

Immigration and Human Capital: Consequences of a 19th century Settlement Policy

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Abstract

We study a settlement policy implemented by the Chilean government between 1882 and 1904 to analyze the relationship between European immigration and the human capital of natives. Based on historical census data, we show that this settlement policy was successful in recruiting Europeans, who located in different parts of the country. Using a panel data of provinces observed between 1860 and 1920, we find a strong, positive, and robust correlation between recruited Europeans and the human capital of natives. This finding is not driven by changes in school enrollment, school construction, or regional shocks. The arrival of Europeans is strongly associated with local economic output fifty years after the policy was terminated. This increase in local economic activity, together with narrative historical evidence, suggest that structural changes in local economies could be a mechanism explaining our results.

Keywords: immigration, settlements, human capital, europeans.

JEL Codes: I21, J15, J24, N36, N96, O15, O18, R38.

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1 Introduction

After the Age of Discovery, a period of great exchange between Europe and the Americas began.¹ Between 1850 and 1917 more than fifty million Europeans sailed to the American continent (Hatton and Williamson, 1998). Was this “Age of Mass Migrations” beneficial for regions in which Europeans settled? We study a policy that incentivized migration from European countries using new disaggregated historical data to shed light on this issue.

The government of Chile implemented a policy between 1882 and 1904 with the goal of recruiting skilled Europeans to settle in the country. Recruitment sites were installed in some European countries to promote—with information and subsidies—skilled emigration to Chile. We are able to track the immigration effects of this policy using national historical censuses. We construct a panel dataset of provinces for the period 1860–1920, i.e., before, during, and after the implementation of this settlement policy. Consistently with the government’s goal, we observe a large increase in the number of Europeans from countries with recruitment sites, but no increase over time in the number of immigrants from other European and non-European countries. In addition, we observe substantial heterogeneity in the number of Europeans across provinces in Chile. These facts suggest that it is possible to empirically evaluate the effects of recruited Europeans. We compare the human capital of natives across provinces before and after the arrival of recruited Europeans, using the number of Europeans from different countries to measure a province’s exposure to the policy.

To gain insights about mechanisms, we construct a simple model to study the response of natives after the arrival of skilled immigrants to the local economy. Upon their arrival, Europeans have the option to start a firm, or work at the existing labor for a fixed wage. The main theoretical predictions we obtain from this exercise guide our empirical analysis in two ways. First, they motivate our choice of control variables. Second, they help us think about two potential mechanisms linking Europeans and the human capital of natives: an increase in the demand for skilled labor, and the construction of public schools.

Besides detailed information on immigrants’ nationality, Chilean national censuses also present precise information on literacy rates, which enable us to construct accurate measures of natives’ literacy rates for each province before, during, and after the arrival of recruited Europeans. Simple comparison of provinces affected and not affected by the arrival of re-

¹The consequences of this Columbian Exchange has been an active area of research in economic history, particularly during the last decade. This research agenda has focused on the impacts this exchange had in the Americas (e.g. Engerman and Sokoloff 2000, Acemoglu et al. 2001, Dell 2010, and Bruhn and Gallego 2012, among others, see Nunn 2009 for a review) and in Europe (e.g. Nunn and Qian 2011, see Nunn and Qian 2010 for a review).

cruited Europeans suggests that natives' literacy rates increased significantly in the years following the policy. However, as recruited Europeans are unlikely to settle randomly across provinces, this simple differences-in-differences strategy might not be appropriate to evaluate the human capital effects of skilled immigration. Our main concern is that recruited Europeans settled in provinces with higher expected development. This could be the case if, for example, Europeans settled in places with relatively high government intervention. We provide several pieces of evidence that suggests our estimates are informative about the effects of recruited Europeans and not other variables.

Following insights from our model, and also details from the history of Chile, we include specific time-varying control variables and regional trends to account for differences in development, public policy, and labor markets across provinces. The effects of most historical events occurring during this time period (e.g., the War of the Pacific), are accounted for using controls and regional trends. Our estimates indicate that for every ten Europeans that arrived in the country, there were five natives that learn to read and write. Estimated coefficients do not change when control variables are included, suggesting selection into provinces with different development trends is not a problem.

In addition, we use Euclidean distances to the main ports of entry during the period of the settlement policy, as exogenous shifters in the number of Europeans. We do this because of two potential concerns. First, the number of Europeans might have been underestimated due to poor census quality, biasing our estimated coefficients downwards. Second, regional trends and control variables might be insufficient to account for Europeans' location decision. A concern with this strategy is that provinces close to ports are different from other provinces and, therefore, the exclusion restriction might be violated. Standard statistical tests, historical evidence, falsification and robustness exercises, and placebo checks with non-operating ports suggest the instruments are valid. Main results indicate a positive, statistically significant, and large effect of European immigrants on natives' literacy rates.

After documenting these results, we proceed to investigate the potential mechanisms linking skilled Europeans and natives' human capital. Our theoretical framework suggests that an increase in the demand for skilled labor, and an increase in public goods, could be mechanisms at work. We are able to test for the latter using a novel dataset of school construction matched to our dataset of provinces in census years. We can partially test for the former mechanism using data on school enrollment. Results indicate that there is no statistical association between European immigration and school construction, our main measure of an increase in public goods. In addition, there is a marginally significant and *negative* effect of Europeans on the total number of enrolled students. This last result is consistent with evidence showing that the development of industries in a locality can increase

dropout rates (e.g., Atkin 2014). Taken together, these results suggests other mechanisms could be at work.

This paper is part of a nascent research agenda that studies the relationship between European immigrants and the human capital of natives during the Age of Mass Migrations (e.g., Lafortune et al. 2014, Rocha et al. 2015), one mechanism through which Europeans could have fostered economic development in the Americas (Easterly and Levine, 2015). There is, however, a large number of articles studying immigration effects in the 19th century, and also immigration effects on natives' outcomes in other periods. Reviewing these literatures is beyond the scope of this paper, but it suffices to say that there are several studies analyzing the determinants of 19th century migration to the United States, Argentina, and Brazil (e.g. Hatton and Williamson 1998, Balderas and Greenwood 2010 and Droller 2013).² There has also been a relatively smaller research agenda studying the selection of migrants from the native population (e.g. Wegge 2002 and Abramitzky et al. 2012). In addition, there have been efforts to quantify the growth effects of European immigration. For example, Stolz et al. (2013) analyze the long-run growth effects of a relatively skilled European migration to Brazil.³

Finally, there is an extensive research agenda analyzing natives' outcomes in response to immigration inflows. For example, Eberhard (2012) constructs a general equilibrium model and finds negative direct effects on earnings and positive effects through human capital accumulation.⁴ In a similar approach to the one in this paper, Card (1990) uses the Mariel Boatlift episode as a natural experiment to study the impact of an unexpected inflow of relatively unskilled immigrants on Miami's labor market, finding that a relatively large influx of unskilled workers did not cause a significant change in the wages of native unskilled workers.⁵

The next section presents the relevant historical background, including details about the operations of the settlement agency and characteristics of the European immigrant population. Section 3 presents a model that links the arrival of a skilled immigrant to a native's human capital decision. Section 4 discusses our data construction and describes the main variables to be used in the empirical analysis. Section 5 presents the main results of the

²There has been less attention to European immigration processes in relatively smaller receiving countries and, in this sense, this paper is also a contribution.

³Interestingly, the authors *assume* the existence of human capital spillovers from skilled Europeans to relatively unskilled natives, argue that human capital is persistent, and then estimate growth regressions at the regional level, finding large and positive effects.

⁴See also Grossman (1982), and Altonji and Card (1991), among many others.

⁵See also Hunt and Gauthier-Loiselle (2010), Kerr and Lincoln (2010) and Peri et al. (2013), among many others.

paper. In section 6 we explore the relative importance of mechanisms. Finally, section 7 offers some conclusions.

2 Historical Background

2.1 Chile at the turn of the 19th century

Between the independence from Spain in 1810 and the 1860s, the foreign population in Chile was low. Although there might be multiple reasons behind this, the country's geographical isolation seems to be one of the main explanations (Norambuena, 1990). However, in the second half of the nineteenth century, countries like Argentina and Brazil promoted immigration to foster the process of industrial development. Chile, following its neighboring countries, also adopted an immigration policy to foster development.⁶

Besides describing the details behind this immigration policy, it is important to briefly describe Chile's economic, political, and historical experience at the turn of the nineteenth century. Perhaps one of the most important events was the War of the Pacific (1879–1883). In this war, Chile, Peru, and Bolivia fought for the mining territory in the Atacama Desert. Chile annexed a territory rich in natural resources after the war, and Bolivia became a landlocked country. This historical episode had a profound impact on the development of the mining sector and the economy of the country (Pinto and Ortega, 1990).

The second half of the nineteenth century was also a period of changes in educational policies. In particular, primary instruction became a priority. The development of the “Primary Instruction Law” summarizes the government's intentions: all children between the ages of six and sixteen were forced to be at least four years at school. Although this law was officially enacted in August of 1920, public spending on education began decades before (Bowman and Wallerstein, 1983). Investments in public infrastructure were necessary for the development of public education, which lead the government to start investing in school construction in the 1860s (Ponce de León, 2010).

Overall, Chile experienced many economic, social, and political changes at the turn of the nineteenth century.⁷ Most of these changes, however, were experienced at the country level. This means we can account for the impact of these events using year fixed effects and

⁶There were some attempts to attract foreigners before the 1880s, but they were largely unsuccessful until the immigration policy was implemented in 1882 (Borgono, 1913).

⁷In Appendix Figure 1 we present time series for real GDP per capita and its growth (Díaz et al., 2007). There is a steady increase in GDP per capita in the period under study.

flexible trends for regions within the country. This is the approach we take in most of our empirical analysis.

2.2 The settlement agency

In order to foster development in Chile, the central government created the settlement agency, officially named “Agencia General de la Inmigración y Colonización de Chile en Europa”, in October of 1882. Former conservative deputy Francisco de Borja Echeverría was appointed to manage the agency’s operations, and chose France as headquarter. The choice of France was motivated both because of its strategic location within Europe, and because of the existence of laws that encouraged the arrival of immigration agencies.

The settlement agency was entrusted with the recruitment and settlement of skilled Europeans in Chile. To achieve this goal, several agencies were established in Spain, France, Germany, Piedmont, Sweden, and Switzerland. Limited financial resources constrained the agency’s operations in other parts of Europe. Indeed, the agency wrote to the Chilean government:

“Financial constraints limit our ability to advertise the role of the settlement agency across all countries in Europe. This is the main reason behind the nationalities of immigrants going to Chile. With more financial resources, we would observe immigrants from all European countries.”⁸

The main roles of the settlement agency in Europe were to provide information about (1) the migration process, and (2) the financial benefits for those who chose to migrate. The diffusion of information was done using pamphlets, maps, and newspaper advertisements. The benefits for Europeans who chose to migrate were: free shipping of their tools and machinery (with a limit of 2 tons), free tickets across Chilean railroads upon arrival, and a significant reduction in travel tickets within Europe—from cities to main ports of departure—and from Europe to Chile.

In 1904, twenty two years after the settlement agency began its operations, President Germán Riesco Errázuriz terminated this immigration policy. As a consequence, the European immigration to the country began to decline (Maldini, 2004). The causes behind the end of the settlement agency are not entirely clear. However, after careful reading of the

⁸Own translation from Agencia de Colonización (2010, p.5). A summary of the agency’s financial statements is available for 1894. Approximately 77% of its budget was used to buy travel tickets for Europeans, 9% was spent in advertisement, and 14% was spent in operational costs (e.g., wages, telegrams).

agency's operations in Europe, it seems that financial resources were an important cause behind the end of this unique immigration policy.

2.3 Europeans as skilled immigrants

Europeans were different from other immigrants.⁹ This claim can be corroborated empirically using national censuses, which present detailed information about occupations and literacy rates by nationality. Columns 1 to 5 in Appendix Table A.3 present occupations from the five largest origin European countries. The majority of Europeans were relatively skilled workers. Columns 6 and 7 show the occupations of two neighboring countries for comparison. These immigrants worked at relatively unskilled occupations such as farmhand or servants.¹⁰

Because the claim that European immigrants in Chile were relatively skilled could be controversial in the context of the literature, some discussion is necessary. In the early nineteenth century, only a small percentage of those able to emigrate qualified as a relatively skilled selection of the population (Cohn, 2010). In the case of the U.S., as new technologies sharply reduced transportation costs and immigrants settled and sent their offspring to the rapidly-expanding educational system, the pattern inverted. For many other countries, including Chile, this was not the case, partially because they were behind in the educational process (Lindert, 2004, p.91-93). Thus, even if individuals recruited by the settlement agency were part of the relatively unskilled population in their home countries, they became relatively skilled immigrants after their arrival to Chile.

In sum, the empirical accounts described above confirm narratives in historical research: even though Europeans represented a relatively small share of the population, they had a large, positive, and significant effect on the development of the country (see Blancpain 1985, Stabili 1986, and Bernedo 1999, among others). Taking into account historical and empirical accounts the next section describes a model to explain how natives' human capital decisions could have changed after the arrival of relatively skilled Europeans.

⁹Although Europeans represented only 2 percent of the population, several historians have argued that they had a large, positive, and significant effect on the development of the country (e.g. Blancpain 1985, Stabili 1986, and Bernedo 1999, among others).

¹⁰In another piece of evidence, Estrada (2005) shows that Europeans owned more than 30 percent of the firms that existed in 1920, even though they only represented around 2% of the total population (Appendix Table A.4).

3 Theoretical Framework

Consider the arrival of a European to a local economy. After his arrival, a European chooses to either (1) work in the existing labor market, or (2) hire natives and start a firm. Natives living in the local economy, on the other hand, observe Europeans' actions and decide whether to acquire (additional) education or not. Our focus falls on natives' decisions. However, we also discuss Europeans' location and labor decisions. We do this to guide our empirical framework, particularly the choice of control variables.

3.1 Europeans

Let w_E be the wage a European can obtain in the existing local labor market, and s his entrepreneurial skill. If he decides to start a firm, instead of entering the labor market, he gets the following profits:

$$\pi(s) = Y(s, \theta, E, L, K) - w_N L - rK \quad (1)$$

Where $Y(s, \theta, E, L, K)$ is the production function of the firm, θ and E represents natives' (unobserved) labor ability and (observed) education respectively, w_N is the wage offered to natives, L the number of natives hired, r the cost of capital, and K the amount of capital employed in the production process. Let the production function of the firm be Cobb-Douglas and the logarithm of (unobserved) natives' labor ability be normally distributed:

$$Y(s, \theta, E, L, K) = s\theta(EL)^\alpha K^\beta, \quad \text{with } \ln(\theta) \sim N(\bar{\theta}, \sigma^2)$$

We assume Europeans know the distribution of $\ln(\theta)$ but not a native's specific θ . In addition, we assume they are fully rational and, hence, will start a firm if and only if the expected payoff is larger than their outside option. This condition translates into:

$$\Pr(\pi(s) \geq w_E) = 1 - \Phi(\ln \tilde{c} - \alpha \ln E - \alpha \ln L - \beta \ln K - \ln s) \quad (2)$$

Where $\tilde{c} = (w_E + w_N L + rK)$ is total cost of production, including opportunity cost w_E . It is clear from equation (2) that Europeans who wish to start a firm will locate in places with relatively more educated natives, higher population density, and where natives' ability is useful for Europeans' entrepreneurial activities. We control for all these variables in our empirical analysis. Finally, we expect that Europeans with relatively high s will be the ones starting firms. We interpret the settlement agency's actions as an attempt to recruit Europeans with high s .

3.2 Natives

Natives in the local economy observe Europeans' labor decisions and decide how much education to acquire in order to maximize their expected utility. We follow Holmstrom and Milgrom (1991) and model a native's expected utility function in the following way:

$$\max_E w_N \cdot P_H(E) - \gamma \cdot E \quad (3)$$

Where w_N is the wage a native gets if hired by some European entrepreneur, $P_H(E)$ is the probability a native of education E is hired, and γ is the cost of acquiring one unit of education.¹¹ Note that, if \tilde{w}_N is native's wage prior to the arrival of Europeans, we need that $w_N > \tilde{w}_N$, otherwise natives are better off by working at their original jobs. As shown in the previous section, Europeans seems to have offered substantially higher wages than other firms, so $w_N > \tilde{w}_N$ seems like a reasonable assumption based on historical evidence. In particular, if we let \tilde{s} be local entrepreneurial skills, \tilde{K} capital, and \tilde{E} local education before Europeans' arrival, it is easy to show from equation (1) that:

$$\ln w_N - \ln \tilde{w}_N = (\ln s - \ln \tilde{s}) + \alpha(\ln E - \ln \tilde{E}) + \beta(\ln K - \ln \tilde{K})$$

This means that Europeans will offer higher wages because they have better entrepreneurial skills, they have a potential impact in natives' education, and they have access to more and better capital.

What is the probability of a native being hired by a European? In this setting it is the joint probability of a European starting a firm, and the probability of being hired from the population of job candidates. We focus here on the case where the number of natives in the local economy is N and the number of European immigrants is M , with $N > M$. The probability of some European starting a firm is simply:

$$P_F(s, E) = \sum_{s \in \mathcal{S}} \Pr[\pi(s, E) \geq w_E(s)]$$

Where $\mathcal{S} = s_1, \dots, s_M$. In addition, let the probability of being hired by some European from the population of job candidates with the same education level be $P_\ell(\tilde{M})$, where $\tilde{M} < M$ is the number of Europeans that decided to start a firm, i.e. European entrepreneurs. We assume that \tilde{M} is perfectly observed by natives, and that $P_\ell(\tilde{M})$ is increasing in \tilde{M} .¹² Thus,

¹¹As education was mostly public during this period, we interpret the cost of education as (i) an opportunity cost related to foregone income in the labor market, and (ii) a transportation cost to go to school.

¹²This can be derived more formally by solving the firm's profit maximization problem. In particular, the

we can write $P_H(E)$ as:

$$P_H(E) = P_F(s, E) \times P_\ell(\tilde{M}) \quad (4)$$

Then, solving a native's maximization problem is straightforward. Plug in equation (4) into equation (3) and take the first order condition with respect to E to find:

$$E^* = \Omega(s, \tilde{M}) \times \frac{\alpha \cdot w_N}{\gamma} \quad (5)$$

Where $\Omega(s, \tilde{M})$ is in an increasing function in \tilde{M} and s .¹³ However, the problem is simplified when $E = \{0, 1\}$, as in our historical setting where natives chose to learn to read and write or not. In this case a native will choose $E = 1$ if:

$$w_N \times P_\ell(\tilde{M}) > \gamma$$

which under the parametric assumptions above implies that the share of natives that will choose $E = 1$ is equal to:

$$Pr \left[w_N \times P_\ell(\tilde{M}) > \gamma \right] \equiv \ell = \Phi \left(\ln s + \beta \ln K + \ln P_\ell(\tilde{M}) + \ln \alpha - \ln \gamma - \ln L \right)$$

Therefore, the effect of Europeans on natives' literacy rate in a particular location is equal to:

$$\frac{\partial \ell}{\partial M} = \phi \times \left(\frac{1}{s} \frac{\partial s}{\partial M} + \frac{1}{K} \frac{\partial K}{\partial M} + \frac{1}{P_\ell(\tilde{M})} \frac{\partial P_\ell(\tilde{M})}{\partial M} \frac{\partial \tilde{M}}{\partial M} - \frac{1}{\gamma} \frac{\partial \gamma}{\partial M} - \frac{1}{L} \frac{\partial s}{\partial L} \right)$$

This means that natives' literacy rate can potentially change due to a number of different reasons. The literacy rate could increase after Europeans' arrival because of an increase in existing entrepreneurial skill, an increase in capital quality and quantity, an increase in the number of entrepreneurs, or a decrease in the cost of schooling. But it could also decrease if any of the positive changes are outweighed by an increase in the number of workers.

firm will choose L to maximize equation (1). Then, $P_\ell(\tilde{M})$ will simply be $P_\ell(\tilde{M}) = \sum_{i=1}^{\tilde{M}} (L_m / \bar{L})$, where \bar{L} is total labor force in the local economy and $m = 1, \dots, \tilde{M}$ indexes the number of European entrepreneurs in the local economy.

¹³In particular, we have that $\Omega(s, E, \tilde{M}) \equiv \min \left\{ \sum_{m=1}^{\tilde{M}} \phi, 1 \right\} \times P_\ell(\tilde{M})$, where $\phi(s)$ represents the increase in the probability of starting a firm with a native's additional unit of education for a European with skill s .

3.3 Discussion

There are several intuitive predictions from this simple theoretical framework. In particular, we focus on the following:

- P1** Europeans who arrived to the country aiming to start a firm will locate in places with relatively educated natives, higher population density, and with local labor markets similar to their entrepreneurial skills.
- P2** If the settlement agency was successful in recruiting Europeans with relatively higher s , there will be more firm creation during the time the agency operated and in places where Europeans settled.
- P3** Conditional on P2, natives' education will be an increasing function in the number of European entrepreneurs \tilde{M} in the local economy. This is a straightforward prediction from equation (5).
- P4** If Europeans are constructing schools in the local economy, or if they are demanding more schools from the central government, this translates into a decrease in γ and a subsequent increase in natives' education.

The first theoretical insight (P1) motivates our choice of control variables in the following section. The second theoretical insight (P2) is consistent with historical accounts, which provide evidence of Europeans starting firms across the country. The third insight (P3) states the main hypothesis of this paper and will be the focus of our empirical analysis. Finally, the fourth insight (P4) is important to test for a potential mechanism.¹⁴

4 Data

4.1 Historical censuses

In order to track the effects of the settlement agency operating in Chile between 1882 and 1904, we hand collected data for 44 Chilean provinces during the period 1865–1920 at each

¹⁴Some researchers have suggested that Europeans constructed schools after their arrival and pressured for public funding of schools in places where they established (e.g. Zavala 2008, De Carvalho Filho and Colistete 2010).

census year (1865, 1875, 1895, 1907, and 1920).¹⁵ Using this information, we constructed the number of Europeans from different countries in each province at each census year.

These censuses also present information about literacy rates at the province level. We then constructed natives' literacy rates and use this variable as a proxy for the human capital of natives. Other variables were also collected from the censuses: total number of immigrants, non-European immigrants, total and urban population, and number of students. In addition, we also hand collected data on school construction from *Guía cronológica de creación de escuelas (1844–1933)* (Chronological guide of school construction), available at the National Archive.¹⁶

4.2 European immigration

The settlement policy implemented between 1882 and 1904 was largely successful in taking skilled Europeans to Chile. In Figure 1 we have plotted the time variation in the number of immigrants from different countries and the years the settlement agency was active in vertical red lines. Specifically, we split all immigrants in each census into three groups: (1) recruited Europeans, (2) other Europeans, and (3) non-Europeans. Recruited Europeans are those individuals born in a European country where the settlement agency was active, other Europeans are individuals born in European countries where the agency did not operate, and non-Europeans are individuals born outside Chile and Europe. It is clear from this figure that while recruited Europeans increased threefold after the agency began its operations, the number of immigrants from other countries remained relatively stable over this time period.¹⁷

It is also interesting to note that the absolute number of Europeans was large when compared to non-European immigrants, including those from neighboring countries, such as Argentina. For example, the number of Spaniards was three times the number of Argentinians. Even the population of English and French was higher than the population of Argentinians. The *percentage* of Europeans in Chile was, however, relatively low when

¹⁵Unfortunately, the 1885 Census does not present information about the number of Europeans by province, so we have dropped it from the analysis.

¹⁶More about school construction and education during this time period in Chile can be found in Ponce de León (2010) and Serrano et al. (2012). More about data construction can be found in Appendix A.

¹⁷The increase in the number of Europeans from countries where the agency was operating is consistent with narrative accounts in Agencia de Colonización (2010) (see Appendix Table A.1). These numbers exclude, as in the subsequent empirical analysis, the annexed territories in the north after the War of the Pacific (1879–1883). Robustness exercises speak directly to a potential confound from this war. Results, however, suggest this is not a concern.

compared to Europeans in other countries such as Argentina, Brazil, or United States (see Hoerder 2002 and Massey et al. 2008).

After the arrival to the main ports of entry in the late 19th century, these skilled Europeans spread unevenly across the country. There is substantial heterogeneity in the number of Europeans located within the country in the 1907 census, after the settlement agency stopped operating. Figure 2 shows this geographic distribution of Europeans within the country (Panel A), together with the geographic distribution of non-Europeans (Panel B) and the main ports of entry. Red dots represent the location of active ports of entry, while yellow dots represent ports that were built after the period the settlement agency was active.

4.3 Descriptive statistics

Table 1 presents the mean and standard deviation of our main variables at the province-year level. We have divided this table in three parts. In the upper panel we show descriptive statistics for our dependent variable (natives' literacy rate), immigration (Europeans and non-Europeans), and population (total and urban). Natives' literacy rate increases from 16 percent to 44 percent in the period of sixty years under study. There are less than 400 Europeans in an average province before the settlement policy, and this number increases by three after its implementation. In contrast, there are approximately 300 non-Europeans in a province throughout this period. Population, on the other hand, is also increasing, with more and more people living in urban places.

In the middle panel of this table we present descriptive statistics for our main labor market variables. As suggested by our theoretical framework, the Europeans' location after their arrival is endogenous, but labor markets should be the main variable affecting their decisions. We use the richness of variables measuring labor markets in the historical censuses to control for the effect different markets had on Europeans' location decision. The three main variables we used are the total number of individuals working in agriculture, commerce, and industry. As we can easily see from this panel, most people worked in the agricultural sector, then industry, and finally in commerce, which is the sector increasing the most in percentage terms.¹⁸

The lower panel of Table 1 present our variables measuring school markets. As previously stated, Europeans could have increased natives' literacy rates, either demanding more schools

¹⁸One might worry that labor market variables are endogenous, as European immigration could have had an effect on how people sorted across industries. Later on we show, however, that estimated coefficients remain unchanged when we include these variables as controls, which suggests Europeans affect natives' literacy rates through a different mechanism.

to the central government, or constructing schools themselves. In order to test for this mechanism we gather data on the number of students from the censuses and data on the number of school constructed in each province in the period under study. Unfortunately, data on students is not available for years 1865 and 1907.

5 Europeans and the Human Capital of Natives

5.1 Main results

As our theoretical framework suggests, the presence of skilled Europeans in a province could have affected the human capital of natives. To test this hypothesis, we take a differences-in-differences approach and compare the human capital of natives before (1865 and 1875) and after (1895, 1907, and 1920) the arrival of Europeans. In particular, we exploit the sharp increase in the number of Europeans from 1875 to 1895 by running regressions of the form:

$$y_{irt} = \alpha_i + \lambda_t + \zeta_{rt} + \beta \cdot I_{it-1} + \mathbf{X}'_{it}\gamma + \varepsilon_{irt} \quad (6)$$

where y_{it} is natives' literacy rate in province i at time t , α_i is a province fixed effect, λ_t is a year fixed effect, I_{it-1} is the logarithm of the number of Europeans in province i at time $t - 1$, and \mathbf{X}_{it} is a vector of control variables that vary across provinces and time and are (theoretically) correlated with both Europeans' and natives' literacy rate. To control for regional trends, we include a full set of region-year indicators.¹⁹ Finally, ε_{it} is an error term capturing omitted variables that affect natives' literacy rates, with $E(\varepsilon_{it}) = 0 \forall i$ and t . The empirical framework in section 3 suggests that $\beta > 0$.

Note that we measure the number of Europeans in a province from the previous census. We do this to avoid a reverse causality problem: Europeans could have settled in places with high literacy rates of natives if, for example, they needed to hire skilled individuals for their firms. Because the number of Europeans is a stock variable, β captures the effect of the number of Europeans that arrived between $t - 2$ and $t - 1$. In addition, note that the dependent variable corresponds to natives' literacy rate, not the average literacy rate of the total population in a province. The difference is Europeans' literacy rate. Without doing this adjustment, there would be a mechanical higher literacy rate because Europeans were more literate.

We consider two specifications: with and without control variables \mathbf{X}_{it} : the logarithm

¹⁹A region is a cluster of provinces. We consider three regions: north, center, and south.

of the number of non-European immigrants, the logarithm of total and urban population, and public school trends. Controlling for non-European immigrants is a useful indirect test, because they were relatively unskilled compared to Europeans and, therefore, we should not expect any effect on natives' literacy rate. Total and urban population enable us to control for general trends in a province's economic development (Acemoglu et al., 2002). In addition, this is also a way to test for short-run economic development as a mechanism linking European immigration and the human capital of natives. If the estimated coefficient β is robust to the inclusion of these population variables, we interpret this as a check that selection due to different development trends is not driving our results, and that short-run economic development is not a mechanism at work.²⁰

Finally, we construct a variable that measures the number of public schools per 1,000 inhabitants in each province in the 1860s, and interact this variable with census year dummies. This is a flexible way to control for pre-determined changes in literacy rates. It is important for two different reasons. First, provinces with a low number of public schools per 1,000 inhabitants presumably had a relatively slower development of human capital of natives due to capacity constraints. And second, if we assume the government constructs more public schools in places where there were relatively less, this is also a way to control for government spending in education.²¹

In Table 2 we present results from estimating equation (6). Immigration and population variables, as well as natives' literacy rates are included in logarithms to interpret coefficients as elasticities. Column 1 shows that, after removing province and year specific effects, there is a positive and statistically significant relationship between European immigration and natives' literacy rates. In particular, a 10 percent increase in the number of Europeans is associated with an increase of 0.6 percent in our measure of human capital. Put differently, the arrival of 300 Europeans to a province (an approximately 100 percent increase) before the settlement policy was implemented, is associated to an increase of 1.2 percentage points in natives' literacy rate, or approximately 600 more natives that know how to read and write.

In column 2 we include the logarithm of non-Europeans as a control variable and as placebo check. Reassuringly, there is no statistical relation between the number of non-Europeans and natives' literacy rates. In the remaining two columns we add the baseline number of schools multiplied by year indicators to control for pre-determined changes in

²⁰If short-run economic development is a mechanism linking European immigration and the human capital of natives, then specifications with these control variables will produce a biased coefficient because of a "bad control" problem (Angrist and Pischke, 2009).

²¹Ponce de León (2010) documents that the government's school construction policy was to follow urban population. This implies that by including the logarithm of total and urban population we also indirectly control for government spending in education.

literacy rates (i.e., more baseline schools means a higher rate in natives' literacy rate) and the logarithm of individuals working in the three sectors previously discussed. None of these control variables changes our main conclusion: there is a positive, statistically and economically significant, and robust relationship between the arrival of Europeans to a province and the subsequent change in natives' literacy rate, even after controlling for province and year specific effects, regional trends, and control variables for population and labor markets.

To more precisely estimate the relationship between Europeans that arrived because of the work of the settlement agency and natives' literacy rate, in Table 3 we use the nationality of Europeans. In particular, as agencies were located in some (but not all) parts of Europe, we can distinguish between those coming from countries with active agencies (recruited) and those migrating from other parts of Europe (non-recruited). In addition to this, we can identify those migrating from countries with "good" and "bad" institutions. We do this by taking the average constraints on the executive power in each European country around the time of the Chilean censuses years. We define an immigrant as migrating from a country with good institutions if the source country scores above the median in the year under study. As the institutional quality of European countries varies throughout this time period, we have independent variation in human capital and institutions that can be used in our econometric framework. Table 3 presents three empirical exercises using variation in human capital and institutions.

Column 1 and 2 present uncontrolled and controlled regressions distinguishing between Europeans coming from countries where agencies were established, and those coming from other parts of Europe. From these columns is clear that all the statistical association between European immigration and natives' literacy rate is coming from recruited Europeans. In columns 3 and 4 we repeat the same exercise but using variation in Europeans migrating from countries with good institutions and bad institutions. There is some positive (but weaker) association between Europeans from countries with good institutions and natives' literacy rates. However, in columns 5 and 6 we include both measures and we see that our coefficient of interest is entirely driven by Europeans migrating from places where agencies were established.

We conclude from Tables 2 and 3 that there is a strong, positive, robust, and statistically significant relationship between the arrival of Europeans and the human capital of natives. Moreover, as most variation in Europeans is coming from the work of the settlement agency, and the coefficient of interest is explained entirely by Europeans coming from countries where agencies were established, we believe there is suggestive evidence of the positive impacts of the policy under study.

Two alternative explanations deserve a discussion. First, it is theoretically possible that

the children of European parents are more educated than children of native parents. Although plausible, the magnitude of the effect we have documented suggest this is not the case. In addition, in Appendix Figure A.2 we show that what there is a strong correlation between European immigration and literacy rates for natives of all ages. Second, it is also possible that resident immigrants acquired Chilean citizenship and become natives for statistical purposes. This is unlikely to be a concern because naturalization rates were extremely low (less than two percent in the largest cities, see Appendix Table A.5).

The main threat to the results previously presented is that there might be omitted factors that change across provinces and time correlated with both natives' literacy rate and Europeans' location decision. This would be the case if Europeans decided to settle in places where the economy was booming, or if they arrived to places that did poorly in the years before their arrival. If this were the case, estimating the impact of Europeans through a comparison of places before and after their arrival would not provide us with the causal effect of interest.²²

5.2 Discussion of causality

In order to explore a potential causal effect between European immigration and the human capital of natives, we use an instrumental variables approach. Although we argue our instruments are valid, and indeed satisfy a wide range of statistical tests, these ultimately rely on untestable assumptions. Therefore, we interpret the following results only as suggestive of causality.

The instruments we use are the distances to the main ports where Europeans arrived. Between 1865 and 1920, the period of study, there were three main ports (Dirección Nacional de Obras Portuarias, 2005). The Talcahuano port is the oldest, is located in the south of the country, and was constructed in 1794. The Valparaíso port is the second oldest, is located in the center, and it was constructed in 1810. Finally, Puerto Montt port is located in the south, and it was constructed in 1888. Because the construction of the last port is probably endogenous,²³ we use only two distances: the distance to Valparaíso port (Port 1) and to Talcahuano port (Port 2). Therefore, the first stage for this instrumental variables approach

²²In particular, if Europeans decided to settle in places with a growing economy, estimates are biased upwards. This is because, presumably, rich provinces can afford higher literacy rates. Estimates are biased downwards if they settled in relatively less developed provinces. Historical evidence suggest the latter is most likely to be the case (Agencia de Colonización, 2010).

²³The port constructed in 1888 could be endogenous if, for example, its construction reflects future economic enterprises. If this is the case, expected economic prosperity could affect investments in human capital for reasons not related to Europeans' presence.

is the following:

$$I_{irt-1} = \mu_i + \zeta_t + \nu_{rt} + \mathbf{Z}'_{it-1}\boldsymbol{\delta} + \mathbf{X}'_{it}\boldsymbol{\xi} + \nu_{irt} \quad (7)$$

Where I_{it-1} is the logarithm of the number of Europeans in province i at census year $t - 1$, μ_i is a province fixed effect, and ζ_t is a census year fixed effect.

Importantly, \mathbf{Z}_{t-1} is a matrix of two variables, distance to Port 1 and distance to Port 2, both interacted with a year dummy for the period after the 1880s, the main period of European immigration:

$$\mathbf{Z}_{irt-1} = \sum_{k \in \{1,2\}} D_{ik} \times \mathbf{1}[t - 1 \in \{1895, 1907\}] \quad (8)$$

where D_{ik} is the distance, measured in kilometers, from province i to Port k , and $\mathbf{1}[t - 1 \in \{1895, 1907\}]$ is a indicator variable for the period after the 1880s, where note the census year 1920 is not included because we use the lag of Europeans in the main specifications. If the distance to the main ports of entry are predictors of Europeans' location decision, we should observe both $\delta_1 < 0$ and $\delta_2 < 0$, i.e. provinces farther away from ports are less affected by European immigration.

The validity of the instruments rely on the presumption that the distances to ports 1 and 2 do not affect natives' literacy rate after the 1880s other than through European immigration. Although this is not a testable assumption, some evidence can be shown to support it. For example, if the assumption holds, we should *not* observe a negative correlation between changes in natives' literacy rate and distances to the ports before the main period of immigration. Figure 3 presents the correlation between the two instruments and changes in natives' literacy rates before the 1880s. These figures clearly show that the correlation is not different from zero (p -values of 0.16 and 0.85), providing further evidence for the identification assumption.

Table 4 presents the statistical association between our main instruments, previously presented in equation (8), and the potentially endogenous variable.²⁴ Columns 1 and 2 present the statistical association between the Euclidean distances from provinces' centroid during the time the agency was operating and the number of Europeans, the core of our first stage. The theoretical motivation behind these instruments emphasizes the role of transportation costs. Moving across a country in the 19th century is costly, and even more

²⁴A graphical representation of the cross sectional variation in distances to the main ports of arrival can be found in Figure 2. Red dots in the map represent the two main active ports, while yellow dots represent ports that are not active during the time the settlement agency was active, but were operating immediately after it.

costly when that country is unknown to an individual. This means we should expect a negative relationship between distances to the ports of arrival and the number of Europeans. This is exactly the relationship we observe in the data.²⁵

There are, however, other reasons why this relationship might hold, which constitutes a threat to the validity of our strategy. To test for this, we show that the empirical relationship between distances to ports and Europeans is only driven by the agency and immigration (i.e., the exclusion restriction holds) using three pieces of evidence. First, we control for any mechanical relationship between levels of development across provinces using province fixed effects, and some of the changes in development patterns are likely to be captured by our labor market and population controls. Second, we identified two other important ports in the country that began its operations *after* the settlement agency and we found that the statistical relation between distances and Europeans completely disappears (columns 3 and 4 in Table 4). Finally, in Figure 3 we show that distances to the main ports of entry are not correlated with changes in natives' literacy rate *before* the settlement agency began its operations.

Two-stage least squares estimates are presented in Table 5. Columns from left to right repeat the previous exercises and add controls progressively to check for the robustness of results. As suggested by the previous analysis, the first stage is strong, even when we include our most comprehensive set of control variables. Estimated coefficients are somewhat larger than before, which is already suggested in Table 3 when we distinguish between Europeans coming from countries with settlement agencies and other Europeans. Results in this table show that a 10 percent increase in the number of Europeans in a province is associated with a 1.6-1.8 percent increase in natives' literacy rate.

6 An Exploration of Mechanisms

The empirical evidence presented so far shows a positive and robust correlation between European immigration and the human capital of natives. In this section, we study two potential mechanisms behind immigration and human capital: demand for skilled labor and provision of public goods. First, we present historical evidence of a change in labor markets after the arrival of Europeans. Second, we show no significant changes in the supply of public schools. As a final piece of indirect evidence, we show significant increases in agricultural output in places where Europeans settled. An increase in agricultural output

²⁵It is perhaps important to emphasize that railroad construction was underway during this time period. However, railroads between the south of the country and the rest of the country were connected only *after* the settlement agency stopped operating. See Forero et al. (2015).

suggests Europeans could have had an impact in some proximate cause of economic growth (e.g., capital or productivity).

6.1 Firms founded by Europeans

Europeans could have caused a shift in local productivity, or increased the availability of physical capital. There are several historical examples of Europeans starting firms and changing the local economy. Appendix Table A.4 presents the distribution of firms by industry and ownership (Estrada, 2005). In this table, we can clearly see that Europeans created firms across the country: out of the 2,967 firms that existed in 1920, Europeans owned 1,004. Other immigrants, on the other hand, owned approximately 6.5% of existing firms. Unfortunately, whether firm creation was large enough to have pushed the demand for skilled labor is an empirical question hard to answer, because there is no systematic data about firms during this time period. We know, however, that Europeans owned more than one-third of the firms that were operating in 1920. To shed light on potential mechanisms, we now provide a brief historical description of these firms.

Bernedo (1999) shows that Germans started modern factories in the south of Chile and contributed to a local industrialization. German entrepreneurs introduced a variety of economic activities that were unknown before their arrival. Many of them had plenty of capital, acquired properties both in the city and the countryside, and imported steam engines from Europe (Pérez Canto, 1888). The biggest industries developed by the Germans were the brewing industry and the tannery industry.^{26,27} Another interesting case are the distillers founded by the Germans. The number of distilleries more than tripled in the late 19th century, going from five to more than twenty in Valdivia. This was a sophisticated industry in terms of technology, and it hired plenty of workers for production.

Another interesting group of immigrants creating firms were the Italians. Italian immigrants were located in many provinces, but there were particularly a large group in Val-

²⁶The most important firm in this industry was the brewery of Carlos Anwandter, a pharmaceutical chemist immigrant from Luckenwalde. At the beginning of the 20th century his firm produced more than 12 million liters and exported its product to several countries in South America. The Anwandter family hired plenty of workers at the breweries (Sociedad de Fomento Fabril, 1914). Importantly, the wages paid to skilled workers were higher in these breweries. According to Pérez Canto (1894), the wages for skilled workers reached the 200 Chilean pesos, while in an alternative job the same worker could obtain a maximum of 130 Chilean pesos.

²⁷The first tannery of Valdivia was founded by the German Hermann Schulke (Sociedad de Fomento Fabril, 1884). Then, with the help of the German Eduard Prochelle, the firm grew to become the *Industrial Company of Valdivia*. By the 1890s the firm had more than fifty workers and used steam engines in the production process.

paraiso. In Valparaiso, Italians started small businesses that were run by the family (colloquially called “Don Giuseppe from the corner”). Other Italians started larger firms that required plenty of work from natives (Rodríguez, 1998). In fact, the Italian consul stated that, by 1904, Italians owned 90 percent of all stores and 74 percent of all offices in Valparaiso.²⁸ Across Chile, they owned 9.3% of all existing firms in 1920 (Estrada, 2005). According to Maldini (2004), there were many Italians in commercial and industrial activities. Another piece of historical evidence comes from the historical industrial census of the Italian colony (Pellegrini, 1926). This document contains details about Italian immigrants living in Chile who are related to industrial or commercial activities. There are many firms mentioned in this document: the Italian Bank, the insurance company Cristoforo Colombo, Vitalizia, the Belgium-Italian Bank, the French-Italian Bank, the Trans-Atlantic Italian Company, and the Italian Sailing Company, among many others.

Finally, consider two other groups of immigrants for which we have historical information: French and Spaniards. The Chilean government, through the settlement agency, allied with a maritime agent from Bordeaux named Charles Colson, with the compromise of bringing 5,000 French families in an 8-year period. According to official statistics, more than 8,000 French arrived to the country between 1882 and 1897 (Blancpain, 1999). According to Fernández (2006), many French immigrants created firms, and their success was explained by their social networks, an efficient use of resources, and the knowledge they brought. French immigrants owned about 8% of all firms in 1920.²⁹ But the largest group of immigrants were the Spaniards.³⁰ In fact, the Spaniards were the foreign group that owned more firms. These firms, however, were of relatively low value when compared other firms owned by Europeans. In total, Spaniards owned 13.1% of all firms in 1920. These firms were concentrated in the tannery, clothing, and food industry.

In summary, although we cannot statistically prove that Europeans had a significant impact on local economies through the creation of firms, there is suggestive historical evidence of this being the case.

²⁸Examples of these are the clockmaking factory Del Gatto, the Lucchetti and Carozzi food factories (which still exist today), and the Rossi millinery, among many others. Some important families were the Ferretti family that sold wines, and the Fortunato and Bosini family who owned a sausage factory.

²⁹An example of these firms were the tanneries owned by Eugene Saint-Macary and his brother Victor in the 1890s. They had a big factory in Valparaiso, a shoe factory in Santiago, and a 8,000 square feet tannery in Concepcion.

³⁰One of the most important Spaniard firms was “Presa Hermanos”, which operated as a distribution company for a wide range of different products (e.g., hardware, fruits, woods, and shoes). This firm also worked as wool exporter, agent of the West Indian and the Ford Motor Company, and sold tractors and other machinery for agricultural activities Estrada (2005).

6.2 School construction

We have constructed rich measures of school construction and the number of students at the province level during the period under study. This enable us to check if the provision of public goods was affected by European immigration.

Empirically, we estimate equation (6) changing the dependent variable by the logarithm of the total number of schools constructed or the logarithm of the total number of students in the corresponding province and census year. As the data on school construction is a province-year dataset, we had to aggregate these data to the province and census-year level. For example, when the logarithm of Europeans in year 1865 is used as the main right hand side variable, we use the logarithm of schools constructed between years 1865 and 1875 as dependent variable. When using total number of students we are forced to restrict attention to years in which this data was collected in the census.

Table 6 present estimates of the effect Europeans had on school construction and enrollment. Columns 1-2 use the logarithm of schools constructed as dependent variable, and different sets of controls, column 3 presents two-stage least squares estimates, and columns 4-5 use the logarithm of total number of students. Across specifications there is no statistical relation between skilled immigrants and school construction, and some specifications even suggest there are *less* schools constructed after the arrival of Europeans. The last two columns in this table suggest a negative impact of Europeans on the total number of students in that province. The effect seems to be somewhat large, but it is not statistically significant at conventional levels. Although counterintuitive, the negative impact on the number of students is consistent with recent evidence showing the positive impacts of business expansion on school dropout rates (Atkin, 2014).

6.3 Long-run effects in the agricultural sector

Finally we turn to the question of long-run effects. We study the within country variation in agricultural inputs and output in 1955. This is the earliest agricultural census with sufficient data to construct meaningful variables of output at the province level, and agriculture was the most important economic activity at the time (Cuesta et al., 2015).

As previously discussed, Europeans were not randomly allocated within the country. In addition, there are no measures of agricultural output and inputs before and after the settlement policy. Therefore, our empirical strategy is to estimate empirical associations at the province level between agriculture in 1955 and the total number of Europeans in 1907, right after the end of the policy under study. Nevertheless, we do control for a number of

variables in 1907 and show that the variation we can explain in our dependent variables is substantial (more than 75 percent), giving little room for omitted variables to play a role (see Oster 2015 and González and Miguel 2015). In particular, we estimate the following regression:

$$y_{p,1955} = \alpha + \beta \times \text{Europeans}_{p,1907} + \gamma X_{i,1907} + \varepsilon_i \quad (9)$$

where $y_{p,1955}$ is our dependent variable of interest in province p in 1955, $\text{Europeans}_{p,1907}$ is the logarithm of the total number of Europeans in province p in 1907, and $X_{i,1907}$ are the following control variables: logarithm of total number of people working in different labor markets (agriculture, commerce, and industry) and the logarithm of total population (total and urban). Our hypothesis is that the settlement agency increased inputs and total agricultural output, which would translate into $\beta > 0$.

Before presenting our results, we attempt to validate the plausibility of our hypothesis by performing a simple analysis. Consider regression equation (9), but change the dependent variable to be the logarithm of the total number of European *landlords* in province p in year 1920. If Europeans had an impact in the agricultural sector, we should expect there to be more European landlords in provinces with more Europeans (controlling for total and urban population). The 1920 census enable us to approximate this exercise, as it presents detailed information on the number of *foreign* landlords and the number of *native* landlords. Columns 1 and 2 in Table 7 present results from this estimation. Interestingly, provinces with more Europeans in 1907 had more foreign landlords in 1920, with an elasticity of 0.58 that is statistically significant at the 5 percent level. Although it is difficult to claim causality, we do not observe the same relationship with non-Europeans immigrants and there is no relationship between Europeans and the number of native landlords. These results are direct evidence that 13 years after the settlement agency stopped its operations, Europeans were in control of part of the agricultural sector. This leads us to hypothesize that Europeans could have had a long-run impact on agriculture in subsequent years.

Using the 1955 agricultural census we are able to measure in a fairly precise manner the within country development of the economy roughly 50 years after the settlement agency. In particular, we follow Cuesta et al. (2015) and use this information to construct three dependent variables of interest. First, we use the total value of agricultural output, which is the sum of output across the fruits, livestock, and primary products sectors. Then, we follow the tradition in economics and divide the space of inputs into capital (e.g., tractors) and labor (e.g., agricultural workers). Results are presented in columns 3 to 8 of Table 7. Overall, we observe a positive effect of European immigration in total output, most of which is explained by an increase in capital, although a smaller share of this increase

is associated with an increase in labor possibly due to migration of specialization. These results are consistent with the observed positive relationship between Europeans and output in specific sectors, as livestock is less capital intensive than other agricultural sectors, and with historical accounts that associate the arrival of Europeans with the modernization of the economy (Bernedo, 1999).³¹

7 Concluding Remarks

Understanding the effect of skilled immigration on the human capital of the receiving population is important for public policy, as evidenced recently by recent public discussions across the world. If individuals modify their human capital decisions after the arrival of high skilled foreigners, then estimating the welfare consequences of immigration requires a more complex analysis than just studying contemporaneous outcomes. However, analyzing how human capital changes after the arrival of skilled immigrants is difficult, mainly because we need data for a long period of time, but also because we need a suitable empirical strategy. Economic history can be particularly useful in this case.

By studying a settlement policy implemented in Chile during the 19th century, we have shown several patterns that suggest a positive relationship between skilled immigration and the human capital of natives. When studying mechanisms, however, the results in this paper become less clear. Theoretically, we highlight two potential channels: an increase in the demand for skilled labor, and an increase in the provision of public goods. However, we find little effect of skilled immigration on both school enrollment and school construction.

Narrative historical evidence suggests that skilled immigration fostered an industrialization process that changed the nature of local economies. It is possible that this could have contributed to an increase in the human capital of natives. This interpretation has some indirect support, in the sense that, in provinces where Europeans settled, we observe an increase in economic output fifty years after the settlement policy was terminated. More research is needed, however, to identify the exact mechanisms through which skilled immigration impacts human capital decisions.

³¹More speculatively, this evidence is also consistent with the importance of human capital from upper tail knowledge for development (Squicciarini and Voigtlander, 2014).

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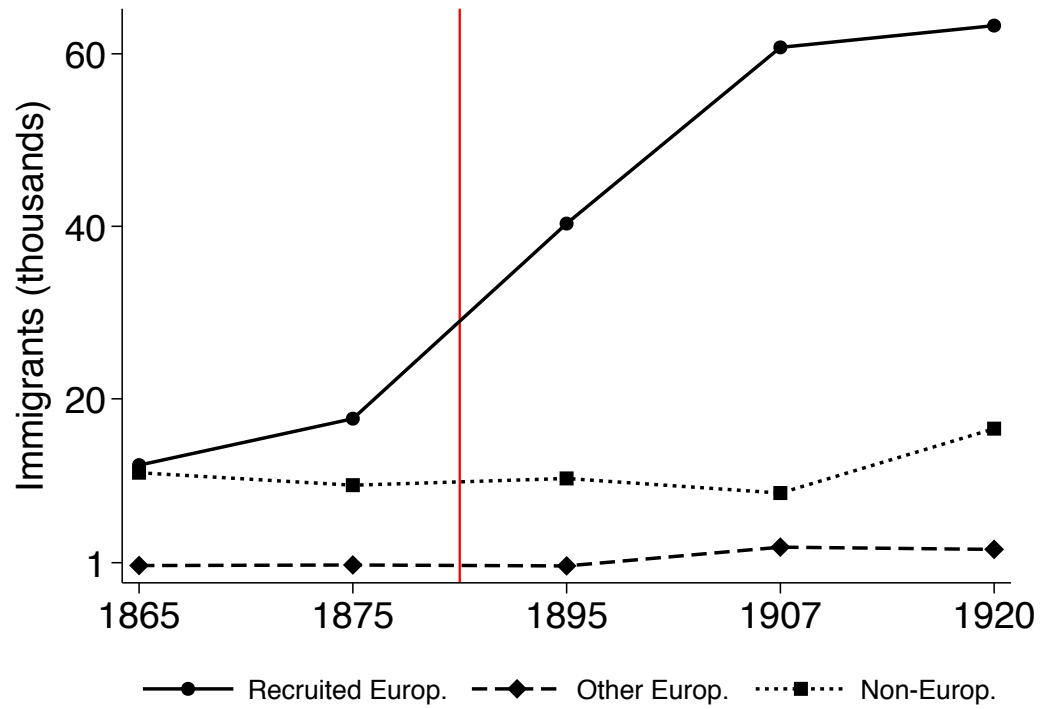
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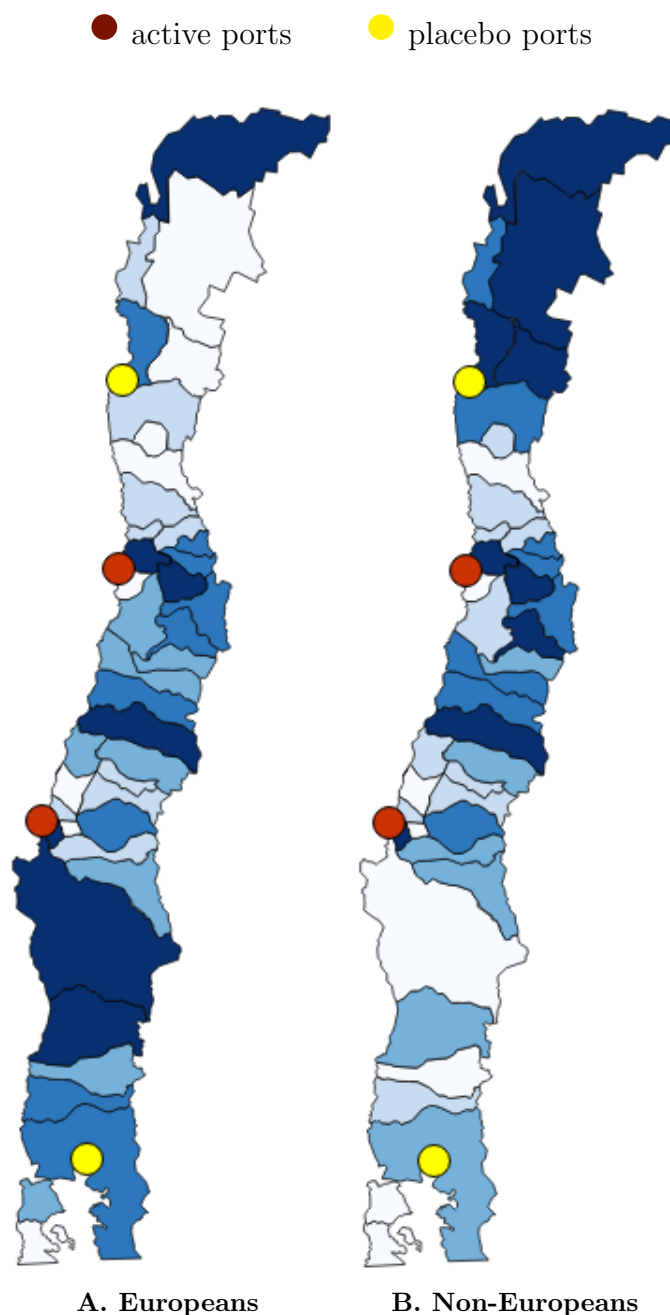
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Figure 1: Immigration over time



Notes: Immigrant population in the territory of interest. Information from historical censuses. *Recruited Europeans* are individuals born in countries where the settlement agency was established. *Other Europeans* are all remaining Europeans. *Non-Europeans* are individuals born outside Chile and Europe (e.g., Argentina, Bolivia, Peru).

Figure 2: Distribution of immigrants after the settlement agency



Notes: These maps show the geographic distribution of the European and non-European population in 1907, after the settlement agency (1882–1904). Colors represent quintiles. Darker colors represent larger populations. An “active port” is defined as a port operating before 1860, and a “placebo port” is defined as a port constructed after 1860. Maps are own construction based on the 1907 census. Provinces were constructed as detailed in the Appendix.

Figure 3: Evidence for identification assumption

Correlation between changes in natives' literacy rate between 1865 and 1875 and the instruments before the settlement agency. Distances are measured in kilometers.

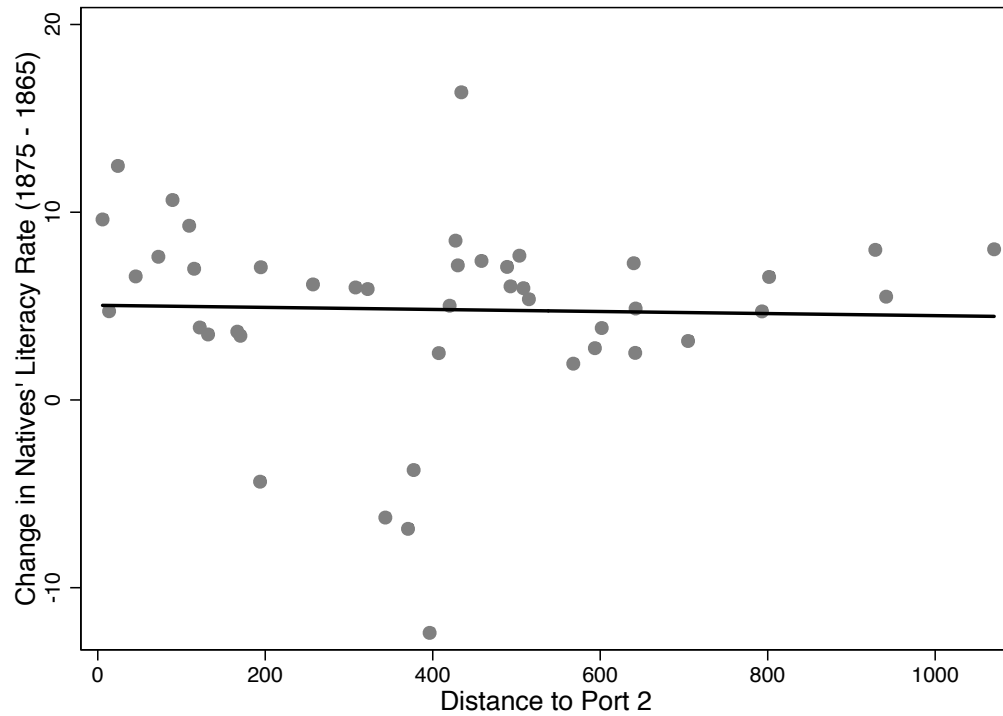
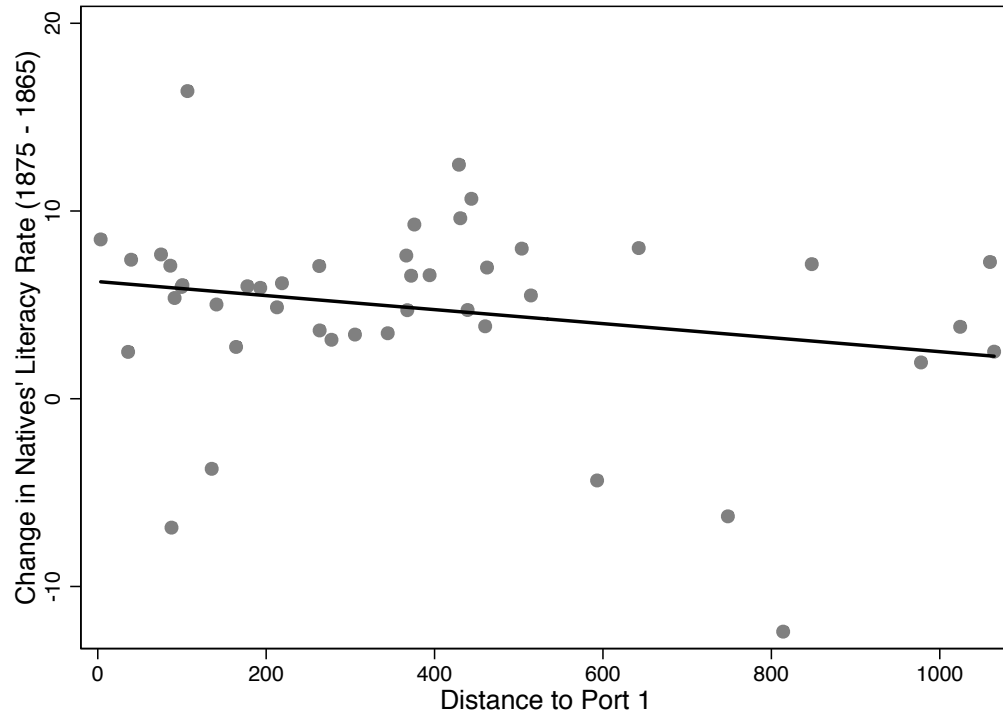


Table 1: Descriptive statistics

Mean and standard deviation at the province and census year level

	1865	1875	1885	1895	1907	1920	All
Main variables							
Natives' literacy rate	15.9 (5.9)	19.5 (6.5)	24.3 (9.3)	25.2 (8.5)	34.4 (8.3)	44.0 (8.7)	27.6 (12.8)
Europeans	271 (588)	374 (936)	—	782 (1,955)	1,202 (3,140)	1,259 (3,530)	778 (2,354)
Non-Europeans	260 (1,012)	227 (777)	—	245 (565)	206 (548)	376 (961)	263 (791)
Population	41,271 (32,461)	47,175 (39,017)	54,805 (52,224)	57,817 (63,866)	67,586 (81,332)	77,456 (105,071)	58,261 (70,338)
Urban population	11,828 (20,072)	16,468 (26,975)	22,247 (33,387)	25,072 (45,396)	28,752 (58,610)	35,778 (83,131)	23,580 (52,265)
Labor markets							
Agriculture	6,850 (5,307)	8,684 (6,654)	—	9,455 (9,142)	9,653 (9,647)	10,788 (12,364)	9,086 (8,980)
Commerce	551 (943)	750 (1,322)	—	1,220 (2,560)	1,715 (3,834)	2,334 (4,305)	1,314 (2,959)
Industry	5,156 (5,253)	6,024 (6,204)	—	6,483 (8,318)	7,606 (12,335)	6,611 (10,963)	6,376 (8,982)
Education markets							
School construction	1.7 (2.1)	2.6 (2.6)	—	10.6 (10.9)	17.1 (19.0)	24.9 (24.4)	11.4 (17.1)
Students	—	250 (782)	—	597 (1,636)	—	6,589 (10,234)	2,479 (6,632)
Observations	44	44	44	44	44	44	220

Notes: Own calculation from national censuses and data from the National Archive.

Table 2: Natives' literacy and Europeans

Estimates of the empirical relationship between log natives' literacy rate and the logarithm of Europeans in the previous census year.

<i>Dependent variable: Log natives' literacy rate</i>					
	(1)	(2)	(3)	(4)	(5)
Log Europeans	0.06*** (0.02)	0.05*** (0.02)	0.06*** (0.02)	0.06*** (0.03)	0.07*** (0.02)
Log non-Europeans		0.02 (0.02)	0.02 (0.02)	0.02 (0.03)	0.03 (0.02)
Province F.E.	Yes	Yes	Yes	Yes	Yes
Census year F.E.	Yes	Yes	Yes	Yes	Yes
<i>Additional Controls:</i>					
Population	No	No	Yes	Yes	Yes
Baseline schools	No	No	Yes	Yes	Yes
Labor markets	No	No	No	Yes	Yes
Regional trends	No	No	No	No	Yes
Provinces	44	44	44	44	44
Observations	176	176	176	176	176

Notes: Standard errors clustered at the province level in parenthesis. Additional controls: *Population* includes the logarithm of total and urban population, *Baseline schools* is public schools per 1,000 inhabitants interacted with year dummies, *Labor markets* is the logarithm of people working in agriculture, commerce, and industry, *Regional trends* are interaction terms between region indicators (North, Central, South) and linear trends. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: The importance of the settlement agency

We split the number of Europeans between (1) those that migrated from countries where the settlement agency operated (*Recruited*) and the rest (*Non-recruited*), and (2) those that migrated from countries with high-quality institutions (*Good institutions*) and low-quality institutions (*Bad institutions*).

	<i>Dep. variable: Log natives' literacy rate</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Log Europeans						
<i>Recruited</i>	0.06*** (0.02)	0.07*** (0.08)			0.10*** (0.03)	0.10*** (0.04)
<i>Non-recruited</i>	-0.01 (0.02)	0.01 (0.02)			0.01 (0.02)	0.03 (0.03)
<i>Good institutions</i>			0.03* (0.02)	0.03* (0.02)	-0.01 (0.02)	-0.02 (0.02)
<i>Bad institutions</i>			-0.02 (0.03)	0.00 (0.03)	-0.05 (0.03)	-0.04 (0.04)
Log non-Europeans	0.02 (0.02)	0.03 (0.03)	0.02 (0.02)	0.03 (0.03)	0.02 (0.02)	0.03 (0.02)
Province F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Census year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
<i>Additional Controls:</i>						
Population	No	Yes	No	Yes	No	Yes
Baseline schools	No	Yes	No	Yes	No	Yes
Labor markets	No	Yes	No	Yes	No	Yes
Regional trends	No	Yes	No	Yes	No	Yes
Provinces	44	44	44	44	44	44
Observations	176	176	176	176	176	176

Notes: Standard errors clustered at the province level in parenthesis. Additional controls: *Population* includes the logarithm of total and urban population, *Baseline schools* is public schools per 1,000 inhabitants interacted with year dummies, *Labor markets* is the logarithm of people working in agriculture, commerce, and industry, *Regional trends* are interaction terms between region indicators (North, Central, South) and linear trends. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Motivation for an instrumental variables approach

<i>Dependent variable: Log European immigrants</i>				
	<i>Active Port 1</i>	<i>Active Port 2</i>	<i>Placebo Port 1</i>	<i>Placebo Port 2</i>
Distance to port \times Agency is active	-1.75*** (0.39)	-2.03** (0.45)	-0.33 (0.46)	-0.14 (0.42)
Province F.E.	Yes	Yes	Yes	Yes
Census Year F.E.	Yes	Yes	Yes	Yes
<i>Additional Controls:</i>				
Population	Yes	Yes	Yes	Yes
Baseline schools	Yes	Yes	Yes	Yes
Labor markets	Yes	Yes	Yes	Yes
Regional trends	Yes	Yes	Yes	Yes
Provinces	44	44	44	44
Observations	176	176	176	176

Notes: Standard errors clustered at the province level in parenthesis. Additional controls: *Population* includes the logarithm of total and urban population, *Baseline schools* is public schools per 1,000 inhabitants interacted with year dummies, *Labor markets* is the logarithm of people working in agriculture, commerce, and industry. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Two-stage least squares

Using distances to active ports interacted with years when the settlement agency was active as instruments for the number of Europeans.

	<i>Dependent variable: Log natives' literacy rate</i>				
	(1)	(2)	(3)	(4)	(5)
<i>Second stage</i>					
Log Europeans	0.17*** (0.04)	0.17*** (0.05)	0.16*** (0.05)	0.17*** (0.06)	0.18*** (0.05)
Log non-Europeans		-0.00 (0.02)	0.00 (0.02)	-0.00 (0.02)	0.00 (0.02)
<i>First stage</i>					
Distance to port 1 \times Agency is active	-0.97*** (0.28)	-0.89*** (0.28)	-1.26*** (0.36)	-1.26*** (0.37)	-1.04** (0.44)
Distance to port 2 \times Agency is active	-1.44*** (0.45)	-1.34*** (0.49)	-1.08** (0.47)	-1.04** (0.48)	-1.29** (0.51)
Province F.E.	Yes	Yes	Yes	Yes	Yes
Census year F.E.	Yes	Yes	Yes	Yes	Yes
<i>Additional Controls:</i>					
Population	No	No	Yes	Yes	Yes
Baseline schools	No	No	Yes	Yes	Yes
Labor markets	No	No	No	Yes	Yes
Regional trends	No	No	No	No	Yes
K-P F-test excl. instruments	13.6	12.9	16.3	17.6	15.8
Provinces	44	44	44	44	44
Observations	176	176	176	176	176

Notes: Standard errors clustered at the province level in parenthesis. Additional controls: *Population* includes the logarithm of total and urban population, *Baseline schools* is public schools per 1,000 inhabitants interacted with year dummies, *Labor markets* is the logarithm of people working in agriculture, commerce, and industry, *Regional trends* are interaction terms between region indicators (North, Central, South) and linear trends. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: School construction

Are Europeans constructing schools or are demanding more schools from the central government?

<i>Dependent variable is:</i>					
	<i>Log schools constructed</i>			<i>Log students</i>	
	(1)	(2)	(3)	(4)	(5)
Log Europeans	0.01 (0.09)	-0.05 (0.09)	-0.08 (0.13)	-0.15 (0.21)	-0.30 (0.20)
Log non-Europeans	-0.01 (0.04)	-0.02 (0.03)	-0.00 (0.03)	-0.20 (0.15)	-0.20 (0.17)
Province F.E.	Yes	Yes	Yes	Yes	Yes
Census year F.E.	Yes	Yes	Yes	Yes	Yes
<i>Additional Controls:</i>					
Population	No	Yes	Yes	No	Yes
Baseline schools	No	Yes	Yes	No	Yes
Labor markets	No	Yes	Yes	No	Yes
Regional trends	No	Yes	Yes	No	Yes
K-P F-test excl. instruments	—	—	15.8	—	—
Provinces	44	44	44	44	44
Observations	176	176	176	132	132

Notes: Standard errors clustered at the province level in parenthesis. Columns (1), (2), (4) and (5) present OLS estimates and column (3) two-stage least squares estimates. Additional controls: *Population* includes the logarithm of total and urban population, *Baseline schools* is public schools per 1,000 inhabitants interacted with year dummies, *Labor market* is the logarithm of people working in agriculture, commerce, and industry. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Long-run effects in the agricultural sector

Estimating the impact of European immigration on inputs and outputs in the agricultural sector using the 1920 housing census and the 1955 agricultural census (OLS regressions).

Dependent variable in the agricultural sector (year)								
Log inputs					Log output (1955)			
	Foreign landlords (1920)	Native landlords (1920)	Capital (1955)	Labor (1955)	Total output	Fruits	Livestock	Primary products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Europeans	0.58** (0.23)	-0.06 (0.08)	0.54** (0.20)	0.15 (0.10)	0.29* (0.16)	0.40** (0.18)	0.15 (0.23)	0.34* (0.19)
Log non-Europeans	-0.05 (0.15)	-0.07 (0.04)	0.26* (0.14)	-0.05 (0.06)	0.03 (0.08)	0.09 (0.12)	-0.07 (0.12)	0.05 (0.10)
Baseline (1907) controls:								
Population	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Labor markets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provinces	44	44	44	44	44	44	44	44
R ²	0.60	0.88	0.72	0.80	0.78	0.70	0.51	0.75

Notes: Standard errors robust to heteroskedasticity in parenthesis. Baseline controls: *Population* includes the logarithm of total and urban population, *Labor markets* is the logarithm of people working in agriculture, commerce, and industry. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

A Data Construction

Censuses can be found in the website of the National Statistics Bureau of Chile. We do not use censuses before 1865 because they do not present information about the immigrant population at the province level. In addition, in our analysis we exclude the territory annexed after the War of the Pacific (1879–1883). We also exclude Magallanes (a province in the very south of the country) because it was unpopulated in the 1860s and then populated mainly by foreigners. It is also geographically disconnected by thousand of kilometres from the rest of the country. Nevertheless, results are quantitatively and qualitatively similar if we include this province.

Variables used in the empirical analysis were constructed in the following way:

Provinces. We construct 44 units that are geographically equivalent during the period 1865–1920. Through the paper we call these units “provinces”. Table A.1 presents these units and the provinces. The majority of units are provinces (26), and only three units include more than four provinces (Ancud, Arauco, and Santiago). All results are robust to exclude units with more than one province.

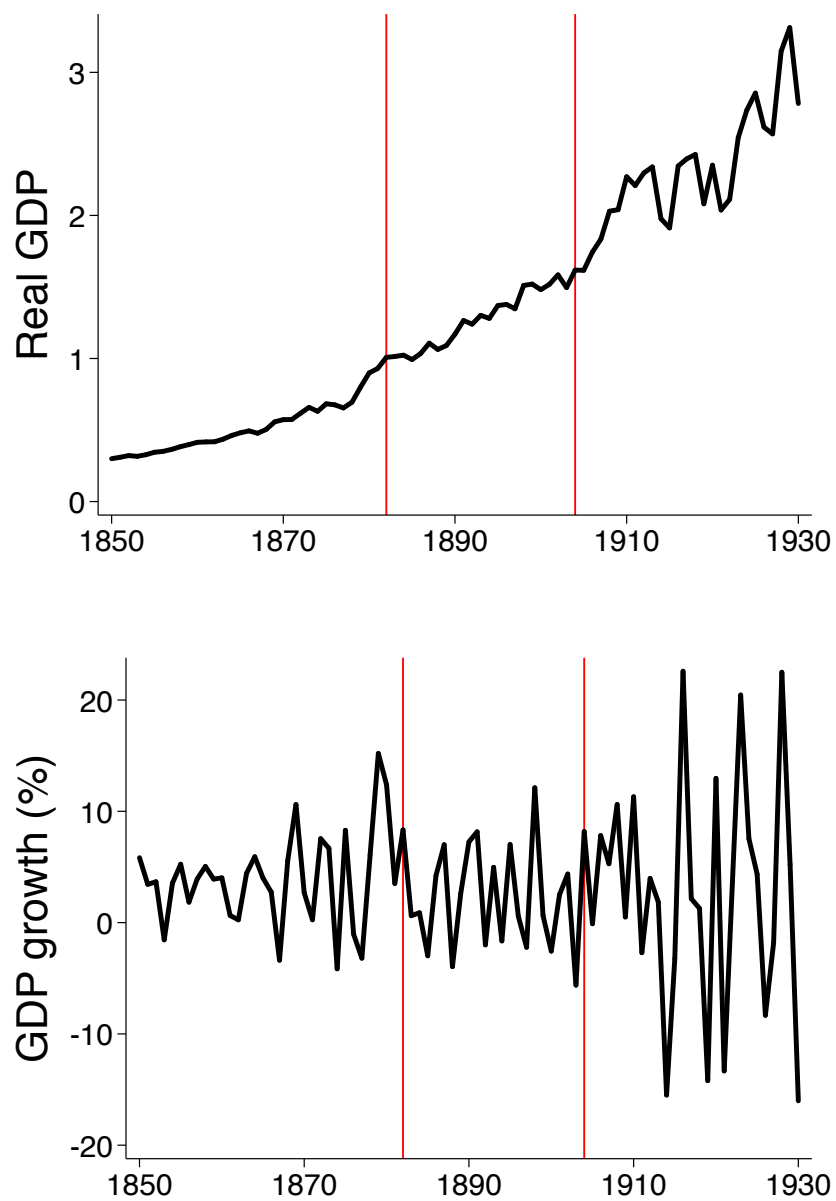
Europeans. We define a European as a person born in one of the following European countries: Austria, Belgium, Czech Republic, Germany, Denmark, Scotland, Spain, France, Great Britain, Ireland, Italy, Netherlands, Norway, Portugal, Sweden, or Switzerland. We label all other immigrants as non-Europeans. Children of Europeans are classified as natives in the census and country statistics. Results are robust to include people from the United States, Canada, and Australia into a category of “high skilled immigrants”.

Natives’ literacy. National censuses present information on the average literacy rate in each province. Let ℓ_{it} be the literacy rate and P_{it} the total population of province i in census year t . To construct natives’ literacy rate we assume all Europeans are literate, although results are robust to other assumptions. Therefore, if E_{it} the number of Europeans in the province i at time t , the natives’ literacy rate is $y_{it} = \frac{\ell_{it} \times P_{it} - E_{it}}{P_{it} - E_{it}}$.

Public schools. National censuses of 1865 and 1875 present information on the number of public schools in each province i at census year t . To construct public schools per 1,000 inhabitants we take the average number of public schools between 1865 and 1875, and divide it by the average population between 1865 and 1875, and then multiply this number by 1,000.

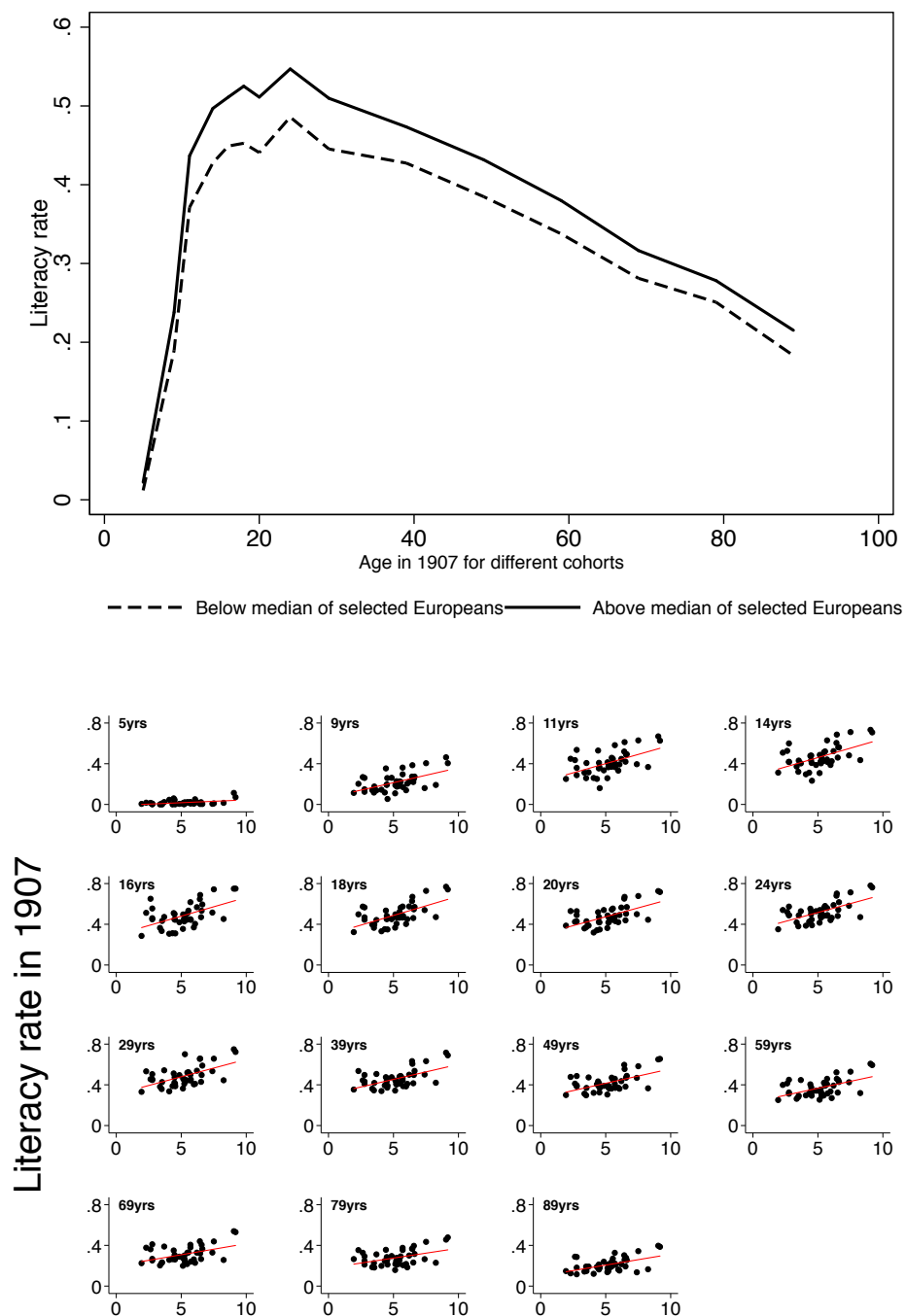
Distances. To calculate the distance between each of the 44 provinces and the two ports of interest we first take information on the latitude and longitude for each province's centroid from Google Maps. Then, we obtain the latitude and longitude for each port using the same procedure. Finally, we use the Stata command `vincenty` to calculate the distance between provinces and ports. This command uses an accurate ellipsoidal model of the Earth to account for the surface's curvature.

Figure A.1: Chilean development at the turn of the 19th century



Source: Díaz et al. (2007).

Figure A.2: Literacy rates by age



Notes: Authors' calculation based on the 1907 national census. UPPER PANEL: Above and below the median of selected Europeans.

Table A.1: Europeans migrating through the settlement agency between 1883 and 1895

COUNTRY	TOTAL
France	7,457
England	1,826
Germany	1,467
Italy	7,068
Switzerland	2,991
Spain	9,717

Source: Agencia de Colonización (2010, p.21).

Table A.2: Provinces

How we grouped provinces over time to construct stable geographical units.

<i>Unit</i>	<i>Provinces</i>	<i>Unit</i>	<i>Provinces</i>
1. Ancud	San Carlos, Chacao, Dalcabue	24. Osorno	-
2. Arauco	Anglo, Traiguén, Mariluan, Collipulli, Nacimiento, Mulchén, Lautaro, Temuco, Llaimea, Lebu, Imperial, Canete	25. Ovalle	-
3. Casablanca	-	26. Parral	-
4. Castro	Lemuy, Chonchi	27. Petorca	-
5. Caupolicán	-	28. Puchacay	-
6. Coelemu	-	29. Putaendo	-
7. Combarbala	-	30. Quillota	Limache
8. Concepción	Quirihue	31. Quinchao	Quenac
9. Constitución	Chanco, Cauquenes	32. Rancagua	Maipo
10. Copiapo	Caldera	33. Rere	-
11. Coquimbo	La Serena	34. San Carlos	-
12. Curico	Vichuquén, Santa Cruz	35. San Felipe	-
13. Elqui	-	36. San Fernando	-
14. Freirina	-	37. Santiago	Colina, Renca, Nunoa, Lampa
15. Illapel	-	38. Talca	Lontue, Curepto
16. Itata	-	39. Talcahuano	-
17. La Ligua	-	40. Unión	Rio Bueno
18. Laja	-	41. Valdivia	Villarrica
19. Linares	Loncomilla	42. Vallenar	-
20. Llanquihue	Calbuco, Carlemapu	43. Valparaíso	-
21. Los Andes	-	44. Victoria	-
22. Magallanes	-	45. Yungay	Bulnes, Chillán
23. Melipilla	San Antonio, Cachapoal		

Source: Own construction based on national census.

Table A.3: Human capital of immigrants
 Skilled Europeans and relatively unskilled non-Europeans.

	<i>Europeans</i>					<i>Non-Europeans</i>	
	Spain	Germany	Italy	France	England	Argentina	Peru
Occupations							
Entrepreneurs	1,155	1,126	1,957	1,072	361	223	631
Farmers ¹	260	489	80	545	259	229	583
Farmhand ²	229	59	119	102	51	1,095	1,029
Employees	522	480	556	506	552	212	732
Carpenters	157	169	162	262	85	51	259
Sailors	72	394	108	110	1,509	14	152
Servants	245	123	72	118	178	302	632
Tailors	121	108	144	177	29	175	402
Blacksmiths	26	45	39	42	37	39	107
Miners	44	37	52	27	89	602	150
Milkman	29	2	3	38	3	230	541
Ecclesiastics	138	50	53	88	7	5	10
Students	73	138	64	92	53	80	77
Labourer	35	17	43	16	23	108	62
Mechanics	8	150	184	122	237	14	105
Teachers	15	168	32	94	59	2	23
Shoemaker	103	55	96	72	6	9	106
Bakers	56	40	54	127	12	25	43
Brewers	5	82	2	232	3	0	1
Engineers	9	87	15	44	166	3	12
Muleteers	0	0	1	0	1	88	75
Literacy rate (%)	83	92	74	87	90	66	64

Notes: Original data from the 1895 national census. Definitions: ¹Farmer is a person that grows crops, ²Farmhand is a wage worker in agricultural activities. Only the most relevant occupations, and the most relevant European and non-European countries, are presented. Literacy rates are data for Valparaiso, the province with the largest number of immigrants.

Table A.4: Firm ownership in 1920

Europeans were mostly entrepreneurs and started many firms across the country.

	<i>Germans</i>	<i>Spaniards</i>	<i>French</i>	<i>English</i>	<i>Italians</i>	<i>Other</i>	<i>Mixed</i>	<i>Anonymous Society</i>	<i>Unknown</i>	<i>Total</i>
Alcohol and drinks	18	13	14	1	25	9	72	9	18	179
Pottery	2	0	2	0	0	0	0	0	4	8
Food	47	120	54	7	99	58	378	20	40	823
Gas and electricity	3	4	6	5	3	3	36	5	36	101
Shipyards	1	0	1	0	1	2	11	2	2	20
Apparel and clothing	6	96	40	1	48	32	116	4	10	353
Woods	9	27	13	5	9	14	132	6	26	241
Construction materials	3	11	5	0	12	4	23	2	4	64
Flexible materials	0	1	0	0	9	0	13	0	11	34
Metals	23	13	17	12	25	11	118	10	12	241
Furniture	8	10	5	0	7	4	31	3	0	68
Paper and printing	7	10	4	8	7	8	98	6	19	167
Tanneries	9	61	57	0	10	21	148	6	4	316
Chemical products	13	8	7	0	11	5	63	3	36	146
Tobbaco	1	0	3	2	1	5	30	2	3	47
Transport	3	2	4	0	3	7	24	3	0	46
Others	7	12	5	3	5	10	66	1	4	113
Total	160	388	237	44	275	193	1,359	82	229	2,967

Source: Reprint of Table 4 in Estrada (2005).

Table A.5: Naturalization

		<i>Non-residents (%)</i>	<i>Residents (%)</i>	<i>Naturalized (%)</i>	<i>Total</i>
VALPARAISO	Europeans	9	89	2	8,567
	Other	11	86	3	1,735
SANTIAGO	Europeans	1	98	1	9,808
	Other	2	96	1	1,833

Source: Authors' calculation based on the 1895 national census.