



Immigration and human capital: consequences of a nineteenth century settlement policy

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Abstract

I 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. Using historical censuses, I show that this policy was successful in recruiting skilled Europeans, who located in different parts of the country. Using a panel data of provinces observed between 1860 and 1920, I find a strong, positive, and robust correlation between recruited Europeans and the human capital of natives. This finding is not driven by changes in the provision of public goods or regional shocks. However, the arrival of Europeans is associated with an increase local economic output 50 years after the policy was terminated. These changes in the local economy, together with narrative historical evidence, suggest that a modernization of economic activities is a potential explanation for the increase in the human capital of natives.

Keywords Immigration · Settlements · Human capital · Europeans

JEL Classification I21 · J15 · J24 · N36 · N96 · O15 · O18 · R38

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” economically beneficial for natives in regions where Europeans settled?

¹ The consequences of this Columbian Exchange has been an active area of research in the last decade, estimating the impact it 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).

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This paper studies the impact of a policy that incentivized migration of skilled workers from European countries to Chile using new disaggregated historical data.

Between 1882 and 1904, the government of Chile implemented a policy to recruit skilled Europeans. Recruitment sites were placed in some European countries to promote—with information and subsidies—skilled emigration to Chile. I track the immigration effects of this policy using national historical censuses. In particular, I construct a panel dataset of provinces for the period 1860–1920, i.e., before, during, and after the implementation of this policy. Consistently with the government's goal, I observe an increase in the number of Europeans from countries with recruitment sites, but no increase in the number of immigrants from other European or non-European countries. In addition, there are substantial differences in the number of recruited Europeans across provinces. I 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, I 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 in the existing labor market for a fixed wage. The predictions of the model guide the empirical analysis in two ways. First, they motivate the choice of control variables. Second, they help us to think about two different mechanisms linking Europeans and the human capital of natives: (1) an increase in the demand for skilled labor—which can be thought as a modernization of the local economy—and (2) an increase in the provision of public goods coming from the government to support the arrival of Europeans.

Besides detailed information about immigrants' country of birth, Chilean national censuses also present precise information on literacy rates, which allow me to construct accurate measures of natives' literacy rates for each province before, during, and after the arrival of recruited Europeans. A simple comparison of provinces differentially affected by the arrival of recruited 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. The 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.

Following insights from the model, and also details from the history of Chile, I 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. The estimates indicate that for every ten Europeans that arrived in the country, there were five natives that learn to read and write. Estimates are similar when control variables are included, suggesting selection into provinces with different development trends is unlikely to be a problem. Additionally, I also use Euclidean distances from provinces to the main ports of entry during the period of the settlement policy as exogenous shifters of the number of recruited Europeans. A concern with this strategy is that

provinces close to ports were different 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. Results indicate a positive and somewhat larger effect of Europeans on natives' literacy rates.

Finally, I investigate the mechanisms linking skilled Europeans and natives. The theoretical framework suggests that an increase in the demand for skilled labor and an increase in public goods are potentially important. To test for the latter, I use a novel dataset of school construction and the number of public servants per province. Results indicate that the provision of public goods remained similar after the arrival of recruited Europeans. To test for the former, I study labor force participation in the short-run and the agricultural sector after the policy was terminated. Results point toward a modernization of the local economy: Europeans became landlords, the use of capital for production became more relevant—without replacing workers, but complementing it—and there is a shift toward the production of modern crops. Taken together, these findings suggest that a modernization of the local economy could be a mechanism.

This paper is part of a 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. 2017), one mechanism through which Europeans could have fostered economic development in the Americas (Easterly and Levine 2016). There are, however, a large number of articles studying immigration effects in the nineteenth century, the fates of immigrants in the receiving countries (Pérez 2017, 2019a), and also immigration effects on natives' outcomes in other periods. Reviewing these studies are beyond the scope of this paper, but there are several studies analyzing the determinants of nineteenth century migration to the USA, Argentina, and Brazil (e.g., Hatton and Williamson 1998; Balderas and Greenwood 2010; Droller 2018). There is also an agenda studying the selection of migrants (e.g., Wegge 2002; Abramitzky et al. 2012; Pérez 2019b). 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.²

Finally, there is an extensive research agenda analyzing how natives might changed their decisions after the arrival of immigrants (e.g., Grossman 1982; Altonji and Card 1991; Wozniak and Murray 2012; Eberhard 2012; Llull 2018). A part of this literature estimates natives' responses in the labor market after the arrival of relatively unskilled immigrants (Card 1990, 2001; Hunt and Gauthier-Loiselle 2010; Kerr and Lincoln 2010; Ottaviano and Peri 2012; Smith 2012; Peri et al. 2015). Another part of this literature estimates how natives' educational performance (Gould et al. 2009; Jensen and Rasmussen 2011; Brunello and Rocco 2013; Ohinata and van Ours 2013) and human capital decisions (Betts 1998; Betts and Lofstrom

² Interestingly, 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.

2000; Borjas 2007; Neymotin 2009) change after the arrival of immigrants, emphasizing general equilibrium effects such as changes in local market prices and the distribution of school resources (McHenry 2015; Jackson 2018), a migration of natives from public to private schools (Betts and Fairlie 2003; Cascio and Lewis 2012), and natives' experience and future labor market (Hunt 2017). Yet, the human capital response of natives in a small country after the arrival of relatively few skilled immigrants has been less studied. This observation is important because, as argued by Chiswick (1989), the quantity and skill of immigrants is key to understand the effect of immigration on natives.

2 Historical background and data

Between independence from Spain in 1810 and the 1860s, the foreign population in Chile was low. The country's geographical isolation seems to be one of the main explanations (Norambuena 1990). In the second half of the nineteenth century, countries like Argentina and Brazil promoted immigration to foster development. Chile followed its neighboring countries and also adopted an immigration policy.³

2.1 The settlement agency

The settlement agency, officially named *Agencia General de la Inmigración y Colonización de Chile en Europa*, was created in 1882. The agency was entrusted with the recruitment and settlement of skilled Europeans in Chile. Former conservative deputy Francisco de Borja Echeverría was in charge of the agency's operations in Europe. Under his mandate, the agency partnered with the National Agricultural Society (*Sociedad Nacional de Agricultura*) with the goal of recruiting skilled agricultural workers. To achieve his goal de Borja decided to initially use the Basque region in Spain as headquarter, where he thought agriculture was exceptionally efficient (Chamber of Deputies, extraordinary session, January 6, 1883 p. 496). He then moved to Paris because of its strategic location within Europe and the existence of laws that facilitated the migration process.

In early 1884, de Borja ended his mandate and a new period began with Benjamín Dávila Larraín as the new person in charge. The goal changed as he wanted to recruit skilled industrial (rather than agricultural) workers. To achieve this goal, the agency partnered with the Factor Building Society (*Sociedad de Fomento Fabril*) and more agencies were established in Spain, France, Germany, Piedmont, and Switzerland. Limited financial resources constrained operations in other countries: "Financial constraints limit our ability to advertise the role of the settlement agency across all countries in Europe. With more financial resources, we would observe immigrants from all European countries." (Agencia de Colonización 2010, p. 5).

³ There were some attempts to attract foreigners before the 1880s, but they were largely unsuccessful until the immigration policy I study was implemented in 1882 (Borgono 1913).

The agency worked as follows. Once a recruiting site was in place, and an *agente de emigración* was put in charge, the agency used two different but complementary strategies to attract potential migrants. First, they spread information using pamphlets, brochures, maps, and newspaper advertisements.⁴ This information included the steps in the migration process, the financial benefits for migrants, and characteristics of the country.⁵ Second, the agency partnered with local immigration houses to find candidates. The market of immigration houses was somewhat competitive, and the agency's decision was more about choosing the right agency to work with (Vega 1896, p. 5).⁶ The agency paid the house a fixed amount per recruited individual. When a potential candidate decided to migrate using the services of the agency, a contract was signed between them. Figure 1b presents an example of a contract signed in 1883 between the Aguirre family and the agency. A summary of the agency's financial statements in 1894 reveals that 77% of its budget was used to buy travel tickets, 9% was spent in advertisement, and 14% was spent in operational costs (e.g., wages).

In 1904, 22 years after the settlement agency began its operations, President Germán Riesco Errázuriz terminated this policy. As a consequence, the migration of Europeans from countries with recruitment sites began to decline (Maldini 2004). The causes behind the end of the settlement agency are not entirely clear, but it seems that financial resources were an important cause (Agencia de Colonización 2010).

2.2 Data and descriptive statistics

To track the effects of the settlement agency I hand collected data for 44 provinces in Chile during the period 1865–1920 at each census year (1865, 1875, 1895, 1907, and 1920).⁷ With this data, I constructed the number of Europeans from different countries in each province at each census year. The censuses also present information about literacy rates by province. I then constructed natives' literacy rates and use this variable as a proxy for the human capital of natives. I also collected the following variables: total number of immigrants, non-European immigrants, total and urban population, number of students, and number of workers. In addition, I also hand collected data on school construction from *Guía cronológica de creación de*

⁴ Figure 1 a presents an example of a brochure used in France. De Borja published a brochure in spanish and french with more than 20,000 copies in 1882. Dávila Larraín published another brochure in french, italian, and german with more than 20,000 copies in 1886. More examples in Vega (1896).

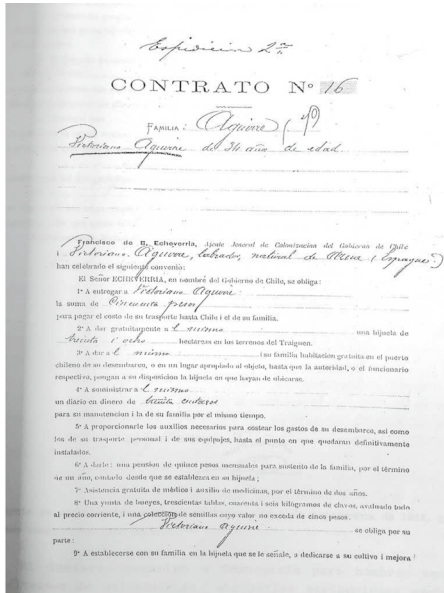
⁵ Some of the benefits for migrants were: free shipping of their tools and machinery (with a limit of 2 tons), free tickets across Chilean railroads upon arrival, and a significant reduction in travel tickets within Europe—from cities to main ports of departure—and from Europe to Chile.

⁶ As European governments wanted to prevent an exodus, only these immigration houses were able to recruit migrants. According to a letter from the agency to the Ministry of Foreign Affairs in February 1884, the agency partnered with the following immigration houses: *A Ch. Colson* in France and Spain; *Casa de Ph. Rommel y Cia.* in Switzerland, Baden, Würtemberg, Baviera, Tiral and Alsacia; and the former consul Carlos Ochsenius for the rest of Germany.

⁷ Unfortunately, the 1885 Census does not present information about the number of Europeans by province, so I had to drop it from the analysis.



(a) Information about Chile



(b) Migration contract

N°	Contrato	Fecha	Arribo	Vapor	Nombre	Sexo	Edad	Nacionalidad	Colonia	Ha.	Observaciones
1	27	8	1883	Patagonia	Nollenberg Paul	m	28	alemán	Huequén		
2	27	8	1883	Patagonia	Nollenberg Maria	f	24	alemán	Huequén		Murió en la colonia
3	61	23	9	1883	Patagonia	Viaña Greg.	m	48	español	Victoria	Se retiró a Europa
4	61	23	9	1883	Patagonia	Viaña Maria	f	42	español	Victoria	Murió en Victoria el 16 de agosto de 1889
5	61	23	9	1883	Patagonia	Viaña Bautista	m	23	español	Victoria	
6	29	27	9	1883	Patagonia	Viaña su pariente	m	23	español	Victoria	
7	29	27	9	1883	Patagonia	Zuratuza Fel.	m	30	español	Victoria	
8	29	27	9	1883	Patagonia	Zuratuza Juan	f	31	español	Victoria	
9	29	27	9	1883	Patagonia	Zuratuza Blas	m	12	español	Victoria	
10	29	27	9	1883	Patagonia	Arve Juan Martin	m	50	español	Victoria	
11	18	27	9	1883	Patagonia	Arve Catalina	f	41	español	Victoria	
12	18	27	9	1883	Patagonia	Arve Domingo	m	70	español	Victoria	92 Murió 29 septiembre 1889. T. D., 20 noviembre 1895
13	18	27	9	1883	Patagonia	Arve Eugenio	m	19	español	Victoria	
14	18	27	9	1883	Patagonia	Arve Francisco	m	16	español	Victoria	Murió en Victoria el 27 octubre 1884
15	18	27	9	1883	Patagonia	Arve Crencio	m	13	español	Victoria	
16	18	27	9	1883	Patagonia	Arve Gumecinde	f	9	español	Victoria	
17	18	27	9	1883	Patagonia	Arve Francisco	m	7	español	Victoria	
18	18	27	9	1883	Patagonia	Arve Hilario	m	6	español	Victoria	
19	18	27	9	1883	Patagonia	Arana Lorenzo	m	n/d	español	Victoria	
20	63	27	9	1883	Patagonia	Arana Stefania	f	n/d	español	Victoria	38 Se retiró de la colonia el 6 de abril de 1886
21	63	27	9	1883	Patagonia	Arre Vicente	m	27	español	Victoria	
22	63	27	9	1883	Patagonia	Arre Francisco	m	24	español	Victoria	38 T. D., 28 agosto 1911
23	63	27	9	1883	Patagonia	Arre Solio	m	10	español	Victoria	
24	63	27	9	1883	Patagonia	Apalaza Claudio	m	44	español	Victoria	
25	63	27	9	1883	Patagonia	Apalaza Carmen	f	42	español	Victoria	56 T. D., 18 junio 1897
26	63	27	9	1883	Patagonia	Alvorosturi Vicente	m	10	español	Victoria	
27	63	27	9	1883	Patagonia	Alvorosturi su esposa	f	51	español	n/d	38 Se retiró de la colonia
28	63	27	9	1883	Patagonia	Alvorosturi su hijo	m	41	español	n/d	Se retiró de la colonia
29	63	27	9	1883	Patagonia	Bosny Clodia	m	30	francés	Victoria	38 Se retiró de la colonia
30	63	27	9	1883	Patagonia	Bosny Felix	f	28	francés	Victoria	38 T. D., 18 diciembre 1893
31	40	27	9	1883	Patagonia	Bosny Augusta	f	6	francés	Victoria	
32	40	27	9	1883	Patagonia	Bosny Carmela	f	3	francés	Victoria	
33	40	27	9	1883	Patagonia	Bosny Raquel	f	2	francés	Victoria	
34	40	27	9	1883	Patagonia	Carfeta Jorge	m	29	español	Victoria	38 T. D., 25 junio 1890
35	11	27	9	1883	Patagonia	Concuero Victor	m	37	español	Victoria	
36	84	27	9	1883	Patagonia	Concuero Barbara	f	34	español	Victoria	56 Murió en Victoria el 23 de octubre de 1884. T. D., 14 marzo 1896
37	84	27	9	1883	Patagonia	Concuero Lucas	m	10	español	Victoria	
38	84	27	9	1883	Patagonia	Concuero Peta	f	7	español	Victoria	
39	84	27	9	1883	Patagonia	Concuero Marcelina	f	5	español	Victoria	
40	84	27	9	1883	Patagonia	Concuero Andrea	f	3	español	Victoria	
41	84	27	9	1883	Patagonia	Egafia Juan	m	52	español	Victoria	74 Murió en Victoria. T. D., 3 diciembre 1897
42	84	27	9	1883	Patagonia	Egafia Maria	f	50	español	Victoria	Se retiró de la colonia
43	21	27	9	1883	Patagonia	Egafia Francisco	m	23	español	Victoria	Se retiró de la colonia
44	21	27	9	1883	Patagonia	Egafia Modesta	f	20	español	Victoria	Se casó con Esteban Pérez
45	21	27	9	1883	Patagonia	Egafia Damaso	m	18	español	Victoria	
46	32	27	9	1883	Patagonia	Errucelguia Euj.	m	37	español	Victoria	38 Se retiró de la colonia
47	32	27	9	1883	Patagonia	Errucelguia Micaela	f	32	español	Victoria	

(c) List of first recruited Europeans

Fig. 1 Information, contract, and first recruited Europeans. Notes: all images are administrative files collected by Bobadilla (1995)

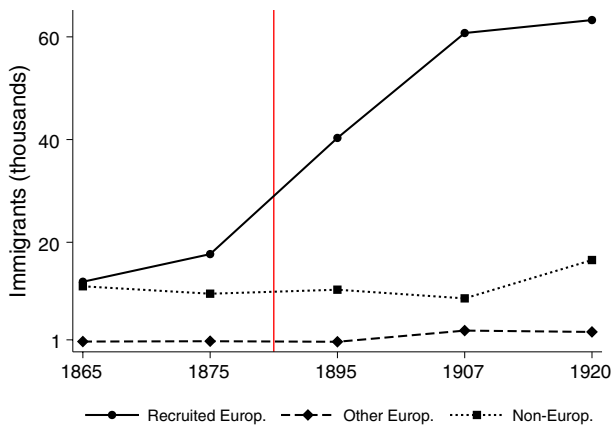


Fig. 2 Immigration over time. Notes: immigrant population in Chile. Information from historical censuses. *Recruited Europeans* are individuals born in countries where the settlement agency was established. *Other Europeans* are all remaining Europeans. *Non-Europeans* are individuals born outside Chile and Europe (e.g., Argentina, Bolivia, Peru).

escuelas (1844–1933) (Chronological guide of school construction), available at the National Archive.⁸

The agency was successful in recruiting skilled Europeans. Figure 2 plots the time variation in the number of immigrants from different countries and the years the settlement agency was active. Specifically, I split all immigrants in each census into three groups: (1) recruited Europeans, (2) other Europeans, and (3) non-Europeans. Recruited Europeans are those born in a European country with a recruitment site, other Europeans are individuals born in European countries where the agency did not operate, and non-Europeans are individuals born outside Chile and Europe. While recruited Europeans increased threefold after the agency began its operations, the number of immigrants from other countries remained relatively stable during this period. Importantly, the observed increase in the number of Europeans from countries where the agency was operating is consistent with administrative data collected by the agency (Agencia de Colonización 2010, p. 21).⁹

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,

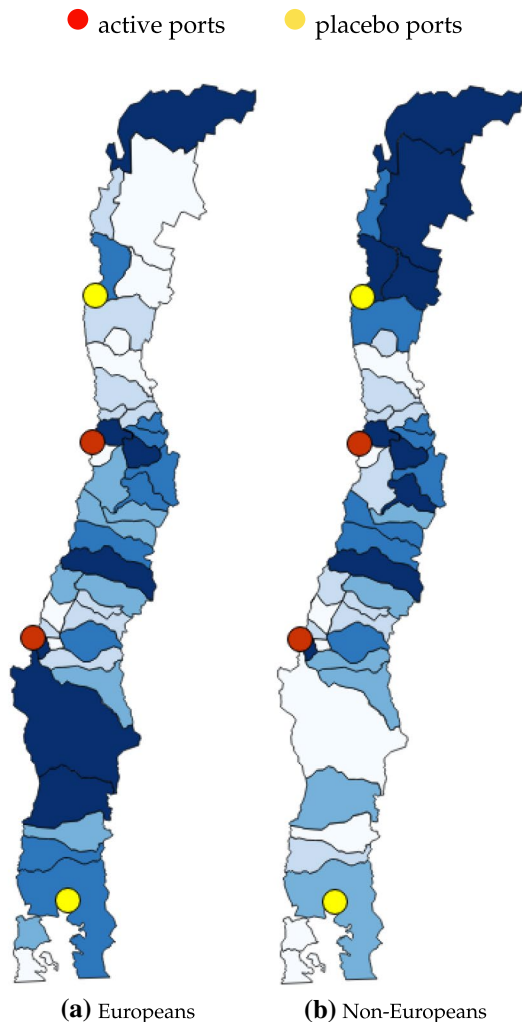
⁸ More about school construction and education during this period can be found in Serrano et al. (2012). The development of the “Primary Instruction Law” summarizes the government’s intentions: all children between the ages of six and sixteen had to be at least 4 years at school. This law was enacted in 1920 but public spending on education began in the 1860s (Bowman and Wallerstein 1982; Ponce de León 2010). These changes were experienced at the country level and I can account for their impact using year fixed effects and regional trends. Figure 5 presents time series for real GDP per capita and its growth (Díaz et al. 2016). More about data construction in “Appendix”.

⁹ The official numbers are: 7457 from France, 1826 from England, 1567 from Germany, 7068 from Italy, and 9717 from Spain. 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.

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

After the arrival to the main ports in the late nineteenth century, 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. Figure 3 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

Fig. 3 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 “Appendix”



entry, while yellow dots represent ports that were built after the period the settlement agency was active.

Table 1 presents descriptive statistics by province-year. Natives' literacy rate increases from 16 to 44% in the period of 60 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. The middle panel presents descriptive statistics for labor market variables. The location of Europeans after their arrival is endogenous, but labor markets should be the main variable affecting their decisions. I use the richness of variables measuring labor markets in the historical censuses to control for the effect different markets had on Europeans' location decision, i.e., the number of individuals working in agriculture, commerce, and industry. The lower panel presents variables measuring school markets. As previously stated, Europeans could have increased natives' literacy rates

Table 1 Descriptive statistics

	1865	1875	1885	1895	1907	1920	All
<i>Main variables</i>							
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 (1955)	1202 (3140)	1259 (3530)	778 (2354)
Non-Europeans	260 (1012)	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)
<i>Labor markets</i>							
Agriculture	6850 (5307)	8684 (6654)	–	9455 (9142)	9653 (9647)	10,788 (12,364)	9086 (8980)
Commerce	551 (943)	750 (1322)	–	1220 (2560)	1715 (3834)	2334 (4305)	1314 (2959)
Industry	5156 (5253)	6024 (6204)	–	6483 (8318)	7606 (12,335)	6611 (10,963)	6376 (8982)
<i>Education markets</i>							
ySchool 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 (1636)	–	6589 (10,234)	2479 (6632)
Observations	44	44	44	44	44	44	220

Mean and standard deviation at the province and census year level

Own calculation from national censuses and data from the National Archive

Table 2 Human capital of Europeans in 1895

	Living in Chile			Living in Argentina		
	Literacy (%)	High-skill (%)	Low-skill (%)	Literacy (%)	High-skill (%)	Low-skill (%)
Country of birth	(1)	(2)	(3)	(4)	(5)	(6)
Spain	83	54	36	82	50	50
Germany	92	66	34	91	49	51
Italy	74	73	27	69	43	57
France	87	62	38	84	45	55
England	90	68	32	89	47	53

Data from the 1895 Chilean census in columns 1–3 and from the 1895 Argentinian census in columns 4–6. Classification of occupations in high-skill and low-skill using the international standard HISCLASS (van Leeuwen et al. 2002)

by increasing government spending. To test for this mechanism I gathered data on public schools and public servants during this period.

2.3 Europeans as skilled immigrants

Europeans were different from other immigrants.¹⁰ This claim can be corroborated empirically using national censuses, which present information about occupations and literacy rates by nationality in 1895. Table 2 presents literacy rates and the percentage of Europeans in low- and high-skill occupations in 1895, using the standard classification of occupations HISCLASS (van Leeuwen et al. 2002). The majority of Europeans were relatively skilled. The last three columns show the same numbers for Argentina, where Europeans were somewhat less skilled. Taken together, this table presents some suggestive evidence of a positive selection of Europeans to Chile.¹¹

As the claim that European immigrants in Chile were relatively skilled could be controversial, 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 USA, 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, pp. 91–93). Thus, even if individuals recruited

¹⁰ Although Europeans represented only 2% 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).

¹¹ Relatedly Estrada (2005) shows that Europeans owned more than 30% of the firms that existed in 1920, even though they only represented around 2% of the total population (Table 10).

by the 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 data confirm that even though Europeans represented a relatively small share of the population, they were relatively skilled and then could have had an effect on the local development of regions (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.

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 observe Europeans' actions and decide whether to acquire (additional) education or not. My focus falls on natives' decisions. However, I also discuss Europeans' location and labor decisions. I 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 get in the existing local labor market, and s his entrepreneurial skill. If he starts 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:

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

I assume Europeans know the distribution of $\ln(\theta)$ but not a native's specific θ . In addition, I 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 the total cost of production, including the opportunity cost w_E . It is clear from Eq. (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. I control for all these variables in the empirical analysis. Finally, I expect that Europeans with relatively high s will be the ones starting firms. I 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' decisions and decide how much education to acquire to maximize their expected utility. I 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 a 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.¹² 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. Section 5.1 shows that Europeans seem 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 Eq. (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 is, Europeans offer higher wages because they have better entrepreneurial skills, have a potential impact on natives' education, and have access to more 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. I 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. I assume that $\tilde{M}$ is perfectly observed by natives, and that $P_\ell(\tilde{M})$ is increasing in $\tilde{M}$.¹³ Thus, I 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 Eq. (4) into Eq. (3) and take the first-order condition with respect to E to find:

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

¹² As education was mostly public during this period, I interpret the cost of education as (i) an opportunity cost related to foregone labor income, and (ii) a transportation cost to go to school.

¹³ This can be derived more formally by solving the firm's profit maximization problem. In particular, the firm will choose L to maximize Eq. (1). Then, $P_\ell(\tilde{M})$ will simply be $P_\ell(\tilde{M}) = \sum_{m=1}^{\tilde{M}} (L_m / \tilde{L})$, where $\tilde{L}$ is total labor force in the local economy and $m = 1, \dots, \tilde{M}$ indexes the number of European entrepreneurs in the local economy.

where $\Omega(s, \tilde{M})$ is an increasing function in $\tilde{M}$ and s .¹⁴ 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:

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

Therefore, the effect of Europeans on natives' literacy rate in a province is:

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

This means that natives' literacy rate can change due to a number of reasons. Literacy can 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. I interpret the former three reasons as a modernization of the local economy.

3.3 Discussion

There are four intuitive predictions from this simple framework. First, 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 (P1). Second, 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 (P2). Third, conditional on P2, natives' education will be an increasing function in the number of European entrepreneurs $\tilde{M}$ in the local economy (P3). This is a straightforward prediction from Eq. (5). Fourth, if government spending increases after the arrival of Europeans, this translates into a decrease in γ and a subsequent increase in natives' education (P4).

The first theoretical insight (P1) motivates the choice of control variables. The second (P2) is consistent with historical accounts, which provide evidence of Europeans starting firms across the country (see Sect. 5.1). The third insight (P3) states the main hypothesis and will be the focus of the empirical analysis. Finally, the fourth insight (P4) is important to test for a potential mechanism.¹⁵

¹⁴ In particular, $\Omega(s, E, \tilde{M}) \equiv \min \left\{ \sum_{m=1}^{\tilde{M}} \phi, 1 \right\} \times P_\ell(\tilde{M})$, 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 .

¹⁵ Some 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).

4 Europeans and the human capital of natives

4.1 Econometric framework

I compare the human capital of natives before (1865 and 1875) and after (1895, 1907, and 1920) the arrival of Europeans. In particular, I 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_{irt} is natives' literacy rate in province i —located in region r —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, I include region-year indicators.¹⁶ 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 theoretical framework in Sect. 3 suggests that $\beta > 0$.

Note that to avoid a reverse causality problem, I measure the number of Europeans in a province from the previous census: Europeans could have settled in places with high literacy rates of natives if, for example, they needed to hire skilled individuals for their firms. The coefficient 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. I also consider specifications with and without controls $\mathbf{X}_{it}$: the logarithm 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 economic trends in a province (Acemoglu et al. 2002).

Finally, I construct a variable that measures the number of public schools per 1000 inhabitants in each province in the 1860s, and interact this variable with census year dummies. This is a flexible way to control for predetermined changes in literacy rates. It is important for two different reasons. First, provinces with a low number of public schools per 1000 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.¹⁷

¹⁶ A region is a cluster of provinces. I consider three regions: north, center, and south.

¹⁷ Ponce 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 I also indirectly control for government spending in education.

4.2 Main results

Table 3 presents estimates of Eq. (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% increase in the number of Europeans is associated with an increase of 0.6% in our measure of human capital. Put differently, the arrival of 300 Europeans to a province (an approximately 100% increase) before the settlement policy was implemented, is associated to an increase of 1.2% points in natives' literacy rate, or approximately 600 more natives that know how to read and write.

Column 2 includes 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. The remaining three columns add the baseline number of schools multiplied by year indicators to control for predetermined changes in literacy rates, the logarithm of individuals working in different sectors, and regional trends. None of these control variables changes our main conclusion: There is a positive, statistically and economically significant, and robust

Table 3 Natives' literacy and Europeans

Dependent variable: log natives' literacy rate

	(1)	(2)	(3)	(4)	(5)
<i>Log Europeans</i>	0.06*** (0.02)	0.05*** (0.02)	0.06*** (0.02)	0.06*** (0.03)	0.07*** (0.02)
<i>Log non-Europeans</i>		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
Additional controls					
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

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

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 1000 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: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

relationship between the arrival of Europeans to a province and the subsequent change in natives' literacy rate.

To more precisely estimate the relationship between recruited Europeans and natives' literacy rate, Table 4 uses the country of birth. In particular, as agencies were located in some (but not all) parts of Europe, I can distinguish between those coming from countries with recruitment sites and those migrating from other parts of Europe (non-recruited). In addition to this, I can identify those migrating from countries with "good" and "bad" institutions by taking the average constraints on the executive power in each European country around the time of the Chilean censuses years. I 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

Table 4 The importance of the settlement agency

	Dep. variable: Log natives' literacy rate					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Log Europeans</i>						
Recruited	0.06*** (0.02)	0.07*** (0.03)			0.10*** (0.03)	0.10*** (0.04)
Non-recruited	− 0.01 (0.02)	0.01 (0.02)			0.01 (0.02)	0.03 (0.03)
Good institutions			0.03* (0.02)	0.03* (0.02)	− 0.01 (0.02)	− 0.02 (0.02)
Bad institutions			− 0.02 (0.03)	0.00 (0.03)	− 0.05 (0.03)	− 0.04 (0.04)
<i>Log non-Europeans</i>						
	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
Additional controls						
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

I 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*)

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 1000 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: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

institutional quality of European countries varies throughout this time period, there is independent variation in human capital and institutions that can be used.

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. Columns 3 and 4 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, columns 5 and 6 include both measures and we see that the coefficient of interest is entirely driven by Europeans migrating from places where agencies were established. Although the correlation between agency location and institutional quality prevents us from a solid conclusion, this table offers suggestive evidence for the importance of the agency.

Tables 3 and 4 show that there is a positive, robust, and statistically significant relationship between the arrival of Europeans and the human capital of natives. 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, there is suggestive evidence of the positive impacts of the policy. Two alternative explanations deserve attention. First, it is theoretically possible that the children of Europeans are more educated than children of natives and this is driving results. Although plausible, the magnitude of the effect I have documented suggest this is not the case. In addition, Fig. 5 shows that 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 became natives for statistical purposes. This is unlikely to be a concern because naturalization rates were extremely low (less than 2 % in the largest cities, see Table 11).

The main threat to results is time-varying omitted factors 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.¹⁸

4.3 Discussion of causality

To explore a potential causal effect between European immigration and the human capital of natives, I use instrumental variables. Although instruments appear valid

¹⁸ In 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).

and satisfy a wide range of statistical tests, these ultimately rely on untestable assumptions. Therefore, I interpret the following results as suggestive of causality.

The instruments I 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, located in the south of the country and constructed in 1794. The Valparaíso port is the second oldest, located in the center and 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,¹⁹ I use only two distances: the distance to Valparaíso port (Port 1) and to Talcahuano port (Port 2). Therefore, the first stage is:

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

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 an indicator for the period in the 1880s and 1990s, when the agency was active:

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

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 and 1990s. If the distance to the main ports of entry is predictors of Europeans' location decision, we should observe both $\delta_1 < 0$ and $\delta_2 < 0$.

The validity of the instruments rely on the assumption 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 testable, 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 agency. Figure 4 presents this exercise: The correlation is not different from zero, providing some evidence for the identification assumption.

Table 5 presents estimates of Eq. (8).²⁰ Columns 1 and 2 present the first stage. The theoretical motivation behind these instruments emphasizes the role of transportation costs. Moving across a country in the nineteenth century was costly, and even more 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

¹⁹ The 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.

²⁰ A graphical representation of the cross-sectional variation in distances to the main ports of arrival can be found in Fig. 3. Red dots in the map represent the two main active ports, while yellow dots represent ports that opened after the agency.

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

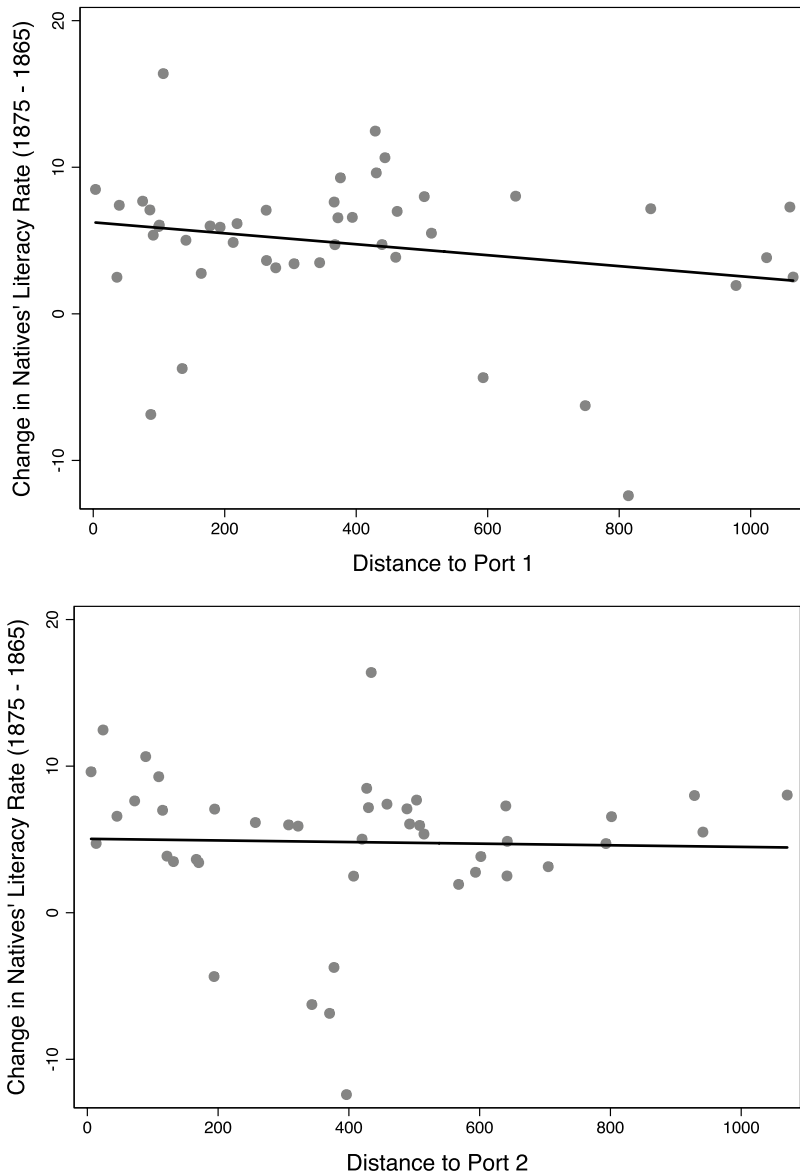


Fig. 4 Evidence for identification assumption. Correlation between changes in natives' literacy rate between 1865 and 1875 and the instruments before the settlement agency. Distances are measured in kilometers

Table 5 Motivation for an instrumental variables approach

Dependent variable: Log European immigrants				
	Active Port 1	Active Port 2	Placebo Port 1	Placebo Port 2
<i>Distance to port × agency is active</i>	− 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
Additional controls				
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

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 1000 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: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

the number of Europeans. This is exactly the relationship we observe in the data.²¹ There are, however, other reasons why this relationship might hold, which constitutes a threat to the validity of the strategy. To test for this, I show that the empirical relationship between ports and Europeans is only driven by the agency and immigration using three pieces of evidence. First, I 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 the labor market and population controls. Second, I identified two other important ports in the country that began its operations *after* the settlement agency and I found that the statistical relation between distances and Europeans completely disappears (columns 3 and 4 in Table 5). Finally, Fig. 4 shows that distances to the main ports of entry are not correlated with changes in natives' literacy rate *before* the settlement agency began its operations.

Table 6 presents two-stage least squares estimates. As suggested by the previous analysis, the first stage is strong, even when including the most comprehensive set of control variables. Estimated coefficients are somewhat larger than before. Results in this table show that a 10 % increase in the number of Europeans in a province is associated with a 1.6–1.8 % increase in natives' literacy rate. Two-stage

²¹ It 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. (2019).

Table 6 Two-stage least squares

	Dependent variable: Log natives' literacy rate				
	(1)	(2)	(3)	(4)	(5)
Second stage					
<i>Log Europeans</i>	0.17*** (0.04)	0.17*** (0.05)	0.16*** (0.05)	0.17*** (0.06)	0.18*** (0.05)
<i>Log non-Europeans</i>		− 0.00 (0.02)	0.00 (0.02)	− 0.00 (0.02)	0.00 (0.02)
First stage					
<i>Distance to port 1 × agency is active</i>	− 0.97*** (0.28)	− 0.89*** (0.28)	− 1.26*** (0.36)	− 1.26*** (0.37)	− 1.04** (0.44)
<i>Distance to port 2 × agency is active</i>	− 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
Additional controls					
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 <i>F</i> 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

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

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 1000 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: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

least squares estimates are larger than OLS presumably for two reasons. First, OLS estimates in Table 3 represent the average effect of immigrants from European countries with and without agencies. As the agency located in more developed countries—and seems to have been successful in recruiting relatively skill Europeans—the OLS is likely to be biased downwards because it includes the effect of Europeans from less developed countries without agencies. Second, the instrument is constructed to shift the number of Europeans from countries with recruitment sites, during a specific period of time (1880s and 1890s), and they affect a subset of provinces (the compliers). These three reasons might also contribute to a larger two-stage estimate.

5 An exploration of mechanisms

This section studies potential mechanisms behind the increase in natives' human capital after the arrival of Europeans, i.e., the provision of public goods and modernization of the local economy. First, I present historical evidence of a change in labor markets after the arrival of Europeans. Second, I show little changes in the supply of public schools and public servants. And third, I show a change in the local economy in places where Europeans settled. These findings suggest that Europeans helped to modernize the local economy and through it affected the human capital of natives.

5.1 Firms founded by Europeans

Europeans could have caused a shift in productivity, increased the availability of physical capital, and modernize the local economy. There are several historical examples. Estrada (2005) constructs the distribution of firms by industry and ownership (Table 10), where we see that Europeans created firms across the country: out of the 2967 firms that existed in 1920, Europeans owned 1004. Other immigrants, on the other hand, owned less than 7% 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 of the lack of systematic data about firms during this period. We know, however, that Europeans owned more than one-third of the firms that were operating in 1920. To shed light on potential links between firms and the human capital of natives, I now provide a brief historical description of these firms.

Germans started modern factories in the south of Chile and contributed to local development (Bernedo 1999). German entrepreneurs introduced a variety of economic activities that were previously unknown. Many of them had plenty of capital, acquired properties both in the city and the countryside, and imported capital from Europe (Pérez Canto 1888). The biggest industries developed by the Germans were the brewing and the tannery industry.^{22,23} Another interesting case is the distillers founded by the Germans. The number of distilleries more than tripled in the late nineteenth 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, a particularly large group in Valparaíso. They started small businesses that were run by the family (colloquially called “Don Giuseppe from the corner”). Other Italians started

²² The 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.

²³ The 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.

larger firms that required plenty of work from natives (Rodríguez 1998). In fact, the Italian consul stated that, by 1904, Italians owned 90 % of all stores and 74 % of all offices in Valparaíso.²⁴ Across Chile, they owned 9% 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 census of the Italian colony (Pellegrini 1926). This document contains details about Italians and their firms: 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 the 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 8000 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 1920.²⁵ But the largest group of immigrants were the Spaniards.²⁶ In fact, the Spaniards were the foreign group that owned more firms (13%). These firms were concentrated in the tannery, clothing, and food industry and were of relatively low value when compared to other European firms.

In summary, although I cannot statistically prove that Europeans had a significant impact on local economies and increase the demand for skilled labor through the creation of firms, there is suggestive historical evidence of this being the case.

5.2 Schools, state presence, and the economy

I constructed measures of public schools during this period, allowing me to check if the provision of public education was affected by Europeans. I also take from the censuses the number of public servants as a measure of state presence, and labor force participation as indicative of the local economy. Empirically, I estimate Eq. (6) but replace the dependent variable by one of these variables.

Table 7 presents estimates. Estimates reveal little statistical relation between skilled immigrants and the construction of public schools, the percentage of students in the population, or the percentage of teachers in the population. There is also little relationship between Europeans and the number of public servants in the years after their arrival, suggesting that state presence is unlikely to be a mechanism. The last column

²⁴ Examples 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.

²⁵ An example of these firms was the tanneries owned by Eugene Saint-Macary and his brother Victor in the 1890s. They had a big factory in Valparaíso, a shoe factory in Santiago, and a 8000 square feet tannery in Concepción.

²⁶ One 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).

Table 7 Mechanisms

	Log public schools over pop. (1)	Log stu- dents over pop. (2)	Log public schools over students (3)	Log teach- ers over pop. (4)	Log public servants over pop. (5)	Log workers over pop. (6)
<i>Log Europeans</i>	− 0.07 (0.09)	0.01 (0.18)	− 0.12 (0.22)	− 0.01 (0.11)	0.04 (0.09)	0.04 (0.03)
<i>Log non-Euro- peans</i>	− 0.04 (0.03)	0.10 (0.21)	− 0.16 (0.21)	− 0.03 (0.05)	0.07 (0.05)	− 0.00 (0.02)
Province F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Census year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls						
Population	Yes	Yes	Yes	Yes	Yes	Yes
Baseline schools	Yes	Yes	Yes	Yes	Yes	Yes
Labor mar- kets	Yes	Yes	Yes	Yes	Yes	Yes
Regional trends	Yes	Yes	Yes	Yes	Yes	Yes
Provinces	44	44	44	44	44	44
Observations	176	132	132	176	176	176

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 1000 inhabitants interacted with year dummies, *Labor market* 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: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

in this table shows weak evidence of an increase in labor force participation (p value of 0.15), which is somewhat consistent with the increase in demand for labor.

Three remarks are necessary to interpret the lack of an effect on schools after the arrival of Europeans. First, I am only able to measure the construction of *public* schools, and *private* schools might have played a role. For example, Italians founded the *Scuola Italiana* in 1891 in Santiago and in 1886 in Valparaíso (Carroll 2013), but to the best of my knowledge there is not systematic data measuring these schools or natives using them. Second, the number of public schools could be a poor measure of government spending in education during this period. Additional monetary resources for existing schools could also be important. Third, the construction of public schools might have not been correlated with the provision of other potential critical public goods. In sum, I cannot completely rule out the role of public goods.

5.3 Modernization of the local economy

Finally, I study the within country variation in agricultural inputs and output in 1955 with the goal of exploring additional evidence of changes in local economies. 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).²⁷

Europeans' location decision was endogenous, and there are no measures of agricultural output and inputs before and after the settlement policy. Therefore, my 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, I do control for a number of variables in 1907 and show that the variation I can explain in our dependent variables is substantial (more than 75%), giving little room for omitted variables to play a role (see González and Miguel 2015 and Oster 2019). In particular, I estimate the following regression:

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

where $y_{p,1955}$ is the 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 and the logarithm of urban and rural population.

Before presenting results, consider regression Eq. (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 8 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 % 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. A decade after the agency stopped its operations, Europeans were in control of part of the agricultural sector.

Using the 1955 agricultural census, I am able to measure in a fairly precise manner the within country development of the economy roughly 50 years after the settlement agency. In particular, I follow Cuesta et al. (2015) and use this information to construct three dependent variables. First, the total value of agricultural output, i.e., the sum of output across the fruits, livestock, and primary products sectors. Then, I 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 8. Overall, there is positive effect of European immigration in total output, most of which is explained by an

²⁷ To the best of my knowledge similar data for the industrial sector in the 1950s does not exist and the period after that is likely to have been affected by an agrarian reform policy in the 1960s, the trade liberalization in the 1970s, and the policies of the dictatorship (1973–1990) more generally.

Table 8 Long-run effects in the agricultural sector

	Dependent variable in the agricultural sector (year)							
	Log inputs				Log output (1955)			
	Foreign land-lords (1920)	Native landlords (1920)	Capital (1955)	Labor (1955)	Total output	Fruits	Livestock	Primary products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Log Europeans</i>	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)
<i>Log non-Europeans</i>	- 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

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)

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: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

increase in capital. 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 local economies (Bernedo 1999).

All in all, the evidence is more consistent with Europeans having an impact on the local economy, modernizing the production function, and through that channel affected the human capital of natives. The government does not appear to have changed their activities locally after the arrival of Europeans.

6 Conclusion

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 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. Historical episodes can be particularly useful.

By studying a settlement policy implemented in Chile during the nineteenth century, I have shown a positive relationship between skilled immigration and the human capital of natives. When studying mechanisms, I highlighted two potential channels: an increase in the demand for skilled labor—i.e., a modernization of the local economy—and an increase in the provision of public goods. I find little evidence of the latter and more evidence consistent with the former. Consequently, in provinces where Europeans settled, there was increase in economic output 50 years after the settlement policy was terminated. More research is needed to identify the exact mechanisms through which skilled immigration impacts human capital decisions.

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Appendix: data construction

Censuses can be found in the website of the National Statistics Bureau of Chile. Censuses before 1865 do not present information about immigrants by province. The analysis excludes the territory annexed after the War of the Pacific (1879–1883) and the Magallanes province because it was unpopulated in the 1860s—then populated mainly by foreigners—and it is geographically disconnected by thousand of kilometers from the rest of the country. Results are similar if I include it.

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

Provinces

I construct 44 units that are geographically equivalent during the period 1865–1920. Through the paper I call these units “provinces.” Table 9 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.

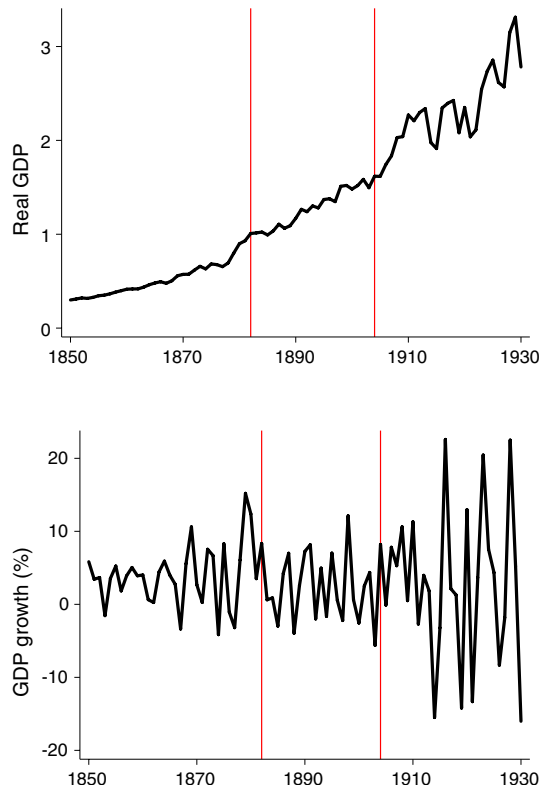
Europeans

I 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. I 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 USA, 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 I assume all Europeans are literate, although results are robust to other assumptions. Therefore, if E_{it} the number of

Fig. 5 Chilean development at the turn of the nineteenth century



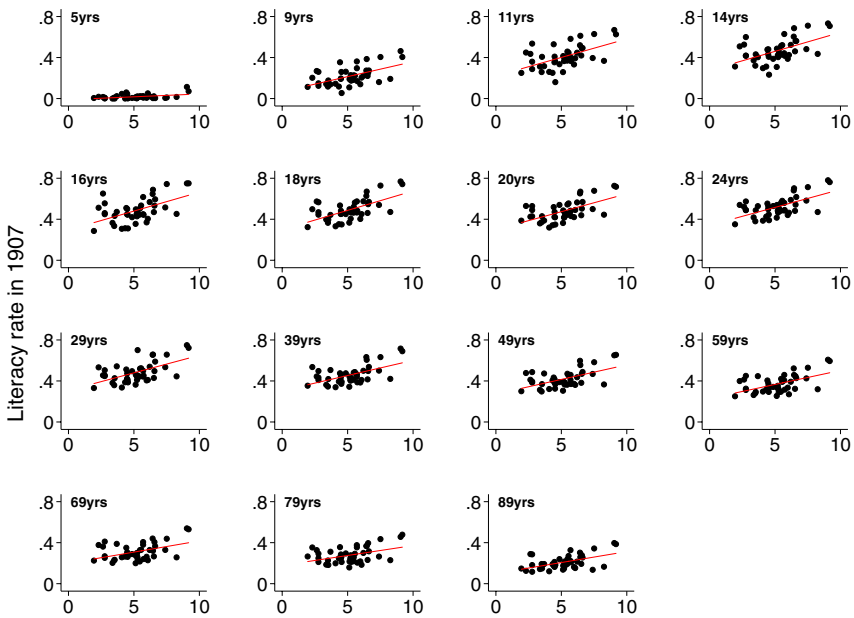
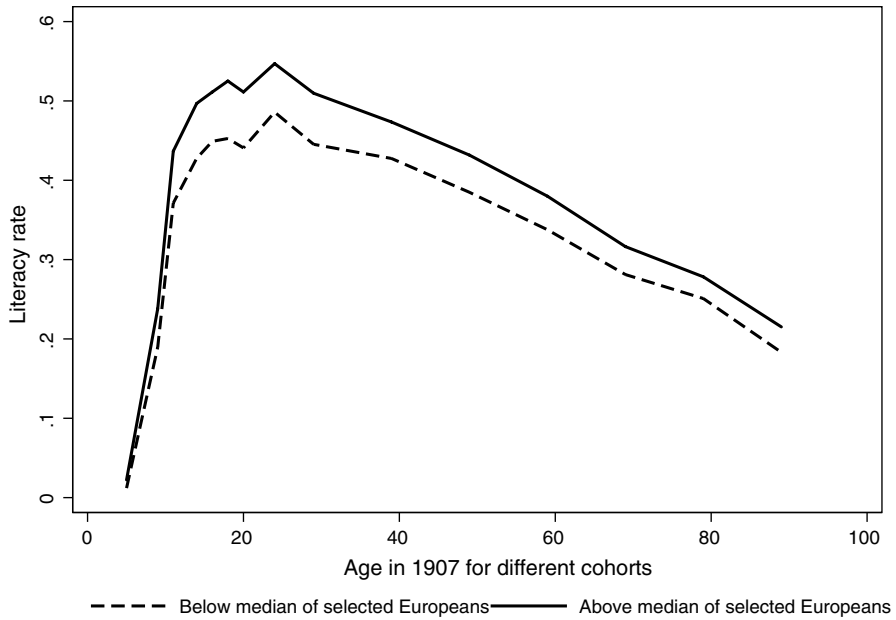


Fig. 6 Literacy rates by age. Notes: Authors' calculation based on the 1907 national census. UPPER PANEL: Above and below the median of selected Europeans

- Europeans in the province i at time t , the natives' literacy rate is $y_{it} = \frac{e_{it} \times P_{it} - E_{it}}{P_{it} - E_{it}}$.
- 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 1000 inhabitants I 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 1000.
- Distances** To calculate the distance between each province and the two ports of interest I first take information on the latitude and longitude for each province's centroid from Google Maps. Then, I obtain the latitude and longitude for each port using the same procedure. Finally, I use the Stata command `vincenty` to

Table 9 Provinces How I grouped provinces over time to construct stable geographical units. *Source:* Own construction based on national census

Unit	Provinces	Unit	Provinces
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, Carelmapu	43. Valparaíso	–
21. Los Andes	–	44. Victoria	–
22. Magallanes	–	45. Yungay	Bulnes, Chillán
23. Melipilla	San Antonio, Cachapoal		

Table 10 Firm ownership in 1920. Europeans were mostly entrepreneurs and started many firms across the country. *Source:* Reprint of Table 4 in Estrada (2005)

	Germans	Spaniards	French	English	Italians	Anonymous				Total
						Other	Mixed	Society	Unknown	
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
Tobacco	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	2967

Table 11 Naturalization.
Source: Authors' calculation
based on the 1895 national
census

	Nonresi- dents (%)	Residents (%)	Naturalized (%)	Total
Valparaíso				
Europeans	9	89	2	8567
Other	11	86	3	1735
Santiago				
Europeans	1	98	1	9808
Other	2	96	1	1833

calculate the distance between provinces and ports. This command uses an accurate ellipsoidal model of the Earth to account for the surface's curvature (see Figs. 5, 6 and Tables 9, 10, 11).

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