence of colonies positively affected investment in human capital.

Various mechanisms proposed in the literature are tested in this chapter to explain this causal relationship. The influence of urbanization is also evaluated in this case. According to historiography, agricultural activity - particularly cereal crops -, by stimulating the establishment in the countryside of a series of economic activities related to industry, commerce and transportation, contributed significantly to the diversification of economic life in the region and, at the same time,

gave a strong impetus to the creation of hundreds of small urban centers. The results suggest that the degree of urbanization could have been part of the explanation, thereby giving support to evidence of similar studies for the Chilean and the Brazilian cases (González, 2020; Rocha, Ferraz, and Soares, 2017). At this point it is worth asking whether the influence of urbanization is via demand as in the aforementioned cases, or via supply as Montalbo (2020) finds for France in the 19th century.

Second, while it is true that the Europeans in the province of Santa Fé had a higher stock of human capital than the natives, there is no evidence that the higher relative incidence of Europeans in the colonies had been part of the explanation for the colonies' relative success as providers of primary education - at least until 1887 -. This finding challenges the research of Droller (2018) for this special case on the European effect in the Pampas and, again, the interpretation can be found in Sánchez Alonso (2019). These results suggest further research on the topic is needed.

Third, while traditional historiography argues that the colonies represented ethnically homogeneous communities, recent research among historians and statistical evidence in Chapter 3 suggest that agricultural colonies were relatively diverse in terms of the nationalities residing in them. In addition, estimations' results point to the relative high heterogeneity in terms of nationalities as part of the explanation regarding the relative success of colonies' primary schooling indicators. This finding also contributes to the social sciences' debate on the degree of cultural heterogeneity as a channel of public goods provision. Again, further research is needed in this topic to better disentangle this mechanism.

Last, in this chapter the relative equality in land ownership - measured as the percentage of owners - is found to be a mechanism by which the colonies performed better in educational terms. Although it is not possible to distinguish between demand or supply drivers of the inequality channel, the fact that the *Contribución Directa* - a wealth tax - constituted an important part of the financing for primary education indicates that at least in this period - that is, prior to the

centralization of budgets for primary education - the supply side of the effects of inequality would have played a role.

Finally, Chapter 4 - co-authored with Antonella Bonacina and Alejandro Danón - studies the long-term effects of inequality at the local level on development using the instrumental variables method. Following Easterly (2007), an instrument is constructed based on the land suitability ratio for sugarcane and cereal crops, due to the link of each of these crops with more unequal and more egalitarian societies, respectively. This instrument is useful for understanding the causal relationship between inequality and development at the local level in Argentina.

The results of the chapter suggest suggest an economically significant negative impact of structural inequality on development outcomes, which contrasts with the positive association indicated in recent Latin American empirical evidence focused on the local level (Dell, 2010; Acemoglu et al., 2007; Summerhill, 2010) but consistent with estimates for other regions (Banerjee and Iyer, 2005; Galor et al., 2009).

As highlighted by empirical studies in other contexts, results in Chapter 4 endorse the human capital mechanism as one of the main channels through which inequality may affect development. Moreover, institutions are also found in this chapter to be a channel connecting structural inequality with development, consistently with Acemoglu and Dell (2010) hypothesis, local institutions vary significantly within countries and states and reproduce the effect of inequality in economic development.

Taken together, all these results suggest that "structural" inequality in Argentina could be part of the explanation for its development failure. Specifically, spatial heterogeneity in Argentina's historical inequality levels caused different development paths that, taken together, hindered the aggregate's growth and development trajectory. Moreover, within this explanation, human capital could have played an important role as a driver of the relative Argentine failure.