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Three essays in human capital formation. From colonial institutions in the Americas to early Catalan industrialization

Èric Gómez-i-Aznar



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*Three essays in human capital formation.
From colonial institutions in the Americas
to early Catalan industrialization*

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A thesis submitted to the Department of Economic History, Institutions, Politics and World Economy of the University of Barcelona for the degree of Doctor of Philosophy, Barcelona, November 2020.

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Barcelona, November 2020

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General acknowledgments

This research is the result of a long journey. Many people helped me along the way, both directly and indirectly, and I would like to take this opportunity to express my gratitude to them.

In particular, I owe an enormous intellectual and personal debt to my two supervisors, Julio Martinez-Galarraga and Miquel Gutiérrez-Poch, whose comments and suggestions taught me a great deal and who always gave me the freedom to set my own research agenda. It was a genuine pleasure to work with them. They always offered me support on a personal level, during both good times and bad times, such as when I experienced the loss of loved ones. There are no words to express my gratitude. I hope to continue working with them on future projects and lines of research.

Many of the people who accompanied me on my journey were PhD colleagues and members of the University of Barcelona's Department of Economic History who always supported me when I needed it or provided me with valuable feedback. These individuals include Marc Badia, Anna Carreras, Sergio Espuelas, María José Fuentes, Alfonso Herranz, José Luís Martínez, Marc Prat, Alba Roldán, Ramon Ramon, Raimon Soler-Becerro and, above all, Josep Maria Benaül, who sadly passed away recently. I would also like to thank the academics who supported me at different stages of my research, including Gabriele Cappelli, Cristián Ducoing, Nikola Koepke, Agustina Reyes, Rodrigo Rivero, Dácil Tania Juif, Julia Sarreal, Sara Torregrosa, Felipe Valencia Caicedo and César Yáñez. I also want to take this opportunity to highlight the support offered by Alfonso Díez Minguela, Francisco J. Beltrán Tapia, Julio Martinez-Galarraga and Daniel Tirado, who provided me with the database on Catalonia from the 1860, 1900 and 1930 censuses used in this thesis.

I would like to extend a special thank you to all members of the Instituto de Economía de la Universidad de la República (IECON) and the "*Pueblos y números del Río de la Plata 1760-1860*" research group for making me feel so welcome during my stay in Montevideo and in my search for Latin American sources, especially Henry Willebald and Carolina Román for their hospitality. I would also like to express my gratitude to María Inés Moraes for introducing me to the fascinating Guarani culture and Julio Djenderedjian for providing me with the registers of missions in the historical archive of Porto Alegre.

Different parts of this thesis have been presented at various seminars, congresses and summer schools around the world, from Japan to Chile. I really appreciate all the suggestions offered by the participants, especially Jörg Baten, Luís Bertola, David Mitch, Joel Mokyr, José Antonio Ocampo, Daniel Santilli, Peter Temin and Jacob Weisdorf. I would also like to say a special thank you to all the archivists I met in the archives I visited over the years for their full, enthusiastic dedication. Without them, it would have been impossible to find many of the documents that ended up becoming the databases used in this doctoral thesis.

Obviously, this research would not have been possible without the financial support provided by many institutions. I am grateful for the funding I received through the Ministry of Science, Innovation and Universities project “*Geografía, capacidad del estado y cambio económico. Un enfoque espacial del desarrollo y sus determinantes en las economías periféricas (siglos XIX-XXI)*” (project reference PGC2018-095821-B-100). I would also like to thank the *Societat Barcelonesa de Amics del País (SEBAP)* for granting me a scholarship for my research stay in Latin America and the Economic History Association for the financial support that allowed me to participate in the 2015 annual meeting of the EHA in Nashville.

Finally, on a more personal level, I would like to thank all my friends, especially those at the “*Penya Moco*”, and family members who have accompanied me on this journey, especially my parents and brother, who have given me everything and make me very proud. Unfortunately, I lost some very important people over the years: Montse, Martí, my grandmother and, most recently, my mother, who left a huge void in my life. I am sure she would have loved to have been able to read my thesis. And many thanks to Txell and our daughter Bruna for loving me, helping me and accompanying me on this and many other adventures. Everything is much better with you by my side. I love you. I dedicate this doctoral thesis to all of you.

List of abbreviations

ACA: Arxiu de la Corona d'Aragó.

ACC: Arxiu Comarcal de la Cerdanya.

ACG: Arxiu Comarcal de la Garrotxa.

AGI: Archivo General de Índias.

AGNBA: Archivo General de la Nación de Buenos Aires.

AGSF: Archivo General de Santa Fe.

AHLL: Arxiu Històric de Lleida.

AHMB: Arxiu Històric Municipal de Badalona.

AHMG: Arxiu Històric Municipal de Girona.

AHM: Arxiu Històric de Manresa.

AHPO: Archivo Histórico de Porto Alegre.

CSA: California State Archives.

MREP: Ministerio de relaciones Exteriores del Perú, Archivo Especial de Límites.

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Publications derived from this thesis

Two chapters (2) of this PhD thesis have been originally published as Working Papers in important scientific research societies, also published in Ideas and RePec:

Gómez-i-Aznar, È (2020). Ad maiorem Dei gloriam. Numeracy levels in the Guarani Jesuit missions. In *EHES Working paper (Issue 181)* http://www.ehes.org/EHES_181.pdf

Gómez-i-Aznar, È (2019). Human capital at the beginnings of the 18th century Catalonia: age-heaping and numeracy in a changing economy. In *Documentos de Trabajo AEHE (Vol.1904)*. <https://econpapers.repec.org/paper/ahedtae/1904.htm>

Chapter 1. Introduction

Human capital is a key factor in economic growth, but what is understood by human capital and what role has it played in historical economic growth processes? Given that there are multiple definitions, depending on the academic discipline to which it refers, human capital can be defined as “the skills the labour force possesses and is regarded as a resource or asset. It encompasses the notion that there are investments in people (e.g. education, training, health) and that these investments increase an individual’s productivity” (Goldin, 2014). Moreover, human capital brings not only productive gains, but also non-monetary benefits such as better health and social interaction skills (Oreopoulos & Salvanes, 2011). Although human capital plays a role in economic development, its acquisition has often been motivated by non-economic reasons such as social prestige and religion.

The role of human capital in pre-industrial times, and especially during the early stages of the Industrial Revolution, has generated an open debate in the field of economic history, mainly due to the difficulty of measuring the notion. The lack of indicators and the complexity and diverse definitions covered by the same concept, which is particularly problematic with respect to the past, has meant that more quantitatively oriented economic history has not attributed such a crucial role to it as modern economic growth theories. However, research in this area, which places a strong focus on formal education and considers that it would not have played such an important role at the beginning of the Industrial Revolution, has been reassessed in recent times through the use of new methodologies and indicators¹. These studies highlight the need to advance the way in which human capital is measured by considering what type of human capital, i.e. what skills, can generate a positive impact on a society’s economic progress.

This doctoral thesis, through its three-essay structure, is framed within this context, as it attempts to evaluate the weight of human capital formation in the long term by following, on a methodological level, a series of recent works, contributing new quantitative data and analysing different geographical areas under the rule of the Hispanic monarchy that were characterized by a certain degree of economic dynamism. The first essay, in Chapter 2, addresses human capital levels based on the arithmetic capacity of the Jesuit Missions of the Guaranis in the 18th century, when this institution was in operation, and compares this capacity with other institutions that were active at the same time. The second essay, in Chapter 3, obtains data from the same indicator on early 18th-century Catalonia to evaluate the role of human capital just

¹ Good summaries of the relationship between economic history and human capital over time are provided by Becker, 2018; Le Chapelain, 2019; and Diebolt et al., 2020.

before the Industrial Revolution. Finally, the last essay, in Chapter 4, analyses the evolution of literacy in Catalonia between 1860 and 1930 at a municipal level to ascertain how it evolved in a context of intense economic transformations.

1.1 About the concept and the measurement of human capital

The concept of human capital is broad and its importance for economic development has been explicitly highlighted since William Petty made the link at the end of the 17th century (Hull, 1899, p.589-95). This line was continued by authors who have played a key role in the history of economic thought, including Adam Smith (Smith, 1776, p.155), Jean Baptiste Say (Say, 1836, p.92-94), Stuart Mill (Mill, 1848, p.47), Alfred Marshall (Marshall, 1925, p.469-470) or León Walras (Walras, 2013, p.216) to name a few who included human beings in the definition of human capital. These academics used two methods to address this concept: the cost of production of “human beings” and the capitalization of their future earnings (Kiker, 1966). But in the middle of the last century, starting with Robert Solow, who analysed US economic growth in the 20th century, and Theodore Schultz, who researched Europe’s economic recovery after the Second World War, it became clear that physical factors (land, labour and capital) could not explain the majority of economic growth. This led to considerable interest in intangible factors, including human capital, which emerged as a key factor.

Solow labelled these factors as "technical change", and later as a "residual factor" (Solow, 1957); but it was Schultz himself who named this hitherto unmeasured factor human capital (Schultz, 1961). This factor included education, the most common investment in human capital, but this author also incorporated public health and migration in search of better labour conditions. In the case of education, however, he distinguished three categories: formal education from elementary schooling to higher education, “on-the-job training”, which includes the entire apprentice system, and education not organized by companies, in which the transmission of agricultural knowledge is particularly important. These represent investments in people that have a long-term return, which makes it difficult to quantify their effects, and the same author pointed out that few data are available on aspects other than formal education. However, the revolution in the study of human capital that has taken place since the middle of the 20th century cannot be understood without considering the contribution of two other authors, Jacob Mincer and Gary Becker, and their approach based on wage inequality. Mincer pointed out that the theory of personal choice is the starting point for the distribution of future income and wages (Mincer, 1958, p.283), while Becker indicated that it is an individual decision through a cost-benefit approach to investment in education (Becker, 1964).

The complex task of quantifying human capital highlighted by Schultz, coupled with the emergence of more sceptical views in the wake of the first oil shock, when the decline in economic growth reduced expectations of returns on educational investments, reduced the weight of this factor within economic development theories (Demeulemeester & Diebolt, 2011). In economic history, the emergence of academic approaches that were critical of the concept cast doubt on its role as the main factor in economic growth in pre-industrial times. According to these academics, if a person's work did not require basic literacy (i.e. the ability to read, write and count), it would have little economic value and therefore would not generate a direct benefit for economic development. Therefore, the contribution of improvements in the formal education system to economic growth was minimized in the early stages of the British Industrial Revolution (Mitch, 1993a), although it may have had socialising effects and reduced class conflict (Mitch, 1999). In addition, other factors contribute to this development, and the mere accumulation of human capital does not translate to economic growth. Determining the explanatory value of the human capital factor has generated a lot of suspicion.

The introduction of human capital into models of economic growth (Aghion & Howitt, 1992; Barro, 1991; Lucas, 1988; Mankiw et al., 1992; Rebelo, 1991; Romer, 1986, 1987, 1990) has made it possible to develop endogenous growth theories and highlight the importance of this factor. However, these models are difficult to contrast empirically by quantitative theory in pre-statistical periods, precisely because of the above-mentioned complexity involved in obtaining the necessary data. In this regard, the long-term perspective provided by economic historians allows us to contrast hypotheses on the role of human capital and develop new ones concerning economic development and education (Tortella & Núñez, 1993, p.34). Identifying the drivers of human capital acquisition in the past helps identify when it became a determining factor (Becker, 2018, p.128).

The early 21st century saw the emergence of the unified growth theory (Galor & Weil, 2000) which seeks to capture the main characteristics of the economic development process within a single conceptual framework. Human capital plays a central role in this theory, since the fast pace of technological progress allows it to accumulate and increases the demand for human capital. This fact makes it possible to break the Malthusian trap and triggers population growth. This theory is complementary to those concerning female empowerment that suggest that reducing the gender gap increases qualified human capital and facilitates the transition to a modern demographic regime. This would imply a decrease in the fertility rate (within the framework of the well-known quantity-quality trade-off) and an increase in the standard of living and would generate sustained economic growth. For example, in the case of Prussia, education in 1849 predicted the fertility transition in 1880-1905 (Becker et al., 2010). Even so,

within historiography and with respect to the early stages of the Industrial Revolution and the demographic transition, the French-English paradox persists, whereby England underwent economic growth early and demographic development later, while the reverse occurred in France (Chesnais, 1992).

Territorial divergences in factor endowments, along with the weight attached to human capital in economic theories since the 1950s, have given rise to extensive literature on its effects at regional level (Demeulemeester & Diebolt, 2011; Gennaioli et al., 2013). These effects are also persistent in the long term at regional level (Beltrán Tapia & Martínez-Galarraga, 2018; Diebolt & Hippe, 2019; Hippe & Baten, 2012). However, if the quality of the data is key to evaluating the effects of human capital on economic growth (Cohen & Soto, 2007), addressing the question of human capital and its relationship with the industrialization process requires new contributions from the most quantitative field of economic history (indicators, methodologies and regions), including approaches and data to enrich the debate with new ways of thinking.

1.2 The paradox of human capital on the periphery: beyond the British case

As mentioned above, when the weight of human capital in economic growth is assessed from the perspective of economic history, it comes close to the predictions of contemporary models when one analyses the period of the Second Industrial Revolution (Le Chapelain, 2019). However, when the First Industrial Revolution is studied, this relationship is not so clear. There are two main approaches to this question. On the one hand, what was the level of human capital prior to the Industrial Revolution and did it enable early industrialization? And, on the other hand, what was the effect of the Industrial Revolution on the existing levels of human capital?

With respect to the first approach, the first cliometric data, which focused primarily on the British case, indicate that human capital played a minimal role during the Industrial Revolution (Allen, 2003; Mitch, 1993b). With respect to the second approach, the industrialization process caused a deskilling effect by increasing the amount of unskilled labour thanks to new technical innovations (Nicholas & Nicholas, 1992). Moreover, as part of this was provided by female and child labour, this caused school attendance to fall and hindered human capital accumulation (Humphries, 2013; Kirby, 2005; Sanderson, 1972). According to these analyses, therefore, human capital was not a determining factor in the take-off of the Industrial Revolution, contrary to economic growth models.

This paradox has been reassessed by a number of academics in recent times. On the one hand, the quality of the data presents a limitation when it comes to carrying out this evaluation (Jacob,

2014); and on the other hand, the literacy rate, especially when extrapolated through people's ability to sign their name, is not the best indicator of the human capital that ended up driving the Industrial Revolution. Furthermore, there were enormous disparities within the same territory between occupational groups (Ó Gráda, 2016). This has led to the emergence of new human capital indicators that show a more positive relationship between human capital and industrialization, especially previous long-term accumulation. These have opened up a range of perspectives on the empirical problem of human capital (Baten & Van Zanden, 2008; Becker et al., 2011; Dittmar & Meisenzahl, 2020; Mokyr, 2010). One of these new indicators, used in part of this PhD thesis, is numeracy, which captures the imprecision of age information. An effect known as age-heaping, which gives a numerical value to arithmetic capacity, is a basic indicator of human capital with greater applicability in the world of work (A'Hearn et al., 2009; Crayen & Baten, 2010; Manzel et al., 2012; Tollnek & Baten, 2017).

Indeed, the use of new human capital indicators and the differences in human capital levels between the various occupational groups have led some authors to reassess the paradox by positing an intermediate position on the role of human capital in the early stages of industrialization. These academics maintain that the advanced knowledge of some small groups, rather than of the whole population, facilitated this industrialization process. This is known as "upper-tail human capital" (Mokyr, 2005, 2010; Mokyr & Voth, 2009). Apart from scientists and intellectual elites, these groups would have included a minority of workers with more advanced skills that would have allowed the new technologies of the early Industrial Revolution to be introduced and adapted (Squicciarini & Voigtlander, 2015). For example, pioneering work focusing on the British textile industry already found that the level of skills among workers in these factories was surprisingly high (Boot, 1995). Therefore, in order to analyse the role played by human capital in early industrialization, indicators that show the technical competence of craftsmen and workers in economically dynamic sectors are key. This has also led academics to focus on apprenticeship systems, especially in the case of the UK. Their flexibility and efficiency may have given Great Britain a competitive advantage through its qualified workforce (Humphries, 2011; Kelly et al., 2014; Zeev et al., 2017).

This new approach has also involved the revision of deskilling and has shown a mixed effect in the British case when using the qualification of professional categories as an indicator of human capital. On the one hand, there was a decrease in skills in agriculture and industry and a reduction in literacy rates; but, at the same time, there was an increase in the more qualified labour force (de Pleijt et al., 2020; de Pleijt & Weisdorf, 2017). In France, on the other hand, the introduction of steam engines led to an increase in literacy rates (Franck & Galor, 2017); from the second half of the 19th century, there was a change in the requirements for labour force

skills, since the arrival of steam power required minimum qualifications (Diebolt et al., 2019). In spite of that, other authors who have studied the case of France have argued that industrialization had a positive impact on the demand for schooling, it applied to a very restricted section of the population only (Montalbo, 2020).

As we have seen, many of the cases that contribute to the discussion concerning the human capital paradox during the first industrialization process focus on Great Britain and its immediate followers. But what about other cases on the periphery? In the field of educational development, Cipolla detected three groups of countries in the mid-19th century; two European groups thus emerged in terms of literacy: a much more literate group in the northern half of the continent, and a second group with much lower literacy rates in southern and eastern Europe (Cipolla, 1969). This distribution has been confirmed by subsequent global studies (O'Rourke & Williamson, 1997), as well as by national studies carried out in countries such as Italy (Cappelli, 2016), Portugal (Reis, 2004) and Sweden (Sandberg, 1979; Westberg, 2020). The data in most studies are from 1850 and later, and obtaining human capital indicators for pre-industrial periods and the early years of the industrialization process is a complex task.

In the case of Spain, Prados de la Escosura & Rosés analysed the role of human capital between 1850 and 2000, and found that it also made a positive, albeit small contribution to the growth of labour productivity by facilitating technological innovation (Prados de la Escosura & Rosés, 2010). However, when early data on literacy in Spain (dating from 1860) were analysed, the results were also paradoxical, since the most industrialized areas did not present high levels of education (Núñez, 1992). Furthermore, the Spanish case is very interesting because, despite the initial failure of the industrialization process (Nadal, 1975), Catalonia represented an exception; this was the only region in the Mediterranean to initially follow the British Industrial Revolution, which, as in Catalonia, began in the textile sector (Martinez-Galarraga & Prat, 2016).

Despite being Spain's main industrial centre, Catalonia showed modest levels of literacy in 1860. Therefore, as in other areas where the First Industrial Revolution took place, there is a human capital paradox with respect to the theories of modern economic growth. To explain this, Jordi Nadal proposed a pioneering idea in the mid-1990s that Catalan industrialization was possible due the technical training of qualified workers and on-the-job training, and that basic literacy was an indicator of human capital that did not fully capture these skills (Nadal, 1995). Therefore, the re-evaluation of the human capital and early industrialization paradox by means of new quantitative indicators from the periphery, specifically in the Catalan case, can

contribute to the debate on measurement of human capital accumulation and its relationship with economic dynamism beyond the British case.

1.3 Institutions, economic dynamism and human capital

Institutions are a key element in explaining not only economic dynamism, but also human capital, since they determine the set of rules and mechanisms that allow it to be diffused, accumulated and socially distributed (North, 1990). The expansion of education is marked by local and regional inequalities, and it is therefore distributed non-homogeneously in the territories (Marsden, 1977). Thus, in order to explain variations in human capital, it is necessary to study the contexts in which they occur and the different institutions that operate, since these differ according to the society and may diverge over time within the same society (Chang, 2011). Furthermore, the same institution has different roles with respect to educational aspects in different regions but within the same period, as pointed out in this thesis with respect to the Jesuits during the 18th century in different regions under the rule of the Hispanic monarchy.

The role of institutions in long-term economic development and their persistence over time is frequently debated in economic history and closely linked to the concept of path dependence (David, 1994, 2007). One of the main discussions lies in the role of colonial institutions (Maloney & Valencia Caicedo, 2016). Many works have analysed the institutions imposed by Europeans in colonial periods (Acemoglu et al., 2001; Nunn, 2008), but also the continuity of the effects of pre-colonial institutions (Angeles & Elizalde, 2017). Some academics argue that the enormous inequalities in Latin America have persisted due to the natural resource extraction institutions of that period, which used labour with low levels of human capital. Specific works have been carried out on the effects of mita exploitation (Dell, 2010) and cane sugar plantations and gold mines (Naritomi et al., 2012). Other scholars have argued that the human capital of the colonizers themselves explained the institutions (Easterly & Levine, 2016; Glaeser et al., 2004). The relationship between human capital, institutions and development is therefore a complex one (Acemoglu et al., 2014).

The debate on colonial institutions is closely linked to that relating to religious institutions and economic growth (Glaeser & Sacerdote, 2008; McCleary & Barro, 2006). In the case of the colonial period, studies have focused on the long-term positive effects of missions (Gallego & Woodberry, 2010; Woodberry, 2004), and research has examined Asia (Calvi et al., 2019), the Americas (Waldinger, 2017) and Africa (Baten & Cappelli, 2016; Fourie & Swanepoel, 2015). However, the impact of religion goes beyond the colonial system, and its impact on human capital in the very long term has also been analysed (Andersen et al., 2017; Cantoni, 2015;

Dittmar, 2011; Rubin, 2014; Saleh, 2015). As religious institutions were in charge of providing education during the modern period, many papers have compared the externalities of human capital of different religious groups over long periods of time (Becker & Woessmann, 2009; Botticini & Eckstein, 2007), where the education provided to their followers was an unrivalled public good (Abramitzky, 2011; Colvin, 2017). In the case of the Iberian Peninsula, studies have also been carried out on the role of religion in determining levels of human capital in the very long term (Cinnirella et al., 2020).

Indeed, in the case of territories under the rule of the Hispanic monarchy, it was the expulsion of a religious order with an enormous influence on the education system, i.e. the Jesuits in 1767, that gave rise to the first school statistics at the end of the 18th century. Thus, a few months after the expulsion, the Royal Provision of 5 October 1767 requested that local and provincial authorities report on the situation and the number of elementary schools with a view to replacing religious teachers and preceptors with seculars (Guereña et al., 1994, p.56). But this substitution was not possible in many cases due to the lack of available teachers and had a considerable negative impact in Malaga, Oviedo, Calatayud, Huesca, Barcelona and Valencia (Oriol Moncanut, 1959, p.42).

Another institutional element that may affect the accumulation of human capital is the unequal access to land, although this remains an open debate (Baten & Hippe, 2018). Some studies support the impact of unequal access to land on human capital formation (Galor et al., 2009; Maloney & Valencia Caicedo, 2016). Others believe that the influence of land inequality on human capital formation is inconsistent (Clark & Gray, 2014). One of the mechanisms of influence of land inequality on human capital is that landowning elites are usually the most likely candidates to oppose the expansion of education (Cinnirella & Hornung, 2016; Galor et al., 2009; Goñi, 2018; Vollrath, 2013). In the case of Spain, the availability of communal land also affected human capital (Beltrán Tapia, 2013), and recent research maintains that inequality in access to land, the origins of which lay in the process of medieval conquest (Oto-Peralías & Romero-Ávila, 2016), had a negative impact on the educational achievements of men in pre-industrial Spain (Beltrán Tapia & Martinez-Galarraga, 2018).

In the case of the First Industrial Revolution, the education systems of the period evolved along different lines. Therefore, human capital levels have been evaluated from different institutional dimensions, thereby reflecting complex situations and singling out the education systems of the first industrialized countries. Thus, studies have been conducted on women's access to education (Cappelli & Vasta, 2020a), the degree of centralization of resources (Cappelli & Vasta, 2020b) and the effects of industrialization on primary schools (Montalbo, 2020), in

addition to studies that have used a greater level of territorial disaggregation when evaluating key factors, thereby giving rise to new perspectives (Go & Lindert, 2010). In the analysis of the Spanish case, there was an enormous regional disparity that seemed to persist over time, in addition to a delay with respect to the rest of Europe (Beltrán Tapia et al., 2019a; Beltrán Tapia & Martínez-Galarraga, 2018).

The liberal European revolutions of the 19th century allowed for a change in the institutional framework that led to significant changes in school systems. For example, in the case of Prussia, the implementation of a policy of massive investment in elementary education as part of its 19th-century industrialization process is of considerable importance (Becker et al., 2011) and contrasts with the role of basic education in the industrialization process seen in the British case, thus contributing to a reassessment of the paradox. In the case of Spain, the liberal revolution did not generate the most suitable institutional framework for the widespread expansion of basic education or for promoting the nascent industrialization process. The high level of political instability, together with a tacit agreement between certain sectors of the bourgeoisie and the nobility, gave rise to an economic policy that was not at all favourable to the secondary sector and a fiscal policy that made it impossible to finance primary education properly (Gutiérrez-Poch, 2018).

Finally, there are other ways to generate human capital beyond the formal education of countries. Thus, the main innovations at the beginning of the Industrial Revolution arose through three mechanisms that are not directly linked to basic education: learning by doing, learning by using and learning by learning (Von Tunzelmann, 1993). Although a more literate environment certainly facilitates the generation and exchange of these innovations, these three mechanisms are linked more closely to the world of work than to the school setting, especially the textile sector, where the first technological innovations took place. However, they also highlight the need for workers with good skills to improve or facilitate the operation of machines. As noted above, this underlines the importance of knowledge transmission through the apprentice system and the institution of guilds (de la Croix et al., 2018; Humphries, 2013; Kelly et al., 2014).

In the specific case of Catalonia, it is important to highlight the role played by a specific institution, the Board of Trade. Through its professional schools, it served as a bridge between formal education and the guild system in the transition period between the pre-industrial economy and the early Catalan industrial revolution. The Board of Trade represented a model of a successful cultural and education institution in the region. By contrast, the Campomanes model that spread throughout the Spanish Crown, the Economic Societies of Friends of the

Country, did not bear fruit in Catalonia. Among the divergences between the two institutions, Lluch highlighted differences with respect to education, which, in the case of the Junta, was conceived in a way that was closely linked to industry and taught to all social classes (Lluch, 1973, p.224)². The position of the Catalans was surely motivated by the fact that the students at the Board of Trade were mostly from families linked to the guilds and by their disagreement with the immediate suppression of the guilds (Monés i Pujol-Busquets, 1987, p.228)³.

We can conclude that, in order to evaluate the role of human capital in periods without homogeneous indicators, it is necessary to analyse the historical context extensively to gain an insight into the institutional and organizational characteristics of the transmission systems. In the case of Spain, whose territory in the 18th century was so extensive and diverse that it stretched from California to the Philippines, and where such a wide range of institutions operated, ranging from the guilds and the Barcelona Board of Trade to the slave plantations of Louisiana and the Jesuit missions in Paraguay, great care must be taken when evaluating human capital and its relationship with economic dynamism. Providing a homogeneous picture characterized by low levels of human capital and little economic development does not correspond to reality. This formulation may be valid for some areas of the Spanish Empire, but inaccurate for others, given the hotchpotch of situations.

1.4 Objectives and development of the thesis

In view of this wide range of situations, this doctoral thesis attempts to contribute to the literature on the role of human capital in some economically dynamic areas under the rule of the Spanish Crown during different periods: from the 18th century, in regions that formed part of the colonial empire during the Old Regime or, within the peninsula itself during the period immediately prior to the Industrial Revolution, to the creation of the 19th-century mass education systems during the transition to the liberal state. The three essays relate to regions that remain on the periphery of the European (and, therefore, British) case, but aim to provide new quantitative data to enhance the debate on the paradox of early economic development and the reduced role of human capital in this process, as well as the role of institutions in training and human capital transmission.

² Other reasons for the differences lie in the fact that a development process was already under way in Catalonia and it was therefore not necessary to start from scratch; that the Board of Trade disagreed with the immediate suppression of the guilds; and that it was conceived based on industrialist liberalism as opposed to the agricultural mercantilism of Campomanes (Lluch, 1973, p.214-235).

³ It should be noted that the Board of Trade “never had concerns about elementary education so that the school structure offered enough minimally schooled people to meet its needs focused on technical-vocational education” (Monés i Pujol-Busquets, 1987, p.29).

To provide new indicators that contribute to the cliometric debate, this thesis is based on the simplest form of human capital, i.e. basic literacy (the ability to read and write) and numeracy (the ability to count). The latter is calculated by means of numeracy through the age-heaping methodology and, as mentioned above, is considered a good indicator of human capital in pre-industrial periods, since the applicability of numeracy to the world of work in that period is higher than that of other indicators and better reflects the training of apprentices and craftsmen. For centuries, this training system was the main channel for the acquisition of technical knowledge (Epstein, 2004). On the other hand, elementary literacy represents a good indicator to shed light on the evolution of human capital with the implementation of mass schooling systems from the 19th century onwards.

These three essays also seek to highlight the territorial diversity and plurality of situations that can occur within the same region. On the one hand, they present the case of a region in Latin America, the Jesuit Missions of the Guaranis, which provided a unique and exceptional institutional framework with respect to human capital that disappeared in 1767 and did not produce an industrialization process, but whose effects are still being felt⁴ (Valencia Caicedo, 2019b), and compares it to other territories ruled by the Hispanic monarchy. One of the underlying goals of this doctoral thesis is to contribute to the debate on the role of institutions and the persistence and intergenerational transmission of human capital after the disappearance of these institutions. However, two of the essays focus on Catalonia in light of the paradox addressed by Jordi Nadal, with the aim of contributing new insights to this debate; indeed, this represents one of the main motives for writing this doctoral thesis (Nadal, 1995). As mentioned above, the Catalan case is particularly interesting because it is the only Mediterranean region that initially followed the British Industrial Revolution, although its educational levels, represented by literacy rates in the mid-19th century, were modest at best compared to other areas of the peninsula.

For these reasons, this doctoral thesis focuses on providing answers to three aspects of human capital, which correspond to the three essays presented. The first aspect relates to the role of institutions in training and transmitting human capital. The hypothesis proposed is that the diversity of institutions and situations within the territories under the colonial rule of the Hispanic kings during the modern period meant that the areas with the greatest economic dynamism had some institution that facilitated the transmission of elementary human capital,

⁴ The areas close to a Jesuit mission present greater educational development (10-15%) 250 years after the institution disappeared. These educational differences translate into incomes that are 10% higher (Valencia Caicedo, 2019b).

and that the more extractive institutions, on the other hand, hindered the process. It is against this backdrop that I analysed the Jesuit missions established in the Guarani territory. The second aspect concerns whether, in the case of Catalonia, previous levels of human capital were higher than estimated just before the Industrial Revolution. The hypothesis is that, at the end of the 17th century and beginning of the 18th century, Catalonia was already undergoing a process of long-term human capital accumulation in certain professional strata that facilitated the implementation of the Industrial Revolution. In view of the apparent paradox between the level of literacy and industrial development in the mid-19th century Catalonia, as mentioned above, this thesis carries out a more in-depth analysis of literacy with a municipal-level descriptive study that sheds light on the geographical variability in 1860 and how this evolved during the first major phase of Catalan industrialization, up to 1930. Future avenues of research have emerged from this initial analysis, including the fact that the most economically dynamic areas also had a greater demand for education, since minimum qualifications were required. These will mark the future research agenda. The three essays attempt to evaluate these three topics, which are considered important for the following reasons.

Regarding the role of institutions, this is, in fact, a central theme of the three essays. The first article studies the case of the Jesuit Missions of the Guaranis, which relates to the open debate on colonial institutions and their long-term persistence (Valencia Caicedo, 2019b) and, more specifically, the discussion on the role of religious institutions, especially missions. One of the greatest difficulties in evaluating this subject lies in obtaining human capital indicators from periods in which the colonial institutions were active. For this reason, this thesis provides a human capital indicator for the Jesuit Missions of the Guaranis throughout the 18th century. It does so by obtaining levels of arithmetical capacity through the exploitation of a new source: the census of Indians. The availability of records for other colonized areas in the Americas and under the rule of the Spanish Crown in the 18th century also made it possible to compare the results obtained in the Jesuit missions with other colonial experiences.

The second essay analyses the influence of institutions using the same age-heaping methodology, but applied to the municipal census of early 18th-century Catalonia, a less biased source than others used during this period. Using this source, attempts were made to obtain an indicator of numeracy levels for a sample of Catalan towns in the 1720s that also allows human capital levels for different economic activities, skills levels, social classes and, in some cases, gender to be studied. This makes it possible, among other things, to analyse the disparities within the same territory between occupational groups, to examine the question of whether training through labour institutions such as guilds might have had an impact on the generation of human capital and to detect the human capital levels in the textile industry, a key sector at the

beginning of the Industrial Revolution in both Catalonia and Great Britain. The database constructed also makes it possible to study whether access to land or social prestige had an impact on basic literacy levels.

Finally, the third essay attempts to evaluate the institutional change brought about by the liberal revolution in the formation of human capital in Spain, specifically in Catalonia. This institutional change transformed the absolute monarchy of the Old Regime, reflected in the two previous essays, and ended with the creation of the modern state. The creation of these nation states entailed making improvements to education systems to modernize the economy, but also centralizing them with a view to homogenizing the population through a single national language (Castilian Spanish in the case of Spain) and strengthening the national identity of the population as citizens of the state (Hippe & Fouquet, 2019, p.26). Spanish liberals were inspired by the modernization of education that had taken place in France, but were also influenced by Prussia⁵ (*Boletín Oficial de Instrucción Pública. Tomo III*, 1842, p.29). Thus, the Quintana Report of 1813, considered the first document to shape the education policy of Spanish liberalism, provided for the centralization of all education⁶. However, the reality of implementing the educational reforms promoted by the liberal governments in the 19th century, one of the most prominent of which was the Moyano Law of 1857, was a far cry from the objectives they pursued, not so much because the children were missing out on education, but because of the lack of an appropriate school structure (Godayol Puig, 2006, p.71) and, above all, a shortage of economic resources. Given that they were financed by the local authorities until 1900, the situation was evaluated at a level of territorial disaggregation not previously used in Catalonia, i.e. municipalities, to examine its evolution in a context of institutional change and, above all, as pointed out below, of profound socio-economic transformation (1860-1930).

Along with the role of the institutions, the reassessment of the paradox relating to the role of human capital and the first industrialization process, the study of Catalonia is particularly attractive, as it analyses a crucial period in the transition from a pre-industrial to an industrial society. The second essay in this thesis aims to examine this point. Due to the scarce information available on human capital in the 18th century, obtaining a new indicator made it possible to evaluate the levels of human capital in Catalonia during the early modern period.

⁵ During a school inspection carried out by Laureano Figuerola in 1841, he indicated with regard to school improvements in the municipality of Centelles, "The education was previously in a state of abandonment. This fact, which is comparable only to the situation in Prussia, is the greatest praise that can be bestowed upon the commission and teacher for the zeal they have displayed" (*Boletín Oficial de Instrucción Pública. Tomo III*, 1842).

⁶ The report was inspired by the French model, as its preparation was based on the "Rapport sur l'instruction publique" that the Marquis de Condorcet had presented to the French National Assembly in 1792.

This was the context characterized by a changing economy that paved the way for early industrialization in the last few decades of the 18th century and the early 19th century. It seeks to analyse whether the levels of human capital during this period, especially among craftsmen and workers with technical skills, were higher than assumptions based on the literacy rates. The new data provided made it possible to position the Catalan case in a comparative perspective with other European regions in the early stages of industrialization for which information is already available, and allowed us to contribute to the global discussion on the human capital paradox.

The third major aspect examined by this doctoral thesis is the impact of the Industrial Revolution on the subsequent evolution of human capital. To this end, the third essay analyses the evolution of literacy in Catalonia during the period between 1860 and 1930. An initial overview of 1860 made it possible to evaluate the impact of the Old Regime on initial literacy levels, but the analysis of a 70-year period disaggregated at local level (including all of Catalonia's nearly one thousand municipalities) provided an insight into the evolution of territorial inequalities with regard to human capital in a context of intense economic growth that also encompassed the Second Industrial Revolution. By means of new descriptive evidence, we assessed the way in which municipal literacy rates improved as the industrialization process advanced, in a context in which the state had begun to regulate the operation of primary schools. Also, the fact that we had access to data on female literacy rates for the whole period allowed us to observe the dynamics of female literacy, characterized by very low figures, in the context of an industrialization process that was affecting the number of women who were joining the workforce (paradigmatically represented by female textile workers). In this regard, this thesis contributes new elements to illustrate the complexity between the provision and endowment of human capital in an environment characterized by such intense economic transformation as Catalonia in the 19th and early 20th centuries.

Following the introduction, the three essays are presented in the next three chapters. Chapter 2 analyses, through the age-heaping methodology, the level of numeracy achieved by the Guarani missions of the 18th century, when the Jesuits were in charge of providing education to the indigenous population, within the colonial context of the modern period. Chapter 3 then focuses on early 18th-century Catalonia and uses the same age-heaping methodology to examine the level of human capital based on a varied sample of Catalan localities, by various occupations and social classes. It then goes on to study the evolution, at municipal level, of literacy rates in Catalonia between 1860 and 1930, among both men and women, at an economically vital time for Catalan society. Finally, the thesis includes a chapter of conclusions concerning the subjects addressed. Apart from attempting to answer the questions asked in this introduction and to

enrich existing debates with new data, indicators and areas, this thesis attempts to shed light on the complexity that characterizes human capital in the hope that the results obtained and the new questions arising from this work will stimulate future research to enhance the contribution made by this work, thereby confirming or challenging the points made. Only in this way will it be possible to gain more in-depth knowledge of human capital in the past and thus enrich our discipline.

Chapter 2. *Ad maiorem Dei gloriam*. Numeracy levels in the Guarani Jesuit missions

2.1 Introduction

The Society of Jesus was created in 1534. This Catholic religious order was born as part of the Counter-Reformation movement that was spreading through Europe at that time and stood out, among other things, for its evangelizing missions⁷. These missions should be studied in the context of European colonial expansion during the Modern Age when the European Crowns, particularly the Iberian Crowns, supported by the Vatican, had the clear objective of extending Christianity to the different areas of the planet under European domination. The Jesuits played an important role in this evangelizing task. In order to spread Christianity, they established missions where, along with their evangelization tasks, they also created schools and provided training. Although the Jesuits founded missions throughout the Americas, their presence was especially noticeable among the Guarani populations in an area close to the borders of today's Argentina, Brazil and Paraguay. This presence began at the beginning of the 17th century and extended for more than a century and a half, until 1767 when the Spanish Crown, under the mandate of Carlos III, expelled the Society of Jesus from America⁸.

The Jesuits founded a total of 30 missions, also called *reducciones*, in this area. In the time of their greatest splendour the missions hosted more than 140,000 Guaranis, which belonged to an indigenous traditionally semi-nomadic tribe. The Guarani Jesuit missions were also a unique social experiment within the missionary experiences of the European empires in Africa, America and Asia, and not only because they promoted the education of the Guarani people to encourage their evangelization. Based on self-sufficiency, the reductions were an alternative for incorporating the Indians into the colonial system during the Modern Age. They played a fundamental defensive role in a border area between the two Iberian empires, and also in the internal conflicts of the crown with the *encomenderos* and other native peoples. In addition, the successful economy of the reductions allowed the Jesuits to achieve remarkable solvency in an area of evident poverty and awakened the ambitions of the merchants and *encomenderos* (Fradkin & Garavaglia, 2009).

⁷ The order, created in 1534 by the Basque knight Ignazio de Loyola at the University of Paris, was approved on 27 September 1540 in Rome by Pope Paul III, who signed the Bull of Confirmation (*Regimini militantis ecclesiae*).

⁸ The effective suppression of the Society of Jesus occurred on 21 July, 1773, when Pope Clement XIV approved the brief *Dominus ac Redemptor*. Although the order would be restored in 1814, the Jesuits would no longer be present in the Guarani reductions.

To study the impact of the missions as institutions that affect the educational levels of their inhabitants (and their general economic conditions and living standards) it is of particular interest their origin. The reductions created new societies, or at least a new social organization, in this case, of the indigenous population. The Jesuits deliberately founded the missions, bringing the people together into a new common space that could accommodate more than 3,000 people. They thus made entire Guarani communities sedentary. The educational and social outcomes obtained in the missions can therefore reasonably be attributed to the organization and functioning of the Jesuits, rather than to the inertia of the past.

Valencia Caicedo analyses the effect of missionaries on education and demonstrates that Guarani Jesuit missions had important long-term educational and economic benefits (Valencia Caicedo, 2019b). On the one hand, beyond the religious conversion, which was the main objective of these Catholic missions, this author maintains that they favoured the formation of human capital through the schooling of children and through the training offered to adults in various occupations. On the other hand, this author stresses the persistence of this situation, since in the areas where the missions were established the author found a positive effect on the human capital and income levels in the present (around 10% higher in both cases), also highlighting the importance of occupational, cultural and behavioural changes as the main channels of transmission. In his work, Valencia Caicedo (2019b) analyses the areas of former Jesuit presence using the distance to the nearest mission; however, he does not have direct indicators that allow him to measure human capital.

All this makes it particularly interesting to study the levels of human capital acquired in the Jesuit missions in the years when they were in operation. This is also a field of study that is directly related to various debates currently present in the literature. In general, historiography tends to give a positive role to religious missions of all kinds, not only those of the Jesuits, considering them to be an instrument for transmitting knowledge, skills and technologies. Therefore, the missionary experiences of Europeans in America, Africa and Asia seem to have played a key role in the long-term educational development of these continents (Meier zu Selhausen, 2019; Valencia Caicedo, 2019a).

The debate on the effects of missions on economic development is also related to other fields of study. This debate falls within the more general area that examines the relationship between religion and economic growth (Glaeser & Sacerdote, 2008; McCleary & Barro, 2006). Moreover, a number of papers have explored the impact of religion on very long-term formation of human capital (Andersen et al., 2017; Cantoni, 2015; Dittmar, 2011; Rubin, 2014). Some studies comparatively assess the externalities of human capital of different religious groups over

long periods of time (Becker & Woessmann, 2009; Botticini & Eckstein, 2007). These works usually consider that religious institutions, in charge of providing education during much of the Modern Age, were providers of public goods and non-rival services such as the education of their members (Abramitzky, 2011; Colvin, 2017). Along these lines, and directly related to this work, there are studies that show that missions had positive effects in the long term (Gallego & Woodberry, 2010; Woodberry, 2004), both in Africa (Baten & Cappelli, 2016; Fourie & Swanepoel, 2015), and in the Americas (Waldinger, 2017) and Asia (Calvi et al., 2019).

These aspects are also linked to a very frequent debate in economic history, that is, the role that institutions play in economic development in the long term and the persistence of this development over time. This debate focuses especially on the structures implemented by Europeans during the colonial periods (Acemoglu et al., 2001; Nunn, 2008). In the specific case of Latin America there are studies on the persistence of the effects of the *mita* system (Dell, 2010) and the exploitation of sugar cane plantations and gold mines (Naritomi et al., 2012). This issue has also been studied in terms of the persistence of the effects of pre-colonial institutions in Latin America (Angeles & Elizalde, 2017). However, the relationship between human capital, institutions and development is complex (Acemoglu et al., 2014). Some authors argue that the abundance of unskilled human capital due to natural resource extraction institutions would explain the extreme inequality in Latin America (Engerman & Sokoloff, 1994). Others argue that more than institutions, the key is in the human capital of the colonisers themselves (Easterly & Levine, 2016; Glaeser et al., 2004).

Nevertheless, the mechanism for transferring human capital in colonial institutions and its persistence in the long term is an open debate. This is partly because to assess the role of human capital in economic growth it is necessary to have an indicator of it over time, and this is not easy. It is even more complicated to obtain it for certain historical points in time, that is, in the period in which the colonial institutions were in operation. To fill this gap, this paper proposes constructing human capital indicators for the Jesuit Guarani missions throughout the 18th century.

Measuring human capital, however, is not an easy task. Currently, one of the various human capital indicators available and used by UNESCO to assess human capital focuses on numeracy. This term refers to certain basic skills that are considered relevant to economic development: the ability to calculate for economic and trade purposes (Huizinga et al., 2009). Thus, numeracy, using age-heaping as a proxy, is considered a good alternative indicator to literacy for the periods of the Modern Age, for which sources are scarce or non-existent (A'Hearn et al., 2009; Crayen & Baten, 2010; Hippe, 2013).

In recent years, different works have emerged on the arithmetic capacity levels in some of the regions under the domination of the Hispanic Monarchy throughout the 18th century, such as Castile (Álvarez & Ramos Palencia, 2018; Tollnek & Baten, 2017), Catalonia (Gómez-i-Aznar, 2019) and the region of Rio de la Plata (Vicario, 2014a). These are added to the works for the areas that today are Colombia, Mexico and Peru (Manzel et al., 2012) or those carried out for periods even before the Conquest (Juif & Baten, 2013). Especially related to this study is the work on the region of Potosi, which shows the differences in the calculation levels between the different native communities in relation to type of institution (Vicario, 2014b) and that of Central New Spain in the 18th century, which highlights the complexity of the situation within the same region (Calderón-Fernández et al., 2020). There is also a more recent work on the differences in numeracy between religious minorities, particularly Jews, in the Iberian Peninsula during the years of the Inquisition (Juif et al., 2020).

In this context, the main contribution of this work is to provide numeracy results for the Jesuit Guarani missions of the 18th century. The objective is to be able to provide data on human capital for a particular case within the religious missions, the effects of which persist in the present despite the expulsion of the Jesuits in 1767 (Valencia Caicedo, 2019b). It is essential to trace the evolution of human capital in this area over almost a century and compare it to other regions of America under the rule of the Hispanic Monarchy to assess the role of the Jesuits in the economic development of the region.

The arithmetic ability in the Jesuit Guarani missions of the 18th century was obtained from a new source: the censuses of Indians or *padrones*. The *padrones* contain data on the age of the entire male population (in some cases also the female population) of the reductions. These data can be used to calculate the age heaping level, and obtain Whipple and ABCC indices. Unlike other sources used for this period, such as military lists, tax information or hospital records, this source reduces possible sample bias, as it includes the entire population of the Jesuit reductions. Specifically, it overcomes the problem of under-representing the most popular classes or the fiscal concealment that can be found in other Modern Age sources⁹.

The sample used in this article obtains information for five Guarani missions and one village founded by the Jesuits, from the thirty reductions that existed, at three different times in the 18th century. Four of these reductions are in what is now Argentina, one in Brazil and one in

⁹ Vicario (2014, 2017) uses a similar source to analyze the characteristics of human capital in the Rio de la Plata region for the period 1744-1858, and for the Andean region of Bolivia between 1683 and 1735. It uses local population censuses for its study.

Paraguay. In total, the population of these five reductions and the town of San Javier amounts to more than 13,000 inhabitants. The results show that the numeracy level of the Guarani population that inhabited the Jesuit missions was extraordinary. This is true both in absolute terms and in comparison with other Latin American, Iberian and Western European regions. This confirms the positive role that Jesuit missionaries would have played in the formation of human capital in the region, similar to that found in Valencia Caicedo (2019b).

The availability of censuses for other colonized areas and under the domination of the Hispanic Crown in the 18th century also allows us to compare the results obtained in the Jesuit missions with other colonial experiences. Communities with indigenous populations have been studied in the region of Puno, in southern Peru near the border with Bolivia. A different case is provided for Spanish Louisiana, currently in the United States and information is also available on Franciscan missions, in the colonization of California. This information can be used to make a comparative analysis of the exceptionality of the Guarani Jesuit missions. With this, the paper contributes to the debate on the impact on human capital of the missions organized in Latin America by different religious orders. In this sense, Waldinger concludes that the effects on the educational outcomes of the Catholic missions in Mexico were very important, and attributes a greater impact to the Franciscan missions than to the Jesuits (Waldinger, 2017). However, Waldinger, in analysing the Catholic missions in Venezuela, finds a long-term negative effect for the Franciscan missions and a positive and significant change for those run by the Augustinians (Waldinger, 2014). This, then, is a debate that remains open.

This article is organized as follows. Section 2 introduces some of the basic characteristics of the Guarani Jesuit missions. Section 3 explains the methodology used to measure human capital with numeracy levels. It also describes the source (the census of Indians), the content and the way in which the information was obtained, as well as the details of the missions that make up the sample. Section 4 shows and discusses the main results. Finally, section 5 presents the conclusions.

2.2 The Guarani Jesuit missions: historical background

The Christian missions or reductions were establishments promoted by different religious orders to evangelize the original peoples in different areas of the world. The Jesuit missions in South America were mainly frontier missions, as can be seen in Figure 2.1 (Bruno, 1966, p.254). They also founded missions on the northern border of the Hispanic Monarchy, in what are now Baja California (Mexico) and Alta California (USA). The Jesuits first arrived in South America in 1549, in Salvador de Bahia in Brazil, and later settled throughout the continent. Their missions

were modelled on the experience of Juli, in present-day Puno next to Lake Titicaca (Peru), the first reduction with an indigenous population founded by the Jesuits in 1565¹⁰. The objective of the mission was to obtain productive self-sufficiency to improve the conditions of daily life, promote the education of the Indians, evade the *encomienda* regime by paying taxes thanks to their agricultural activities (Carbonell de Masy, 1992, p.39), and in general, "to correct the abuses of indiscriminate exploitation to which they [the native people] were subjected in the early days of the conquest" (Maeder, 1995, p.75). In any case, the final objective of all these measures was to accelerate and facilitate evangelization¹¹.

The Jesuits arrived in Asunción (Paraguay) in 1588 and later founded the first Guarani missions at the beginning of the 17th century (1609). These missions were in operation for a long time until the expulsion of the Society of Jesus in 1767 by order of King Carlos III. Throughout this period the Jesuits created new settlements where they located large communities of Guaranis, who had had a semi-nomadic lifestyle until then¹². The Guarani-Jesuit missions were established in an area between the basins of the Paraná and Uruguay rivers, and offered tens of thousands of Guaranis an education that included reading and writing in Guarani, basic arithmetic and trades¹³. They were exempt from the *encomienda* service, and were further away from the main population centres than, for example, the Guarani Franciscan missions, which gave them a greater degree of independence. The evangelization was carried out exclusively in Guarani, the language of the inhabitants of the reductions, so that the Jesuits created important foundations for the survival of this language, which is an exceptional case of use (and conservation) of the indigenous languages of Latin America (Lustig, 1996)¹⁴. The Guarani language in its different variants seems to have been a fundamental unifying element for the formation of the missions (Wilde, 2016).

¹⁰ Initially, the Jesuits went to the big cities (Bogotá, Buenos Aires, Lima and Mexico City) where they mainly educated the elite Creole women. After Juli's first experience with indigenous people, others followed in what is now Peru (mainas), Bolivia (chiquitos and moxos), Colombia and Venezuela (Casanare and Orinoco), Mexico (Baja California) and the US (Alta California). (Valencia Caicedo, 2019a).

¹¹ "It is hard to overemphasize the value of education for the Jesuit order. Jesuits were at the technological frontier of the time, and their cultural contributions to music and the arts are well known [with] achievements in cartography, ethnography, linguistics, botany, mathematics, and medicine. Jesuits introduced the printing press to Argentina, Brazil, and Paraguay and even established an astronomical observatory in San Cosme and Damián, in modern-day Paraguay" (Valencia Caicedo 2019a, p. 515).

¹² In the first years up to a total of 14 of the first 20 reductions that existed in 1640 were relocated due to various conflicts (Maeder, 1995).

¹³ Except for the initial reductions, most Jesuits were governed by legislation passed by Francisco de Alfaro in 1611.

¹⁴ Its use as a language of evangelization also involved a transformation of the grammatical structures of the original Guarani to Indo-European syntax and the coinage of neologisms.

Figure 2.1 Location of the Jesuit missions in South America



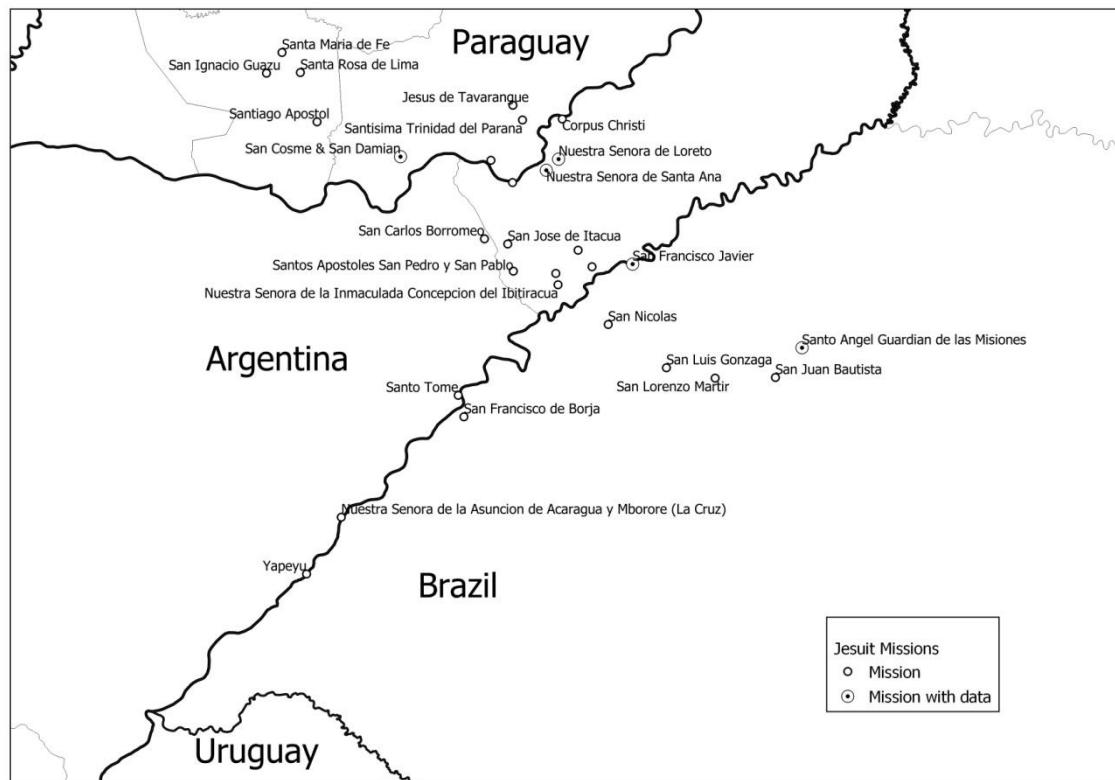
Source: Bruno (1966, p.254)

The territorial organization of the Guaraní Jesuit missions was based on a legal system constituted by royal decrees or *cédulas*. There were a total of thirty Jesuit missions or towns distributed in a vast region that at present includes three states: Argentina, Brazil and Paraguay. The missions developed most during the 18th century, which led the Jesuits to organize the thirty missions in two districts. The first included the communities on both sides of the Paraná River¹⁵. The second district covered those located on the two sides of the Uruguay River (Jackson, 2004)¹⁶. Its location can be seen in Figure 2.2 and its current territorial distribution would be fifteen missions in Argentina, eight in Paraguay and seven in Brazil.

¹⁵ They were San Ignacio Guazú, La Fe, Santa Rosa, Santiago, Encarnación de Itapúa, Candelaria, San Cosme y Damián, Santa Ana, Loreto, San Ignacio Mini, Corpus Christi, Jesús and Trinidad.

¹⁶This group included St. Joseph, St. Charles, The Holy Apostles, Concepcion, St. Mary Major, St. Francis Xavier, The Holy Martyrs of Japan, St. Nicholas, St. Louis Gonzaga, St. Lawrence Martyr, St. Michael, St. John the Baptist, St. Angel Custos, St. Tome, St. Francis Borgia, La Cruz and Yapeyú.

Figure 2.2 Location of the Guarani Jesuit missions

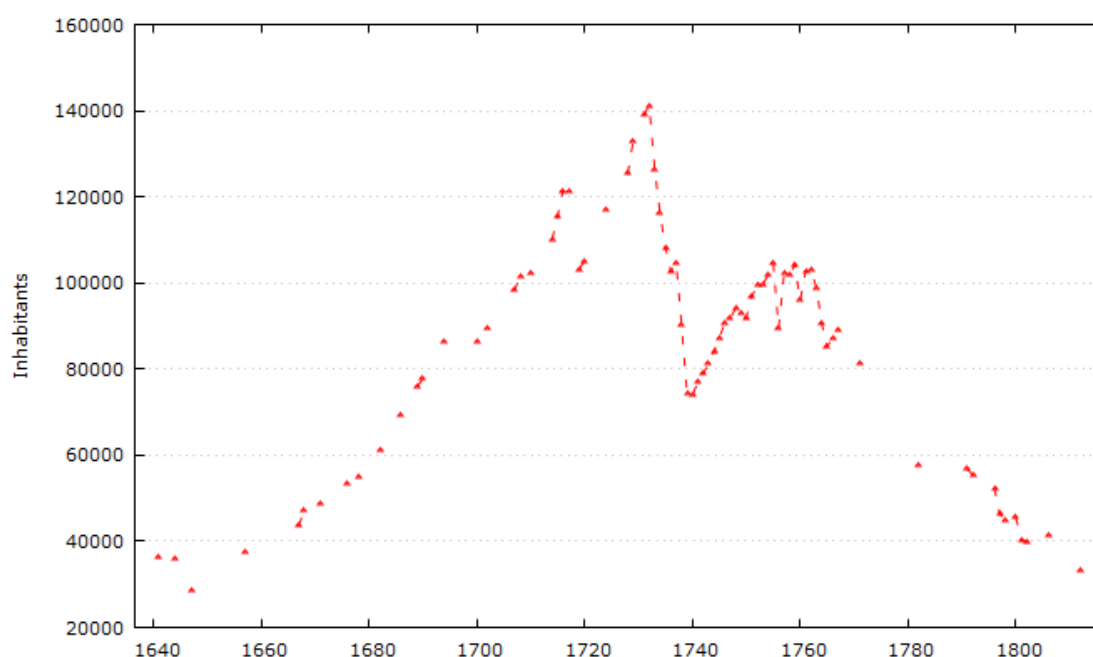


Source: Own elaboration

The evolution of the population of the Guarani missions between 1642 and 1812 is shown in Figure 2.3. In the middle of the 17th century the combined population was around 40,000 inhabitants. From then on, we can see its spectacular increase during the Jesuit period, which led to a maximum population in the missions in 1732, when 141,182 Guaranies lived there (Carbonell de Masy, 1992, p.274). This continued increase in population was only limited by two very large demographic crises in 1712, and particularly between 1733 and 1736, caused by smallpox. In the middle of the century, the Guarani wars took place as a consequence of the signing of the Treaty of Madrid in 1750, in which the Spanish and Portuguese empires established new borders that affected the reductions¹⁷. Finally, the subsequent fall in population shows the decline of the missions after the expulsion of the Jesuits in 1767. Just before the independence processes, the population of the missions had already returned to values similar to those of the beginning of the period.

¹⁷ For the Spanish Crown, the Guarani were legally considered subjects of the king, a fact that prevented them from being enslaved, unlike the Portuguese Crown. In this context, the division of the empires and the layout of the borders agreed upon by the two crowns in the Treaty of Madrid in 1750 meant that seven reductions were transferred to Portuguese territory, which opened the door to possible enslavement of the Guarani. The Guaranis rebelled, giving rise to the Guarani wars that led to the drafting and approval of a new treaty (Pardo 1761) that established that the missions would remain in Spanish hands.

Figure 2.3 Demographic evolution of the Guarani missions 1642-1812



Source: Own elaboration based on Livi-Bacci & Maeder (Livi-Bacci & Maeder, 2004)

The political organization of the Jesuit missions combined two types of authority: the native one, exercised by the cacique (Tuvichá or Mburuvichá); and the one imposed by the Jesuits through the corregidor or indigenous cabildo. The combination of the two figures sought (apparently successfully) to maintain social cohesion and the two Jesuit fathers assigned to each reduction played the role of privileged mediators (Wilde, 2001). These were the priest (paí tuyá), responsible for the economy and planning, and the vicar (paí miní), who was usually a young man destined to learn the language and who fulfilled the functions of the catechist, with spiritual responsibilities (Cuervo Álvarez, 2014). The death penalty and torture were prohibited, and any sanction required a previous trial and the penalty had to be appropriate to the crime (Carbonell de Masy, 1992, p. 203).

Its military organization was fundamentally different from that of the chiefdom (Takeda, 2014). Despite their high organizational hierarchy, the Guarani themselves played a crucial role in the functioning of the mission. The presence of only two fathers is insufficient for explaining their successful performance. It was a process of Guaraniization of the mission, similar to what happened later in the African missions, emphasizing the role of the local agency. The autonomy of each village, with its particular endowment of natural and human resources, stimulated technical adaptation, creativity and specialization, as well as the disinterested dissemination of knowledge and technical skills (Carbonell de Masy, 1992, p. 161).

In the economic field, the Jesuits modified the Guarani behaviour and organized productive work in agriculture and cattle raising (Cuervo Álvarez, 2014). The missions had a mixed economic system (Sarreal, 2014). On one hand, there was private property (abambaé), and on the other hand, common property (tupambaé), on which everyone worked to support the religious people and the widows and orphans. Each family was assured of their livelihood because all of them were given a plot of land as well as the tools to harvest and do essential craft work¹⁸. The common property occupied a space similar to the private one and each Guarani had to work on it at least twice a week to pay the tribute to the Crown and to sustain the social and defence structure of the reduction. The Jesuits also encouraged savings and the collection of food. This allowed them to obtain surpluses that were saved for times of shortage. In turn, these surpluses could be distributed to other missions in need (free of charge), or marketed through the Procuratorates or Offices located in the cities, for storage and marketing in the regional circuits (Wilde, 2001).

The economic dynamism of the reductions was remarkable. With the arrival of the Jesuits, livestock rearing, mainly cattle became an important part of their activity and the basis of their diet. Along with traditional crops such as cassava or corn, their main crop was yerba mate, of which they had between 20 and 30% of the market in Santa Fe and Buenos Aires. Similarly, in the 18th century, the Jesuit missions provided between 60 and 90% of the cotton canvases sold on the coast of the Río de la Plata. With respect to other products, they were responsible for between 30 and 60% of the production of sugar and between 15 and 30% of the tobacco circulating in the Buenos Aires market, as well as 10% of the total hides exported to Europe (Moraes, 2012). In addition, the dynamism of the missions' economies had an important influence on the whole region, such as Uruguay (Moraes, 2008). The departments in the northwest of the country, territories that had been under the influence of the Jesuit cattle ranches¹⁹ in what is known as the Missionary North, had a high per capita income even in the mid-nineteenth century (Martinez-Galarraga et al., 2020).

Culturally, all children were taught writing, reading and basic arithmetic between the ages of 6 and 12 (Ganson, 2005; Labrador Herráiz, 2006). The Jesuit missions were the first to print books in South America, with the incorporation of the printing press from 1700 (Rizzo, 2014). Many of the works were printed in Guarani, which indicates that the vernacular language was

¹⁸The daily dietary contribution per individual of the Guarani people in 1766 in energy expressed in grams was 2,508.8 kilocalories; 84.1 grams of protein and 58.6 grams of fat (Carbonell, 2003, p.107).

¹⁹The cattle ranches (estancias or vaquerías) were unguarded communal cattle reserve spaces, delimited by water currents, at the service of the mission system to supply them with meat.

used in teaching (Cardiel & Ollero, 1989)²⁰. The reductions also had a library,²¹ and music and art were taught. The adults were instructed in craftsmanship and construction, and one of the missions was specialize in the manufacture of stringed instruments. In order to improve their training and apprenticeship, the Jesuits also brought in European craftsmen to professionally train the Guarani people in the latest technical developments taking place in Europe (Carbonell de Masy, 1992, p. 208).

The Jesuits were expelled from the territories of the Spanish Crown, including all of its Latin American colonies, in 1767, as they had previously been expelled from France and Portugal. The execution of the expulsion of the thirty missions was carried out in July under the supervision of the governor of Buenos Aires, and took no more than a month (Wilde, 2001). Once it was carried out, the Jesuits were replaced by other religious orders and a lay administrator, and they did not return to the area again. From the point of view of organization, the greatest difficulty after the expulsion lay in finding doctrinaire priests in charge of the religious life, education and teaching of minors at a time when a minimum of seventy religious people were needed with the minimum condition of knowing the Guarani language. The work was entrusted to three religious orders (all of them mendicants) existing in the terms of their jurisdiction: Dominican, Franciscan and Mercedarian. These were distributed in an arbitrary way but arranged so that each order did not have two neighbouring reductions (Martínez Martín, 2003).

In addition, general provisions on production, work, pay, possession of goods, trade and residence were established in the missions after the expulsion. Likewise, Spanish dress was made compulsory, the teaching of Spanish was introduced through the schools with lay teachers, and the union of mixed marriages was encouraged with the aim of assimilating the Guarani, a policy that would be intensified over the years (Quarleri, 2013). It was in this context, following the expulsion of the Jesuits, that the economic and demographic decline of the missions began²².

²⁰ This was common in the African missions, for example, where the intention of Christian conversion prevailed over the imposition of the language of the metropolis (Frankema, 2012).

²¹ The library of the Candelaria mission, with book loans to the thirty villages, had in its inventory of 1768 a total of 102 books on mathematical subjects (Carbonell, 1992, p.160).

²² In addition to the demographic decline, an example of the decline can be seen, for example, in the supply of meat per Guarani family, which in 1786 had fallen by half compared to 1766 (Carbonell, 2003, p. 296).

2.3 A New Source for Measuring Numeracy: los padrones de indios

2.3.1 Methodology: age-heaping as a proxy for numeracy

Numeracy is a person's ability to calculate, understood as the ability to process, understand and transmit mathematical and numerical information. The basic arithmetic ability is a good indicator of the informal training that takes place in the periods prior to compulsory schooling. It is common to use age-heaping calculations to obtain historical data on arithmetic ability (A'Hearn et al., 2009; Mokyr, 1985). This refers to rounding ages into numbers ending in zero or five when a person does not know his or her exact age. For this reason, there is age heaping in a census (and consequently less arithmetic ability) when there is an inflated frequency of observations with numbers ending in zero and five²³. This is why age heaping is an indicator of the numeracy level of a population and is considered a good proxy for arithmetic ability (Blum & Krauss, 2018).

The degree of age-heaping, and therefore the level of numeracy, is usually calculated using the Whipple Index (WI). This index relates the number of ages ending in zero or five over the total population (normally) between 23 and 62 years old. The WI is calculated using the following formula:

$$WI = \frac{\sum_{i=5}^{14} n_{5i}}{\frac{1}{5} \sum_{i=23}^{62} n_i} \times 100$$

where i represents the years of age and n the number of observations. The range of WI values is between 100 and 500, where 100 means no age heaping (i.e., high level of numeracy), and 500 indicates that all observations end in zero or five (low numeracy). To facilitate interpretation, A'Hearn et al. (2009) propose a linear transformation of the WI, called the ABCC index, which has the following formulation:

$$ABCC = \left(1 - \frac{WI - 100}{400}\right) * 100$$

The ABCC index has the advantage that it is easier to understand than the Whipple index because the values are between 0 and 100, where one hundred is the maximum arithmetic capacity and zero is the minimum. In this article, as usual, the observations of the age cohorts between 23 and 62 are used for calculating the age heaping indicator. In the age cohort between 23 and 32 years old, and due to the possibly greater ability to remember age, we applied the

²³ The reason for using numbers ending in zero and five when a person does not know his own age is biological. In most cultures around the world, people learn to count using their hands and fingers because we use our bodies to communicate with other individuals (Sheets-Johnstone, 2010).

correction factor proposed by Crayen and Baten (Crayen & Baten, 2010). Finally, at this point it is worth mentioning that, although the original Guarani numbering system was based on multiples of four, the Jesuits taught them the decimal system by adapting their language to it (Bareiro Saguier, 1986).

Age heaping can be used as an indicator of the arithmetic abilities of a group of individuals, but it also refers to the conditions and factors of the environment where it is located. For this reason, in periods where education is widespread it has a high correlation with literacy (A'Hearn et al., 2009) and other environmental factors such as height (Baten et al., 2014). In contrast, other authors question whether age heaping is a good proxy for numeracy (Spennemann, 2017), while others indicate that more than an indicator of cognitive skills, what it could show is institutional and cultural modernization (A'Hearn et al., 2019). In addition, the quality of local censuses for calculating numeracy varies according to the time and place (Szołtysek et al., 2018).

2.3.2 Los padrones de indios: population counts in the Jesuit missions

To be able to use the age-heaping methodology, it is necessary to have the ages of a set of populations individualized and not grouped. In the case of the regions that were under the dominion of the Spanish empire during the Modern Age, there is a source for obtaining these individualized ages: the registers. Unlike the sources used in works that exploit age heaping, the registers are not a fiscal source, although they could be applied for this purpose, so there are less biases and concealments than in other works of the same period.

In the case of Latin America, municipal registers can be found mainly in urban areas, as in the Iberian Peninsula. However, in Latin America, the methodology for drawing up the registers was also applied to the different communities of native peoples living outside urban environments, including villages, haciendas and missions. Therefore, a singularity of the registers of Indians is that they often differentiate the origin of the neighbours (Spanish, mestizo, black or Indian) in agrarian communities. In any case, the purpose of the registers was to monitor the size of the population, although they were also used for other purposes, such as applying the rules of the *encomienda* system, a socio-economic institution through which one group of individuals were forced to pay another in work, kind, or other means, or to collect the respective fees (Salinas, 2008).

The Jesuit missions also prepared these censuses when they were ordered to by the viceroyalty governors, following the monarch's instructions. From 1647 onwards, the viceroy count of

Salvatierra declared the Guarani people vassals of the Crown in return for their role in the fight against the Paulist invasions of Brazil. This implied that each Guarani man between the age of 18 and 50, in recognition of the lordship of the monarch, had to pay a peso of eight reals of silver, in currency and not in fruit. For collection purposes, it was established that the royal officials of Buenos Aires would be in charge of the census (Martínez Martín, 2003). Later, the Royal Decree of Felipe V of 1726 regarding the Guarani missions indicated that the census would be ordered by the Governor of Buenos Aires in agreement with the doctrinaire fathers²⁴. In addition, they had to be repeated every six years, and a copy sent to the Council of the Indies²⁵, although the follow-up was very irregular (Muratori, 1999, p. 268).

After the expulsion of the Jesuits, standards continued to be drawn up. Governor Bucalari issued instructions in 1768, entrusting subordinate governors to make the censuses of their villages. These were organized according to the laws of the Indies, paying particular attention to the caciques with the aim of consolidating their social role within the village²⁶. The main objective of these censuses was to exercise control over the tax of Indians and to know how many were exercising this position, with respect to bias and how many Indians made up their chiefdom (Martínez Martín, 2003). In certain cases and with the appropriate checks, the registers are a reliable source, although sometimes they have limitations (Marino, 1998).

One of the crucial aspects to be taken into account in this type of work, since it is key to validating the strategy of calculating age heaping, is the way in which the information related to age is collected, in this case, for the elaboration of the standards. The registers of the Guarani missions have proven to be a high quality demographic source (Livi-Bacci & Maeder, 2004). Moreover, the temporal and methodological continuity of the Jesuit mission registers gives the source a homogeneous character for the whole colonial period, both during and after the presence of the Jesuits.

Each mission was administered, as mentioned above, by two Jesuit fathers, who were responsible for thousands of Guaranis. One of the two priests was responsible for the spiritual government and the other for the organization of life in the mission. The daily power was

²⁴ "Royal Decree, foreseeing what is to be observed in the Missions and Indian villages of the districts of Paraguay and Buenos Aires, which are in the charge of the Fathers of the Society of Jesus".

²⁵ The Council of the Indies was the body that advised the King on the executive, legislative and judicial function of the Indian administration (Americas and the Philippines). The members of the Council of the Indies were appointed by the king, they were generally enlightened and competent persons with legislative powers over America, appointed viceroys, governors, ombudsmen, judges, among others. They also exercised the right of patronage.

²⁶ The caciques were exempt from taxation, as were the first-born sons.

exercised by the caciques²⁷, who were part of the cabildo. In turn, the reduction was divided into large communal houses and each communal house was under the orbit of a cacique. These houses accommodated the large Guaraní families, in many cases with more than a hundred members, and all those living there were considered relatives (Álvarez Kern, 2013).

The residential units were distributed around a large central square (okara) for collective use. In order to draw up the census, those responsible were called to the public square and each inhabitant was registered according to the data declared by that person (Takeda, 2016). The distribution of the information from the census used is based on the emptying of all the people living in each house with their main characteristics (age and kinship). In some cases, the names of those responsible for compiling the registers and the date on which the information was collected are known. These were drawn up both by the Jesuits and by the secular authorities after the expulsion following this system. It is recorded that lists were drawn up for the 30 Guaraní villages in the years 1656-57, 1676-77, 1715, 1721, 1735, 1759, 1772, 1777, 1784, 1794, 1799 and 1801.

Of these, only some of them are preserved, and some are in a state of difficult transcription. In this work, we consider six lists of Indians referring to Guaraní missions with the aim of obtaining a representative geographic and temporal coverage. The reductions included in the work, along with some of the characteristics of the information provided by the census, are shown in Table 2.1. Of these six entities, one of them corresponds to the census of the town of San Javier in 1785, located in northern Santa Fe, and founded by the Jesuits in 1743. This was a reduction of the Mocovíes aborigines²⁸, and had a production and organizational structure similar to that of the missions. The Jesuits, besides providing them with basic education, taught them various occupations, arts and crafts, which meant a significant transformation of the place and the way of life. Moreover, their inclusion for the 1780s, together with the reduction of Santo Angel, makes it possible to analyse the mark left by the Jesuits after the expulsion of the Society of Jesus in 1767, when San Javier passed first to the Mercedarians and then to the Franciscans (Moriconi, 2012; Saeger, 1985).

²⁷ The cacique of each house was a kind of representative, similar to the colonial figure of civil character, but in practice this was a formal position without implying, for example, a position of representation or even leadership within the community or the house.

²⁸ The Mocovíes are an indigenous people of the Chaco area who have been separated from the guaicurú group. Their language is part of the mataco-guaicuru linguistic family and is still spoken in some of the areas they inhabit in the provinces of Formosa, Santa Fe and Chaco.

The five missions analysed and the town founded by the Jesuits are grouped into three temporal moments. In 1735 we have two censuses: San Javier and San Cosme²⁹. It should be noted that this year corresponds to the time immediately following the maximum population of the Guarani missions, but also to a time when thousands of Guarani died from epidemics in 1733, 1735 and 1736³⁰. By 1759, having overcome the impact of the mortality crises, the census of Santa Ana and Nuestra Señora de Loreto was available. Finally, by 1785, once the Society of Jesus had been expelled, the padrones of Santo Ángel and the town of San Javier were available. These years (1759-1785) coincided with Carlos III's reform agenda to strengthen the administration and military defence of Spanish America, which led to a change in the crown's attitude towards the missions as a frontier institution.

Table 2.1 List of Indian registers and censuses of the sample with its characteristics

Year	Reduction	Region	Country	N	N(23-62) men	N(23-62) women
1735	San Francisco Javier San Cosme y San	Misiones	Argentina	2,497	589	-
1735	Damián	Misiones	Paraguay	1,143	394	-
1759	Nuestra Señora de Loreto	Misiones	Argentina	3,322	903	-
1759	Santa Ana	Misiones	Argentina	3,191	956	-
1784	Santo Ángel	Misiones	Brazil	2,032	445	343
1785	San Javier (Pueblo)	Chaco	Argentina	1,038	287	231
Total				13,223	3,661	574

Sources: San Francisco Javier, 1735: padrón de indios AGNBA; San Cosme & San Damián, 1735: padrón de indios AGNBA; Santa Ana, 1759: padrón de indios AGNBA; Nuestra Señora de Loreto, 1759: padrón de indios AGNBA; Santo Ángel, 1784: padrón de indios AHPO; San Javier Pueblo, 1785: padrón de indios AGSF³¹

Together, these six entities had a population of 13,223. The population used for the age-heaping calculations totalled 3,661 men between 23 and 62 years of age, which is therefore the set of observations available for the study of the Guarani missions³². Figure A.2.1 in the Appendix provides a sample of these standards, which also reflect the social organization established in the reductions. As mentioned, the Guaranies were organized in collective houses in which various family units lived and had some kind of personal/family bond. Thus, the censuses present the information house by house, detailing the different families that live in each house.

²⁹ The full name of this last reduction was San Cosme and San Damián. In order to simplify, from now on we refer to it simply as San Cosme.

³⁰ An indication of the high mortality is that in the censuses used in 1735, young children and women sometimes appear as substitutes for adult chiefs killed during epidemics.

³¹ AGNBA: Archivo General de la Nación Buenos Aires; AHPO: Archivo Histórico de Porto Alegre; AGSF: Archivo General de Santa Fe.

³² To these should be added 574 women in the reductions of Santo Angel and the village of San Javier in the 1780s, which gives a total of 4,235 observations.

Information is provided on the structure of each family (marital status, sex, number of children)³³, and the status of those people who for various reasons had a different situation within the houses (caciques, reserved, fugitives, orphans, widows) is also indicated³⁴.

A determining factor in applying this methodology is whether the age indicated by each of the filers was compared with the date of birth of each of those registered in the baptismal book. For example, the instructions for preparing the census of Larrazábal in 1772 included a comparison with the baptismal and burial books (Martínez Martín, 2003). However, other registers did not make this aspect explicit in their instructions (besides which, it is not possible to ascertain whether this comparison was actually made) and in the registers used for this research everything suggests that the age was not compared. There are several reasons for this statement and two of them are linked to the results.

The first is that the distribution by age cohorts is not homogeneous, and if they had been matched, this difference would not have occurred³⁵. The second is that there are differences in the results between the respondents and the fugitives. Of the latter, whose age was declared by a close relative, their name and surname were available and the age could have easily been compared. Two other reasons are linked to the actual completion of the registers. This hypothesis seems to be reinforced by the fact that the results differ due to changes in administrators (change of religious order) and the institution conducting the census (preparation by officials). Moreover, the censuses were made in only a few days, with a small structure and for a very large population. In any case, although the Guarani themselves provided their ages, it must be borne in mind that it is a documentation source that served the interests of the occupying institution (Jesuits or the Crown), and therefore, like all documentation available for the period, does not give the original peoples' point of view.

³³ By the 18th century, the Guarani people of the missions had become monogamous and joined in marriage.

³⁴ The reserved ones are those who were exempt from paying the tax as they were over 50 years old. Fugitives refer to those who had escaped from the reduction (which often happened).

³⁵ Figure A.2 in the Appendix shows the results by age cohorts. Each census is divided into four age cohorts (23-32, 33-42, 43-52, 53-62) and the results of each are shown. The same census has decreases in some cohorts, which indicates that the data of a census are not homogeneous and would not have been contrasted. Furthermore, these decreases seem to have similar patterns between the different missions and coincide with the two demographic crises that occurred in the period studied.

2.4 Results

2.4.1 Age heaping and numeracy in the Guarani Jesuit missions

The general results of arithmetic ability in the Jesuit Guarani missions throughout the eighteenth century are shown in Table 2.2. The observations grouped around 1735 and 1759 include four reductions (two in each year) that reflect the situation when these were under the supervision of the Society of Jesus. Around 1785, data from two census surveys show the levels after the expulsion of the Jesuits. In all cases, the results show extraordinarily high levels in terms of the ABCC index throughout the 18th century. Both in 1735 and in the middle and end of the 18th century, values close to 100 are observed in all the reductions, i.e. the practical absence of age heaping. This would indicate that, regardless of their location and over time, the Guarani Jesuit missions had reached high levels of numeracy. The only exception would be the Santa Ana reduction, which has lower ABCC values; however, in any case, they are still remarkably high (above 95).

Table 2.2 Levels of ABCC in the Jesuit missions 1735-1785

Year	Reduction	ABCC
1735	San Cosme & San Damián	100
1735	San Francisco Javier	99
1759	Nuestra Señora de Loreto	99
1759	Santa Ana	95
1784	San Angel	98
1785	San Javier (Pueblo)	99

Sources: San Javier, 1735: padrón de indios AGNBA; San Cosme y San Damián, 1735: padrón de indios AGNBA; Santa Ana, 1759: padrón de indios AGNBA; Nuestra Señora de Loreto, 1759: padrón de indios AGNBA; Santo Ángel, 1784: padrón de indios AHPO; San Javier Pueblo, 1785: padrón de indios AGSF

Likewise, the census for the 1780s provides separate data for men and women in both the mission of Santo Angel and the town of San Javier. For the town of San Javier, there are hardly any differences between the ABCC of men and women, and in both cases the index is close to 100. This seems to imply, with the necessary caution as these data are only partial, that the Jesuit missions also had a positive effect on education for women. It should be kept in mind that school attendance in the missions, even if segregated by sex, was compulsory for both boys and girls.

These results are in line with the literature that suggests that the Guarani Jesuit missions had a positive effect on forming human capital (Valencia Caicedo, 2019b). At a time when formal education in any other region of the world was still very scarce (compulsory primary education would come later), the high ABCC would confirm that the education given by the Jesuits in the missions effectively reached all the inhabitants of the reductions. Likewise, the fact that these

values were maintained in the census carried out at the end of the eighteenth century after the expulsion of the Society, would indicate a persistence in the effects of the formation offered by the Jesuits³⁶. The works of Valencia Caicedo and Valencia Caicedo and Voth point out that the Guarani could have transmitted that knowledge between generations beyond the institution through non-cognitive skills and pro-social behaviour (Valencia Caicedo, 2019b; Valencia Caicedo & Voth, 2018).

The evidence gathered in various works that follow the age-heaping methodology shows that the arithmetic capacity levels in various regions of Latin America under the domination of the Hispanic Monarchy between 1700 and 1800 were much lower than those recorded in the Guarani Jesuit missions. For example, by the 1780s, the main cities in Latin America had ABCC index values ranging from 60 to 70. This is the case of Buenos Aires, Cartagena de Indias, Mexico City, Montevideo and Sao Paulo (Figure 6). Decades earlier, at the beginning of the century, around the 1720s, other important capitals such as La Paz and Lima had clearly lower ABCC values, 57 and 45, respectively, as did the city of Buenos Aires itself at that time (ABCC=50). Differences are thus greatly in favour of the Guarani Jesuit Missions.

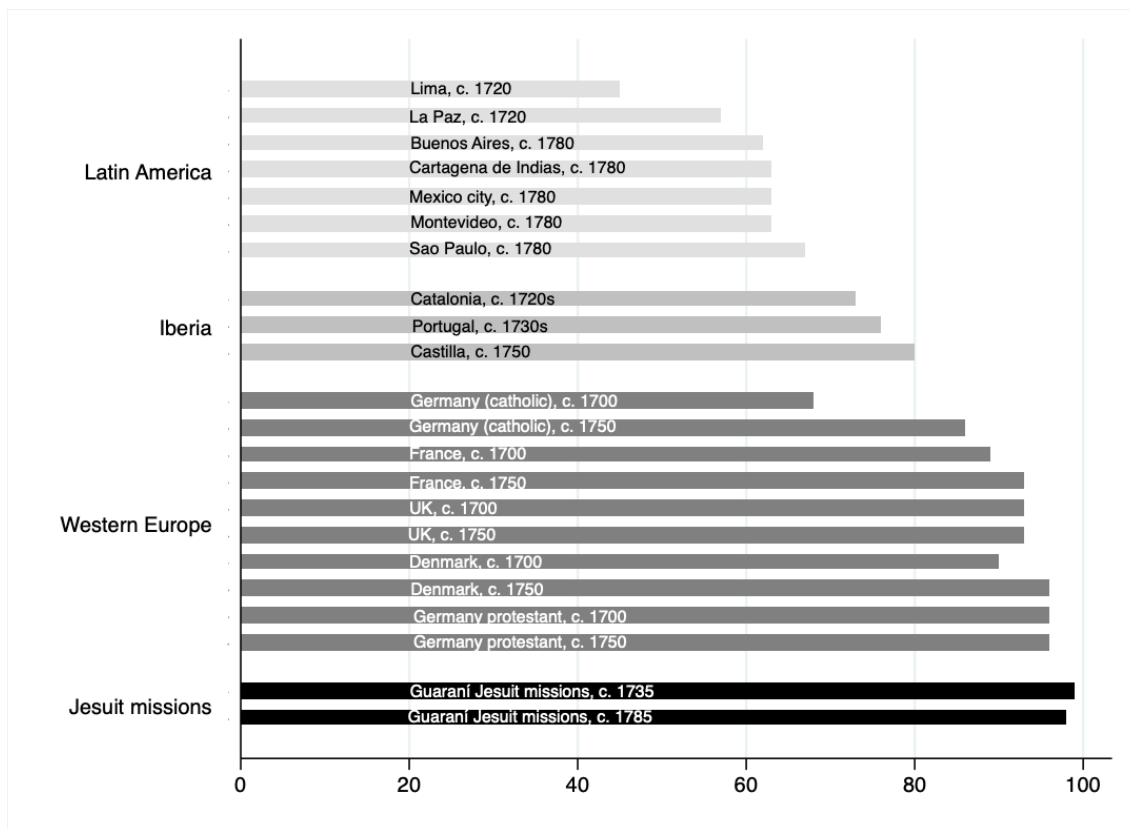
In turn, Figure 2.4 also shows that the numerical capacity of the Jesuit reductions far exceeds that obtained in the Iberian Peninsula, where the colonial metropolises were located. The data referring to the north of Castile, Catalonia and Portugal show ABCC index values between 70 and 80 in the first half of the 18th century³⁷. These values are clearly below those observed in the Jesuit Guarani missions throughout the 18th century. This evidences once again the exceptionality of these missions within the Hispanic Monarchy in terms of access to education. This also takes into account that the areas with information available for Castile (Palencia, Madrid and Guadalajara) have traditionally had the highest levels of literacy and numeracy within Spain³⁸. Finally, the extraordinary levels of numeracy achieved in the Jesuit reductions are clearly evident when they are compared with those of Western Europe, where ABCC values were usually between 80 and 90 at that time (A'Hearn et al., 2009). As shown in Figure 6, even for the areas with greatest numeracy in the 1750s, such as Protestant Germany and Denmark (ABCC=96), the values obtained in the Jesuit missions exceed this.

³⁶ Obviously, in order to contrast the persistence, it would be optimal to have data for the same reduction over time, before and after the expulsion of the Jesuits and for several generations, but this has not been possible and consequently this last result must be considered with caution.

³⁷ The data for Castile (for the current province of Palencia) come from the Ensenada cadaster of 1749 (Álvarez & Ramos Palencia, 2018), while for Catalonia, population registers (padrons) were used, mainly for the 1720s (Gómez-i-Aznar, 2019). For Portugal, see Stolz et al. (Stolz et al., 2013).

³⁸ This is shown by existing work carried out with census sources for literacy and numeracy in the mid and late 19th century (Beltrán Tapia et al., 2018, 2019b).

Figure 2.4 ABCC index in different world regions, 18th c.



Sources: Castilla: Álvarez and Ramos (2018); Catalonia: Gómez-i-Aznar (2019); Portugal: Stolz et al. (2013); Latin America: Manzel et al. (2012); Western Europe: A'Hearn et al. (2009)

4.2. Beyond the Guaranis and the Jesuits: other territories within the Spanish monarchy

In order to quantify the magnitude of progress in numeracy, and in human capital in general, obtained in the Jesuit missions, we will now study other areas dominated by the Hispanic Crown where there were settlements with indigenous communities as well as initiatives carried out by other religious orders, mainly the Franciscans, in this case in North America.

2.4.2.1 Indigenous, non-religious settlements: colonial exploitation from south Peru to Louisiana

Among the previous works on age heaping and numeracy during the colonial period in Latin America, those focusing on the Andean regions of La Paz, Potosi and Oruro probably bear the closest resemblance to the present study: they use a similar source, and the census collects only the native population (Vicario, 2014b). The region of Oruro obtains the value closest to that obtained by the Jesuit missions as it has an ABCC index of 87 for 1735. In the silver mines of Oruro there were only free workers, since the market of forced labour was prohibited, which

attracted qualified workers due to the better living conditions. In addition, Indians and mestizos had greater influence in political institutions, which contributed to making it the first place in the domains of the Hispanic monarchy where an anti-colonial revolution took place, in 1739. However, in the region of Potosi, which had an ABCC level of 60 by 1683, there was forced labour and the silver mines were exploited with slave indigenous populations obtained through the forced migration of the Mita. In La Paz there were many outsiders, who were those who had escaped from the La Mita system and had neither land nor animals, as well as the lowest castes of the Inca system (Urinsaya), and in 1684 this region had a value of 57. In both cases, these areas had much lower levels of numeracy (Vicario, 2014b).

In order to make a comparison with other regions under the rule of the Hispanic Monarchy, the census of the town of Paucarcolla, near the city of Puno, belonging to the viceroyalty of Peru, is available for 1728 (see Figure A.3 of the appendix). Paucarcolla is a town located on the north-western shore of Lake Titicaca, at an altitude of 3,500 meters, whose main activity was cattle ranching (Hampe Martínez, 1985). The 1728 census was conducted as part of a general population count in the area of the Collao Plateau, a region that currently includes part of north-western Argentina, western Bolivia, part of northern Chile and part of southern Peru³⁹. The 753 inhabitants of Paucarcolla appear in the census divided into four spaces: the *ayllus* aimaras, the *ayllus* urus, the *estancias* and the *ingenios* (Hampe Martínez, 1985)⁴⁰. The *ayllu* or *ejido* is a form of extensive social community in the Andean region of pre-colonial origin, based on common descent – real or supposed – that works collectively on a territory of archpriest property, and that was under the doctrine of a parish priest. They were self-sustaining units and their function was to educate their own children, trade and serve as a farm for all the food they consumed. On the other hand, the *estancias* were large extensions of land granted in property to a subject, a family or a religious order, mainly for the exploitation of cattle, and where the Indians (Yanaconas) who did not own land lived and worked (Klein, 1995). Finally, the *ingenios* were a type of productive agro-manufacturing farm with facilities to process primary products in order to obtain other goods. Both the *estancias* and the *ingenios* therefore represent a typically colonial organization of exploitation where the owner (who does not appear in the census) was a colonist of Spanish origin, although sometimes they could belong to the clergy, and the workers were indigenous.

³⁹ This 1728 recount came shortly after the region was severely affected by the epidemic known as the Great Plague. The demographic decline had suspended the obligation of the Mita in those provinces farthest from the mining center, such as Paucarcolla (Zavala, 1978).

⁴⁰ The Aymaras are a people originally from South America who have inhabited the Andean plateau of Lake Titicaca since pre-Columbian times, dividing their population between western Bolivia, northern Argentina, southeastern Peru and the Great North of Chile. The Urus are considered the oldest ethnic group of the Collao plateau and would have established themselves in this territory around 1200 B.C.

The results obtained for Paucarcolla as a whole give an ABCC of 91.2, a value which, when put in a comparative perspective, is surprisingly high. However, the results show two clearly differentiated realities. While in the *ayllus* the ABCC was close to 100, in the *estancias* and mills the value was clearly lower: 79.5. Thus, Spanish domination in this area would have resulted in a society with a high degree of exploitation of part of the indigenous population and a social, occupational and ethnic differentiation that would have translated into very unequal ABCC index levels⁴¹. Even so, two aspects should be noted: The *ayllus*, with their collective organization, had extraordinarily advanced levels of numeracy, similar to those obtained in the Jesuit missions. However, in the case of the *estancias* and sugar mills of Alto Perú, the indigenous population that worked under conditions inherited from the *encomienda*, would also have been allowed to use the land as payment for the work done on the hacienda (Klein, 1995), which could explain why the ABCC levels obtained are relatively high. Elsewhere in the empire, as we will see below, colonial exploitation would be more intense.

It was possible to obtain census data referring to other locations of the Spanish Crown where the institutions were also based on the exploitation of indigenous labour, in this case in North America. These settlements would be the antecedent of the plantations that would expand throughout the southern United States. The towns of Attakapas and Opelousas, located in Louisiana, were founded by French colonists between the end of the seventeenth and beginning of the eighteenth centuries. Following the Treaty of Paris in 1763, France ceded the historic territory of Louisiana to Spain, which it ruled until 1803 and which covered much of the U.S. Midwest.⁴² These two settlements specialized during the 18th century in producing tobacco in plantations (Frederick, 2000). These plantations or estates had a slave model that generated some conflicts during the period of Spanish domination, since unlike the Code Noir, which defined the conditions of slavery in the French empire, or the English or Anglo-American slavery laws, those of the Hispanic Monarchy prohibited the slavery of Indians but not the slavery of the coloured population, and also allowed the manumission of slaves (Webre, 1984). Before passing into the hands of the Spanish Crown, the settlements used slave labour of Indian and African origin; however, from the O'Reilly decree of 7 December 1769 only slaves of

⁴¹ However, in this case, the aggregate gender gap would be very large (women ABCC= 58.3 vs. men ABCC=91.2). This gap occurred mainly in the *estancias* and mills (women ABCC = 46.5 vs. men ABCC = 79.5) but also in the *ayllus* (women ABCC = 71.2 vs. men ABCC = 100).

⁴² The territory of the Spanish Louisiana covered an area of 2,275,940 km² comprising in whole or in part, more than a dozen states of the current United States.

African origin were available (Ingersoll, 1996)⁴³. This provoked resistance from plantation owners of French origin (Hall, 1986)⁴⁴.

Attakapas had a population of 837 in 1777 (see Figure A.3 in the Appendix), which gives a sample of 203 men aged 23-62. Of these, 58.5% were landowners while the remaining 41.5% were slaves. For Opelousas, of the 738 inhabitants, a sample of 183 men between 23-62 years of age is obtained, 70% of whom are owners and 30% slaves. Under these conditions, as expected, the results show that there was a great disparity between the plantation owners and the slaves who worked on the plantations⁴⁵. In Attakapas, the owners' ABCC is 84.2, a high value. The gap with the slaves is enormously significant, since in their case the ABCC is 18.5. A similar situation, although with a smaller gap, is found in the Opelousas settlement: the owners' ABCC is 71 while the slaves' is 25. In typically colonial societies based on exploitation, the numerical capacity is much lower, mainly among the exploited and enslaved population. This once again shows the exceptionality of the Jesuit missions within the colonial sphere. In any case, the differences between ethnic groups in Central New Spain by the end of the 18th century show the diversity of situations that could be found within the same territory (Calderón-Fernández et al., 2020), as in the case of California.

2.4.2.2 Other religious settlements: Franciscans in California

In the whole of Latin America in the 18th century the presence of religious orders was dominated, as in the two previous centuries, by the Franciscans, who had more than 2,500 ecclesiastics carrying out tasks of evangelisation on the continent. The Jesuits were second with almost 2,000 ecclesiastics, and in third place was the Capuchins, who barely exceeded 500. The Dominicans, who had come to have a notable presence in the 17th century (1,500) had a testimonial presence in this century (Valencia Caicedo, 2019a, p.65). Together with the Jesuit missions, Franciscan missions were also established in the Guarani area. The Franciscan reductions were founded between 1580 and 1615, mainly in the vicinity of Asunción, and although they reached 11 reductions from 1660-1670 only four remained active: Itá, Caazapá,

⁴³ Alejandro O'Reilly was the second Spanish governor of Louisiana. Of Irish origin, he was sent to re-establish control after the expulsion of the first governor by French colonists for restricting trade to only six peninsular ports. He punished the rebels severely, even to the point of publicly executing their six ringleaders. This repression was greatly criticized by the French population, and he is still remembered today as Bloody O'Reilly.

⁴⁴ Even so, the different governors adapted the regulations of the metropolis to the reality of the territory in order to avoid uprisings.

⁴⁵ The fact that there was a change of Crown would make the results largely attributable to the French colonial organization.

Yutí and Itatí⁴⁶. The two religious orders both offered resistance to the requirements of indigenous labour, but the geographical proximity of the Franciscans to Asunción and the direct contact with the metropolitan authorities by the Jesuits for their defence before the local powers, caused the Franciscans to be under a regime of *encomienda* and the Jesuits to be exempt (Maeder, 1995).

Valencia Caicedo (2019b) shows that the presence of the Jesuit missions in Guarani lands is positively linked to higher education and income levels in the present. This positive effect, however, does not appear in the case of the Guarani Franciscan missions. The reason given by this author for the different outcomes has to do with the differences in the organization of the missions of the different religious orders, and the lower interest in education of the mendicant orders, such as the Franciscans. The results obtained in the same period for Mexico, however, show a different outcome. Waldinger (2017) finds a positive impact of Catholic missions on educational levels, but the effect is stronger in the case of the Franciscan missions than in the Jesuit missions. However, in a previous work, Waldinger (2014) analysed the religious missions that were established in the territory of present-day Venezuela. In this case, however, while she found that the Franciscan missions had a negative impact, which he attributes to the colonial system of the *encomienda*, her work gives evidence that the Augustinian missions had a positive effect⁴⁷.

The results of the previous work are at best ambiguous. To delve further into these questions the analysis has been completed with the study of three Franciscan missions established in California for which information is again available thanks to the registers⁴⁸. The California missions were based on the colonizing model of border institutions⁴⁹. In the northwest of New Spain, after failed attempts by the Franciscans, the missionary work was carried out by the Jesuit religious people. As in the Guarani missions, they prevented contact with the settlers and

⁴⁶ The Jesuit missions were, in any case, more successful than the Franciscan missions in the Guarani area. According to Maeder (1995, p.71): "one can see a demographic stagnation in the Franciscan reductions and a greater dynamism in the Jesuit missions: while the former barely maintain a stable number of inhabitants and villages, the latter increase their population and the number of their reductions". Unfortunately, it has not been possible to locate the census of these Franciscan reductions.

⁴⁷ Other work has focused on missions in Africa. For example, Fourie & Swanepoel show the levels of numeracy in various Protestant missions in South Africa in 1849, with ranges from 24.2 to 76.3 (Fourie & Swanepoel, 2015). Even so, the South African missions are considered to have been key to the high arithmetic levels of slaves born in that country compared to other areas of Africa.

⁴⁸ California State Archives (CSA). See appendix Table A.2.1.

⁴⁹ Along with the missions, the Spanish colonization incorporated prisons and villages. The prison was a military post with a population settlement that protected the missions. The towns were settlements of colonists promoted and financed by the crown to prevent the preponderant role that the missions had in the Jesuit system. In addition, the creation of ranches was promoted as instruments of colonization of the large spaces that remained unpopulated between the Missions, the pueblos and the presidios.

the Indians from working for them⁵⁰. The missionaries taught and encouraged agricultural activities such as the cultivation of crops like grape vines, corn, wheat and cotton, and the raising of livestock. The Indians, who carried out all these tasks, received two daily rations of corn and meat and once a year fabrics and clothing. In addition, they promoted construction sites where soap, shoes, fabrics, clothes, etc. were manufactured, products that increased the economic power of the missions (Ortega Soto, 1999)⁵¹. The Jesuits undertook the colonization of Baja California in 1697. The expulsion stopped their plans to extend over Upper California, but the base of the subsequent colonization was the former Jesuit missions in the northwest since the Franciscans not only based their model on productive self-sufficiency and the teaching of the gospel, but the resources to undertake the evangelizing enterprise were obtained from the expropriated Jesuit missions⁵².

This makes the study of the California missions particularly interesting as it is, to a large extent, an exceptional case: that is, Franciscans founding and managing missions following the (successful) guidelines carried out by the Jesuits in Baja California⁵³. The previous links between the two orders in this region, with a dynamic in which persuasion replaced force (Osante, 2010, p.52-55), would explain in this case the similarities of the methods used to found the missions in this area (Ruíz Gutiérrez & Sorroche Cuerva, 2014). Upper California had a sedentary population despite not practicing agriculture, and they lived from hunting due to the great abundance of environmental resources (Ettinger, 2010). The introduction of cattle into the region by the Franciscans generated tensions between indigenous villages and missions, as the indigenous people lost an important source of food as cattle consumed the pastures that served as food for the native population. They moved to the missions because of food shortages, as they found a more reliable food supply there (Jackson, 1999), and thus changed their eating habits (Bernabéu Albert & Ortega Soto, 2011)⁵⁴. One of the main differences was that the

⁵⁰ As it happened in the missions of Paraguay, the settlers who followed the Jesuits in their advance, accused them of monopolizing the best lands.

⁵¹ The *obrajes* in colonial America, and especially in New Spain, were small industries that existed from the mid-sixteenth century until the nineteenth century, where different products were manufactured, especially textiles, by mainly indigenous labour.

⁵² The financing of the expeditions was provided by the Royal Treasury, which used the Pious Fund of the Californias, which had passed into its hands following the expulsion of the Jesuits. Indians, cattle, seeds and even working tools and church ornaments for the new missions were obtained from the Baja California establishments.

⁵³ The group, led by Majorcan Fray Junípero Serra (founder and president of the new missions of Upper California, 1769-1784), had acquired extensive experience in the Sierra Gorda and Baja California for almost 20 years (Rex Galindo, 2007).

⁵⁴ Jackson (1999) establishes a statistical relationship between the number of livestock in a mission and the incorporation of the native population, showing the relationship between livestock development, the destruction of the natural habitat of the indigenous people and the preference for missionary life.

Franciscans made occasional use of soldiers from nearby prisons in the case of conflict⁵⁵. To overcome the barriers some friars learned the native languages and wrote bilingual catechisms, and although the teaching of Spanish was promoted, at the end of the 18th century the Franciscans recognized the use of the native languages in the missions (Rex Galindo, 2007)⁵⁶.

In this case we have information regarding three Franciscan missions in the second half of the 1790s: St. Anthony, St. Louis and Soledad. Of these three missions, the one with the largest population was San Antonio (1,137), followed by San Lu s (792) and Soledad (344), all of which were inhabited by indigenous communities⁵⁷. The total sample of men between 23-62 years of age in these three missions together amounts to 891 individuals (see Table A.2.1 in the appendix). The results show that these Californian Franciscan missions, with similar patterns to the Guarani Jesuit experience, show ABCC index levels of 100 or close to it⁵⁸. These results, i.e. the absence of age heaping, reinforce the view that certain Catholic Christian missions during the colonial era were successful in offering their indigenous mission inhabitants a high level of education, in this case in terms of numeracy, which, moreover, as noted in Waldinger (2014, 2017) and Valencia Caicedo (2019b), has been shown to be persistent over time, making its effects felt even today.

2.5 Conclusions

The results obtained in this work suggest that the knowledge of numerical skills in the Guarani Jesuit reductions throughout the 18th century was exceptionally high. Although the sample analysed has more than 3,600 observations altogether, the diversity of local situations means that an overall image can only be elaborated with caution; however, the results obtained seem to indicate that the level of calculation capacity in the Jesuit Guarani missions, as well as those in Alta California that replicate the mission model, was close to one hundred percent in the 18th century. These levels are much higher than any region under the rule of the Hispanic Monarchy

⁵⁵ The native Californians who received the Franciscans best were the Juane os, the Gabrielinos, the Tataviam, the Chumash and the Salinan.

⁵⁶ When the Franciscan friars arrived in 1769, Alta California was populated by twenty indigenous ethnic groups from six different language families with a large number of subgroups, and it is considered that there were probably between 64 and 80 different languages. Despite the ethnic and linguistic diversity, these groups shared a number of cultural traits.

⁵⁷ San Antonio de Padua was inhabited by Salinan Indians, San Luis Obispo by the Chumash and Nuestra Se ora de la Soledad by Chalon, Yokuts, and Salinan.

⁵⁸ In the case of Soledad the ABCC is lower (91.4), but unlike the other two, it had been founded only recently (1791). In any case, obtaining ABCCs of 100 in San Antonio and San Lu s, as in the Jesuit missions, reduces the concern that the results obtained, in both these missions (along with the ayllus of Paucarcolla), are a consequence of how the census was prepared and the information collected.

during that same period, and are only comparable to the more advanced countries in Western Europe. Moreover, they seem to be persistent over time.

These results confirm the positive vision of an institution, as indicated in the literature, which was one of the first in the world to school the whole population. At a time when the rest of the Hispanic Monarchy was teaching in an informal education environment, and learning in the workplace was an important element of the acquisition of this knowledge, in the missions studied, the school was a central element, and all children could access it. This would also be part of a model based on the adaptation to the Guarani worldview with evangelization in their language, a cohesive social structure in which the Indians had a determining role and an egalitarian productive structure that included a support mechanism between the missions in case of shortage. All these factors could explain their successful educational performance and the inter-generational transfer of human capital after the Jesuits were expelled from the missions.

The comparison with other experiences and regions points to the relevance of institutional characteristics. The societies with more resource-extractive colonial institutions were those with lower levels of numeracy in that period. However, within the same territory there could be different types of institutions, which results in more complex realities. Furthermore, this result has to be framed within the literature that studies the role played by the different Catholic religious orders in the formation of human capital. The Jesuits were not the only order that attempted to evangelize the populations that inhabited the areas conquered by the Spanish Crown: Franciscans, Dominicans and Augustinians also formed part of this intense missionary presence in Latin America during colonization.

However, these other religious orders differed from the Jesuits in that they are mendicant orders, so their aim was to expand Christianity from a commitment to reducing poverty. However, the Jesuits are an order of regular clerics who showed greater concern for the organization of economic activity in the communities they governed. In contrast, the Franciscans also founded Guarani missions, but unlike the Jesuits, their effects are not seen today (Valencia Caicedo, 2019b). This asymmetry also occurs in the demographic evolution between the Franciscan and Jesuit Guarani reductions (Maeder, 1995). A particular case analysed here would be the Missions of Alta California because in these missions the Franciscans followed the enterprise begun by the Jesuits in Baja California and used a similar model. These missions show equally positive results.

Overall, the results point to the role that the type of institution in a territory would have had on numeracy education, which would have been particularly low in non-religious institutions based

on models of extreme inequality with less respect for the pre-existing social structure and culture, such as extractive institutions. This has implications for future research on this issue, and this study contributes to the debate on religious institutions, the effects of missions and their dissemination of human capital, and their implications for long-term economic development.

Figure A.2.1 Image of a padrón de indios

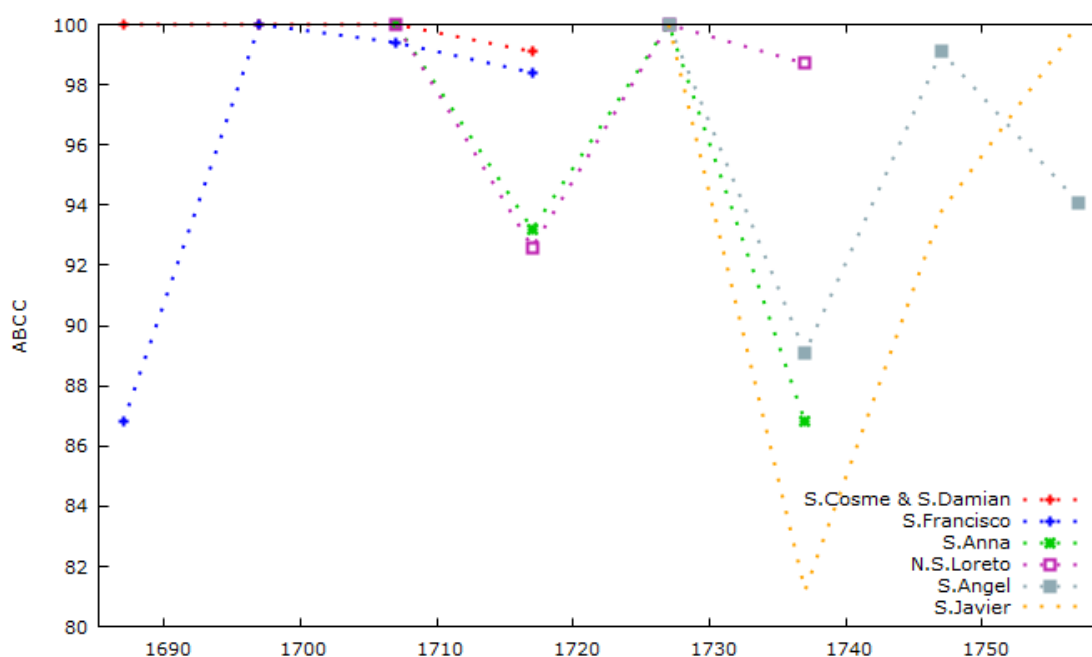
*Padrón del Pueblo de S. Cosme y S. Damián
que se hizo este presente año de 1734.*

Primera Casa.

Aprobado. de Legis.	1. D. Pablo Abasi Cacique de 64. años casado con	
	2. Isabel Cayan.	2.
	2. Pablo Abasi Primezonito del Cacique de 32. años	
	casado con Maria Yaxhuu. Sus hijos Juan Abasi	
	primezonito de 8. años, Hesáaxo de 6. años, y su	
	hija Rosalia	5.
	3. Fran. Abasi de 24. años casado con Maria Yaxhuu	
	Sus hijos Cuxebio de 5. años y medio	3.
	4. Miguel Abasi de 37. años casado con Maria Guabuy.	
	Sus hijos Miguel de 7. años, y su hija Maria	4.
	5. Balchaxax Abasi de 35. años casado con Maria Ca-	
	nicuina. Sus hijos Domingo de 13. años, y su hija Man-	
	guita	4.
	6. Chaxilob. Abasi de 37. años casado con Anabania Aba-	
	cuina. Sus hijos Ignacio de 13. años, y su hija Maria	
	Rosa	4.
Aprobado.	7. Ignacio Abasi de 34. años casado con Ignacia Guasichari.	
	Sus hijos Fran. de 16. años, y Juan de 15. años, y su hija	
	Daxchéla	5.
	8. Felipe Abasi de 24. años casado con Ana Kaxaxiyu.	
	Sus hijos Juana, y Clara	4.
	9. Anáaxo Jamba de 38. años casado con Damiana	
	Jabaxax. Sus hijos Anáaxo de 13. años, Lagax de	
	8. años, y Mathias de 2. años	5.
	10. Fran. Davica Muxiyu de 26. años casado con Josefa	
	Duyi. Sus hijos Antimo de 6. años, Luciano de un año,	
	y Julian de un año	5.
	11. Pedro Muxiyu de 34. años casado con Maria Abaxua.	
	Sus hijos Fabian de 16. años, Fran. de 10. años, y	
	Teófilo de 6. años.	5.
	12. Anáaxo Cayux de 32. años, casado con Ana Guaxu.	
	Sus hijos Manuel de tres y medio y su hija Rosalia	4.

Source: Sheet from the padrón de indios of San Cosme and San Damián, 1735, AGNBA

Figure A.2.2 ABCC levels by age cohorts in the Jesuit missions 1735-1785



Sources: San Javier 1735 padrón de indios AGNBA; San Cosme 1735 padrón de indios AGNBA; Santa Ana 1759 padrón de indios AGNBA; Nuestra Señora de Loreto 1759 padrón de indios AGNBA San Ángel 1783 padrón de indios AHPO; San Javier Pueblo 1785 padrón de indios AGSF

Table A.2.1 List of Indian registers and censuses of other regions with their characteristics

Year	Entity	Repartimiento	Region	Country	N	N(23-62) Men	N(23-62) Women
1728	Paucarcolla	Puno	Collao	Perú	753	133	150
1777	Attakapas	Attakapas	Louisiana	USA	837	203	133
1777	Opelousas Mission San Antonio	Opelousas	Louisiana	USA	738	183	115
1795	Mission San Antonio	Monterrey	California	USA	1,133	254	213
1798	Mission San Luís	San Luís	California	USA	792	162	154
1798	Mission Soledad	Monterrey	California	USA	344	55	53
Total					4,597	990	818

Sources: Paucarcolla, 1728: padrón de indios MREP; Attakapas, 1777: censo AGI; Opelousas, 1777: censo AGI; San Antonio, 1795, San Luis, 1797, Soledad, 1797: padrón CSA⁵⁹

⁵⁹ MREP: Ministerio de Relaciones Exteriores del Perú, Archivo Especial de Limites ; AGI: Archivo General de Indias; CSA: California State Archive.

Chapter 3. Human capital at the beginning of 18th-century Catalonia: age-heaping and numeracy in a changing economy

3.1 Introduction

Human capital is regarded as a relevant factor in modern economic growth theories (Galor, 2011; Glaeser et al., 2004; Jones, 1995; Lucas, 1988; Mankiw et al., 1992; Romer, 1986). From an economic history perspective, a key unresolved debate concerns the contribution of human capital during the earlier stages of industrialization and whether it promoted the growth of industrialization in certain countries and regions before others. The role played by human capital accumulation in the long term and in pre-industrial societies is subject to conflicting views. On the one hand, some consider that it was minimal (Allen, 2003; McCloskey, 2010; Mitch, 1993b), while others claim that it had a significant effect (Baten & Van Zanden, 2008; Becker et al., 2011; Mokyr, 2010).

To evaluate the role of human capital in economic growth, a human capital indicator is necessary. The most frequent indicators used to calculate human capital in contemporary periods include years of schooling (Barro & Lee, 2013; Barro & Sala-i-Martin, 1995), education expenditure (Barro & Lee, 1996, 2001), productivity growth due to education (Woessmann, 2003), schooling rates (Becker & Woessmann, 2009; Mankiw et al., 1992) and PISA test results (Hanushek & Woessmann, 2010). These data are nonetheless very difficult to obtain for historical periods. Under these circumstances, one of the most frequent indicators used to study human capital in the past is literacy rates based on information from population censuses, which often go as far back as the mid-19th century. For pre-statistical periods, particularly prior to 1800, this indicator has been obtained by analysing the signatures on documents (notarial documents, marriage registers, etc.).

An alternative indicator used to assess the human capital levels of different societies is numeracy, which measures one of the basic capacities for economic development: numerical skills for economic and commercial ends. Numeracy or arithmetic capacity, using age-heaping as a proxy through the calculation of Whipple's index (WI) and the ABCC index, is considered a good alternative to literacy as an indicator for eras such as

the early modern period, for which sources are scarce or even non-existent. In recent years, a large and growing number of academic articles have measured arithmetic capacity through the age-heaping methodology (A'Hearn et al., 2009; Crayen & Baten, 2010; Hippe, 2013). Several of these authors have focused on some of the regions under the rule of the Hispanic monarchy in the 18th century, such as Castilla (Álvarez & Ramos Palencia, 2018), the region of Río de la Plata (Vicario, 2014), Colombia, Mexico and Peru (Manzel et al., 2012; Calderón-Fernández et al., 2020), and the Jesuit Missions of the Guaranis (Gómez-i-Aznar, 2020). This methodology has also been used to study religious minorities during the Inquisition (Juif et al., 2020) and even periods preceding the *Conquista* (Juif & Baten, 2013)⁶⁰.

This study focuses on 18th-century Catalonia, around the 1720s. To assess the role of human capital in economic development, it is important to describe its long-term evolution in this region and compare it with other regions in Southern and Northern Europe. The case of Catalonia is particularly interesting given that it was the only region in the Mediterranean that became an early adopter of the British Industrial Revolution (Vilar, 1974). Catalonia started participating in international commerce in the 17th and 18th centuries and specialized in sectors such as wine and spirits (Valls Junyent, 2004). During this period, the region underwent rapid population growth and intensification of its agricultural and proto-industrialization sectors (Torras i Ribé, 1994). The latter provided continuity in terms of organization of production and human capital, thereby facilitating the future transition to factories (Marfany, 2010).

Throughout the 18th century, a trade relations model was established, thus turning Catalonia into an open economy. A key factor in the emergence and consolidation of the first cotton manufacturer was the import of cotton and linen fabric in exchange for Catalan viticulture production (Nadal et al., 2012). As early as the 19th century, the industrialization process was characterized by the adoption of a modern manufacturing system in the textile sector (Nadal, 1975; Sánchez, 2000), complemented by other, more traditional pioneer sectors (Nadal & Catalan, 1994). Therefore, this industrial growth in the 18th century was underpinned by this dual process, which facilitated technological adaptation (Feliu, 2012, p.92). It was against this backdrop that Catalonia, which came

⁶⁰ Other works have provided evidence of age heaping in Spain in the 19th and early 20th century by adopting a regional perspective (Beltrán Tapia et al., 2018; Manzel, 2007).

to be known as “a little England” at the end of the 18th century, and Barcelona, “the Catalan Manchester”, would end up becoming the “factory of Spain” in the 19th century (Martinez-Galarraga & Prat, 2016).

The main contribution of this article lies in its utilization of a thus-far unexploited source, i.e. municipal population registers (*padrons*), to obtain the arithmetic capacity levels of 18th-century Catalonia. These registers contain information for calculating age-heaping for the entire male population (and, in some cases, the female population) of a town. Unlike other sources used to obtain information on this period, such as military lists, tax information and hospital records, this source reduces possible biases, since it encompasses all age groups, occupations and social classes⁶¹. Thus, given that they list the entire male population of a locality, regardless of social and economic status, *padrons* help avoid the problems associated with under-representation of the lowest classes and tax evasion found in other sources from the early modern period⁶².

The sample used in this article includes information from 13 different Catalan localities (covering 10 of the 12 administrative divisions of the period) in the 1720s. Although the geographical coverage of the sample is somewhat limited, its importance lies in the fact that it offers information for a period for which very few human capital indicators are available. More importantly, with over 14,000 observations (6,640 of which were used to calculate numeracy levels), it represents a large data set to compute numeracy levels and also provides information on activity sector, occupation, property and gender. Based on this information, Whipple’s index and the ABCC index, covering all these dimensions, were used to undertake an analysis of the numeracy levels in different economic activities, skills and social classes. Thus, this new evidence made it possible to evaluate the levels of human capital in Catalonia during the early modern period, in the context of a changing economy that was paving the way for early industrialization in the final few decades of the 18th century. That then allowed the Catalan case to be put into comparative perspective with other European regions for which information is already available.

⁶¹ The only exception is registers that do not include clergy.

⁶² Vicario uses a similar source to analyse the characteristics of human capital in the region of Rio de la Plata for the period 1744-1858 (Vicario, 2014).

This article is structured in the following manner: section two presents an overview of the existing literature regarding human capital in the early modern period; section three describes the methodology and source used and the localities included in our sample; section four presents new evidence and the main results of our research; and, finally, the paper closes with a brief conclusion.

3.2 Literature review

3.2.1 Human capital in Europe during the early modern period

The challenge of analysing the long-term evolution of human capital is further compounded by the difficulty of finding indicators. The concept of human capital is broad and comprises all those abilities required to carry out an economic activity. The limited sources mean that partial indicators are often used. Furthermore, outside of Northern and Central Europe, it is often even more difficult to obtain comparable, homogeneous data such as school enrolment rates between 1830 and 1910 (Lindert, 2004) and schooling and literacy since 1870 (Crafts, 1996).

Literacy is measured primarily through information from historical censuses that reflect reading and writing skills. In the absence of this information for earlier periods, the proportion of people with the ability to sign notarial documents or marriage registers is used. Based on this indicator, Reis (2005) reported major differences in literacy data between 15 European regions around 1800⁶³. This disparity and the low levels found in some areas have led authors to conclude that literacy is not a factor that can account for European economic performance between 1300 and 1800 (Allen, 2003)⁶⁴.

By contrast, researchers who use indicators other than literacy rates support the hypothesis that human capital did indeed play an important role during the early modern period. There are numerous methods in addition to numeracy: the number of secondary schools (Boucekkine et al., 2007), book production (Baten & Van Zanden, 2008) and the stock of total years of schooling in England (de Pleijt, 2018). All these studies

⁶³ In the case of male literacy rates, these ranged from 60% in northeastern Europe to 20% in some parts of Italy and below 10% in Eastern Europe (Reis, 2005).

⁶⁴ According to Allen (2003), literacy rates in 1800 were: England 53%, Holland 68%, Belgium 49%, Germany 35%, France 37%, Austria-Hungary 21%, Poland 21%, Italy 22% and Spain 20%.

evaluate the development of human capital in the very long term and reveal that it may indeed have played a key role.

A strand of the literature has hypothesized that the Protestant Reform favoured the increase in human capital levels (Becker et al., 2011), although other authors maintain that Protestantism had no effect when it interacted with other factors that probably determined economic development (Cantoni, 2015). Although the Protestant Reform could have been a stimulus for educational development in Northern and Central Europe, the Catholic Church reacted to it with popular education measures like the creation and promotion of the religious teaching orders, such as the Jesuits, Capuchins, Carmelites and Piarists (Hébrard, 1989). This progress was due to the ecclesiastical promotion following the Council of Trent (Vergara, 1993), but also to the interest among local authorities in promoting education (Solà, 2011, p.102).

Other authors propose that the Industrial Revolution in Great Britain probably led to a deskilling process (de Pleijt & Weisdorf, 2017), an effect also observed in the development of the fishing industry in Northern Europe (Ojala et al., 2016). By contrast, authors have claimed that the Industrial Revolution in France brought about an improvement in human capital (Franck & Galor, 2017), but this disappeared from the mid-19th century (Diebolt et al., 2019). Finally, some authors have pointed to the so-called upper-tail knowledge hypothesis, in which a minority but highly qualified group allowed new technologies to be implemented (Meisenzahl & Mokyr, 2012; Mokyr & Voth, 2009; Squicciarini & Voigtlander, 2015; Zeev et al., 2017).

3.2.2 Human capital in pre-industrial Spain

Literacy data, which have been available since the mid-19th century, represent the most commonly used human capital indicator to analyse the Spanish case (Núñez, 2003, 2005; Sarasúa, 2002; Viñao, 1990, 1999). The creation of indicators for earlier periods is complicated by the same difficulties associated with the scarcity, heterogeneity and lack of accuracy of the sources. The first regional estimates of literacy available for Spain date from 1860 (Núñez, 1992), when education levels were low⁶⁵. The lack of

⁶⁵ In 1860, only 20.1% of the population over the age of 10 were able to read and write.

homogeneous statistical data prior to 1860 means that our knowledge of the evolution of human capital levels in Spain and their potential impact on regional economic growth is limited. The enormous methodological problems associated with studying the evolution of human capital in early modern Spain mean that the most commonly used indicator is the ability to sign documents (Soubeyroux, 1985), but the data remain fragmentary.

In this context, some academics have not considered human capital as a prerequisite for the partial industrialization of Spain, and a comprehensive analysis of schooling and literacy data appears to support this standpoint. The historical framework has given rise to the paradox of Spain, where the most industrialized areas had relatively low literacy levels (except for Madrid and the Basque Country), and the more literate areas were less developed (Nadal, 1995). Given these low literacy levels, Nadal, who used the role played by qualified industrial workers and professional training, and Rosés (1998) claimed that the Catalan industrialization process was possible because the human capital levels in the industrial sector were sufficient for the adoption and modification of new technologies. In Rosés (1998), this is a consequence of the fact that a significant proportion of education was carried out informally in the workplace. This learning-by-doing did not favour literacy directly, but it did strengthen the skills of industrial workers.

Thus, the development of industrial professional training for skilled workers and technicians is considered a possible key factor in the success of the industrialization process, mainly during the Second Industrial Revolution. Between 1889 and 1935, supply and demand for professional training in Spain grew due to the role of the public administration and the institutionalization of the education system in the mid-19th century (Lozano López De Medrano, 2008). The two most industrial areas of Spain (Catalonia and the Basque Country) had the highest number of vocational schools. Here, there was less state involvement in finance, which meant that the development of the vocational school network relied on the role of local corporations. This gave them greater flexibility with regard to state-regulated academic content, which in turn favoured greater curricular specialization for the local production system.

In recent years, some studies have explored the development of human capital in Spain by analysing numeracy and using the age-heaping methodology. For example, Manzel

(2007) applied numeracy and the age-heaping methodology to determine the arithmetic levels of the Spanish population between 1830 and 1930. Much like the literacy data for 1860, this study reveals that the most economically dynamic regions were not among those that had lower levels of numeracy than other regions. Juif & Baten (2013) also used numeracy data for earlier periods to calculate the levels in certain Hispanic localities, and obtained poorer results than those of other European areas.

Finally, some works link the human capital levels in Spain to inequality. For the 18th century, Álvarez and Ramos Palencia (2018) used the *Catastro de Ensenada* (a census carried out in 1749) to show that human capital (measured in numeracy and literacy) in pre-industrial Castilla contributed to income inequality. For mid-19th century Spain, Beltrán Tapia and Martínez-Galarraga (2018) maintained that the degree of inequality in access to land, measured as the proportion of agricultural labourers who were non-owners compared to the population working in agriculture, had a negative impact on male literacy rates in pre-industrial Spain.

3.2.3 Human capital in Catalonia during the early modern period

The Catalan case, as indicated in the previous section, provides a clear example of the Spanish paradox regarding the modest development of literacy rates in the most industrialized regions, as noted by Nadal (1995). In this context, Núñez (1992) and Manzel (2007) contributed data that appear to confirm this hypothesis for Catalonia. The above-mentioned scarcity of pre-mid-19th century data also affects Catalonia, thus affecting the ability to assess the stock of human capital. Literacy levels in modern Catalonia in both cities and rural areas have been subject to very little research. If one wanted to study Catalan literacy prior to 1860, for example, the only information that is available, to our knowledge, relates to the city of Girona (Antón Pelayo, 1998) and the towns of Mataró (Ventura i Munné, 1986) and Terrassa (Fernández Clarés, 2007), and often reflects only certain social strata.

In addition, Expósito i Amagat (2015) showed that Catalonia was much more diverse and literate than traditionally assumed. This is a viewpoint shared by Solà (2011, p.108), since the Catalan elementary school network appears to have been strengthened in the 16th and 17th centuries. The municipalities were also concerned about popular

education and usually provided a space for teachers to give classes to children. There were three types of lesson: writing; reading and writing; and reading, writing and counting. The fact that the service was free was key to ensuring access to all social classes, given that the cost of education was borne by local institutions or Church profits and revenue. The institution that funded the schooling appointed the teacher (Solà, 2011, p.117). Burgos Rincón (1994) highlighted the expansion of the primary school system in the 18th century, and provided a detailed list of Catalan towns that had schools between 1730 and 1800, for which he obtained high numbers⁶⁶. In addition, an analysis of schooling rates carried out by Lloret based on data from Zamora's questionnaire yielded ample results (Lloret i Carbó, 1991).

As noted by Expósito i Amagat (2015), these figures clearly do not indicate literacy levels, but represent an important indicator to bear in mind when evaluating the conditions under which education expanded in Catalonia. Thus, a range of data on the expansion of education are available. For instance, in the town of Vilafranca del Penedès, there was an elementary school in the 16th century and several religious orders gave free classes in the 17th and 18th centuries (Solà, 2011). With respect to the town of Cervera, a list of teachers who were paid by the municipality between 1338 and 1770 is available (Duran Sanpere, 1977). For Olot, there are records from as early as the 15th century that reveal that a teacher authorized by the Church gave classes in a house rented by the town council, and data that show that this same council selected and paid 14 teachers to provide basic education for children in the 18th century (Expósito i Amagat, 2015).

One factor to bear in mind is that a wide range of municipal, parish and private schools did not guarantee schooling for all children due to the fact that the number of school-age children far exceeded the number of places available. Moreover, it is worth highlighting that, although some of these schools were free, the opportunity costs of most of the population meant that many children helped financially support their families rather than attend school. In addition, formal schools always focused on part of the male population and, despite the fact that initiatives to promote popular education for girls

⁶⁶ In municipalities with over 1,000 inhabitants (a total of 164), 69% had a school; in cities with over 2,000 inhabitants (61), the percentage was 85%. This was also the case in more than 50 towns with between 500 and 1,000 inhabitants. Hence, "half the population of Catalonia lived in places that had an open school at some point in the 18th century" (Burgos Rincón, 1994).

started emerging in the 18th century (Solà, 2011, p.112), most girls did not have access to education. Hence, with few exceptions, only the wealthiest families could afford a private teacher at home for educating girls (Puig i Reixach, 2010). Furthermore, unlike boys' education, which consisted of grammar, rhetoric and trades, the school curriculum for girls consisted of domestic subjects that focused directly on their responsibilities in the home.

However, the low level of investment in public education and the high opportunity costs for families meant that they could not rely on schools as the main means of securing an education in pre-industrial societies. A key element in the transmission of knowledge in Girona was apprenticeships for craftspeople and liberal professionals (Antón Pelayo, 1999) and training offered to young people in workhouses in Barcelona, which provided them with access to guilds, domestic service or the army (Carbonell-Esteller & Marfany, 2017). Furthermore, in areas with a predominantly rural economy, the population also needed access to literacy and arithmetic, which accelerated the education process (Expósito i Amagat, 2015). This knowledge, however, which was acquired more formally and was difficult to quantify, became more uniform and began to be taught in classrooms over the course of the 19th century. However, this does not mean that access to non-formal education did not coexist for a long time and that it did not exist prior to this.

One institution of Catalonia that played a major role in the development of human capital from the late 18th century was Barcelona Chamber of Commerce. This institution created a series of schools, which were free of charge and taught technical and practical knowledge with the aim of improving workforce skills (Monés i Pujol-Busquets, 1987). The Chamber of Commerce facilitated the transition to industrial technologies (Agustí i Cullell, 1983, p.55) and helped create favourable conditions for innovation that were necessary for the introduction of the factory system (Nadal et al., 2012). The collaboration between scientists and artisans was a key factor in the introduction of the first machines in Catalonia's early industrialization process (Agustí i Cullell, 1983, p.75). Nevertheless, the main school remained the workshop or the home itself, since the learning process was fundamentally practical. Additionally, as

mentioned above, many vocational schools in Catalonia at the end of the 19th century were not subject to official regulations (López De Medrano, 2007, p.203)⁶⁷.

3.3 A new source for measuring numeracy: municipal population registers (*padrons*)

3.3.1 Methodology

Numeracy is a term that refers to people's capacity to calculate. This capacity is the ability to process, understand and transmit mathematical and numerical information. Economic historians generally agree that arithmetic capacity is a particularly good indicator of human capital formation in the context of the informal training available in the modern period and the early stages of industrialization (de Pleijt, 2018; Humphries, 2011; Mokyr, 2010; Wallis, 2008). The ability to do basic mathematical operations was vital in an increasingly monetized and industrialized economy. For this reason, high levels of numeracy may also be a good indicator of a market-oriented economy, as opposed to a subsistence economy where monetary transactions were much less frequent.

In the past, obtaining historical information about numerical skills involved the use of age-heaping calculations (A'Hearn et al., 2009; Mokyr, 1985). This refers to the tendency of people to round their ages to numbers ending in zero or five when they do not know their exact age. Thus, age-heaping exists in censuses where there is a high frequency of numbers ending in zero or five⁶⁸. Age-heaping is thus an indicator of a population's numeracy skills and is considered a good proxy for arithmetic capacity (Blum & Krauss, 2018).

Age-heaping can be used as an indicator of numerical skills in a group of individuals, but it also reflects the conditions and factors of the context in which these individuals lived. For this reason, in periods when education was widespread, age-heaping was strongly correlated with literacy (A'Hearn et al., 2009) and other environmental factors

⁶⁷ Given that they were managed by religious orders, local corporations, workers' associations or even the factories themselves, which enabled them to better adapt to the demands of local companies.

⁶⁸ The reason people use numbers ending in zero or five when they do not know their own age is biological. In many cultures around the world, people learn to count using their hands and fingers, since we use our body to communicate with other individuals (Sheets-Johnstone, 2010).

such as height (Baten et al., 2010). By contrast, other authors have questioned whether age-heaping is a good proxy for numeracy (Spennemann, 2017), and others still have pointed out that it may be an indicator of institutional and cultural modernization rather than of cognitive abilities (A’Hearn et al., 2019). Moreover, the quality of local censuses used to calculate numeracy varies according to the period and location (Szołtysek et al., 2018).

Age-heaping is calculated using a transformed Whipple’s index called the ABCC index. Whipple’s index shows the number of ages ending in zero or five out of the total:

$$WI = \frac{\sum_{i=5}^{14} n_{5i}}{\frac{1}{5} \sum_{i=23}^{62} n_i} \times 100$$

where i represents age and n the number of observations. The index ranges from 100 to 500, where a value of 100 means that there is no age-heaping and 500 indicates that all observations end in five or zero⁶⁹. To make it easier to interpret the index, A’Hearn et al. (2009) proposed a linear transformation of Whipple’s index, i.e. the ABCC index, which can be expressed as:

$$ABCC = \left(1 - \frac{WI - 100}{400}\right) * 100$$

The ABCC index has the advantage of being more comprehensible than Whipple’s index, since the values it encompasses range from 1 to 100, where 100 represents maximum arithmetic capacity and zero represents minimum arithmetic capacity. In this paper, the WI was first calculated before being transformed into the ABCC index. In so doing, the number of observations of age cohorts between the ages of 23 and 62 was used⁷⁰. In the 23-32 age cohort, the correction factor proposed by Crayen and Baten

⁶⁹ Values below 100 are possible in samples with a high number of observations.

⁷⁰ Younger people may recall their age with greater accuracy due to external factors and, for this reason, those below the age of 23 were excluded. People over the age of 62 were excluded for two reasons: first, to avoid an age effect that might cause an upward bias in the sample (Crayen & Baten, 2010), since individuals who reached this age in the early modern period had the best living conditions and lower levels of mortality, and consequently higher literacy rates; and, second, because they might have been tempted to exaggerate their age to impress interlocutors or because they did not remember it (Ewbank, 1981; Reis, 2008).

(2010) was applied, due to the potentially higher capacity for these individuals to remember their age ⁷¹.

3.3.2 Municipal population registers (*padrons*)

Employing the age-heaping methodology requires individual rather than group ages. In the case of regions under the rule of the Spanish Empire in the early modern period, these ages are obtained from the municipal population register. The municipal register is a list of citizens living in each locality, in which those who wanted to become full residents were recorded from the Middle Ages onwards. As of the 18th century, some registers include both age and occupation, thereby making it possible to calculate age-heaping according to professional category. This is not a fiscal source, although it could be used for this purpose; we can therefore safely assume that it is less biased and subject to less concealment than other sources from the same period.

Municipal population registers are divided into two major groups, according to whether they measure *vecinos*⁷² or inhabitants (García España, 1991). These two groups are primitive censuses, which were conducted from the beginning of the 15th century to the mid-18th century, and modern censuses, which have been carried out since the mid-18th century. Primitive censuses are characterized by three fundamental features: the basic unit used was the *vecino* and not the individual and its main goal was not to gain knowledge about the population and its characteristics, but instead they were almost always carried out for primarily fiscal reasons and only secondarily provided information on the size of the population, measured in *vecinos*⁷³; and the main information was provided by the town's authorities without any obligation to refer to the element that represented the object of study.

By contrast, modern censuses are defined by four factors: the basic unit is the individual; they seek to include all inhabitants and only design defects can give rise to incomplete coverage; they almost exclusively aim to gain knowledge about the population and its main characteristics and later apply this to the subject for which the

⁷¹ The adjustment is made using the following equation: $ABCC_{23-32adjust} = ((ABCC_{23-32} - 100) * 0.25) - ABCC_{23-32}$.

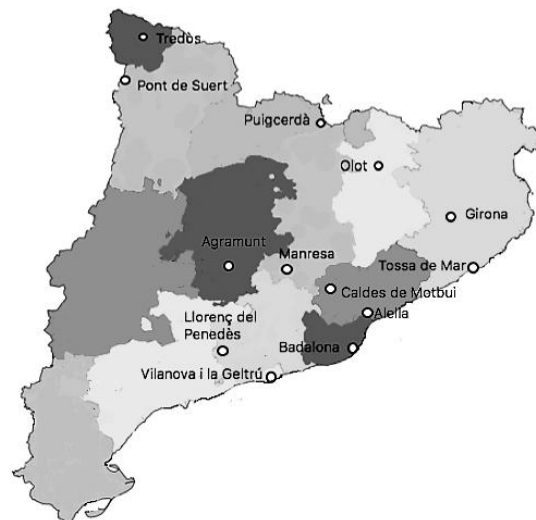
⁷² In the Spanish Monarchy, a *vecino* was a person who had a house and home in a town or city and contributed to its expenses. It was similar to "freeman" or "freeholder".

⁷³ In some cases, they indicated the number of *almas* ("souls"), i.e. people who lived in the same home.

information is being sought; and the main information is provided by the people themselves, while the authorities seek the information from the households (*Calle hita* in Old Spanish).

The territorial and fiscal organization of Catalonia by the Bourbons that emerged following the 1714 defeat of the pro-Habsburg forces in the War of the Spanish Succession was built on the pre-existing territorial structure of *vegueries* and *sotsvegueries*. The territorial organization was left unchanged so as to take advantage of the knowledge and resources of the previous administration and thus facilitate the implementation of the Nueva Planta decree of 1716. Patiño, intendant of Catalonia from 1711 to 1718, was in charge of its implementation and designed the jurisdictions based on all pre-existing *vegueries* (Burgueño & Gras, 2014, p.96). Thus, 18th-century Catalonia was divided into 12 jurisdictions or *corregimientos* (Figure 3.1)⁷⁴. The sample used in this study includes information from the municipal registers of 10 of these⁷⁵. Few registers from the 18th century have been preserved due to various conflicts throughout the 19th and 20th centuries, and the registers used are therefore from localities that had this source available.

Figure 3.1 Location of municipalities in the sample



Source: Own elaboration

⁷⁴ Barcelona, Cervera, Girona, Lleida, Manresa, Mataró, Puigcerdà, Tàrragona, Tortosa, Vic and Vilafranca del Penedès. The Vall d'Aran was a separate entity and not considered a jurisdiction.

⁷⁵ A register is also available for one locality in the Vall d'Aran.

The distribution of the information from the municipal registers was based on the data extracted for all people per household, street by street, with information on their main characteristics (age, occupation, kinship, etc.). This indicates that those in charge of compiling the register went from home to home to collect the information and that they sought to include all inhabitants (in some cases only males were included, both adults and children).

To carry out these *padrons*, the compilers did not use previous information from the Campoflorido census of 1712 or registers such as those created by the Church. The registers were compiled by the local authorities in accordance with specific, homogeneous instructions and under the supervision of Patiño. In some cases, we know the names of those in charge of compiling the registers and the cost involved for the municipality⁷⁶. Thus, the registers used in this paper to calculate the evolution of arithmetic capacity would be considered modern censuses.

Interestingly, the analysis of numeracy in 18th-century Catalonia can be broken down by activity sector, occupation, social group and gender. First, the classification into activity sectors (primary, secondary and tertiary) follows the Cambridge Group's PST System (Wrigley, 2006)⁷⁷. The preponderance of each sector was used to identify whether a locality was urban or rural. Second, the HISCO methodology, a coding system to construct quantifiable and comparable models of historic occupation in diverse contexts, was applied to categorize occupations (Van Leeuwen et al., 2002). Third, HISCLASS, a classification system to analyse social mobility derived from this occupational stratification was used to determine the level of training linked to these occupations (Van Leeuwen & Maas, 2011). In the particular case of Catalonia, there were problems associated with a lack of specificity of some occupations between the 15th and 20th centuries. To avoid wasting the extensive information contained in some municipal registers, we took account of the solutions adopted in previous studies (Pujadas-Mora et al., 2014). Finally, with respect to gender, male and female age-heaping levels should be analysed with caution in registers that contain this information.

⁷⁶ For example, the municipal register in Olot indicates that it was compiled by the notary Francesc Masbernat, who was also the municipal secretary, assisted by the scribe Pere Pau Vayreda.

⁷⁷ The abbreviation "PST" refers to the primary, secondary and tertiary sectors.

3.3.3 Localities

The 13 localities analysed were created around 1720. These 13 registers were distributed across three urban municipalities: Olot (1716), Girona (1720) and Puigcerdà (1721)⁷⁸; and 10 rural municipalities: Badalona (1717), Pont de Suert (1717), Tredòs (1718), Tossa de Mar (1720), Agramunt (1721), Manresa (1721), Llorenç del Penedès (1722), Alella (1724), Caldes de Montbui (1724)⁷⁹ and Vilanova i la Geltrú (1724). The registers used are shown in Table 3.1 and are classified in chronological order, according to the year they were compiled. Altogether, the registers contained information for around 14,000 individuals, 6,640 of whom were used to calculate numeracy levels given that they were aged between 23 and 62 years⁸⁰.

The towns in the 1720 sample were municipalities that were emerging from the War of the Spanish Succession and were beginning their economic and demographic recovery. During the 18th century, trade in agricultural surpluses began, thus triggering economic growth and the industrialization process. Some municipalities that were also characterized by demographic growth tied to commercial expansion in coastal areas were: Alella (Ferrer i Alòs, 2012), Badalona (Carreras i García, 1993), Tossa de Mar (Zucchitello, 2013, p.167) and Vilanova i la Geltrú (Martínez i Rodríguez, 1987); in pre-coastal areas: Caldes de Montbui (Ferrer i Alòs, 2012) and Llorenç del Penedès (Moreno Claverías, 2004); in inland areas: Agramunt (Tello i Aragay, 1990); and in mountainous areas: Pont de Suert or Tredòs (Sanllehy i Sabi, 1996). However, if Catalan localities in the 18th century were characterized by one thing, it was the consolidation of the first textile manufacturers in the pre-industrial to industrial transition, as was the case in Girona (Boadas i Raset, 1986), Manresa (Ferrer i Alòs, 1983), Puigcerdà (Prat Forga, 2012) and Olot (Lluch, 1981; Puig i Reixach, 1988).

To calculate numeracy levels according to the PST system, municipalities were classified by whether they belonged to the primary, secondary or tertiary sector. An

⁷⁸ Puigcerdà was the border capital of a *vegueria* of small, rural localities; however, it encompassed the secondary and tertiary occupations of the surrounding area (Prat Forga, 2012).

⁷⁹ In the case of the two localities in the jurisdiction of Mataró (Alella and Caldes de Montbui), we used the list of *vecinos* taken from the census. The list was compiled after the census and the person who compiled it added one year to all ages. In this case, we have subtracted one year from the sample so as to calculate age-heaping.

⁸⁰ Information on number of inhabitants in the *padrons* is similar to that supplied by Iglésies, and in some cases, such as Olot, the registers used included a higher number of observations (Iglésies, 1974).

analysis of the composition of the municipal registers by activity sector, reflected in Figure 3.2, shows that some localities in the early 18th century already had an extensive manufacturing and service sector and a reduced agricultural sector.

Table 3.1 List of municipal registers in the sample and their characteristics⁸¹

Year	Town	Corregiment	Type	N	N(23-62) Men	N(23-62) women
1716	Olot	Vic	Urban	4,125	840	846
1717	Badalona	Barcelona	Rural	657	185	180
1717	Pont de Suert	Talarn	Rural	74	37	-
1718	Tredòs	Vall d'Aran	Rural	116	55	-
1720	Girona	Girona	Urban	4,696	1,080	1,178
1720	Tossa de Mar	Girona	Rural	256	112	-
1721	Agramunt	Cervera	Rural	254	126	-
1722	Manresa	Manresa	Rural	1,612	882	-
1722	Puigcerdà	Puigcerdà	Urban	488	252	-
1724	Llorenç del Penedès	Vilafranca del Penedès	Rural	40	24	-
1724	Alella	Mataró	Rural	121	65	-
1724	Caldes de Montbui	Tarragona	Rural	707	346	-
1724	Vilanova i la Geltrú	Tarragona	Rural	807	432	-
Total				13,953	4,436	2,204

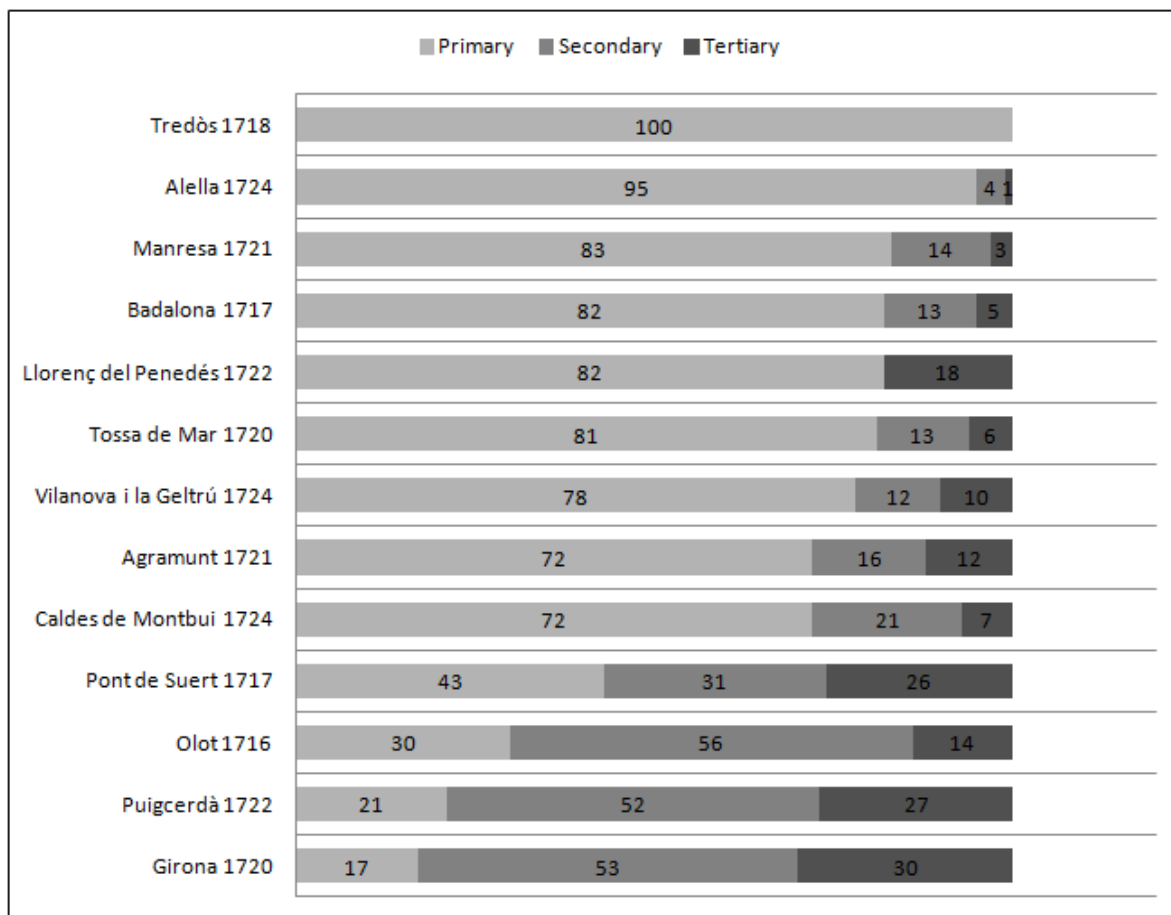
Sources: Olot 1716 municipal register ACG; Badalona 1717 municipal register AHMB; Pont de Suert 1717 municipal register AHLL; Tredòs 1717 municipal register AHLL; Girona 1720 municipal register AHMG; Tossa de Mar 1720 municipal register AHLL; Agramunt 1721 municipal register AHLL; Manresa 1721 municipal register AHM; Puigcerdà 1722 municipal register ACC; Llorenç del Penedès 1722 municipal register AHLL; Alella 1724 ACA; Caldes de Montbui 1724; Vilanova i la Geltrú 1724, ACG

To indicate whether the municipality was urban or rural, the size of each sector was used, regardless of the number of inhabitants, a criterion used by other academics for pre-industrial British localities (Glennie & Whyte, 2000, p.167-168). Thus, when the weight of the primary sector was greater, the municipality was regarded as rural. By contrast, when the weight of manufacturing and services was greater, the municipality

⁸¹ The frequency distributions of the final digit for the ages can be found in Table A.3.1 in the Appendix.

was considered urban. Other than in the case of Manresa, the rural municipalities were demographically smaller and urban municipalities had a higher number of inhabitants⁸².

Figure 3.2 Weight of activity sectors by municipality



Sources: see Table 3.1

To calculate numeracy levels according to professional category, we analysed the municipal registers that indicated occupations and used the head of the family as the unit of study. Moreover, to present the overall results, we used the male head of the family, since this indicator was common to all registers. Some registers also contained information about household wealth levels (home ownership, domestic service and the possession of draft or pack animals in the case of agricultural labourers). These were not homogenous indicators for all municipalities, but they allowed us to obtain results and assess trends in this respect.

⁸² Manresa was a highly populated locality in 1721, but it had a high percentage of primary occupations. This was to change through the 18th century with the growth of the textile sector (Ferrer i Alòs, 2012).

In three municipalities (Olot, Badalona, Girona), it was possible to show differentiated results in arithmetic capacity levels between men and women, not only in cases where widows were the head of the family, but for the whole female population⁸³. Although women's professional categories were absent, except in the case of servants, it was possible to make a guess based on the husband or father's professional activity, although we accepted that this would skew the information somewhat, since it represented a male classification. The results of female age-heaping should be treated with caution, as shown by Blum et al. (2017) for rural 19th-century Ireland. The main uncertainty with regard to female ABCC levels lies in the origin of the information contained in the registers. The debate with respect to pre-industrial periods concerned who provided ages. According to Földvári et al. (2012), men provided the age of the women in the household, since great differences were detected when the levels of married women and unmarried women were compared (Földvári et al., 2012). By contrast, other authors claim that women provided their own ages, since women had higher arithmetic capacity levels than men in some cases (Baten & Szoltysek, 2012).

3.4 Results

3.4.1 Overall results: Catalonia in the 1720s

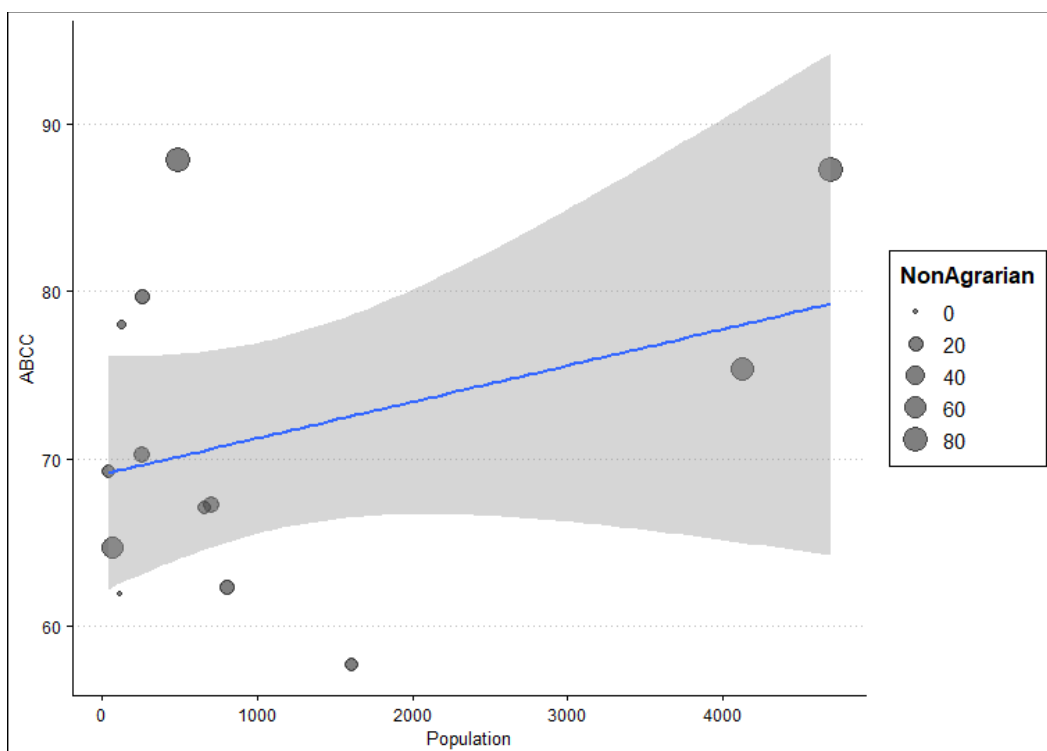
The overall results of arithmetic levels in Catalonia in the early 18th century, according to the ABCC index, are shown in Figure 3.3. There are 13 registers from around 1720. The ABCC levels of the municipalities are shown according to the size of the non-agricultural sectors in each municipality and the size of the population. Figure 3.4 reflects some noteworthy results⁸⁴. First, there was a large variation across the different municipalities. While arithmetic capacity levels were on average close to 70 at the beginning of the 18th century, the ABCC index in the 13 municipalities considered ranges from around 60 (Manresa) to 90 (Girona and Llorenç del Penedès). Second, there was a positive relationship between town size and numeracy levels. Third, the municipalities in which non-agricultural activities had greater weight seemed to have higher numeracy levels, regardless of the size of the municipality.

⁸³ Pont de Suert and Tredòs did not have enough observations ($n \geq 30$) about women to assess their arithmetic capacity.

⁸⁴ The results by municipality are shown in Table A.4.4 of the Appendix.

These results seem to indicate that, in a Catalan economy based increasingly on commercial exchanges, households were giving priority to the acquisition of basic numeracy in areas that were more dynamic. Despite the fact that formal education was very scarce in these societies (compulsory primary education came much later), attaining a better position in society, and presumably in the job market, in an increasingly open and commercial economy required people to attain a basic level of numeracy.

Figure 3.3 ABCC index by population and non-agrarian sector around 1720



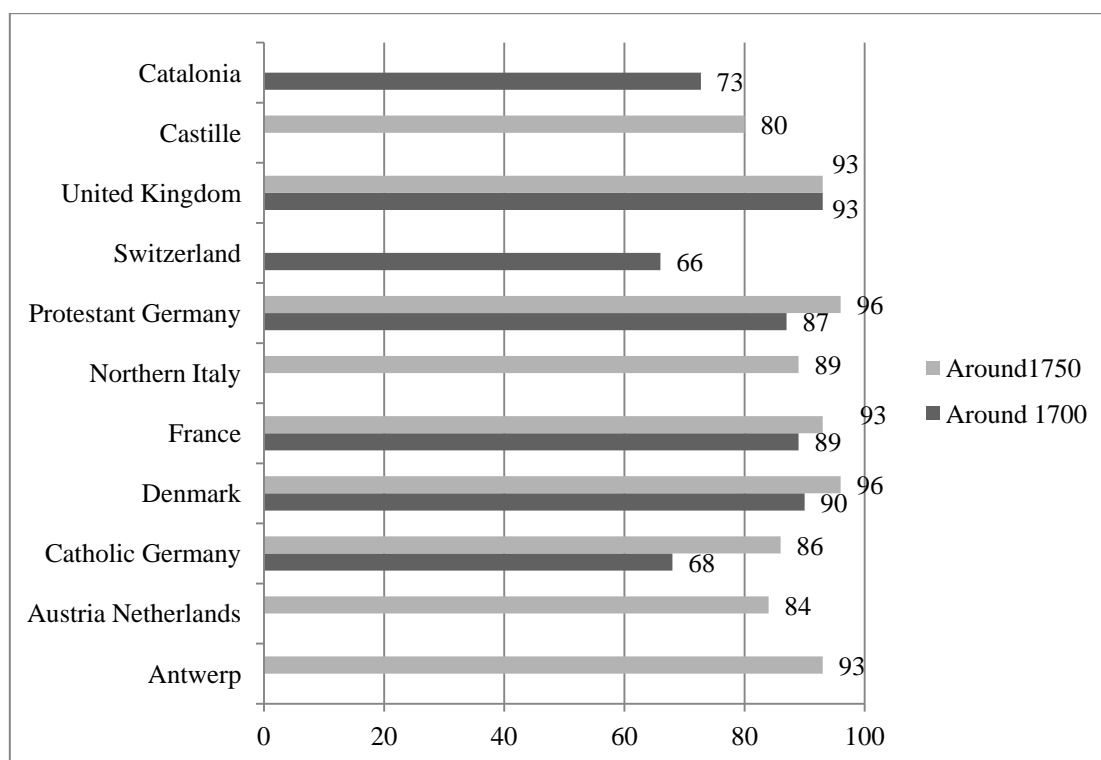
Sources: see Table 3.1

To complement these initial results, Figure 3.4 compares Catalonia with the arithmetic capacity levels in different European regions and countries around 1700 and 1750. The overall ABCC levels for Catalonia in the early 1700s are below those of Northern European regions, although they are slightly higher than in Catholic Germany and

Switzerland; furthermore, in some municipalities they do not differ markedly from the areas with the highest ABCC levels in Western Europe⁸⁵.

Another interesting comparison can be made with other areas of Spain. Compared to northern Castile in the 1750s, the average ABCC value obtained for Catalonia in the 1720s was lower (Álvarez & Ramos Palencia, 2018). However, it should be noted that northern Castile was proxied by information relating to three decades later and to the provinces of Palencia, Madrid and Guadalajara, which traditionally enjoyed the highest levels of human capital in Spain and can thus be regarded as an upper bound.

Figure 3.4 ABCC levels in different European regions between 1700 and 1750



Sources: Crayen & Baten (2010), Verhoeven (2014), Álvarez & Ramos Palencia (2018) and the author's own research (see Table 3.1)

With this in mind, it can be concluded that the results place Catalonia in a relatively good position within the context of Spain. Finally, it is important to point out the general context of the first half of the 18th century, which was characterized by a

⁸⁵ In Catholic Germany, and particularly in Switzerland, the starting level was lower but the arithmetic capacity improvement process was fast.

gradual improvement in numeracy across all European regions. As a result, some regions showed relative high numeracy levels, with ABCC indices well above 90, a level recorded only in a couple of Catalan localities (while 11 out the 13 had ABCC levels below 80). To gain more insight into the arithmetic capacity of Catalonia, the numeracy indicators for Catalonia will now be examined in more detail by looking at different economic and social divisions.

3.4.2 Results by activity sector and professional group

In Table 3.2, the individuals that make up the sample are classified according to their occupation by activity sector in accordance with the PST methodology (primary, secondary and tertiary). The results are presented separately for urban and rural towns. In rural localities, although primary sector jobs such as farming, fishing and sheepherding predominated, there were also manufacturing and artisanal occupations such as carpentry, blacksmithing and shoemaking and tertiary jobs such as medicine, pharmacy and sales. Within the secondary sector, a sub-division of these occupations linked to the textile industry also existed (e.g. knitters, tailors and peelers⁸⁶) due to their importance within Catalonia's manufacturing sector, in both urban and rural areas.

Table 3.2 also shows numeracy values by professional group in accordance with the HISCO methodology⁸⁷. Four professional groups were used, based on the level of skills, whether these were acquired through formal training or hands-on experience of a profession. This information was obtained by converting HISCO to HISCLASS codes: unskilled (occupations that require fewer than 30 days of training), low-skilled (requiring between one month and one year of training), medium-skilled (one to 10 years of training) and high-skilled (more than 10 years of training)⁸⁸. The HISCO

⁸⁶ The original Catalan term, *paraire* is not translated into other languages in the HISCO system, where it is listed as code 75540. It refers to a “peeler” of animal skins, an occupation in the textile industry, but with a level of managerial responsibility.

⁸⁷ This was compiled using the rural localities of Badalona in 1717, Pont de Suert in 1717, Tredòs in 1718, Tossa de Mar in 1720, Agramunt 1721, Manresa in 1721, Llorenç del Penedès in 1722, Alella 1724, Caldes de Montbui 1724 and Vilafranca del Penedès in 1724; and the urban localities of Olot in 1716, Girona in 1720 and Puigcerdà in 1722.

⁸⁸ There is also Armstrong's methodology for classifying the training levels of occupations, although in this study we opted for the HISCLASS system so that we could also assess social prestige and the weight of textile occupations in the secondary sector. (Armstrong, 1972). Nonetheless, Table A.4.2 of the appendices provides the results based on Armstrong's classification so as to facilitate comparisons with studies that use this methodology.

system excludes some descriptions found in municipal registers, such as nobles, widows, students and, particularly, the poor, from its professional codes⁸⁹.

Table 3.2 shows the results obtained for around 1720. The results show, first, that the arithmetic capacity in urban areas of Catalonia, with an ABCC value of 82.2, had already reached levels close to the average found in Western European countries. Second, there was a substantial urban-rural gap that year, given that rural areas presented an ABCC value of 72.7, that is, 10 points below that of urban areas. In rural municipalities, except for in the tertiary sector, workers from the primary and secondary sectors showed lower numeracy levels than those in urban localities. This finding differs from the data for Castile in 1757, where no differences were detected between urban and rural contexts (Álvarez & Ramos Palencia, 2018). However, the data also revealed that the difference in rural areas would be smaller in occupations linked to the textile industry, since rural workers in this sub-sector (78.7) had higher arithmetic capacity levels than other artisans in the secondary sector (70.4).

Table 3.2 also reveals a correlation between ABCC levels and skill levels. The higher the skills training level, the higher the arithmetic capacity level. As expected, the tertiary sector had the highest concentration of highly trained workers, in both urban and rural areas, with higher numeracy levels in urban areas. For medium- and low-skilled jobs, the urban-rural gap was also wide at around 10 points. It could be argued that, in these urban areas, where subsistence economies were rarer and trade relations more common, attaining arithmetic capacity was more necessary, except among unskilled workers.

The results suggest that numerical skills were a priority for many citizens in Catalonia. Throughout the century, Catalonia became a more open economy, subsistence agriculture was replaced by commercial agriculture and manufacturing production intensified, especially in the textile industry. In a context in which formal education was somewhat limited, it could be argued that informal education, that is, learning in the workplace, may have played an important role in the acquisition of this knowledge.

⁸⁹ These are encompassed by code -1 and are excluded from the analysis. The detail of each group can be obtained at <https://hicosdigos.wordpress.com/clasificacion-por-sector-y-subsector-de-los-codigos-hisco-3/> Grupo de Investigación Consolidado: Trabajo, Instituciones y Género” [TIG].

Table 3.2 ABCC levels by activity sector in 1720

Activity sector	Basic skills		Occupational skills				N
	(%)	ABCC 1720	Unskilled (%)	Low skilled (%)	Medium skilled (%)	High skilled (%)	
<i>Rural</i>							
Primary	70.3	72.17	58.0	12.3	29.7	0.0	1
Secondary	21.3	70.44	0.2	54.0	44.8	0.9	433
Textile	20.6	78.65	0,0	67,4	32,6	0,0	89
Tertiary	8.4	81.62	9.4	25.9	21.8	42.9	170
All rural workers	100	72.7	41.6	22.3	32.1	4.8	2
			ABCC	67.8	75.2	75.7	82.8
<i>Urban</i>							
Primary	24.8	74.03	73.2	0.4	26.4	0.0	488
Secondary	54.1	85.37	0.1	48.8	50.9	0.2	1
Textile	28	86.41	0.0	65.1	34.9	0.0	298
Tertiary	21.1	86.84	8.4	19.0	37.5	35.1	416
All urban workers	100	82.18	19.9	30.5	42.0	7.5	2
			ABCC	70.2	85.2	86.5	87.0

Sources: see Table 3.1

3.4.3 Inequality and social prestige

The conversion of HISCO codes into HISCLASS codes also made it possible to classify occupations according to the social prestige linked to professions⁹⁰. Although social prestige does not indicate income level, it does reflect the numeracy levels of the different social groups. Five groups were used: members of the elite in professions with high social prestige, such as lawyers and doctors; members of the middle class with commercial and administrative professions, such as vendors and booksellers; workers with medium- or low-level skills linked to their occupational training as artisans or guild workers, such as tailors and glove-makers; farmers or fishermen; and unskilled

⁹⁰ HISCLASS codes can be found in List 1 of the appendices.

workers such as labourers. The ABCC levels by social prestige in around 1720 are shown in Table 3.3.

The data in Table 3.3 shows that the highest arithmetic capacity levels were found among members of the elite and, above all, members of the middle class with mercantile professions and those in more urban contexts. They were already at the same level as the rest of Europe at the beginning of the century (Figure 5). The 18th century in Catalonia represented a time of transition between the Old Regime and the contemporary period, when there were signs that the traditional guild system was starting to decline and an industry was beginning to emerge that went on to develop throughout the 19th century (Torras i Ribé, 1974). The data on social prestige linked to professions reflect a social dynamic that made numeracy a necessary, though not sufficient, condition for upward socioeconomic mobility.

Table 3.3 ABCC levels by social prestige around 1720

HISCLASS	ABCC 1720	(%)	N
Elite (senior managers and higher-level professionals)	85.4	5.6	218
Lower middle class (lower-level managers, professionals, clerical and sales personnel and foremen)	92.5	6.8	250
Skilled workers (medium-skilled and lower-skilled)	76.7	45.1	1,688
Self-employed farmers and fishermen	81.1	13.1	558
Unskilled workers and farm labourers	69.1	29.3	1,282
ABCC HISCLASS	76.3	100	3,996

Sources: see Table 3.1

The results in Table 3.3 show that medium- and low-skilled workers also had relatively high skill levels at the beginning of the 18th century, not dissimilar to the European norm. These results also indicate that farmers had ABCC levels equivalent to skilled urban workers, or possibly even higher. These high levels observed in farmers as early as the beginning of the 18th century, as seen all over Europe, may have provided the

workforce with good arithmetic capacity in the rapid occupational changes that accompanied the industrial transformation in some European regions (Tollnek & Baten, 2017). The high numeracy levels among maritime professionals are also consistent with the levels among Hispanic sailors estimated by other scholars (van Lottum & Poulsen, 2011; van Lottum & van Zanden, 2014). Finally, unskilled workers and farm labourers clearly presented the lowest ABCC values, below 70, and a wide gap compared to other social groups.

To further explore this issue, we next looked at numeracy levels according to land access. A common indicator of inequality in the primary sector is land ownership. Table 3.4 shows the ABCC levels of agricultural workers on the basis of land rights (peasant farmers, market gardeners and sharecroppers) and those without land rights (labourers and farm workers) from municipal registers that contained this information for 1720 (Olot, Badalona and Girona). The results indicate that ABCC levels in primary occupations may be strongly associated with land-ownership rights (the main production factor in an organic economy), since this group already cultivated less for the subsistence economy and more for commercial exchanges. The index presents wide differences between the two groups, close to 14 points. Thus, whether or not an individual had access to land ownership is key to explaining arithmetic capacity in early 18th-century Catalonia.

Table 3.4 ABCC levels according to land ownership around 1720

Land rights	ABCC		
	1720	(%)	N
Farmers and sharecroppers	81.8	29.4	492
Labourers	67.7	70.6	1,180

Sources: see Table 3.1

Moreover, from a demand perspective, access to education could be influenced by household income level, since public education was not readily available. Given the lack of direct income level indicators, other aspects found in municipal registers make it possible to differentiate household wealth levels, such as the presence of servants. Table 3.5 indicates the ABCC values for households with and without servants in the four registers that contained this information for 1720 (Olot, Tredòs, Girona and Badalona).

Domestic service was a clear indicator of household wealth, and Table 3.5 shows that households with servants had higher levels in around 1720 (close to eight points).

Table 3.5 ABCC levels by household according to whether they had servants or not, around 1720

<i>Padrons with data on servants</i>	ABCC		
	1720	(%)	N
With servants	86.69	24.3	509
Without servants	78.85	75.7	1,609

Sources: Olot 1716 municipal register ACG; Badalona 1717 municipal register AHMB; Tredòs 1717 municipal register AHLL; Girona 1720, municipal register AHMG

Taken together, the results of tables 3.2, 3.3 and 3.4, albeit that they partially capture the numeracy levels for different occupations, social groups according to social prestige and different wealth levels, seem to indicate that access to numeracy training in pre-industrial Catalonia occurred particularly in the middle classes.

3.4.4 Was there a gender gap?

Even though it is not possible to assert with certainty that women reported their own ages in municipal registers, this section presents the results of men and women's ABCC levels separately with a view to applying these data to the debate on the gender gap in Europe during the early modern period. The heads of household in the registers were men, since they had the social prestige and legal capacity in a society that was run by men. In marital unions, however, especially among the affluent classes, those with a certain social prestige and those in a context of upward social mobility, women played an important role, since the social and economic level of the woman's family and the economic resources of the dowry she might bring were valued. In Catalonia, the figure of the *pubilla* was created in the Middle Ages to avoid dividing family estates and to retain the family's wealth. In this system, the family assets were bestowed on the eldest daughter in the absence of a son.

Table 3.6 shows the arithmetic capacity levels of men and women around 1720 for registers in which it was possible to carry out this comparison with a sufficient number of observations⁹¹. For around 1720, data are available for two urban municipalities around 1720: Olot 1716 and Girona 1720; and for one rural locality: Badalona 1717. There are differences in the levels of women and men, but these are far from the enormous disparities found in the literacy data available for 18th-century Catalonia (Antón Pelayo, 1998; Ventura i Munné, 1986). In two localities (Olot, Badalona) women even presented higher levels than those reported by men, as occurred in other areas in Europe (De Moor & Zuijderduijn, 2013; Baten & Szoltysek, 2012). The differences between male and female ABCC values might indicate that women reported their own ages. However, if we calculate only information on widows, the numeracy levels drop drastically, which could be due to the fact that male heads of household reported women's ages, as proposed by Földvári et al. (2012).

Table 3.6 ABCC levels by gender around 1720

<i>Padrons with women</i>	ABCC		ABCC	
	Men	N	Women	N
Olot 1716	75.6	840	78.8	846
Badalona 1717	67.6	185	70.1	180
Girona 1720	87.5	1,080	82.7	1,178
		2,105		2,204

Sources: Olot 1716 municipal register ACG; Badalona 1717 municipal register AHMB

With respect to widows, it should be noted that they were usually more vulnerable in terms of social protection and had less access to equal opportunities. As shown in the results of tables 3.3, 3.4 and 3.5, these factors may also have influenced the female ABCC results. The only rural municipality with data available shows that women's training in rural contexts may have been high. In the case of Girona, an urban setting, lower levels were observed for women, but the differences were much lower than in the case of literacy, and the gender debate therefore remains unresolved.

⁹¹ A sufficient number of observations is considered 30 or more.

Since the source of the information in municipal registers cannot be confirmed with any accuracy, no definitive conclusions can be drawn. However, these high arithmetic capacity levels among women do not appear so unusual in a context in which women played an important role in the household and in which Catalan civil law afforded them certain economic rights and, to a certain extent, protected their assets and kept them separate from those of their husbands (Pérez i Molina, 1988). The possible non-existence of the gender gap in numeracy levels suggests that women played a key role in the formation of human capital.

3.5 Conclusions

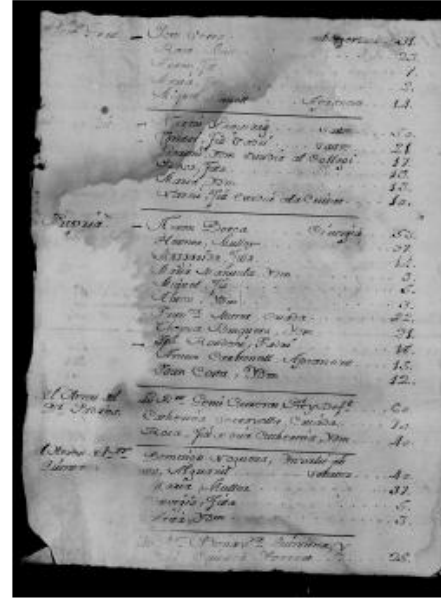
This paper examines numeracy skills in early 18th-century Catalonia by means of a source that is particularly suited to measuring age-heaping: municipal population registers (*padrons*). Information on 13 municipalities was obtained, including towns from 10 out of the 12 administrative divisions (*corregiments*) that existed in Catalonia at that time. Although these towns were home to over 14,000 inhabitants, the sample studied (people between 23 and 62 years of age) comprised around 6,700 observations. The diversity of local situations led us to exercise caution when building an overall picture, but the results obtained appeared to indicate that the level of numerical skills in Catalonia was relatively high before the Industrial Revolution. In urban areas, the levels were close to those of other European cities as early as the beginning of the century. This coincided with the period in which the Catalan economy was increasingly focused on commercial production and a trade relations model had been established.

Thus, in pre-industrial Catalonia, which was characterized by a rapid intensification process in the agricultural sector and protoindustrialization, it appears that the incentives for numerical skills acquisition were high in the 18th century. Furthermore, in a context of low investment in public education, training in the workplace and home may have facilitated access to a certain level of training and knowledge, and opportunities to this training may have been related to inequality. Moreover, despite the caution exercised with respect to the results for the female population, the fact that the values relating to women's arithmetic capacity were similar to those obtained for other European regions indicates that women may have accessed numeracy training outside of schools, particularly in rural areas.

These new findings relating to numeracy levels and human capital in Catalonia have implications for future research, and this study contributes to the debate on whether pre-existing human capital played a role in driving the industrialization process. In the case of Catalonia, numeracy levels were relatively high in the early 18th century, particularly in certain occupations and social groups. By contrast, human capital levels in Catalonia in 1860, reflected by literacy indicators, were not particularly high, although arithmetic capacity may be a better indicator of learning in the workplace. These data did not allow us to evaluate whether the human capital levels reflected by basic population indicators were important for Catalonia's subsequent growth and development. However, they do indicate that numeracy skills were already high, comparable with those of other parts of Europe, and that training must have been provided outside of the institutionalized school system. In a transforming economy, greater human capital was probably required, and Catalan society made significant progress in this sense.

Appendix

Figure A.3.1. Examples of municipal population registers (*padrons*)



Source: Page from the Municipal Register of Badalona, 1717 Source: Page from the Municipal Register of Girona, 1718

Table A.3.1 Distribution of frequencies of terminal digit of ages in municipal registers

Terminal Digit	Olot 1716	Badalona 1717	Pont de Suert 1717	Tredòs 1718	Girona 1720	Tossa de Mar 1720	Agramunt 1721	Manresa 1721	Llorenç del Penedès 1722	Puigcerdà 1722	Alella 1724	Caldes de Montbui 1724	Vilanova i la Geltrú 1724
0	23,7	24,9	33,3	34,6	12,9	17,0	16,7	17,3	4,2	34,9	20,0	33,4	27,5
1	6,3	3,2	0,0	0,0	7,8	17,9	3,2	9,9	4,2	2,4	13,9	1,5	10,0
2	6,0	15,1	9,5	11,5	8,9	5,4	7,1	2,4	4,2	8,7	16,9	7,1	8,3
3	5,2	2,2	4,8	3,8	11,2	1,8	6,3	8,4	8,3	6,7	3,1	6,2	5,8
4	9,5	8,6	9,5	0,0	9,2	6,3	11,1	2,8	8,3	11,9	3,1	9,8	7,2
5	15,8	21,1	14,3	15,4	17,1	18,8	27,0	35,8	25,0	9,1	16,9	12,4	14,4
6	11,0	7,6	4,8	11,5	10,6	18,8	5,6	2,4	4,2	13,1	6,2	8,9	12,3
7	6,2	2,7	4,8	3,8	5,8	5,4	4,8	7,9	12,5	0,8	9,2	4,4	2,5
8	11,9	9,2	4,8	7,7	8,9	2,7	4,8	5,6	4,2	9,9	6,2	10,9	9,0
9	4,4	5,4	14,3	11,5	7,7	6,3	13,5	7,5	25,0	2,4	4,6	5,3	3,0

Sources: see Table 3.1

Table A.3.2 ABCC levels by skill level with Armstrong classification in 1720

Armstrong 1720	ABCC	N	%
UNSKILLED	66,8	1138	29,8
SEMI-SKILLED	79,4	589	15,4
SKILLED	81,2	1608	42,1
NON-MANUAL	84,7	242	6,3
PROFESSIONAL	91,9	238	6,2

Sources: see Table 3.1

Table A3.3 HISCLASS codes and conversion to HISCLASS 5 codes

HISCLASS code		
1		Higher-level managers
2		Higher-level professionals
3		Lower-level managers
4		Lower-level professionals, [higher and middle] clerical and sales personnel
5		Lower clerical and sales personnel
6		Foremen
7		Medium-skilled workers
8		Farmers and fishermen
9		Lower-skilled workers
10		Lower-skilled farm workers
11		Unskilled workers
12		Unskilled farm workers
13		Unskilled workers (not specified)
-1		No HISCLASS code
HISCLASS 5 codes		
1	1 and 2	Elite (senior managers and higher-level professionals)
2	3, 4, 5 and 6	Lower middle class (lower-level managers, professionals, clerical and sales personnel and foremen)
3	8	Self-employed farmers and fishermen
4	7 and 9	Skilled workers (medium skilled and lower skilled)
5	10, 11, 12 and 13	Unskilled workers and farm workers
-1	-1	No HISCLASS code

Table A.3.4 ABCC index by municipalites

Year	Town	Type	N	N(23-62) Men	ABCC	N(23-62) Women	ABCC
1716	Olot	Urban	4.125	840	75.60	846	78.75
1717	Badalona	Rural	657	185	70.14	180	70.14
1717	Pont de Suert	Rural	74	37	65.48	-	
1718	Tredòs	Rural	116	55	62.5	-	
1720	Girona	Urban	4.696	1.080	87.50	1.178	82.66
1720	Tossa de Mar	Rural	256	112	80.36	-	
1721	Agramunt	Rural	254	126	70.44	-	
1722	Manresa	Rural	1.612	882	58.53	-	
1722	Puigcerdà	Urban	488	252	69.94	-	
1724	Llorenç del Penedès	Rural	40	24	88.54	-	
1724	Alella	Rural	121	65	78.85	-	
1724	Caldes de Montbui	Rural	707	346	64.94	-	
1724	Vilanova i la Geltrú	Rural	807	432	62.5	-	
Total			13.953	4.436		2.204	

Sources: see Table 3.1

Chapter 4. The Catalan literacy puzzle during industrialization (1860-1930)

4.1 Introduction

Contemporary theories of economic development indicate that human capital endowment is a key determinant of long-term economic growth (Romer, 1986; Lucas, 1988; Mankiw et al., 1992; Barro, 2001). However, when we refer to the origins of the Industrial Revolution the debate is more diverse. Some authors argue that it had minimal impact (Mitch, 1993; Allen, 2003; McCloskey, 2010), while others argue that it was key during the early stages of industrialization (Baten & Van Zanden, 2008; Mokyr, 2010; Becker et al., 2011). Between the two positions, there is an intermediate position that maintains that a highly qualified minority was able to implement and adapt the new technologies (Squicciarini & Voigtlander, 2015; Zeev et al., 2017).

One of the main difficulties for studying human capital from a historical perspective is obtaining homogeneous data for measuring it. The indicator most frequently used in historical studies is literacy, understood as the ability to know how to read and write, which is usually reflected in population censuses. For pre-industrial periods for which this information is not available, other ways of capturing literacy are used, for example, based on the ability to sign documents (Allen, 2003; Reis, 2005)⁹². Other alternative indicators for approximating human capital include arithmetic ability using the age-heaping method (A'Hearn et al., 2009; Tollnek & Baten, 2017) and book production (Baten & Van Zanden, 2008). Regardless of which indicator is used, Southern Europe consistently shows lower indicators than the rest of Western Europe (Cipolla, 1969). In the case of Spain, the information from the 1860 census already showed a delay with respect to Europe in terms of the literacy rate and enormous regional disparity that persisted over time (Nuñez, 1992; Beltrán Tapia et al., 2018).

Recent contributions have added new elements to show more complex situations regarding the provision and endowment of human capital, such as the debate on the effect of centralisation or decentralisation of education systems on training levels (Cappelli & Vasta, 2020b), the impact of democracy on schooling (Gallego, 2010), the effects of industrialisation on elementary schools (Montalbo, 2020), human capital accumulation and the gender gap (Cappelli & Vasta, 2020a) as well as the analysis of the historical determinants of human capital with a higher level of territorial disaggregation (Go & Lindert, 2010; Cinnirella & Hornung, 2016). In Spain, new

⁹² Male literacy ratios after 1800 in Northern Europe are close to 60%, while in Southern Europe they are over 20%, and in Eastern Europe they are over 10%.

approaches have also been used to determine how different factors affect human capital, such as the availability of common lands (Beltrán Tapia, 2013), access to land ownership (Beltrán Tapia & Martínez-Galarraga, 2018) and the role of religions (Cinnirella et al., 2020).

Inequality in human capital endowments may explain regional disparity in economic development (Becker & Cinnirella, 2020). This is particularly interesting in the case of Spain, as the historical legacy of the mid-19th century seems to have influenced educational levels at the beginning of the 21st century (Beltrán Tapia et al., 2019a, p.12). Looking at Spain as a whole, historiography has already highlighted that the provinces with the highest literacy rates in 1860 were not those that led industrialisation or those that were the most economically developed (Tortella & Núñez, 1993). For example, Catalonia shows literacy levels that can be described as modest at best; however, it was the first and main industrial centre of the Iberian Peninsula. It also became the only region of the Mediterranean that was an initial follower of the British Industrial Revolution, and in the 19th century it was considered the "factory of Spain" (Nadal, 1975; Martínez-Galarraga & Prat, 2016).

Given this apparent paradoxical situation of literacy levels with respect to the theories of economic growth in Catalonia, some authors maintain that Catalan industrialisation was made possible by the technical training of qualified workers and training in the workplace (Nadal, 1995). The acquisition of these skills would not be reflected well in literacy indicators but they would make it possible to adopt and modify new industrial technologies leading to the transition to the manufacturing system (Rosés, 1998). However, one of the difficulties of analysing the literacy level is that regional literacy data do not show the disparity that exists within provinces; for example, between rural and urban municipalities, between those that are larger and those that are smaller, or between municipalities that are industrialised and those that are not.

In this context, this article analyses the evolution of the literacy rate in the 946 Catalan municipalities between 1860 and 1930 for the first time in detail at a municipal level. This new approach, based on a disaggregated analysis of municipal data, allows us to explore the spatial and temporal evolution of literacy throughout the central years of Catalan industrialisation. Following Beltrán Tapia et al. (2019a), this article evaluates the evolution of literacy in Catalonia between 1860 and 1930 through analyses at the municipal level. This study aims to contribute not only to the debate on regional disparity in literacy through the presentation of the Catalan literacy puzzle during industrialisation, but also to offer another piece of the puzzle that will make it possible to contribute in the future to the international analysis of the historical determinants of human capital based on a greater territorial disaggregation.

A descriptive analysis of the new evidence is made differentiated into two periods. The first period covers the second half of the 19th century (1860-1900) and the second period the first decades of the 20th century (1900-1930). Although these two periods were characterised by notable progress in industrialisation in Catalonia and intense economic growth and structural change, the division of the period into two sub-periods also has a historical logic in the changes that occurred in the institutional framework. During the second half of the 19th century, from the approval of the Public Education Act or Moyano Act in 1857, financing of primary education was in the hands of the municipalities, as it always had been. However, with the turn of the century and the creation of the Ministry of Public Instruction and Fine Arts, financing was centralised and became the responsibility of the Ministry. This justifies analysing these two sub-periods separately. Moreover, the differences observed in the levels and evolutions of male and female literacy make it also necessary to analyse these separately.

After the introduction, the article reviews the literature and the main phases of literacy in Catalonia. The third section deals with the data and methodology used and presents some of the aggregate results of the study. The fourth section focuses on the analysis of male literacy through the different stages of the study period. A similar analysis is carried out for female literacy in the fifth section. Finally, the main conclusions of the article are given.

4.2 Literature review: Primary schooling and literacy in Catalonia

There are few studies on literacy levels in Old Regime Catalonia, and most are based on signing ability. Data are available for some large towns in Catalonia, such as Girona (Antón Pelayo, 1998), Igualada (Marfany, 2016), Mataró (Ventura i Munné, 1986) and Terrassa (Fernández Clarés, 2007)⁹³. These show literacy levels closer to those of Western European countries by the end of the 18th century, which are very different from the overall levels for Spain (Allen, 2003) and show a large gender difference. There are also studies for rural Catalonia for the same period that show high levels of male literacy, which suggests that it was also important to know how to read and write outside the cities (Expósito i Amagat, 2015)⁹⁴.

The literacy situation during the Modern Age is more complex than signature skills might indicate, as situations of semi-literacy or teaching through reading aloud were common

⁹³ Literacy levels in Girona in 1787 (72% of men and 43% of women), in Igualada between 1780 and 1829 (70% of men and 21% of women), in Mataró between 1796 and 1800 (63.9% of men and 24.3% of women) and in Terrassa between 1755 and 1765 (52% of men and 4% of women).

⁹⁴ There are fourteen towns in northern Catalonia, in the regions of la Garrotxa, la Selva, Osona and Berguedà.

(Expósito i Amagat, 2014). Moreover, most of the research corresponds to *Catalunya Vella*⁹⁵, which prevents it from being generalised to all of Catalonia. But these studies also show that literacy levels varied according to the occupational group, and were higher in the more qualified professions.

The reason for this is that at that time, until the generalisation of the public school network at the end of the 19th century, learning at the workplace was a key factor in the literacy process. The apprentice system facilitated access to education (Antón Pelayo, 1999; Carbonell-Esteller & Marfany, 2017), a practical training that also often implied the social need to know how to read and write. For example, in Barcelona at the end of the 18th century approximately 85% of the building workers were literate (Arranz, 1981, p.163)⁹⁶. Professionals and craftsmen in Catalonia at the beginning of the 18th century, especially in the textile sector, showed a high arithmetic ability, similar to levels obtained in other parts of Western Europe, which reflects this occupational training (Gómez-i-Aznar, 2019).

Despite the importance of training at work, another of the main literacy agents in the Old Regime was the school. Since the elites tended to have private teachers in their homes, schools were focused on children from the lower classes. In many cases, the municipalities also promoted education, paying for it so that it was free for the poorest children. However, most of the time there were insufficient places available and the opportunity costs for families to send their children were too high. Even so, during the 18th century, half of the Catalan population lived in towns that had open schools at some point in the century, whether public or private. (Burgos Rincón, 1994). Until the creation of the Ministry of Public Instruction and Fine Arts in 1900, schools had been financed at a municipal level for centuries, which resulted in a great diversity of local situations. Therefore, the approach at a municipal level is essential to be able to evaluate the issue of literacy at the level of Catalonia.

School activity during this stage, whether public or private, was under the supervision of the church. Since the Council of Trent (1545-1563), and as a response to the Protestant Reformation, the education of minors was a main objective of the Catholic Church, with the creation of various congregations (Hébrard, 1989)⁹⁷. In Catalonia, the bishops had the power to

⁹⁵ A term of historical geography referring to the territories of Catalonia where there were *remensa* farmers, and this would include the bishopric of Girona, as well as the eastern half of the bishopric of Vic and the bishopric of Barcelona to the east of the Llobregat River.

⁹⁶ The municipal government of the capital obliged the bricklayers to make delivery notes specifying the type of work, the amount and the date.

⁹⁷ In Catalonia, the two religious orders with the greatest presence in the school environment were the Capuchins with 7 schools in 1791, and the Jesuits until their expulsion in 1767, who had 21 schools, but preferably of rhetoric and grammar (secondary).

authorise teachers by means of a licence. Furthermore, as the financing depended on the municipalities, in many Catalan towns the teacher was the parish priest of the municipality in order to reduce costs. In Barcelona, during the seventeenth century, a dozen free schools of first letters were opened in convents in the city⁹⁸, but in smaller towns there were parish schools (Expósito i Amagat, 2014).

The different literacy institutions during the Old Regime (work, school, church, public authorities and family) did not play a homogeneous role in all territories and could even sometimes act in opposition to the educational drive (Viñao, 2009). This led to different situations in different areas, even when the same institution was acting. For example, in the 18th century in Catalonia the education efforts of the Jesuits were mainly aimed at training the elite and in their schools they were obliged to use Spanish as the language of instruction (Solà, 2011, p.136); however, in the same period the same order provided basic education to all children without exception in the Guaraní missions and did so in their own language (Gómez-i-Aznar, 2020).

Throughout this period, women suffered enormous discrimination in access to literacy. Private tutors were available to wealthy families, but the vast majority of women could only access education through one of the few schools for girls in Catalonia. Another way of accessing literacy was through female sewing teachers (who had a strong network and long tradition in Barcelona), or through some female religious communities. However, literacy was always complementary, since the priority was to teach work and catechism, and it was only at the end of the 18th century that reading and writing became widespread (Venini i Redín, 1990).

Throughout the 19th century, the processes of formal and informal education diversified with respect to the Old Regime and the importance of the school network increased. One factor was that workers' movements demanded access to education. Another factor was that the liberal governments of the first half of the nineteenth century tried to implement the bases of an education system that would allow the desired reforms to be carried out. It was at the beginning of the nineteenth century that the tendency towards centralisation and uniformity in education was reaffirmed⁹⁹. The 1838 "Law authorizing the provisional submission of a Primary Education Plan" already indicated that the management of basic schooling was the responsibility of the Ministry of the Interior and even empowered it to expel local teachers.

⁹⁸ They were promoted during the bishopric of Josep Climent (1766-1775).

⁹⁹ During the previous century, there was already a trend towards standardisation through the Royal Decree of Aranjuez (1768), which imposed the Spanish language on all education, and the approval in 1760 by the Royal Court of the ordinances of the *Germandat de Sant Sebastià* (an institution that brought together Catalan teachers), establishing the requirements for educators.

However, the administration did not have the financial resources to develop these projects beyond statistical control, and inspection visits show that schools lacked material resources and the teacher competence levels were very irregular (Gurrera and Lluch, 2005). This left it up to local corporations and their resources to invest in education¹⁰⁰. In Catalonia, during the first half of the 19th century, municipalities allocated a significant part of their budget to trying to meet the needs of primary education (Casas, 1996, p.107)¹⁰¹. Some city councils established specific taxes to finance schools, for example in Vic, where the council applied a tax on meat consumption for providing funds for education (Godayol Puig, 2006).

In 1857 the Public Instruction Law (LIP), also known as the Moyano Law, was passed. The main interest of the LIP was university education, leaving elementary education unattended (Núñez, 1992, p.213). Although this law made primary education compulsory and free, in practice this was still at the expense of the financial capacity of the municipalities. This meant that the application of this law was problematic and very disparate between municipalities due to the town councils and provincial councils lacking resources. The State itself was aware of the impossibility of properly financing primary education from the local corporations because the reform of the local finances in 1845 had reduced their autonomy and increased their expenditures (Comín, 1996, p.193)¹⁰². Otherwise, it was a law that centralised all provisions and did not recognise any other language other than Spanish. In Catalonia, this led public school teachers to have a pragmatic attitude, as they needed Catalan in their classes, and they became more aware of the importance of their own language and culture (Solà, 2011, p.167).

It is in this complex environment of high political instability of the second half of the 19th century that municipal initiatives arose to try to meet a growing demand for education. Thus, in the industrial city of Sabadell, in 1862 the *Casino Industrial* organised evening classes for workers; in 1863 the city's *Institut Industrial* proposed the creation of technical textile training; and in 1872, its Town Hall asked for permission to create an industrial school for the workers' children (Solà, 2011, p.171). These actions were promoted by local elites and show a need for training for the factory system. Their antecedents can be found in the 18th century with the network of schools of the *Junta de Comerç* (Monés i Pujol-Busquets, 1987). This diversity of local initiatives contributed to the very heterogeneous literacy levels during this period at the territorial level.

¹⁰⁰ The liberal revolution in Spain did not generate the most suitable institutional framework for either elementary education or the industrialisation process (Gutiérrez-Poch, 2018).

¹⁰¹ Casas estimates that medium-sized municipalities spend 21.20% of their budget on primary education, with small and large municipalities spending about 15%.

¹⁰² With the 1845 tax reform, the municipalities obtained their funds from three major contributions: the territorial, the industrial and the consumer. At the same time, specific taxes disappeared, such as the one mentioned in the text on meat that financed education in Vic.

Another element to take into account in the case of Catalonia since the mid-19th century, as in other parts of Europe, is the institutions that provided education to the working classes beyond the school environment. Of particular note are the athenaeums, which were institutions that disseminated culture and which in many cases had a library and a school. There was also the choral movement promoted by Anselm Clavé, which involved educational and social activity through a popular associative current that reinforced mutualism when workers' associations were banned in 1856 (Carbonell i Porro et al., 1995).

In Catalonia the phenomenon of textile colonies must also be taken into account for this period. Although they also occurred elsewhere in Europe, nowhere was there such a density of industrial colonies as in Catalonia, which led to the industrialisation and urbanisation of rural municipalities during the last four decades of the 19th century. Based on self-sufficiency in production, the creation of an industrial colony involved setting up a school for the children of all the workers, and providing night schooling (Serra i Rotés, 2011). Training was part of the production model and was necessary for professional advancement.

The Ministry of Public Education and Fine Arts was created at the beginning of the 20th century, which would be responsible for the educational system from 1900 to 1936. From 1902 onwards, elementary education became the responsibility of the General State Budget, with the declared objective of investing in it homogeneously and not at the expense of the financing capacity of the municipalities¹⁰³. Therefore, in the period studied, two major cycles in the literacy process can be distinguished. The first goes from the promulgation of the Moyano Law in 1857 to the creation of the Ministry of Public Education and Fine Arts in 1900. The second cycle runs from this date until 1936, when the Spanish Civil War broke out.

However, in Catalonia, other factors must also be taken into account in this last period. At this time of tension over the control of teaching and the secularisation of the laws between the Church and the State, the "Escola Moderna" movement appeared, which advocated pedagogical renewal¹⁰⁴. Promoted by Ferrer i Guàrdia, it defended a public and secular school. The first school of this movement was opened in 1901, and in 1905 it already had 147 centres in the province of Barcelona (Cappelletti, 1980, p.30). However, with more conservative postulates and defending denominational education, religious schools also proliferated in the first decade

¹⁰³ Other improvements were made during this period to promote schooling and correct infrastructural deficiencies, such as extending compulsory education to 12 years. The School of Higher Education for Teachers was also created in 1909, from 1910 women were guaranteed the right to enrol in any official study, and the General Directorate of Primary Education was created in 1911.

¹⁰⁴ Its main innovations were the co-education of the sexes, the importance of play in the educational process and individualised teaching based on the evolution of the student. Its success spread throughout Spain (Solà, 2011, p.213).

of the 20th century, especially in the city of Barcelona, when the secularisation of the Third French Republic forced many religious orders to move and found schools in Spain (Canellas Julià & Toran, 2013).

Another element to consider is the work of the Mancomunitat de Catalunya. Created in 1914 by grouping the four Catalan councils, it modernised communications, social services and cultural and educational institutions. As well as creating a network of public libraries, the Mancomunitat managed a network of 32 schools (Mateu, 2015)¹⁰⁵. Other initiatives linked to educational proposals for the pedagogical renewal of Catalanism also emerged, such as the network of schools related to the “*Associació Protectora de l’Ensenyança Catalana*”¹⁰⁶; or those linked to the bourgeoisie and the wealthy Catalan classes, such as the Mont d’Or schools, and which would have a great influence on later educational trends (Canellas Julià & Toran, 2013). The importance of public schools and educational initiatives that were not controlled directly by the central government, precisely in order to compensate for the insufficient number of teachers and educational centres of the State itself, especially in the province of Barcelona, was recognised by the Minister of Public Instruction himself in a parliamentary session (*Diario de sesiones de Cortes. Congreso de los Diputados. Sesión 14 de diciembre, 1906, p.4570-4571*)¹⁰⁷.

Another factor to be taken into account in the evolution of literacy during the period under study is that child labour became prohibited. Although the Benot Act of 1873 regularised work in workshops and teaching children in schools for both sexes, it was never applied. However, from 1900, with the enactment of a new law¹⁰⁸, regulation in this area began to be applied despite opposition from employers, who defended child labour on the grounds that it supplemented the subsistence wages of working families (Borrás Llop, 1995). In industrialised regions, such as

¹⁰⁵ The *Mancomunitat* also promoted a quarterly publication on educational issues (*Quaderns d’Estudi*) and encouraged summer teacher training schools that disseminated the Montessori method.

¹⁰⁶ The *Associació Protectora de la Ensenyança Catalana* (APEC), popularly known as the Protectora, was an organisation founded in 1898 by the pedagogue Francesc Flos i Calcat with the aim of promoting the Catalan school model according to modern pedagogical trends. In 1923, before the arrival of the Primo de Rivera dictatorship, it had more than 10,000 members, subsidised schools and gave scholarships to pupils.

¹⁰⁷ “... thousands came to light, and I have the statistics here, thousands of establishments of all kinds that had long been open and dedicated to teaching, without the public authorities having the slightest knowledge of the founders, the programmes, the teachers, their constitution or their orientation in the work of teaching... Official education in Spain is very deficient in all areas, but more especially in primary education establishments, and there are not enough schools as required by law, nor the number of teachers required, nor does the State devote all the necessary attention to supporting the educational establishments responsible for raising the level of national culture;... Are there enough schools to teach our illiterates; is the entire school population locked up in official establishments? No... Are the innumerable schools run by the associations, and the workers’ atheneums, and the republican associations and atheneums, and the charitable associations and atheneums, which are not religious, and that all the schools that are named after lay people are anarchist schools?...”

¹⁰⁸ Law “on the work of women and children in industrial and commercial establishments”. The law also prohibits night work by children under 18 and is enforced by the Institute of Social Reforms.

Barcelona and its hinterland, new restrictions led to married women (Camps, 1997) substituting children in the workplace, and consequently an increase in schooling possibilities.

Finally, when examining education in Catalonia during this period, it should be kept in mind that, in the analysis of an industrialised city with rapid demographic growth since the 19th century, like Sabadell, it is argued that the dual economy model (Lewis, 1954) did not operate in the Catalan context of the 19th century or during the beginning of the second technological revolution (Camps, 1995). This has important implications for human capital levels as it shows that the industrial model of that period required high levels of qualification and that migratory flows in Catalonia consisted, above all, as in all of Europe, of intraregional movements of a highly qualified population. The cases of Igualada (Marfany, 2001), Manlleu (Llonch & Sancho, 1990) and Olot (Simon i Tarrés, 1996) show that migratory movements to industrial areas during this period were not only rural but were largely caused by immigration from traditional manufacturing centres in decline.

4.3 Data, methodology and a general overview of literacy rates in Catalonia (1860-1930)

This paper uses data on the education level in Catalan municipalities from the population censuses of 1860, 1900 and 1930 (Beltrán Tapia et al., 2019a)¹⁰⁹. The 1860 census is considered to be the first modern population census that also contains statistical data on education¹¹⁰, and was conducted by the Kingdom's Statistical Commission. This same institution, under the name of Directorate General of the Cartographic and Statistical Institute, produced the 1900 census. In 1930, the Geographic and Cadastral and Statistical Institute made the third census used here. These three time periods allow us to assess the Catalan literacy situation prior to the Moyano Law (1860), the educational effects of this law throughout the second half of the 19th century (1900) and the effects of the creation of the Ministry of Public Instruction during the first three decades of the 20th century (1930).

Population censuses provide literacy data for the whole of Spain and for this reason they have been used in different studies on human capital, although the data used are mostly at a provincial level (Núñez, 1992). However, the censuses also provide information on literacy on a municipality-by-municipality basis. Using these censuses is a recent initiative in Spain and allows new approaches and results to be obtained (Beltrán Tapia et al., 2019a). The population

¹⁰⁹ I would like to thank Francisco J. Beltrán Tapia, Alfonso Díez-Minguela, Julio Martínez-Galarraga and Daniel A. Tirado for providing the data for the study.

¹¹⁰ There were previous educational statistical initiatives but the lack of continuity and homogeneity of the series complicates comparisons (Guereña et al., 1994; Guereña & Viñao, 1999).

censuses contain information on the number of people who "can read", "can read and write" and "cannot read", as well as the total population, for each municipality¹¹¹. This makes it possible to calculate the percentage of the population that is literate (that can read and write), further broken down for men and women. The most common measure of literacy excludes people in the process of being educated, and therefore, the literacy rate is usually calculated on the population over ten or fifteen years of age. This is not possible in this case, since information on age groups is not available in the municipal census and so minors cannot be excluded. Therefore, literacy calculations have to be made on the total population.

In Spain, and consequently in Catalonia, the Law of Town Halls of 1845 defined the basic characteristics of most of today's municipalities (Burgueño & Gras, 2014, p.12)¹¹². Even so, during the period studied, the number of municipalities was reduced, as can be seen in Table 4.1. This decrease requires a homogenisation process to make it possible to compare the entire period studied, as well as graphically represent the indicators for the current municipalities¹¹³. The territorial distribution of the 2001 population census of the National Institute of Statistics (INE) was used to see the correspondence between the current municipalities and those existing in 1860, 1900 and 1930. The municipalities that appear in the three censuses used have been assigned the current INE code of the current municipality to which they belong, according to Appendix 2 of Goerlich Gisbert et al. (2006) and the information provided in the INE document "*Variaciones de los municipios de España desde 1842*" (Administraciones Públicas, 2008).

Table 4.1. Evolution of the number of municipalities in Catalonia.

Province	1860	1900	1930	2001	Area (km ²)	Municipalities Area (km ²)
Barcelona	327	318	308	311	7,728.2	24.8
Girona	251	247	249	221	5,909.9	26.7
Lleida	325	325	320	231	12,170.5	52.7
Tarragona	186	185	185	183	6,302.9	34.4
Total	1,089	1,075	1,062	946	26,201.6	(average) 34.65

Source: Population censuses & Beltrán Tapia et al. (2019a)

¹¹¹ The 1900 and 1930 censuses include a fourth group ("Not recorded") but the size of this category is very small (0.11% in 1900 and 1.15% in 1930). In addition, the 1860 census only gives the de facto population (the population regardless of whether it is registered in the place where it is located), and not the de jure population (the population registered in a certain place), so the former was used.

¹¹² The law was contrary to municipal smallholdings and required a minimum of 30 residents (150 inhabitants) to retain the town hall. José Matías Bermar, the civil governor of Lleida, published as an exposition of the reasons for the Law that "Without its own resources to attend to the expenses attached to the character of the city council, without a school, without a secretary or instruction in the councillors to make up for the lack, nor even intelligence to understand the Spanish language, the efforts of the Government of His Majesty would always be fruitless". (Burgueño & Gras, 2014, p.148).

¹¹³ The homogenised data for Catalonia come from Beltrán Tapia et al. (2019a).

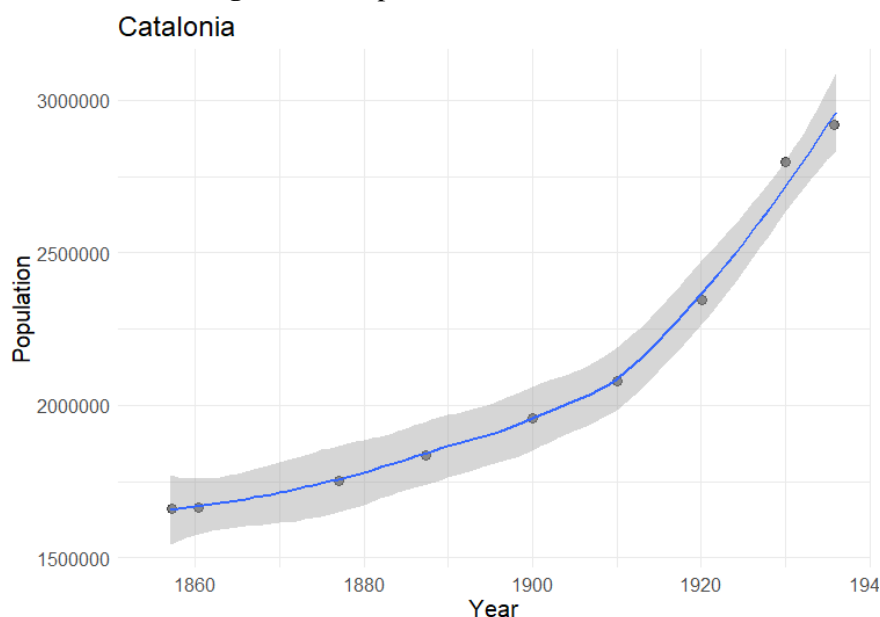
The reduction in the total number of municipalities over time is the result of aggregations, mergers and segregations. Converting the 1,089 municipalities from 1860 to the 946 existing in 2001 required creating a series of pseudo-municipalities, where entities that have been part of the same municipality at some point during this period are grouped together. Thus, when the municipality did not exist in the period studied, and was created as a segregation of another municipality, then a pseudo-municipality has been created to include the two entities that made up the municipality. For example, La Palma de Cervelló was separated from Cervelló at the end of the 20th century. To avoid the loss of information, a pseudo-municipality has been created to include both. In total, 27 pseudo-municipalities were created, encompassing 62 municipalities (see Appendix Table A.4.1)¹¹⁴.

The first census that collected information on elementary education was that of 1860, and from then on this information was systematically collected in subsequent censuses. Figure 4.1 shows the evolution of the population of Catalonia from that date until the end of the Civil War, a period marked by the advance of industrialisation, important economic dynamism and also by the relevant educational reforms on a national level mentioned previously. Although there was population growth throughout the period, an acceleration of this can be observed from 1910 onwards, which also occurred throughout Spain (Nadal, 1971, p.204). This factor needs to be taken into account, as a growing population puts greater pressure on primary school provision.

Population growth in Catalonia was concentrated around the area of Barcelona, as the influx of immigrants to this area increased, while in the other territories the growth of the provincial population stagnated or slowed down. Given the continuous reduction in fertility in this period, the contribution of the migratory balance was decisive in this growth (Nadal et al., 2012, p.76). Until 1914, most of this migration came from the other three Catalan provinces. From this date until 1930 the bulk came from these, plus the provinces that made up the former Crown of Aragon, Murcia and Almeria (Silvestre et al., 2015). Unfortunately, the information provided by population censuses does not allow us to determine the influence of migration on literacy levels.

¹¹⁴ There are 11 for Barcelona, 6 for Girona, 7 for Lleida and 3 for Tarragona. The 946 municipalities, once the groupings in pseudo-municipalities have been created, are now in 911 municipalities.

Figure 4.1: Population of Catalonia, 1850-1936



Source: Population censuses

Table 4.2 shows the evolution of literacy percentages in Catalonia for the three censuses used in this paper. The starting values are low both for men and especially for women. Less than a third of men could read and write in 1860 and for women the percentage was not even 10%. However, in both cases, there is an overall improvement in the two periods analysed, although it is proportionally higher between 1900 and 1930. Nevertheless, this general positive evolution was not homogeneous in all the municipalities and there was a large variety of situations, as will be seen when the periods are analysed specifically.

Table 4.2 Literacy rates in Catalonia, 1860-1930

Literacy rate (%)			
Census year	Men	Women	Total
1860	30.56	8.87	19.77
1900	48.27	31.57	39.81
1930	74.27	64.51	69.26

Note: Literacy rate calculated as the proportion of the population that could read and write over the total population

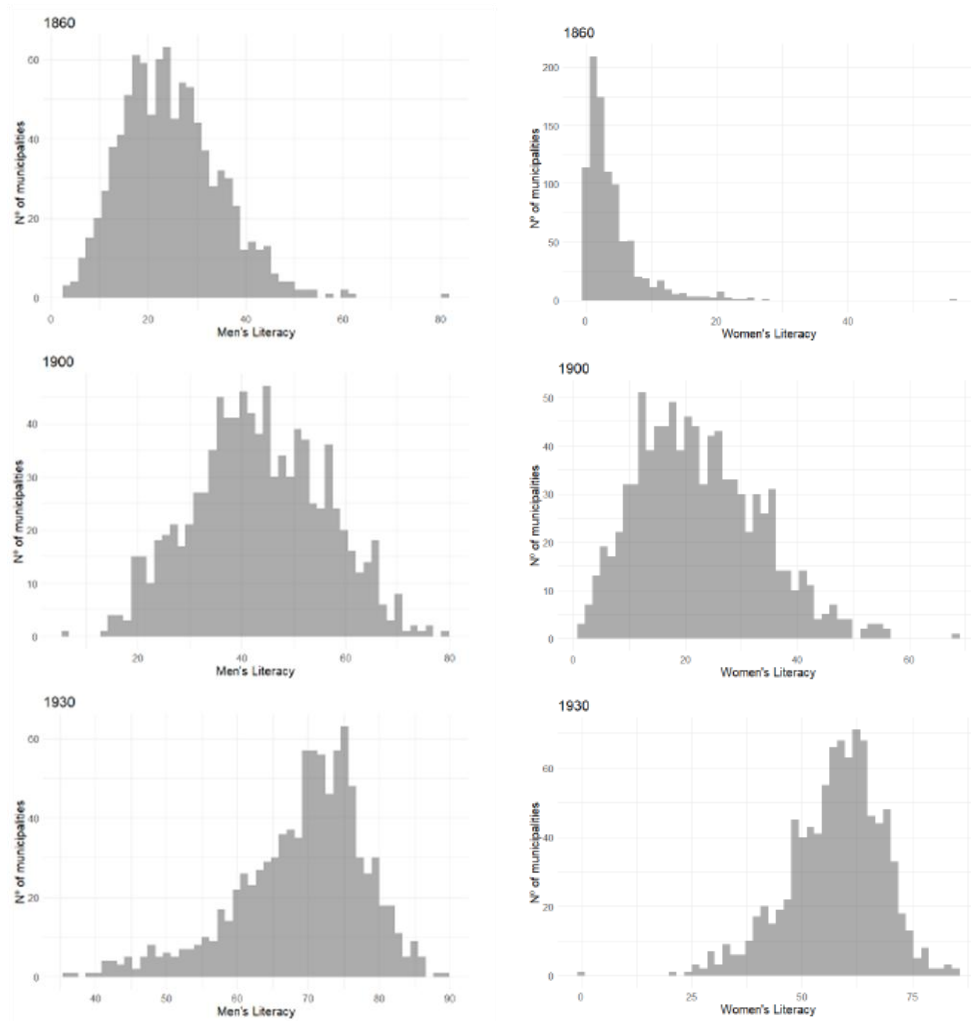
Source: Population censuses

To complement this overview, Figure 4.2 shows the histograms of the literate population in the three time periods used: 1860, 1900 and 1930. The cuts are grouped in 2% bars, which show the number of municipalities aggregated according to literacy level, differentiating between men and women. In the case of male literacy, it can be seen that the bulk of the observations is

around an average of 20%. From that point, there is a clear improvement between 1860 and 1900, as shown by the progress towards the right of the distribution, which continues between 1900 and 1930. Overall, the shift in distribution to the right is indicative of the progress made in literacy in Catalonia during the seven decades (of intense industrialisation) that make up this study.

In the case of female literacy, there is also clear progress, especially given the low starting level. In fact, the singularity of the evolution of female literacy, much more marked than in the case of men, means that the analysis of the evolution of municipal literacy in these key years of the Catalan economy must be considered separately for men and women. In what follows, the analysis focuses on male literacy (section 4), and then the evolution of female literacy (section 5).

Figure 4.2 Histogram for male (left) and female (right) literacy rates in Catalonia, 1860-1930



Note: The histogram distributes the municipalities into 2% bars

Source: Population censuses

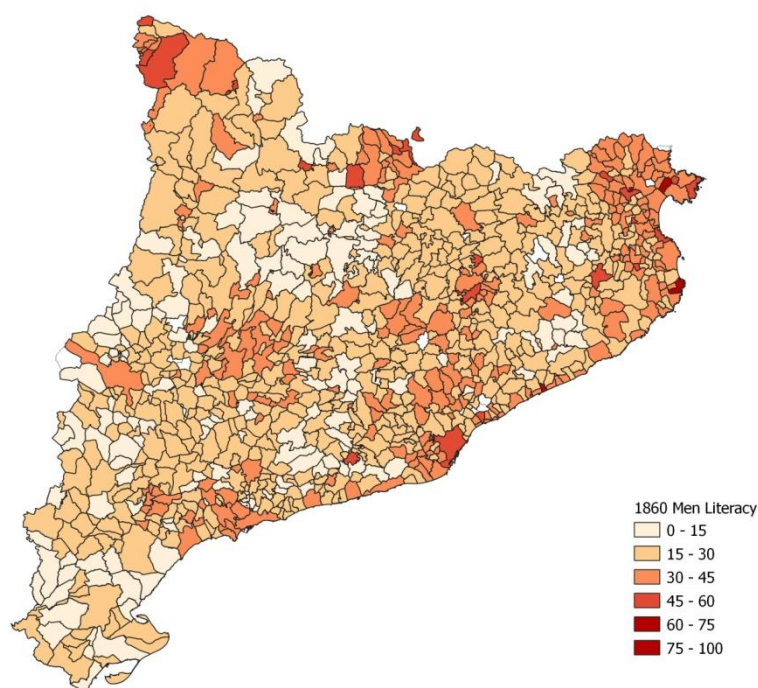
4.4 Male literacy rates in Catalonia at the municipality level (1860-1930)

4.4.1 Literacy rates in 1860: the legacy of the past

In order to deepen our understanding of the territorial patterns of Catalan literacy, a descriptive analysis of the new available evidence is carried out below. An analysis is first made of the male literacy rate at municipal level for Catalonia as a whole. Figure 4.3 shows the percentage of men who could read and write in 1860 for each of the Catalan municipalities, which allows us to observe in great detail the geographical distribution of literacy. The map of 1860 therefore provides the initial image from which the application of the Law of Public Instruction or "Moyano Law", approved in 1857, began to take effect.

The results show significant differences in municipal literacy levels. This marked diversity in the central decades of the nineteenth century implies that the origin of the differences in human capital endowment can probably be found in the pre-industrial periods. In general terms, the city of Barcelona and its surroundings, Girona, the regions of Empordà, Osona, la Cerdanya, el Vallès Occidental, el Bages, el Maresme, the area between the cities of Tarragona and Reus, la Segarra, l'Urgell and la Vall d'Aran are the areas which concentrate municipalities with the highest levels of literacy, with rates of over 45%, and in some cases even over 60%. In contrast, many municipalities in Catalonia, those marked on the map with a lighter colour, mainly in inland areas and to the south, were still below 15% (or between 15-30%).

Figure 4.3 Male literacy rates in Catalonia, 1860



Source: Population census of 1860

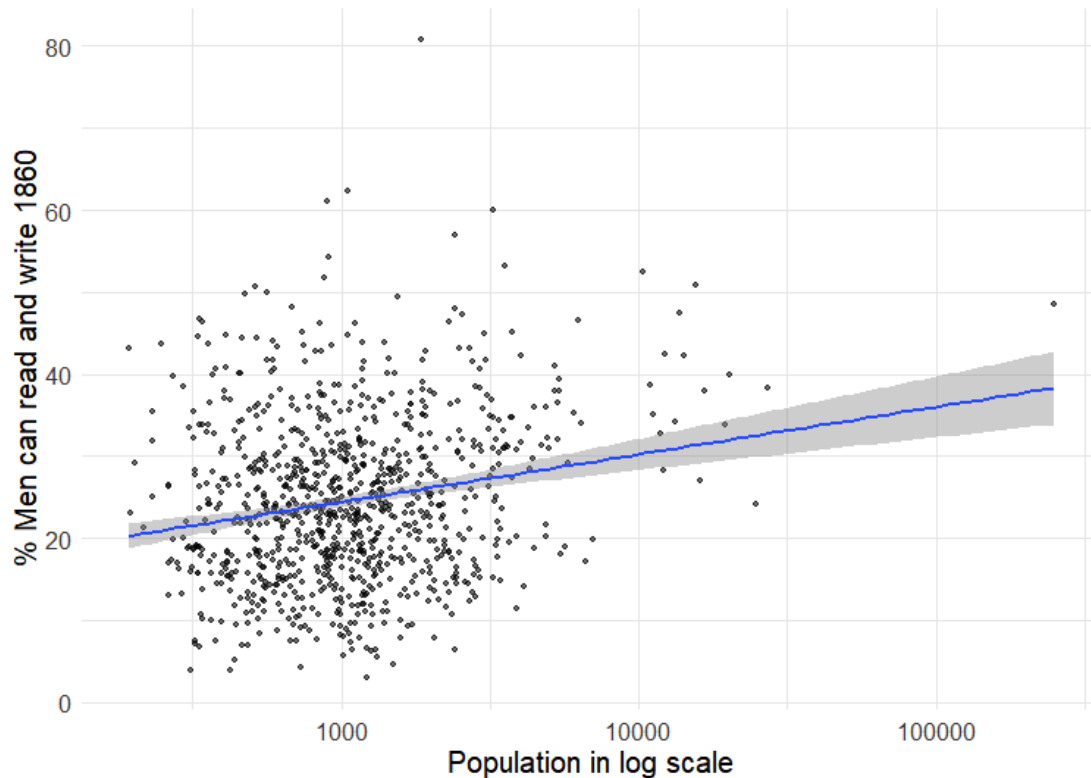
The diversity of situations appears, however, as a remarkable feature, making it difficult to establish a clear geographical pattern. For example, the map shows that the dichotomy between literate urban environments and non-literate rural environments did not always occur. There are rural areas with high levels of literacy (especially on the Costa Brava and the Vall d'Aran) and urban areas with lower than average levels, such as Tortosa. In addition, the diversity of characteristics and sizes existing among the municipalities with higher levels of education, makes it difficult to establish any pattern that explains the differences in this regard. However, basing the analysis on municipal information rather than provincial data allows us to tackle this complexity in greater detail, and begin to consider possible causes of this plurality.

To do this, firstly it was evaluated whether in the case of Catalonia there was a relationship between municipal size and literacy in 1860. Figure 4.4 shows the percentage of men who could read and write in relation to the size of the municipality in terms of population in that year. The results show that there is a positive relationship, as indicated by the trend line, although the degree of dispersion of the point cloud is high¹¹⁵. In other words, the largest municipalities and cities were home to the majority of the literate population. It is therefore possible to hypothesise that since the Catalan economy was already fully immersed in the process of industrialisation, this relationship could be because, as found in the literature, the industrial and commercial activity was mainly carried out in the urban centres, where the elite resided, making literacy levels higher in these centres¹¹⁶.

¹¹⁵ The positive correlation exists even if the calculations are made excluding the city of Barcelona (which had a literacy rate close to 50%). Therefore, the size of the Catalan capital would not be skewing the sample.

¹¹⁶ It should also be considered that there may be a bias in urban centres as a result of selective migration of adult men; however, as discussed above, this is not captured in the censuses.

Figure 4.4 Male literacy rates and size (log scale) in Catalonia, 1860

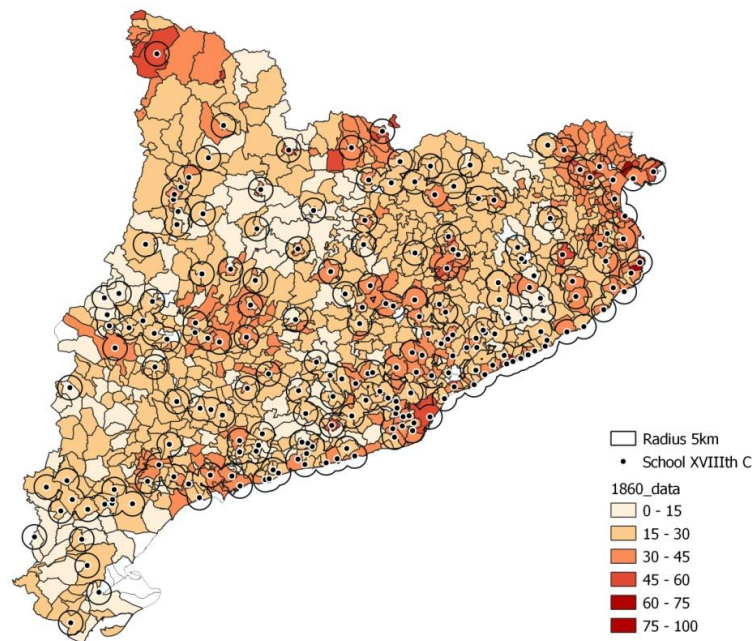


Source: Population census of 1860

Some of the reasons for the local disparity in literacy levels in 1860, as noted, could be rooted in the legacy of the Old Regime. The educational infrastructure prior to the Law on Public Instruction is a factor to be taken into account as an explanatory cause. This infrastructure was very heterogeneous in the territory, partly because the school network depended on the financing capacity of the municipality. Figure 4.5 shows the information referring to male literacy in 1860 crossed with the school network existing in the 18th century. The data on the school network in this period come from the work of Burgos Rincón (1994), which includes those municipalities that had a primary school between 1730 and 1800¹¹⁷. The map shows that most of the municipalities that had the highest male literacy rates in 1860, had schools for men during the 18th century or were less than 5 kilometres away from them, thus establishing a possible link with the past due to the previous provision of educational infrastructures.

¹¹⁷ Burgos combines data from three sources: the interviews with Francisco de Zamora about the schools, collected by Lloret i Carbó (1991); the references by Zamora himself in his Diary of journeys made in Catalonia; and, finally, the documentation of the Royal Court of the Archives of the Crown of Aragon (ACA).

Figure 4.5 Male literacy rates in 1860 and municipalities with a school in the 18th century.



Source: Population census of 1860 & Burgos Rincón (1994)

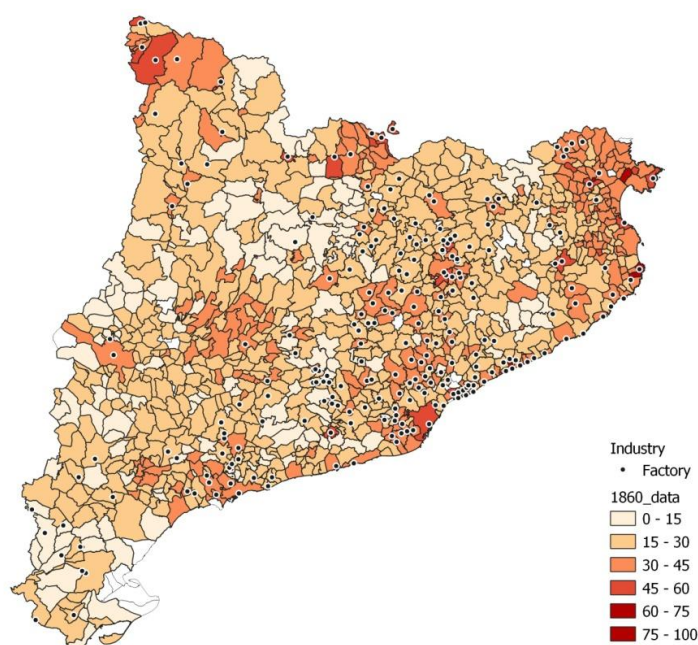
This geographical distribution of literacy occurred in a context in which Catalonia in 1860 was already a territory where early industrialisation had taken place. In 1841, Laureà Figuerola, after visiting primary schools in the province of Barcelona, found that the number of schools depended on geographical and communication factors. In particular, he showed that industrial and irrigated agricultural areas were more likely to have schools, and consequently higher levels of literacy (Solà, 2011, p.165). However, he warned that the children of agricultural labourers had less access to schools than landowners, and that child labour in factories carried the risk that children would not attend school as observed in the inspections (*Boletín Oficial de Instrucción Pública. Tomo III*, 1842, p.455)¹¹⁸. With regard to irrigation, the data provided on the typology of crops in Catalonia in the first half of the 19th century (Garrabou & Ramon-Muñoz, 2011; Ferrer & Alòs, 2019) show that market garden crops were concentrated in two large areas of irrigated land, the most extensive in the Ponent regions (Segrià, Pla d'Urgell, Noguera, Urgell and Garrigues) and another area in the Ebro lands (Montsià and Baix Ebre). Although a more detailed study on a local scale is necessary, the results do not seem to point to a coincidence between the areas of Catalonia with irrigated land and the existence of greater literacy; although

¹¹⁸ In the specific case of the municipality of Centelles it affirmed that the "factories leave the schools empty".

the export dynamics of some localities with certain primary products (wine and cork) should also be considered.

In contrast, if we look at Figure 4.3, the hypothesis that areas with industry would be better endowed with human capital seems plausible. Figure 4.6 relates the levels of male literacy and the process of industrial development. On the map of male literacy levels in 1860, those municipalities where industry was more present are indicated based on the industrial data of 1861 provided by Giménez y Guitied (1862)¹¹⁹. The location of these industries and their connection with the manufacturing centres of the 18th century led historiography to conclude that the protoindustry could have provided the new Catalan factories with the human capital necessary to adopt and modify the new technologies. Training, however, was not based on schooling but rather on learning at work (Rosés, 1998). As can be seen in the resulting figure, the municipal information shows that, although not all the municipalities with high levels of literacy had industry, in general, those that had industry were located in municipalities with high literacy levels. The results of Figure 4.6 suggest that in Catalonia industrialisation could have increased the demand for school training, and that schooling and work training could have been more complementary than has been suggested.

Figure 4.6 Male literacy rates in 1860 and ‘industrial’ municipalities in 1861



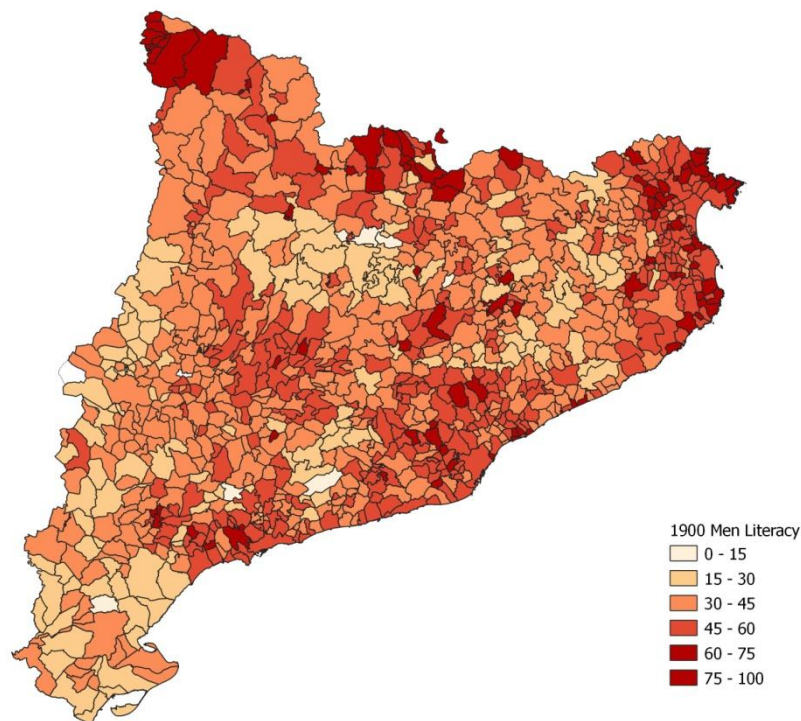
Source: Population census of 1860 and Giménez i Guitied (1862)

¹¹⁹ Specifically, these are data for the entire textile industry, the leather and tanning industry, the paper industry and the cork industry, to which the coral factories have been added (Ferrer i Alòs, 2017).

4.4.2 From 1860 to 1900: a geographically even progress of literacy rates

Figure 4.7 shows the male literacy rates for 1900. A general improvement can be observed in all municipalities. Progress in the second half of the 19th century in Catalonia was remarkable. In a general context in which the Catalan male population went from a literacy rate of 30% in 1860 to one of almost 50%, we can see that there are many areas where the values were above this value. The coastal area (except for the southernmost tip of the Terres de l'Ebre), the areas around the capitals of Barcelona, Tarragona and Girona, inland areas, and the mountainous areas in the Pyrenees stand out due to their darker colouring, i.e. due to their higher literacy rates.

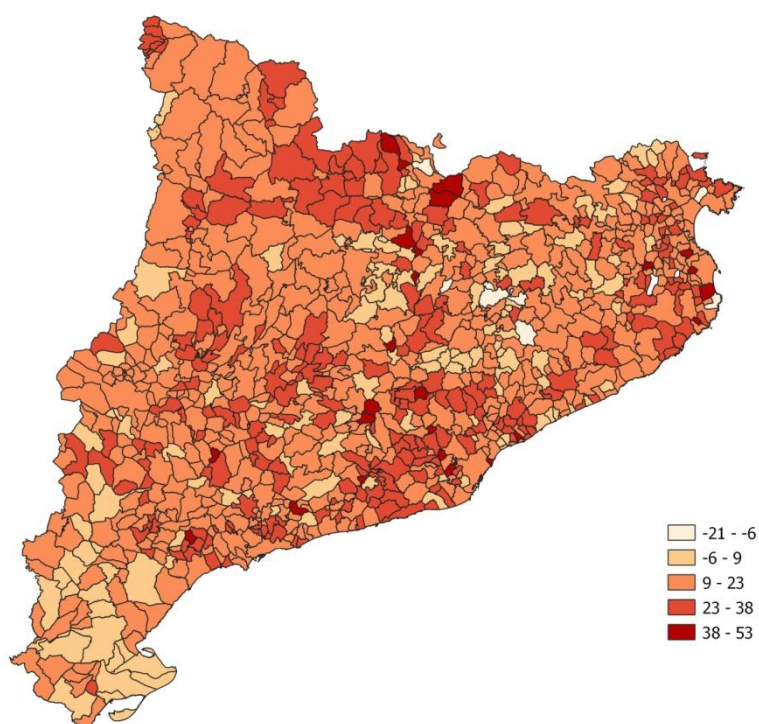
Figure 4.7 Male literacy rates in Catalonia, 1900



Source: Population census of 1900

To assess the change produced from 1860 to 1900, Figure 4.8 illustrates the increase (and in some cases the decrease) in percentage points of the male literacy rate between these two years for all Catalan municipalities. The map shows that the improvements are more intense in the urban areas of the coast, but there is also a substantial improvement in scattered municipalities in central Catalonia and in the mountainous areas of the north. In contrast, the southernmost areas and some scattered municipalities in inland Catalonia made the least progress during the second half of the 19th century.

Figure 4.8 Growth in male literacy rates in Catalonia, 1860-1900



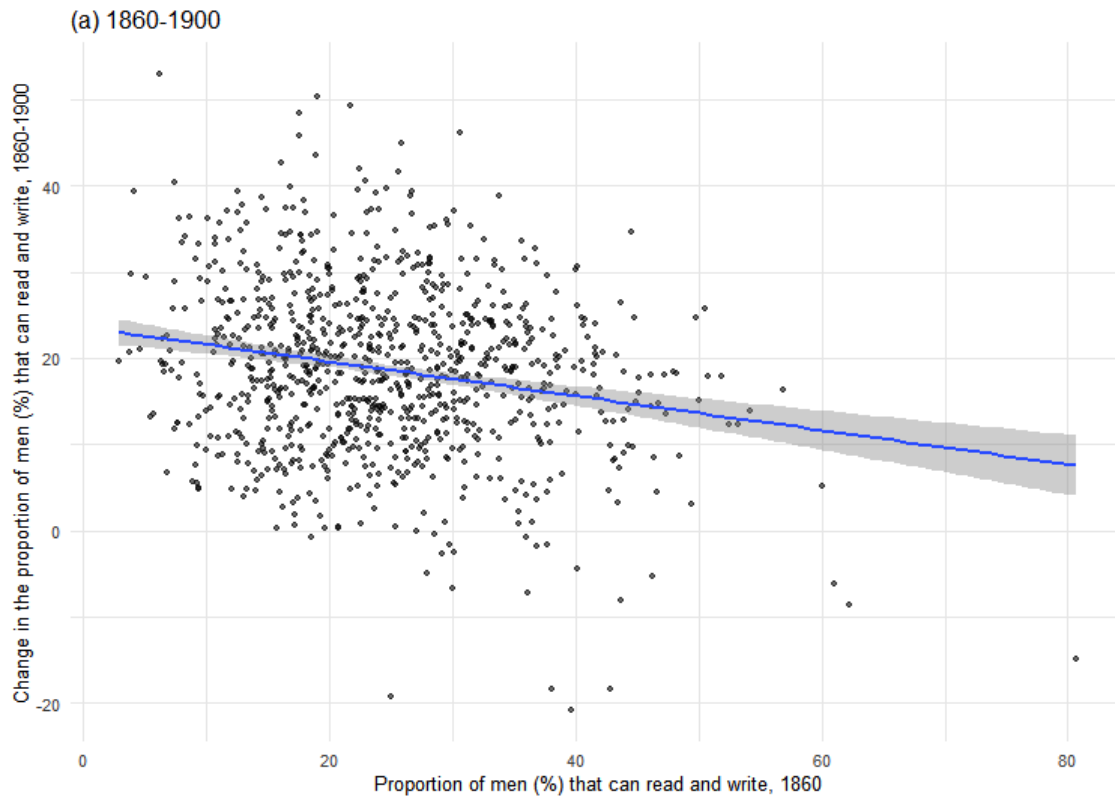
Source: Population census

A typical convergence analysis was carried out applied to the male literacy rate in Catalan towns to assess this issue in greater detail. Thus, Figure 4.9 studies the relationship between the literacy rates of 1860 and the increase in these rates in the subsequent period, between 1860 and 1900. For Spain as a whole, Beltrán Tapia et al. (2019b) point out that during the second half of the nineteenth century there was no convergence pattern, that is, the municipalities that started out with a lower level of literacy were not those that had a greater increase in literacy. This means that the differences after the approval of the Moyano Law of 1857 continued until the end of the century, thus making the situation of the mid-nineteenth century chronic.

In contrast, the dynamic was different in Catalonia. Figure 4.9 indicates that, in aggregate terms, during the period between 1860 and 1900 the greatest increases in male literacy rates occurred in the municipalities located in areas that started from lower levels in 1860. The negative trend line shows that there was a convergence process and the differences between municipalities tended to decrease. Although the high dispersion with respect to the trend line suggests that these results should be analysed with caution, the assessment of the progress of literacy during the second half of the nineteenth century, in the context of the approval and development of the Moyano Law, is more positive in the Catalan case than in the Spanish case as a whole. The economic progress of Catalonia and the consequent greater demand for education by families or

the greater volume of resources generated in the municipalities in an economy in full transformation could explain this improvement. This occurred within a legal framework that, on one hand, did not substantially transform the previous institutional context in terms of the financing of primary education schools (which continued to fall to the municipalities), and, on the other hand, did not generate the same effects on literacy in other parts of the peninsula (Beltrán Tapia et al., 2019b).

Figure 4.9 Convergence in male literacy rates in Catalonia, 1860-1900



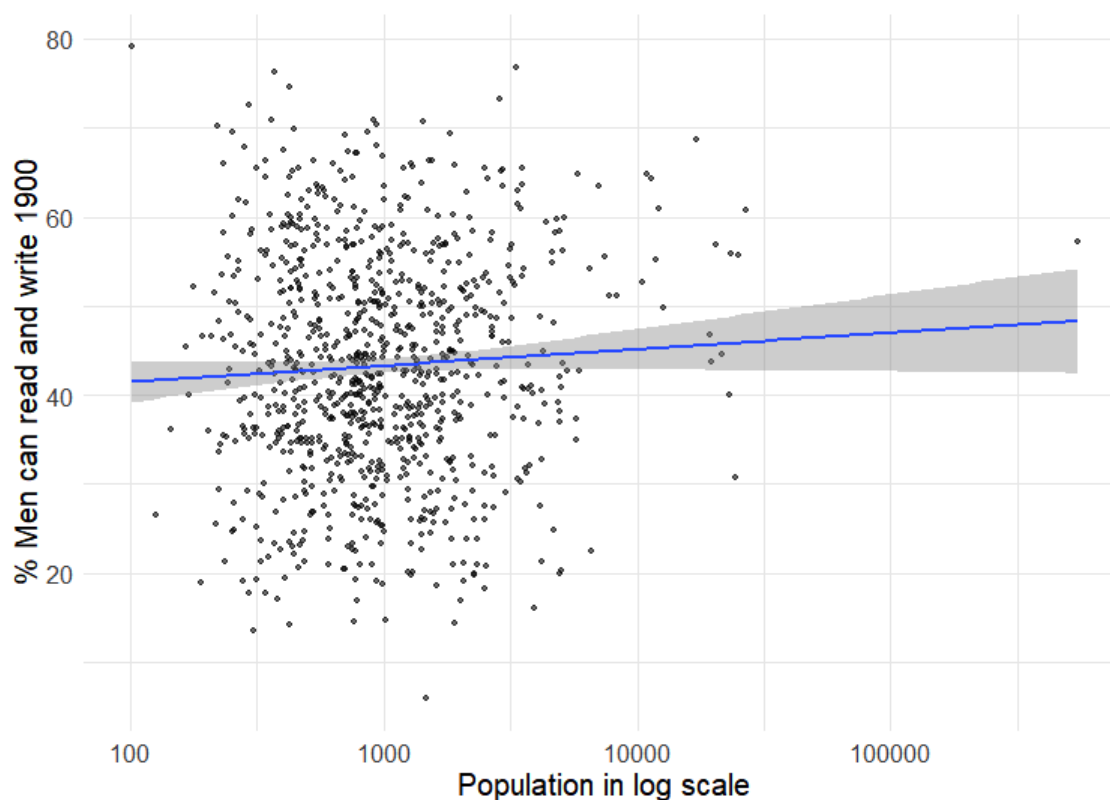
Source: Population censuses

To further characterise Catalan male literacy in 1900, Figure 4.10 explores the correlation between the size of the municipality and the percentage of men who could read and write in that year. Although in 1860 this relationship seemed to exist, the situation seems to have changed in 1900. The positive trend line has practically disappeared and the point cloud is characterised by a high degree of dispersion with respect to this line¹²⁰. This result implies that the convergence observed in Figure 9 would be leading to an equalisation in literacy levels between rural and urban Catalonia (which was potentially more industrial). The literacy effort and the progress

¹²⁰ Again, the relationship is maintained when the city of Barcelona is excluded from the calculations, so it would not be biasing the sample either.

recorded therefore seem to have been widespread in Catalonia over the four decades between censuses.

Figure 4.10 Male literacy rates and size (log scale) in Catalonia, 1900



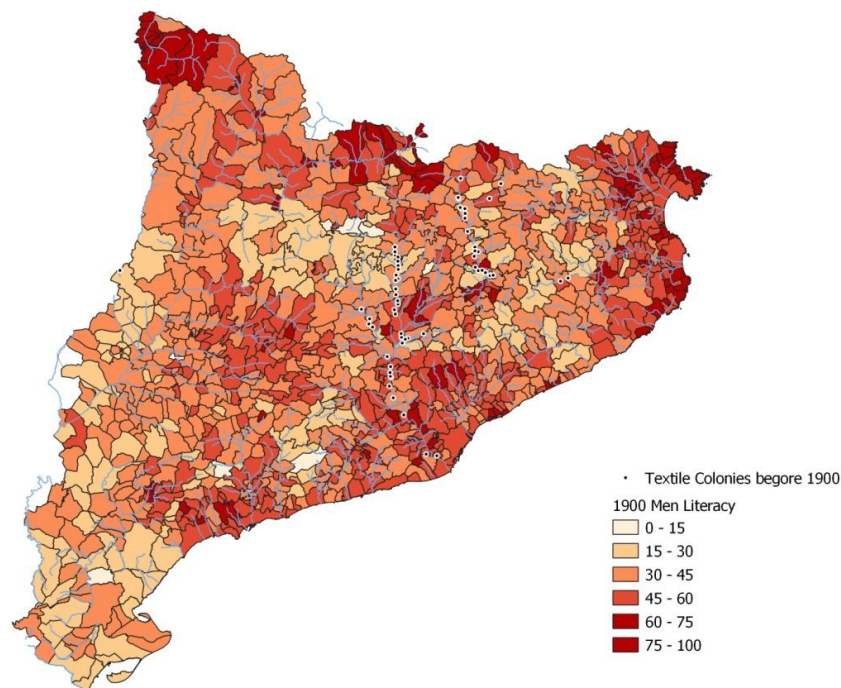
Source: Population census of 1900

However, in this general context described, it is necessary to take into account a certain fact, among many others, linked to industrialisation, which could have affected the results obtained previously. The years between 1860 and 1900 coincide with the time period in which most of the textile colonies in Catalonia were opened, one of the most characteristic phenomena of the industrialisation process in Catalonia (Terrades i Saborit, 1985; Dorel-Ferré, 2003). Their location was predefined by a geographical feature: a river with enough flow to be used as a driving force. Therefore, they were far from the traditional urban and industrial centres¹²¹. The opening of an industrial colony involved the creation of a productive population centre in a rural area, industrialising and urbanising it. In the year 1900 it can therefore be assessed whether the location of the textile colonies had an impact on the literacy levels of the municipalities where they were located, either by attracting qualified labour from the surrounding villages or due to the training provided by the school. Figure 4.11 shows the literacy rates of the male population

¹²¹ In Catalonia they were concentrated in the river basins of the Ter and Llobregat Rivers, and more specifically in the regions of Ripollès, Osona, Berguedà and Bages.

in 1900 and the location of all the textile colonies created before 1900. The map seems to indicate that the municipalities that had a textile colony had high literacy rates. As can be seen in Figure 5, which shows the location of the industries in 1860, industrialisation during these years does not seem to have a negative effect on literacy rates, but rather the opposite. Certainly, training was fundamental in order to be able to move up the hierarchy of the factory or colony, and for this, basic literacy was a necessary first step. Thus, the greater dispersion of industry would have also led to a greater dispersion of literacy.

Figure 4.11. Male literacy rates and municipalities with textile colonies in 1900



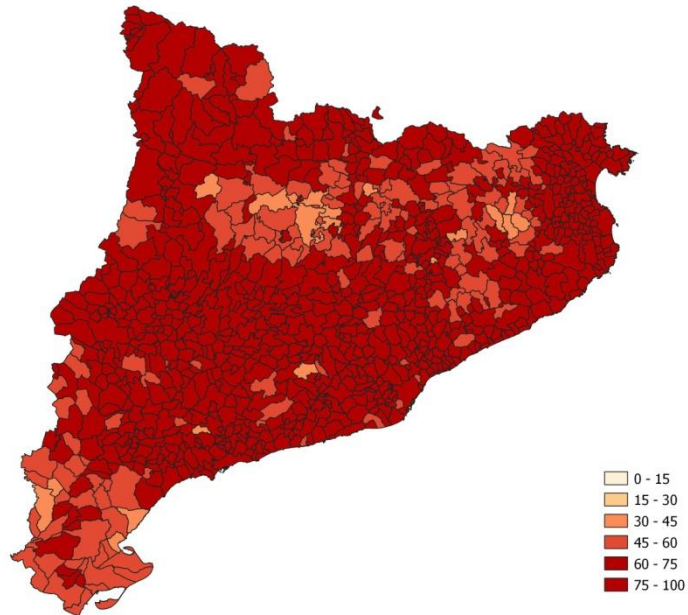
Source: Population censuses and Nadal et al. (2012)

4.4.3 From 1900 to 1930: economic progress, institutional change and improvement in literacy

The first three decades of the 20th century were years of profound transformation in the Catalan economy and society, marked by the intensification of structural change in favour of industry, among other factors. In this context, literacy took a great leap forward in Catalonia. As shown in Table 4.2, in 1900 the male literacy rate was around 50%, and three decades later, in 1930, this rate had increased to almost 75%. The new evidence available for the Catalan municipalities makes it possible to analyse this progress in detail from a territorial point of view. The map in Figure 4.12 shows the percentage of men who could read and write in 1930. The progress is evident and the majority of municipalities are already at rates of over 60% or 75%. Although the lowest literacy rates are still found in the south and in some inland areas, the differences seem to

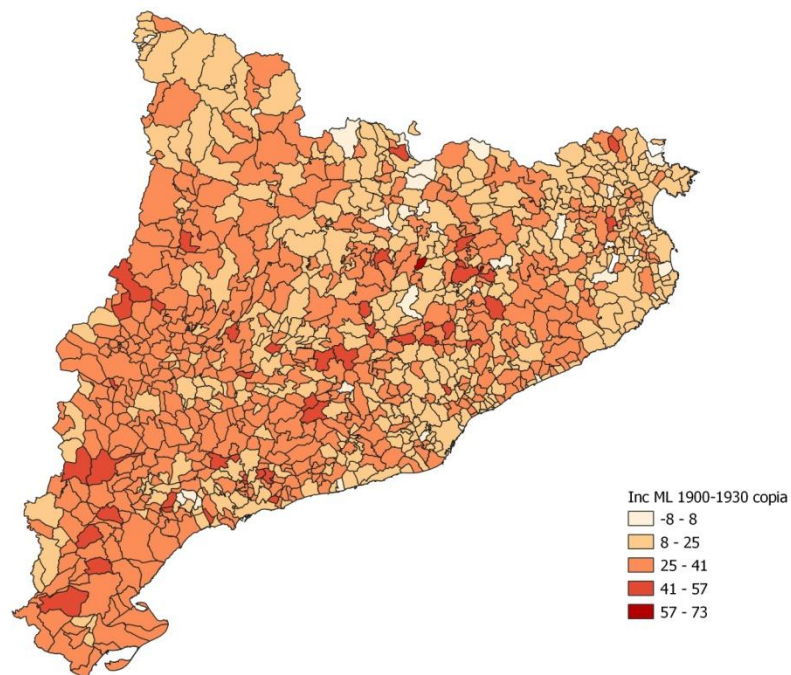
have narrowed. In fact, these areas of lower literacy seem to have the highest growth rates between 1900 and 1930, as shown in Figure 4.13.

Figure 4.12. Male literacy rates in Catalonia, 1930.



Source: Population census of 1930

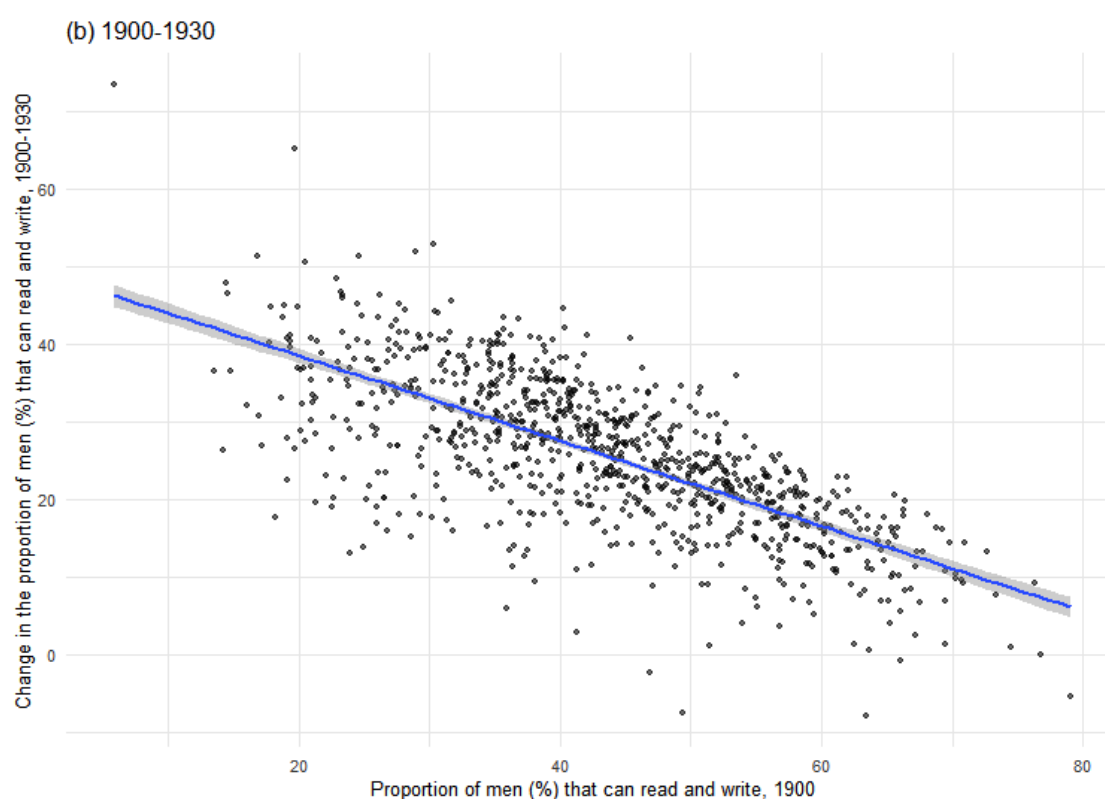
Figure 4.13. Growth in male literacy rates in Catalonia, 1900-1930



Source: Population censuses

Again, the basic convergence analysis reinforces this result (Figure 4.14). During the period between 1900 and 1930, the greatest increases in literacy rates occurred in municipalities that started from lower levels. Not only is the slope of the trend curve markedly negative, but the dispersion with respect to the trend line has decreased considerably. This is therefore a period characterised by a clear and intense convergence pattern. The differences in literacy among Catalan municipalities were substantially reduced in the first decades of the 20th century, making these years a period in which municipal literacy rates were significantly equalised.

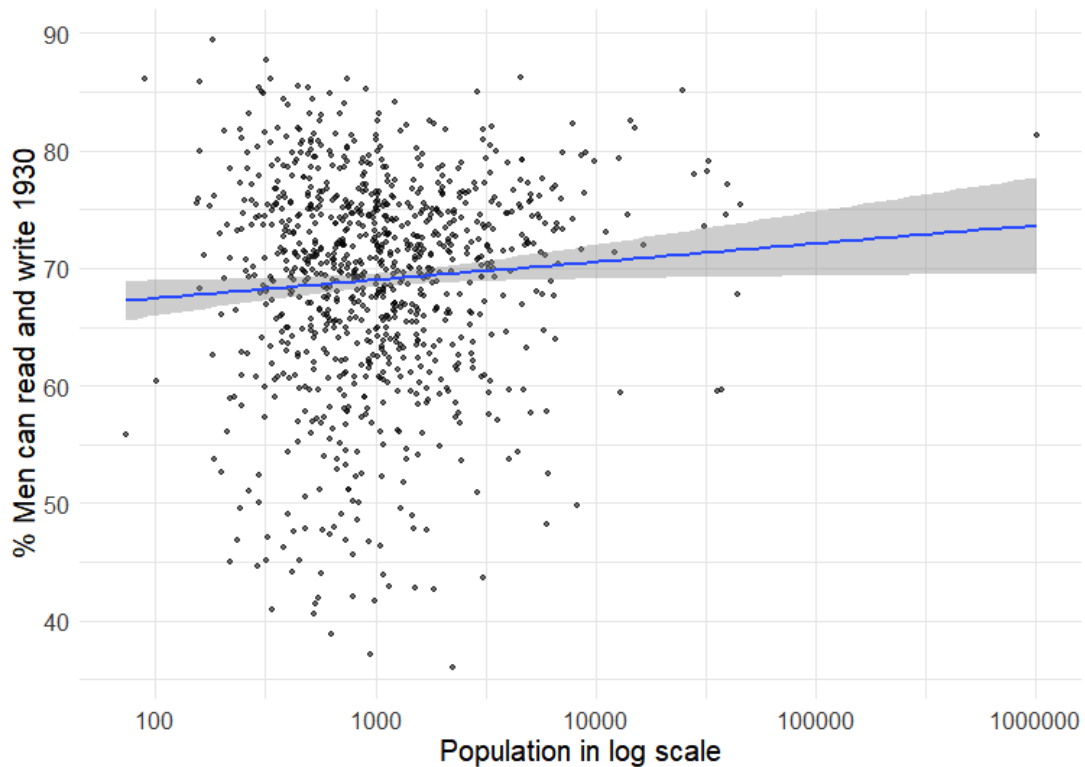
Figure 4.14. Convergence in male literacy rates in Catalonia, 1900-1930



Source: Population censuses

If, as before, we analyse the relationship between male literacy and the size of the municipalities in 1930 (Figure 4.15), the situation is very similar to that obtained for 1900. The relationship hardly appears. The slope of the curve is minimally positive, but the dispersion with respect to the line is greatly accentuated. As in 1900, literacy no longer seems to depend on the size of the municipality. The initial situation of 1860 has changed completely. The increasing extension of literacy to rural areas, where the size of the municipalities is generally smaller, would be at the base of the convergence experienced since then.

Figure 4.15. Male literacy rates and size (log scale) in Catalonia, 1930



Source: Population censuses of 1930

The analysis of the previous period (1860-1900) already pointed to the possible existence of a demand for schooling since the beginning of industrialisation and an effort by the municipalities to satisfy this despite the potential lack of economic resources in a period when the provision of primary education still fell on local entities. From that time onwards, and especially since 1900, Catalonia's economic progress has been intense, and so has the general improvement in literacy. For example, the industrial working population in Catalonia rose from 28% in 1900 to 47% in 1930, and the GDP practically tripled in the same years (Díez-Minguela et al., 2016). Moreover, this occurred in a context in which it was receiving the bulk of internal migratory flows, and its localities were experiencing growing urbanisation. The economic dynamism could therefore have increased the demand for education by Catalan society as a whole, both in urban and rural areas¹²².

Institutional changes in supply aspects were also relevant, and could have had an impact on education provision. In 1902, with the creation of the Ministry of Public Instruction and Fine Arts, the education system, as far as primary education is concerned, was centralised. The

¹²² In the case of Spain, it is also argued that there is a significant relationship between the uneven progress of literacy and socio-economic change in this period (Beltrán Tapia et al., 2019b).

financing of the system was now the responsibility of the Ministry and was no longer in the hands of the municipalities. The progress in literacy described in the previous paragraphs was made within this new institutional framework¹²³. To this should be added the many local initiatives that proliferated in these years within Catalan society, which are described in the second section. Together, these elements were able to play, both from the supply side (the increase in resources to finance education) and from the demand side (the assessment of the usefulness of education by families in a strongly expanding economy), an important role in the progress of literacy. However, at this point it is not yet possible to disentangle the relative importance of these two effects, one of a more economic nature and the other of a more institutional nature, although this does mark a possible avenue of research.

4.5 The evolution of female literacy in Catalonia, 1860-1930.

The period under review is characterised by a framework of discrimination against women in all areas and sectors. Education was not immune to this reality, and gender inequality in literacy rates are evident (Núñez, 1992). Thus, if in the Catalonia of 1860 30.56% of men could read and write, for women the percentage was only 8.87%. Families devoted far more resources to educating their sons than their daughters. In addition, girls' education was often provided by religious orders and focused on moral and domestic issues, so it was not necessarily related to literacy (Sarasúa, 2002, p.459). In this context, in Catalonia, in 1860, the gender gap in absolute terms was 21.69%, although this differential was reduced to 16.7% in 1900 and 9.76% in 1930¹²⁴. This would reflect, in part, the progress in access to education for girls that was achieved in this period.

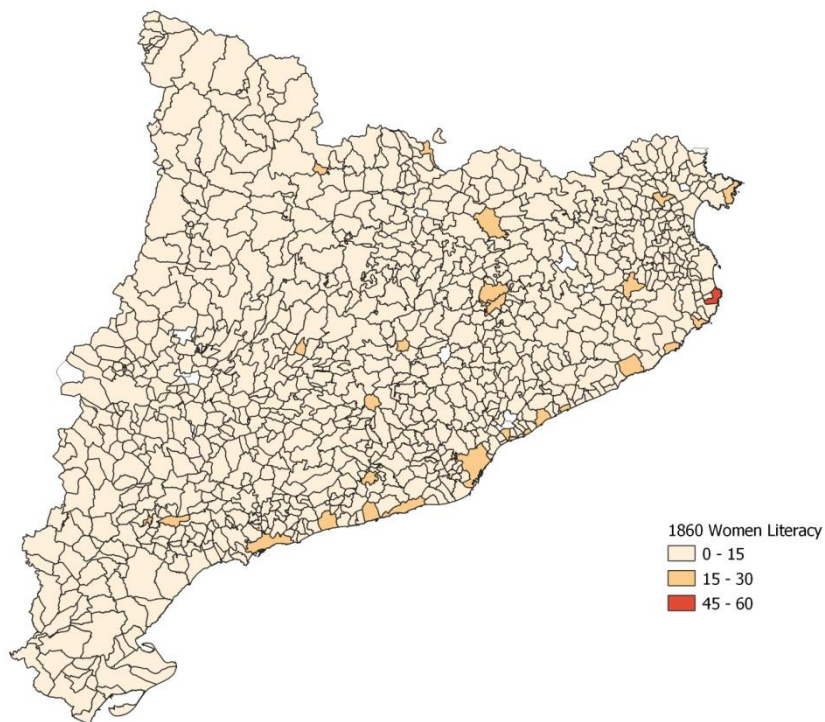
However, the initial situation of female literacy in Catalonia in 1860 was dramatic. With the exception of a small group of municipalities, barely twenty, the rest showed rates of less than 15% (Figure 16). In 1900, however, there was a general improvement with an aggregate female literacy rate that rose from 8.9% to 31.6%. Nevertheless, Figure 17 illustrates how this improvement was concentrated geographically in the coastal zone, around the capitals and, to a lesser extent, in some inland and mountainous areas. In general, it can be seen that the map of female literacy in 1900 shows a large resemblance to that obtained for male literacy in 1860,

¹²³ This conclusion is based on the assumption that the centralisation of the system led to an improvement in the provision of primary education by ensuring the financing of the entire school network, regardless of the resources that the municipality could devote. Although this assumption seems reasonable for the Spanish case as a whole, its fulfilment in the case of Catalonia is an element that needs to be studied further.

¹²⁴ In the case of Spain as a whole, the difference was greater: 26.78% in 1860, 21.41% in 1900 and 12.54% in 1930 (Beltrán Tapia et al., 2019a).

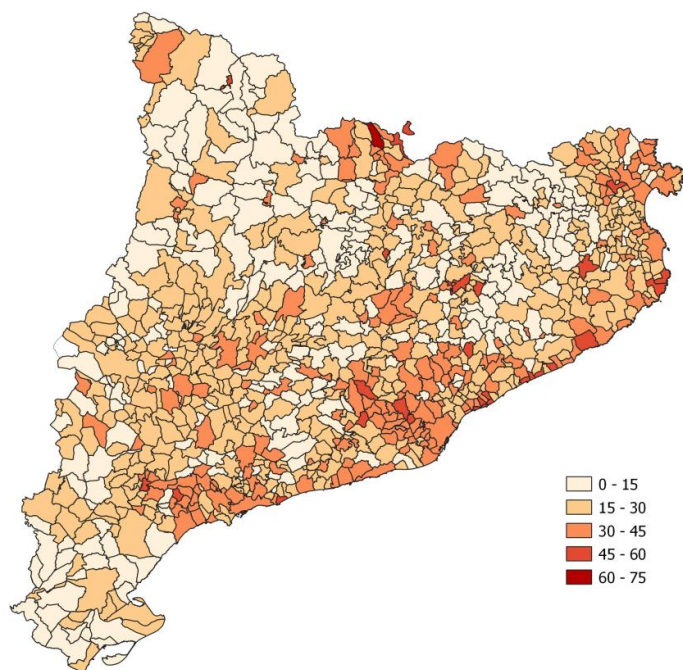
which would indicate that, as in Spain, the advance of female literacy began in those areas that previously had greater male literacy (Beltrán Tapia et al., 2019a). In 1930, in a context where two out of every three Catalan women could read and write, with a percentage of literate women approaching 65%, the advance was characterised by being geographically widespread (Figure 18). In addition, the distribution of literacy in that year continues to resemble the patterns observed previously for male literacy.

Figure 4.16 Female literacy rates in Catalonia, 1860



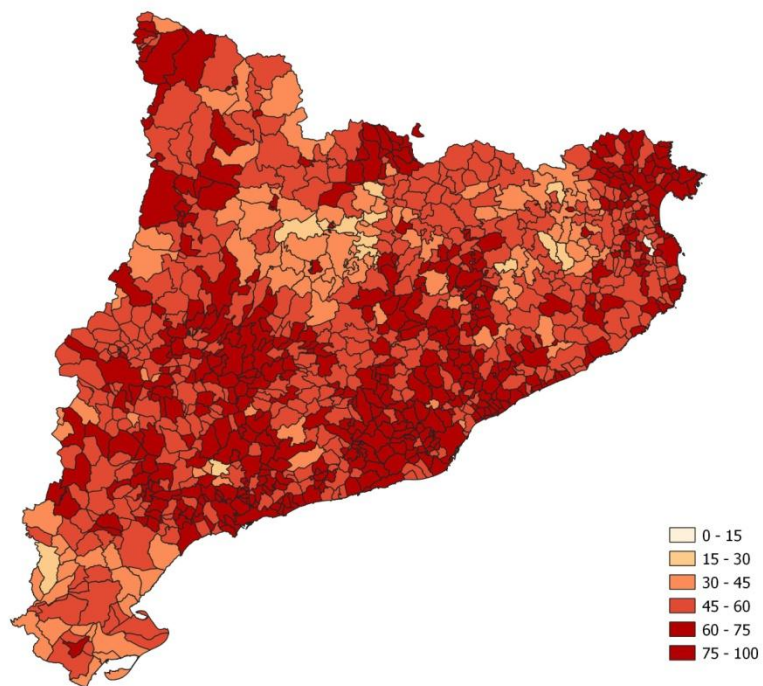
Source: Population census of 1860

Figure 4.17 Female literacy rates in Catalonia, 1900.



Source: Population census of 1900

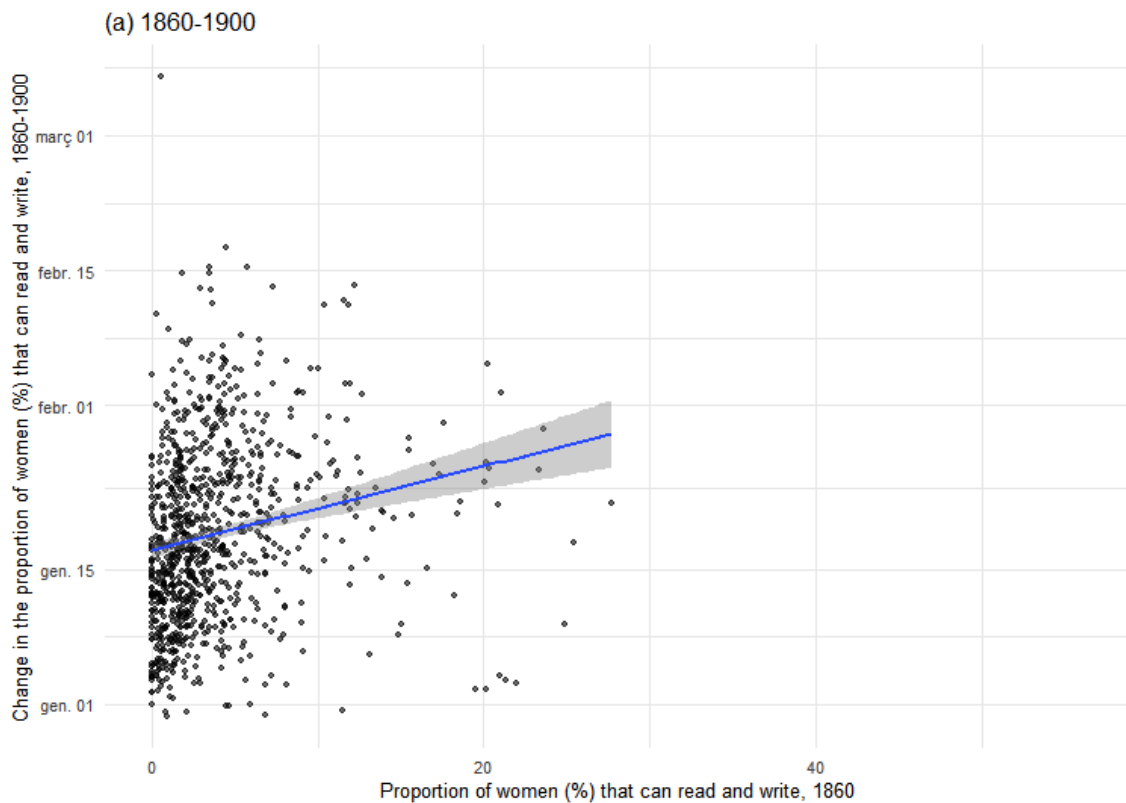
Figure 4.18 Female literacy rates in Catalonia, 1930.



Source: Population census of 1930

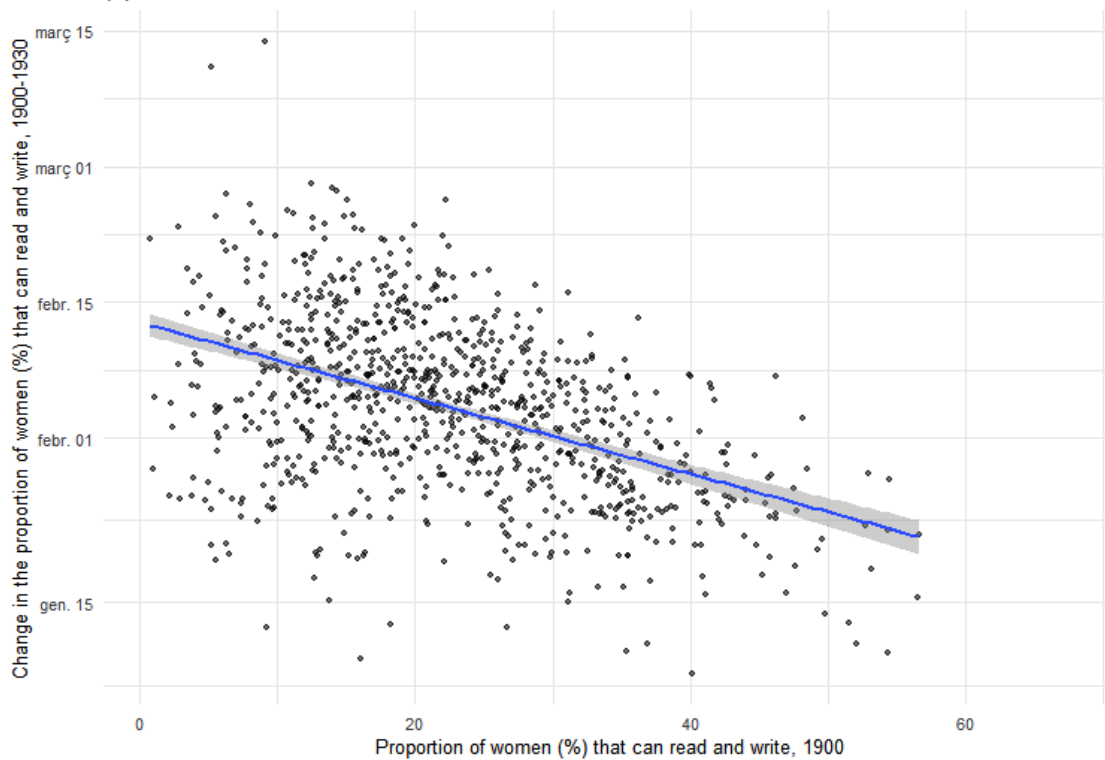
Considering the evolution of differences in female literacy rates, the convergence analysis shows significant variations between the two major periods under consideration. Figure 4.19 offers a picture of clear divergence between 1860 and 1900, where the municipalities that started out with the greatest female literacy are, in aggregate terms, those that experienced the greatest growth in literacy. This lack of convergence contrasts with what was observed in male literacy, which in this period showed a convergence pattern (Figure 4.9). In the case of women, however, the differences increased. In contrast, the first decades of the 20th century, as shown in Figure 20, were marked by a clear convergence pattern (along the lines of what was also observed for male literacy). Thus, the growing differences in women's literacy in Catalan municipalities observed during the second half of the nineteenth century stopped and were reversed between 1900 and 1930.

Figure 4.19 Convergence in female literacy rates in Catalonia, 1860-1900



Source: Population censuses

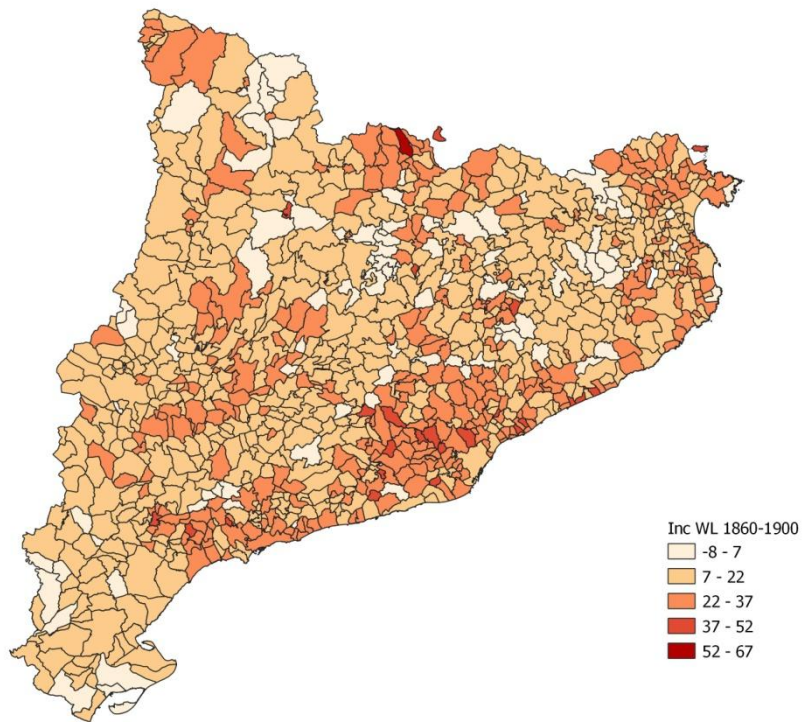
Figure 4.20 Convergence in female literacy rates in Catalonia, 1900-1930
 (b) 1900-1930



Source: Population censuses

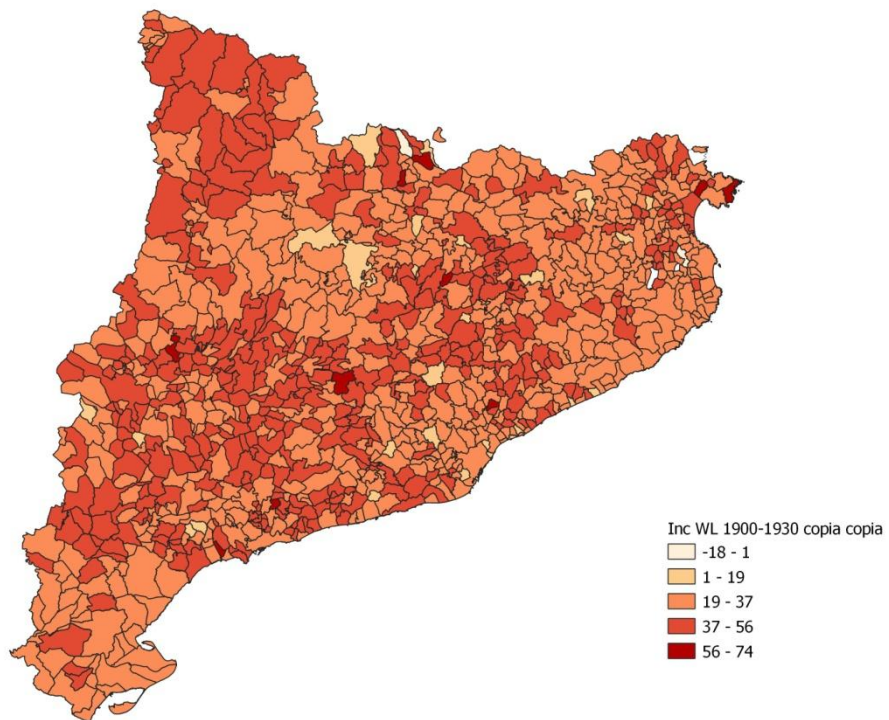
To complete the previous analysis of convergence, Figures 4.21 and 4.22 show on each map the increases in the percentage of women who could read and write for 1860-1900 and 1900-1930 in each of the Catalan municipalities. In the second half of the 19th century it can be seen that literacy seems to have had a greater incidence in urban contexts and in those areas that already had better levels of male literacy in 1860 (Figure 4.21). From an institutional point of view it could be argued that in the context of the Moyano Law, territorial inequality in female literacy increased. In contrast, for the period between 1900 and 1930, the improvement in female literacy is more homogeneous and the greatest increases occurred in those municipalities that benefited less in the previous stage, mainly in inland Catalonia. Therefore, the period which coincided with the intensification of economic growth, structural change and migration in parallel with the creation of the Ministry of Public Education and the centralisation of the financing of public primary schools, brought about a considerable advance in women's literacy and a decrease in territorial inequalities in female literacy rates.

Figure 4.21 Growth in female literacy rates in Catalonia, 1860-1900



Source: Population censuses

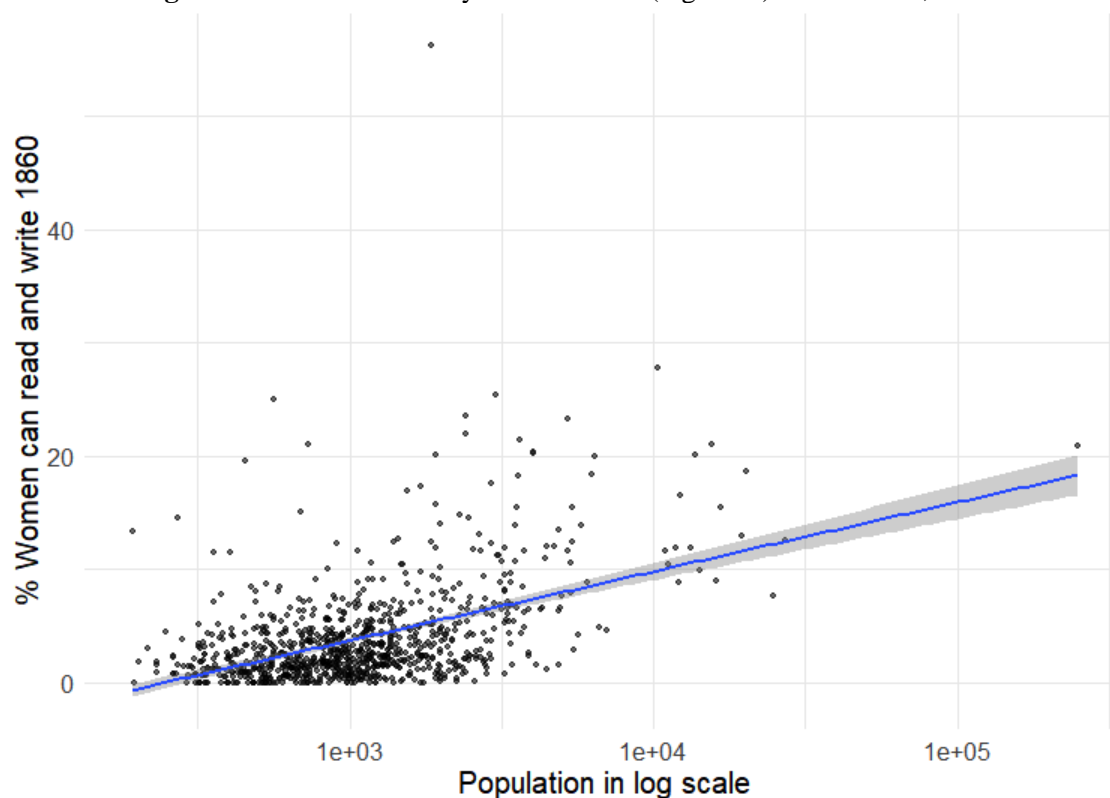
Figure 4.22 Growth in female literacy rates in Catalonia, 1900-1930



Source: Population censuses

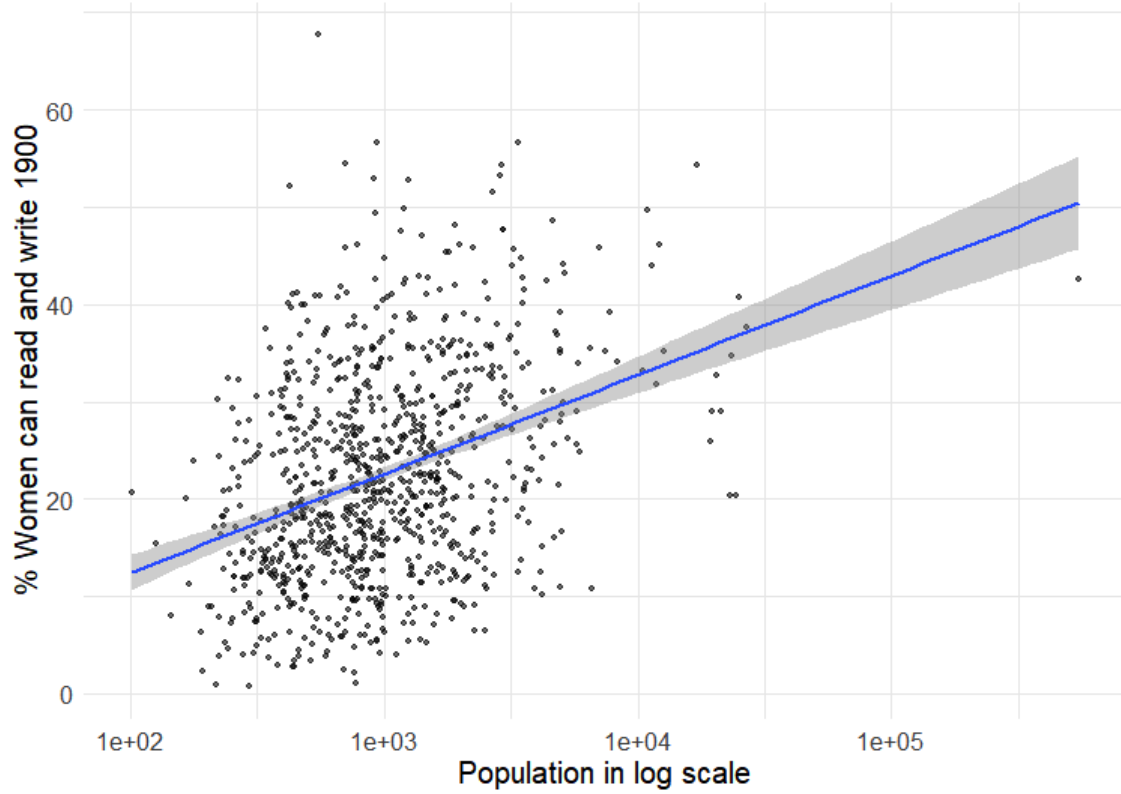
Finally, it is examined whether female literacy was higher in urban settings than in rural ones. In all years considered, there seems to be a positive relationship between the two variables, which shows that opportunities for female literacy were greater in cities (Figures 4.23-4.25). While in 1860 and 1900 this relationship is more intense, in 1930 the advantages associated with living in an urban environment for women seem to have weakened. Again, the evolution of female literacy seems to follow, with a certain time lag, the pattern for male literacy, and the relationship that appeared in 1860 had already weakened in 1900. Thus, from the beginning of the 20th century, female literacy made significant progress in the rural areas of Catalonia, which, in a context of improved female literacy and convergence in literacy rates at a municipal level made it possible to close the gap that existed with respect to urban areas.

Figure 4.23 Female literacy rates and size (log scale) in Catalonia, 1860



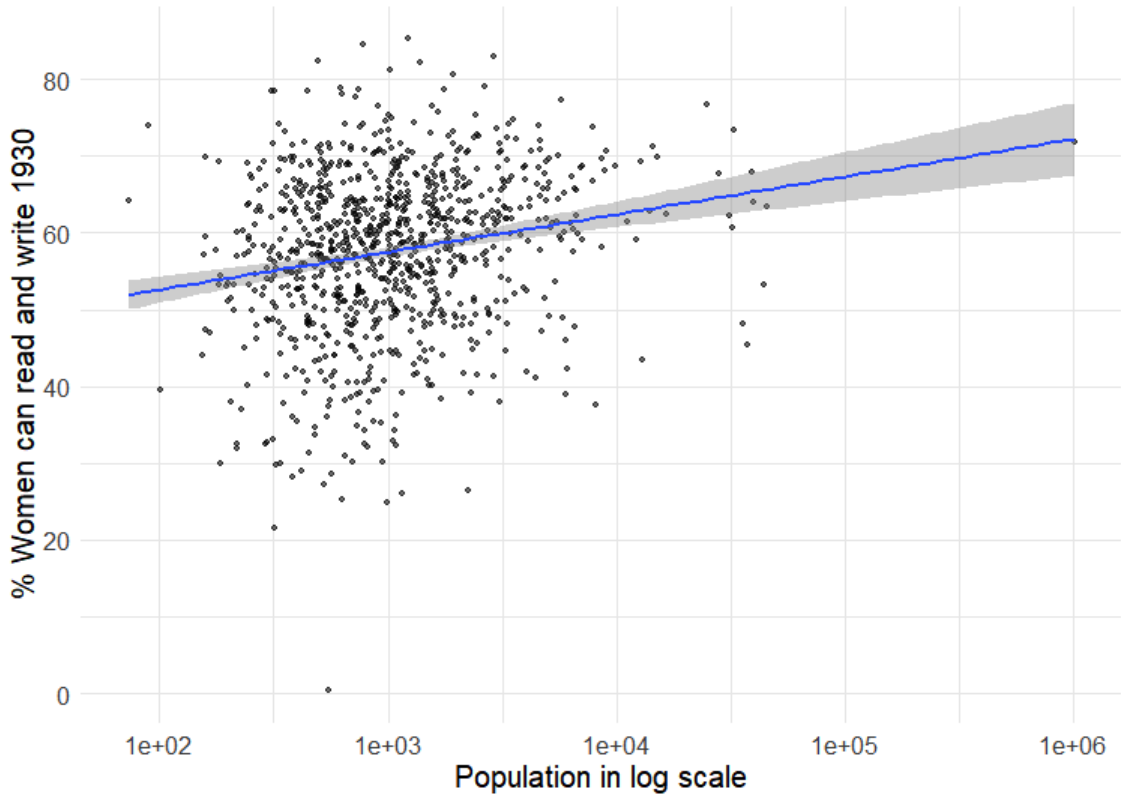
Source: Population census of 1860

Figure 4.24 Female literacy rates and size (log scale) in Catalonia, 1900



Source: Population census of 1900

Figure 4.25 Female literacy rates and size (log scale) in Catalonia, 1930



Source: Population census of 1930

4.6 Conclusions

The main contribution of this work is to present the evolution of literacy in Catalonia between 1860 and 1930 from a spatial perspective. Specifically, the study analyses, for the first time, Catalan literacy rates in a high degree of territorial detail: the municipalities. Thus, this study makes a descriptive analysis that leads to an advance in the knowledge of the educational situation in Catalonia in this crucial period of its history, offering a more complex and varied vision than the one held until now, which was mainly based on provincial data. At the same time, the disaggregated analysis for men and women offers the possibility of examining the different trajectories followed in the male and female literacy rates.

The new available evidence shows, firstly, that in 1860 the differences in male literacy were already large. This points to the relevance of studying what happened in previous periods, during the first stages of industrialisation and the Old Regime, in order to obtain a better understanding of the causes that originated these differences in literacy. A positive relationship was found between the degree of industrialisation in the middle of the 19th century and male literacy rates, as well as the existence of a possible persistence pattern that links these municipal literacy rates to the existence of a school during the 18th century. Moreover, in the mid-nineteenth century, the proportion of men who could read and write in Catalonia was higher in urban environments, although there were notable exceptions. This may be because the cities were where the majority of the buoyant industrial and commercial activity took place, and where the elite resided.

Secondly, it can be seen that during the second half of the 19th century, male literacy increased notably and in a more or less generalized way throughout the territory. This reduced the differences observed in the initial year of study. Between 1860 and 1900 there was a convergence in male literacy among the Catalan municipalities. This, in turn, was accompanied by a reduction in the positive correlation between municipality size and literacy rates. In other words, during this period, rural Catalonia also participated in the increase in literacy. This is a development that contrasts with that observed for Spain as a whole, where the second half of the century was characterized by the slow progress of literacy and the increase of territorial inequalities in educational terms (Beltrán Tapia et al., 2019a).

Historiography has linked this evolution in the Spanish case to the institutional context of the approval of the Moyano Law in 1857, which, by leaving the financing of primary education in the hands of local entities, would not have favoured the improvement of literacy in the poorest areas that started with lower educational levels in the middle of the 19th century. This interpretation, however, cannot be extrapolated to the case of Catalonia when we consider the

new available evidence. The particular socio-economic circumstances, resulting from the economic and industrialising dynamism in this period could have favoured a more positive evolution in the second half of the 19th century. That is, the industrialisation process could have increased the demand for schooling, and led to an increase in the educational offer. It also suggests that literacy and training in the working environment may have been more complete than has been supposed.

In turn, these characteristics were accentuated between 1900 and 1930. Male literacy reached an average of nearly 75% in 1930 and a large part of Catalonia participated in educational improvement. With the exception of the southern zone and some inland areas, which had traditionally had the lowest literacy rates, most municipalities had already reached significant levels of male literacy by that time. This was again accompanied by a reduction in inequalities between municipalities, as the process of convergence also intensified. The intense growth of the Catalan economy, the structural changes, the greater urbanisation and the migratory movements could be behind this improvement in literacy, taking into account that this took place within a different institutional framework than in the previous period. These decades were characterised by the centralisation of the financing of primary education that led to the creation of the Ministry of Public Instruction and Fine Arts from 1900.

The evolution of female literacy was, however, different from that of men. With very low starting levels in 1860 in practically all of Catalonia, there was a significant increase between that date and 1900, and even more intense progress between 1900 and 1930, which narrowed the gender gap significantly. In the second half of the 19th century the municipalities that improved most were those that started from higher levels in 1860, especially those where the male literacy rate was higher, widening the territorial differences. However, from 1900 onwards all Catalan municipalities participated in the advance of female literacy and the differences between them were reduced. Even so, during the entire period it seems that women had more opportunities to access school and literacy in the larger municipalities, that is, in urban environments. This fact could be linked to both supply and demand factors.

Overall, the results obtained indicate a large change in the endowment of human capital in a territory that was moving decisively forward in the process of industrialisation between 1860 and 1930. The higher level of territorial disaggregation offered by this work suggests that the areas with the greatest economic dynamism in Catalonia and with the highest population growth would have made an effort to provide their population with educational infrastructure as early as the mid-19th century. Thus, it is suggested that, in Catalonia, the process of industrialisation may have increased the demand for schooling in this period. This suggests that literacy and

training in the workplace may have been more complete than had been assumed. In addition, in a context where the participation of women in the workplace (in many cases, industrial) stands out, the progress recorded in literacy between 1860 and 1930 would imply a positive feedback between the two elements. Nevertheless, these results, and others, that emerge from the descriptive analysis carried out require a more solid analysis to be able to contrast the validity of these arguments, and study the different elements that determined the complex reality that the Catalan case shows. It could be examined, for example, whether the advance in literacy is linked more to the economic progress of Catalonia in those years, to the change in 1900 in the institutional framework that governed primary education at the state level, or to the proliferation of local initiatives and new pedagogical methods from the end of the 19th century. In any case, one of the contributions of this work is the presentation of new descriptive evidence which raises questions that can stimulate more in-depth future research into literacy, its determinants and its impact on industrialisation and economic development in the long term.

Appendix

Table A.4.1 List of the pseudo-municipalities created.

New code	INE code	Municipality	Province
801	8123	Molins de Rei	Barcelona
801	8211	Sant Feliu de Llobregat	Barcelona
802	8036	Calonge de Segarra	Barcelona
802	8176	Pujalt	Barcelona
803	8034	Calders	Barcelona
803	8128	Monistrol de Calders	Barcelona
804	8099	Guardiola de Berguedà	Barcelona
804	8903	Sant Julià de Cerdanyola	Barcelona
805	8105	Llagosta, La	Barcelona
805	8209	Sant Fost de Campsentelles	Barcelona
806	8115	Martorelles	Barcelona
806	8256	Santa Maria de Martorelles	Barcelona
807	8131	Montesquíu	Barcelona
807	8237	Sant Quirze de Besora	Barcelona
808	8126	Montgat	Barcelona
808	8282	Tiana	Barcelona
809	8136	Montornès del Vallès	Barcelona
809	8181	Roca del Vallès, La	Barcelona
809	8296	Vallromanes	Barcelona
809	8902	Vilanova del Vallès	Barcelona
810	8252	Barberá del Vallès	Barcelona
810	8266	Cerdanyola del Vallès	Barcelona
811	8068	Cervelló	Barcelona
811	8905	Palma de Cervelló	Barcelona
1701	17007	Amer	Girona
1701	17903	Sant Julià de Llor i Bonmatí	Girona
1702	17129	Pedret i Marzà	Girona
1702	17132	Peralada	Girona
1703	17054	Colera	Girona
1703	17138	Portbou	Girona
1704	17133	Planes d'Hostoles, Les	Girona
1704	17161	Sant Feliu de Pallerols	Girona
1705	17068	Foixà	Girona
1705	17203	Ultramort	Girona
1706	17097	Madremanya	Girona
1706	17173	Sant Martí Vell	Girona
2501	25112	Ivars de Noguera	Lleida
2501	25156	Os de Balaguer	Lleida
2502	25035	Sentiu de Sió, La	Lleida
2502	25047	Bellcaire d'Urgell	Lleida
2503	25051	Bellver de Cerdanya	Lleida
2503	25913	Riu de Cerdanya	Lleida
2504	25052	Bellvís	Lleida

2504	25168	Poal, El	Lleida
2505	25068	Castellnou de Seana	Lleida
2505	25238	Vallbona de les Monges	Lleida
2505	25239	Valls de Valira, Les	Lleida
2505	25252	Vila-Sana	Lleida
2506	25023	Alpicat	Lleida
2506	25912	Gimenells i el Pla de la Font	Lleida
2507	25092	Floresta, La	Lleida
2507	25153	Omellons, Els	Lleida
4301	43155	Tortosa	Tarragona
4301	43901	Deltebre	Tarragona
4301	43902	Sant Jaume d'Enveja	Tarragona
4301	43903	Camarles	Tarragona
4301	43904	Aldea, L'	Tarragona
4302	43171	Vila-Seca	Tarragona
4302	43905	Salou	Tarragona
4303	43013	Ametlla de Mar, L'	Tarragona
4303	43104	Perelló, El	Tarragona
4303	43906	Amplolla, L'	Tarragona

Chapter 5. Conclusions

Human capital has become a key element in economic growth theories but its accumulation over the very long term and its role in the early stages of the Industrial Revolution remain open debates. This is a consequence of the challenges faced by the most quantitatively oriented field of economic history with respect to empirically confirming certain theoretical models due to the lack of data. This doctoral thesis seeks to contrast and develop new hypotheses on economic development and human capital levels through new data, and goes beyond the British case by focusing on regions under the rule of the Hispanic monarchy.

This doctoral thesis makes three main contributions in an attempt to incorporate new ideas into the debates addressed in the introduction. The first contribution lies in the quantification of the human capital created by a religious colonial institution, the Jesuit Missions of the Guaranis, to facilitate its comparison with other institutions while they were in operation. The second contribution is an indicator of human capital in Catalonia, the only Mediterranean region that followed the Industrial Revolution, precisely at a time of economic effervescence; this allowed us to assess whether the human capital levels during the pre-industrial period may have brought about greater economic dynamism. Finally, the third contribution lies in identification of the geographical pattern of literacy in Catalonia on a municipal scale during the industrialization period and the study of its evolution within the process of industrial development.

With regard to the first contribution, the results obtained by the missions established in Guaraní territory and those carried out in Alta California, which replicated this model, suggest that arithmetic skills were exceptional throughout the 18th century, given that they were close to one hundred percent. These levels are far higher than any region under the rule of the Hispanic monarchy during this period and are comparable only to some Western European countries. Furthermore, the results seem to be persistent over time, which could explain the intergenerational transfer of human capital after the Jesuits were expelled from the reductions and could be linked to the current educational differences between areas located near a former Jesuit mission and areas located further away (Valencia Caicedo, 2019b).

These levels also confirm that, when the missions were active, all children were schooled and education was a key aspect of the development model. Moreover, this took place at a time when universal access to education was unheard of in most parts of the world. This was a social model in which the Guaranis played a predominant role, based on evangelization in their own language, adaptation to the Guaraní worldview, an egalitarian production structure with a

mechanism to provide aid to orphans and widows, and support among missions in case of shortages. When these regions are compared to others under the rule of the Hispanic monarchy in the same period, but whose institutions were more extractive, the arithmetic levels drop considerably. However, within the same territory with institutions other than religious ones, those that were characterized by greater egalitarianism also had higher levels of numeracy. These results highlight the weight of institutions in the formation of human capital.

In general, the results point to the potential role played by the institutions in a territory in numeracy training; this role was minimal in those based on models of extreme inequality and with less respect for the pre-existing social structure and culture, but much greater in regions with institutions that focused more on social cohesion. Furthermore, several institutions coexisted in the same area, and the same institution could exercise a different dynamic in each territory, thereby leading to geographical heterogeneity with respect to the distribution of human capital throughout the 18th century in areas under the rule of the Hispanic monarchy. These results are consistent with those reported for New Spain during the same period (Calderón-Fernández et al., 2020) and show a greater complexity with respect to the colonial legacy than assumed by historiographers. In addition, the results indicate a possible persistence in the very long term of the determinants of human capital that go far beyond ethnicity. This has implications for future research on this subject and this study contributes to the debate on religious and colonial institutions, the effects of missions and their dissemination of human capital, and their consequences for long-term economic development.

With regard to the second contribution of this doctoral thesis, although the sample studied for the Catalan case at the beginning of the 18th century was large (6,700 observations) and covered a broad territorial scope (10 of the 12 existing administrative divisions), the diversity of local situations calls for a cautious approach to generalizing the results; however, they indicate that the numeracy levels in Catalonia may have been relatively high even before the Industrial Revolution. They also reveal a difference between urban and rural settings that was not detected in Castile; however, in rural areas, this gap would not have existed in the pre-industrial textile sector, as the workers in this field would have had high levels of arithmetic ability equivalent to those found in other parts of Spain (Álvarez & Ramos Palencia, 2018) and Europe (Boot, 1995). This period coincides with a Catalan economy characterized by a rapid agricultural intensification process, proto-industrialization and the expansion of a production model based on trade relations.

The results also show that levels of arithmetic capacity may have been related to social class and inequality, especially in terms of access to land. These results are in line with those reported for both Castile (Pérez Artés, 2020) and Europe (Tollnek & Baten, 2017) for the same period, and are also consistent with an analysis of Spain's human capital in the 19th century (Beltrán Tapia & Martínez-Galarraga, 2018). In addition, the level of occupational skills also seems to be highly correlated with numeracy levels, particularly in the textile industry in terms of the secondary sector. Everything seems to indicate that, in a setting characterized by low public investment in education, training in the workplace and at home may have facilitated access to education in a context of economic dynamism such as that of 18th-century Catalonia, which may have incentivized the acquisition of these numeracy skills. Furthermore, despite the caution with which the results for the female population must be treated, their similarity to those obtained in other European regions (i.e. equally high) could also indicate that women accessed this training outside the school system.

These new results contribute to the debate on the existing levels of human capital in the pre-industrial period, thus showing that the levels of arithmetic capacity were relatively high in certain sectors, occupations and social groups in Catalonia at the beginning of the 18th century and, more importantly, comparable to those reported for other dynamic areas of Europe. This training was also acquired outside the institutionalized school system, as indicated by Jordi Nadal (1995), and shows that the pre-industrial legacy may have had a greater influence on the levels of human capital in later periods than previously assumed. These new findings have implications for future research because they contribute to the debate on human capital prior to the Industrial Revolution by revealing that, in a changing economy, the pre-existing levels were fairly high in some sectors that may have played a role in driving the industrialization process. These contributions are consistent with the literature concerning the role played by useful knowledge in fostering innovation in the previous stages of the Industrial Revolution to explain how economies embarked upon the path to modern economic growth (Mokyr, 2002, 2005; Morgan et al., 2020; Squicciarini & Voigtlander, 2015).

The third contribution of this doctoral thesis lies in the first descriptive analysis of Catalan literacy rates with a high degree of territorial detail (i.e. municipalities) between 1860 and 1930. The municipal scale made it possible to obtain a more complex and varied view than previous, province-level data. The diversity of situations is in line with the findings of recent work on other regions of Spain (Beltrán Tapia et al., 2020) and Catalonia itself, such as the possible link between literacy levels and the expansion of cooperativism (Medina-Albaladejo et al., 2020). It also allowed us to examine the divergent trajectories followed by male and female literacy rates. This new evidence shows that the differences in male literacy rates in 1860 were already

significant and reinforces the hypothesis that these disparities may have had their origin in the pre-industrial legacy. It also shows that Catalonia's urban environments at that time presented higher literacy rates, although there were notable exceptions, a finding that may be linked to the fact that these areas had the most industrial and commercial activity and were home to the elite.

The evolution between 1860 and 1930 reflects a reduction in the initial differences and a generalized improvement in which rural Catalonia also participated in the advance of literacy rates. This fact is at odds with the evolution observed for the whole of Spain during the same period, where literacy rates improved slowly and the territorial inequalities with respect to education increased, especially in the second half of the 19th century (Beltrán Tapia et al., 2019a). The particular socioeconomic characteristics of Catalonia, which were the result of the economic dynamism and industrialization process of this period, may have increased the demand for schooling and facilitated the increased supply of education. This result points to literacy and training in the work environment as more comprehensive than previously assumed, as suggested by Nadal. These characteristics were particularly notable between 1900 and 1930 within a different institutional framework than the previous period. In 1930, most of Catalonia already had high rates of male literacy and a large part of the territory was involved in educational improvements.

The evolution of female literacy differed from that of male literacy. The levels were very low in 1860 and improved significantly until 1900, especially in municipalities that started out with high levels and had higher male literacy rates. This increased territorial differences. Progress between 1900 and 1930 was even more intense, but all Catalan municipalities participated. However, it seems that women had more opportunities to access school in urban environments throughout the period analysed. In a context where female participation in the workplace was high (in many cases, in the textile industry), the positive evolution between 1860 and 1930 reinforced the positive feedback of the complementary relationship between literacy and training in the workplace, and the more economically dynamic areas also presented a greater demand for training.

In general, the results of these three contributions to this doctoral thesis can be grouped into two major pieces of evidence. The first contributes to the existing international debate regarding the role played by institutions in the formation of human capital in the long term (Acemoglu et al., 2001; David, 1994; North, 1990), specifically, religious institutions within the colonial framework of the modern period (Valencia Caicedo, 2019b, 2019a). In this regard, human capital levels were found to present geographical heterogeneity due to the institutional diversity of the different areas under the rule of the Hispanic monarchy in the pre-industrial era. While

the most extractive institutions hindered the accumulation of human capital, probably through a demand mechanism, the areas with greatest economic dynamism already presented high levels of human capital in certain groups or sectors. Furthermore, this legacy of the Old Regime seems to have persisted over time in all areas studied, a finding that points to the importance of analysing the events in pre-industrialization periods in order to ascertain the effects of human capital on long-term economic development, as recent studies have done in other areas (Bozzano & Cappelli, 2019; Postigliola & Rota, 2020).

The second piece of evidence refers to the specific case of Catalonia and its unique characteristics with respect to human capital. As a European region that played a pioneering role in the First Industrial Revolution, the study of human capital formation represents a contribution to the existing debates regarding the importance of the most basic aspects of human capital, such as numeracy and literacy, during the industrialization process and the early stages of economic development (Allen, 2003; Mitch, 1993b; Mokyr, 2010). Data on Catalonia reveal that urban areas, which enjoyed greater economic and commercial dynamism, had higher levels of human capital than rural areas in the early 18th century, a finding that contrasts with the case of Castile, where such differences did not exist. By contrast, the evolution of male literacy rates between 1860 and 1900 in Catalan municipalities, within an institutional framework that differed from that of the previous period, shows a reduction in territorial inequalities that contrasts with the rest of Spain. These results reveal the complex reality of Catalonia and require a more solid analysis to contrast the validity of some of these arguments. However, they also suggest that pre-industrial economic dynamism and the subsequent industrialization process may have increased the demand for human capital in the long term, a fact that would indicate that education and training in the working environment may have been more comprehensive than previously assumed and contributes to a reassessment of the paradox of human capital and a rethinking of the current paradigm of the Catalan case (Nadal, 1995; Rosés, 1998).

In any case, this doctoral thesis has presented new quantitative evidence, which should hopefully give rise to questions that stimulate future research and open the door to a more in-depth examination of the causes and consequences of human capital endowment during the early stages of economic development. In other words, it should help encourage and facilitate research that more fully explores the role of human capital, its determinants and its impact on industrialization and economic development in the long term, thereby confirming or challenging the contributions and evidence presented here, with a view to continue shedding light on the role played by human capital in different societies in a context of economic progress throughout history.

Bibliography

- A'Hearn, B., Baten, J., & Crayen, D. (2009). Quantifying quantitative literacy: Age heaping and the history of human capital. *Journal of Economic History*, 69(3), 783–808.
- A'Hearn, B., Delfino, A., & Nuvolari, A. (2019). Cognition, culture, and state capacity: Age-heaping in XIX Century Italy. In *CEPR Discussion Papers*.
- Abramitzky, R. (2011). Lessons from the kibbutz on the equality-incentives trade-off. *Journal of Economic Perspectives*, 25(1), 185–208.
- Acemoglu, D., Gallego, F. A., & Robinson, J. A. (2014). Institutions, human capital, and development. *Annual Review of Economics*, 6, 875–912.
- Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369–1401.
- Administraciones Públicas, M. de. (2008). *Variaciones de los municipios de España desde 1842*. Ministerio de Administraciones Públicas.
- Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60(2), 323–351.
- Agustí i Cullell, J. (1983). *Ciència i tècnica a Catalunya en el segle XVIII: la introducció de la màquina de vapor*. Institut d'Estudis Catalans.
- Allen, R. C. (2003). Progress and poverty in early modern Europe. *Economic History Review*, 56(3), 403–443.
- Álvarez, B., & Ramos Palencia, F. (2018). Human capital and earnings in eighteenth-century Castile. *Explorations in Economic History*, 67, 105–133.
- Álvarez Kern, A. (2013). Jesuitas, Guaraníes y sexualidad en las misiones coloniales en el Río de la Plata. *Cuadernos de Antropología*, 10(10), 355–373.
- Andersen, T. B., Bentzen, J., Dalgaard, C. J., & Sharp, P. (2017). Pre-reformation Roots of the Protestant Ethic. *Economic Journal*, 127(604), 1756–1793.
- Angeles, L., & Elizalde, A. (2017). Pre-colonial institutions and socioeconomic development: The case of Latin America. *Journal of Development Economics*, 124, 22–40.
- Antón Pelayo, J. (1998). Alfabetización y lectura en la ciudad de Girona (1747-1807). In *Monografies "Manuscrits"* (Vol. 4). Universitat Autònoma de Barcelona.
- Antón Pelayo, J. (1999). Espill de l'ensenyament i de l'escolarització a la Girona del segle XVIII. *Revista de Girona*, 192, 55–58.
- Armstrong, W. A. (1972). The use of information about occupation. In W. A. Armstrong & E. A. Wrigley (Eds.), *Nineteenth-century society: essays in the use of quantitative methods for the study of social data* (pp. 191–310). Cambridge University Press.
- Arranz, M. (1981). *Los profesionales de la construcción en la Barcelona del siglo XVIII*. Universitat de Barcelona.

- Bareiro Saguier, R. (1986). La numeracion en guaraní. *Amerindia*, 11, 145–154.
- Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2), 407–443.
- Barro, R. J. (2001). Human Capital and Growth. *American Economic Review*, 91(2), 12–17.
- Barro, R. J., & Lee, J. W. (1996). International measures of schooling years and schooling quality. *The American Economic Review*, 86(2), 218–223.
- Barro, R. J., & Lee, J. W. (2001). International data on educational attainment: updates and implications. *Oxford Economic Papers*, 53(3), 541–563.
- Barro, R. J., & Lee, J. W. (2013). A new data set of educational attainment in the world, 1950–2010. *Journal of Development Economics*, 104, 184–198.
- Barro, R. J., & Sala-i-Martin, X. (1995). *Economic Growth*. McGraw-Hill.
- Baten, J., & Cappelli, G. (2016). The evolution of human capital in Africa, 1730-1970: A colonial legacy? In *CEPR Discussion Papers*.
- Baten, J., Crayen, D., & Voth, H.-J. (2010). Poor, hungry and ignorant: Numeracy and the impact of high food prices in industrializing Britain, 1780-1850. *Beiträge Zur Jahrestagung Des Vereins Für Socialpolitik 2010: Ökonomie Der Familie - Session: History as Laboratory: Natural Experiments in Economic History E1-V1*.
- Baten, J., Crayen, D., & Voth, H.-J. (2014). Numeracy and the impact of high food prices in industrializing Britain, 1780–1850. *Review of Economics and Statistics*, 96(4), 710–728.
- Baten, J., & Hippe, R. (2018). Geography, land inequality and regional numeracy in Europe in historical perspective. *Journal of Economic Growth*, 23(1), 79–109.
- Baten, J., & Szoltysek, M. (2012). The human capital of Central-Eastern and Eastern Europe in European perspective. In *Max Planck Institute for Demographic Research Working Paper* (Vol. 02).
- Baten, J., & Van Zanden, J. L. (2008). Book production and the onset of modern economic growth. *Journal of Economic Growth*, 13(3), 217–235.
- Becker, G. (1964). *Human capital. A theoretical and empirical analysis with special reference to education*. Columbia University Press.
- Becker, S. O. (2018). Education and human capital. In M. Blum & C. L. Colvin (Eds.), *An economist's guide to economic history* (pp. 121–131). Palgrave Macmillan.
- Becker, S. O., & Cinnirella, F. (2020). Prussia disaggregated : The demography of its universe of localities in 1871. In *CESifo Working Paper* (Vol. 8277).
- Becker, S. O., Cinnirella, F., & Woessmann, L. (2010). The trade-off between fertility and education: Evidence from before the demographic transition. *Journal of Economic Growth*, 15(3), 177–204.
- Becker, S. O., Hornung, E., & Woessmann, L. (2011). Education and catch-up in the Industrial

- Revolution. *American Economic Journal: Macroeconomics*, 3(3), 92–126.
- Becker, S. O., & Woessmann, L. (2009). Was weber wrong? A human capital theory of protestant economic history. *Quarterly Journal of Economics*, 124(2), 531–596.
- Beltrán Tapia, F. J. (2013). Enclosing literacy? Common lands and human capital in Spain, 1860-1930. *Journal of Institutional Economics*, 9(4), 491–515.
- Beltrán Tapia, F. J., Díez-Minguela, A., Gómez-Tello, A., Martínez-Galarraga, J., & Tirado-Fabregat, D. A. (2020). Lordships, state capacity and beyond: Literacy rates in mid-nineteenth-century Valencia. In *EHES Working Paper* (Issue 196).
- Beltrán Tapia, F. J., Díez-Minguela, A., Martínez-Galarraga, J., & Tirado-Fabregat, D. A. (2018). Two stories, one fate: Age-heaping and literacy in Spain, 1877-1930. In *EHES Working Paper* (Issue 139).
- Beltrán Tapia, F. J., Díez-Minguela, A., Martínez-Galarraga, J., & Tirado-Fabregat, D. A. (2019a). *Capital humano y desigualdad territorial. El proceso de alfabetización en los municipios españoles desde la Ley Moyano hasta la Guerra Civil*. Banco de España.
- Beltrán Tapia, F. J., Díez-Minguela, A., Martínez-Galarraga, J., & Tirado-Fabregat, D. A. (2019b). The uneven transition towards universal literacy in Spain, 1860-1930. In *EHES Working Paper* (Issue 173).
- Beltrán Tapia, F. J., & Martínez-Galarraga, J. (2018). Inequality and education in pre-industrial economies: Evidence from Spain. *Explorations in Economic History*, 69(2), 81–101.
- Bernabéu Albert, S., & Ortega Soto, M. (2011). Indios y franciscanos en la construcción de la Alta California. In E. García Cruzado (Ed.), *Actas de las Jornadas de Historia sobre el descubrimiento de América: Jornadas IV, V y VI (2008, 2009 y 2010), Tomo II* (pp. 405–434). Universidad Internacional de Andalucía.
- Blum, M., & Krauss, K. P. (2018). Age heaping and numeracy: Looking behind the curtain. *Economic History Review*, 71(2), 464–479.
- Boadas i Raset, J. (1986). *Girona després de la guerra de Successió. Riquesa urbana i estructura social al primer quart del segle XVIII*. Institut d'Estudis Gironins.
- Boletín Oficial de Instrucción Pública. Tomo III.* (1842). Imprenta Nacional.
- Boot, H. M. (1995). How skilled were Lancashire cotton factory workers in 1833? *The Economic History Review*, 48(2), 283–303.
- Borrás Llop, J. (1995). Actitudes patronales ante la regularización del trabajo infantil, en el tránsito del siglo XIX al XX: Salarios de subsistencia y economías domésticas. *Hispania: Revista Española de Historia*, 55(190), 629–644.
- Botticini, M., & Eckstein, Z. (2007). From farmers to merchants, conversions and diaspora: Human capital and Jewish history. *Journal of the European Economic Association*, 5(5), 885–926.
- Boucekkine, R., de la Croix, D., & Peeters, D. (2007). Early literacy achievements, population density, and the transition to modern growth. *Journal of the European Economic Association*

Association, 5(1), 183–226.

- Bozzano, M., & Cappelli, G. (2019). The legacy of history or the outcome of reforms? Primary education and literacy in Liberal Italy (1871-1911). *Quaderni Del Dipartimento Di Economia Politica e Statistica*, 801.
- Bruno, C. (1966). *Historia de la Iglesia en la Argentina: 1686-1740 (Vol.4)*. Editorial Don Bosco.
- Burgos Rincón, J. (1994). Alfabetización y escuela en Cataluña en el Siglo de las Luces. Una hipótesis interpretativa. *Manuscrits: Revista d'Història Moderna*, 12, 109–147.
- Burgueño, J., & Gras, M. M. (2014). Atles de la Catalunya senyorial. Els ens locals en el canvi de règim (1800-1860). In *Cartoteca*, 2. Rafael Dalmau.
- Calderón-Fernández, A., Dobado-González, R., & Garcíá-Hiernaux, A. (2020). Numeracy in Central New Spain during the Enlightenment. *Revista de Historia Economica - Journal of Iberian and Latin American Economic History*.
- Calvi, R., Mantovanelli, F., & Hoehn-Velasco, L. (2019). The Protestant legacy: Missions and human capital in India. In *SSRN Electronic Journal* (Issue 3354891).
- Camps, E. (1997). Las transformaciones del mercado de trabajo en Cataluña (1850-1925): Migraciones, ciclo de vida y economía familiares. *Revista de Historia Industrial*, 11, 45–72.
- Canellas Julià, C., & Toran, R. (2013). La gestió escolar a Barcelona (1900-1936). Iniciatives i limitacions de les institucions catalanes. *Recerques: Història, Economia i Cultura*, 66, 61–90.
- Cantoni, D. (2015). The economic effects of the protestant reformation: Testing the weber hypothesis in the German lands. *Journal of the European Economic Association*, 13(4), 561–598.
- Cappelletti, A. (1980). *Francisco Ferrer Guardia y la pedagogía libertaria*. La Malatesta.
- Cappelli, G. (2016). Escaping from a human capital trap? Italy's regions and the move to centralized primary schooling, 1861-1936. *European Review of Economic History*, 20(1), 46–65.
- Cappelli, G., & Vasta, M. (2020a). A “Silent Revolution”: school reforms and Italy's educational gender gap in the Liberal Age (1861–1921). *Cliometrica*, 14(1), 1–27.
- Cappelli, G., & Vasta, M. (2020b). Can school centralization foster human capital accumulation? A quasi-experiment from early twentieth-century Italy. *Economic History Review*, 73(1), 159–184.
- Carbonell-Esteller, M., & Marfany, J. (2017). Gender, life cycle, and family ‘strategies’ among the poor: the Barcelona workhouse, 1762–1805. *Economic History Review*, 70(3), 810–836.
- Carbonell de Masy, R. (1992). *Estrategias de desarrollo rural en los pueblos guaraníes (1609-1767)*. Antoni Bosch Editor.

- Carbonell i Porro, J. A., Ollé i Torrent, M., Renom i Puit, M., Santacana i Torres, C., & Tribó i Traveria, G. (1995). Aproximació a les formes i evolució de l'Associacionisme al Baix Llobregat, en el marc de les transformacions socio-econòmiques i polítiques de l'època, segle XIX-1930. In À. Calvo (Ed.), *El pas de la societat agrària a industrial al Baix Llobregat. Agricultura intensiva i industrialització* (pp. 681–732). Publicacions de l'Abadia de Montserrat.
- Cardiel, J., & Ollero, H. S. (1989). *Las misiones del Paraguay*. Información y Revistas.
- Carreras i García, M. (1993). La indústria a Badalona. Del 700 al 1936. *Carrer Dels Arbres. Revista Anuari Del Museu de Badalona*, 1(4), 71–88.
- Casas, J. (1996). La hisenda municipal liberal a Catalunya durant la primera meitat del segle XIX. In P. Anguera (Ed.), *Actes del III Congrés Internacional d'Historia Local de Catalunya. Funcionament de les finances al llarg de la història* (p. 436). L'Avenç.
- Chang, H. J. (2011). Institutions and economic development: Theory, policy and history. *Journal of Institutional Economics*, 7(4), 473–498.
- Chesnais, J.-C. (1992). *The demographic transition: Stages, patterns, and economic implications*. Oxford University Press.
- Cinnirella, F., & Hornung, E. (2016). Landownership concentration and the expansion of education. *Journal of Development Economics*, 121, 135–152.
- Cinnirella, F., Naghavi, A., & Prarolo, G. (2020). Islam and human capital in historical Spain. In *CEPR Discussion Paper* (Vol. 14561).
- Cipolla, C. (1969). *Literacy and development in the West*. Penguin.
- Clark, G., & Gray, R. (2014). Geography is not destiny: Geography, institutions and literacy in England, 1837-63. *Oxford Economic Papers*, 66(4), 1042–1069.
- Cohen, D., & Soto, M. (2007). Growth and human capital: Good data, good results. *Journal of Economic Growth*, 12(1), 51–76.
- Colvin, C. L. (2017). Banking on a religious divide: Accounting for the success of the Netherlands' Raiffeisen cooperatives in the crisis of the 1920s. *Journal of Economic History*, 77(3), 866–919.
- Comín, F. (1996). *Historia de la Hacienda pública, II: España (1808-1995)*. Editorial Crítica.
- Crafts, N. F. R. (1996). The First Industrial Revolution: A guided tour for growth economists. *The American Economic Review*, 86(2), 197–201.
- Crayen, D., & Baten, J. (2010). Global trends in numeracy 1820-1949 and its implications for long-term growth. *Explorations in Economic History*, 47(1), 82–99.
- Cuervo Álvarez, B. (2014). Las misiones de los padres jesuitas en Latinoamérica (1606- 1767). *La Razón Histórica. Revista Hispanoamericana de Historia de Las Ideas Políticas y Sociales*, 27, 146–185.
- David, Paul A. (1994). Why are institutions the “carriers of history”? Path dependence and the

- evolution of conventions, organizations and institutions. *Structural Change and Economic Dynamics*, 5(2), 205–220.
- David, Paul A. (2007). Path dependence: A foundational concept for historical social science. *Cliometrica*, 1(2), 91–114.
- de la Croix, D., Doepke, M., & Mokyr, J. (2018). Clans, guilds, and markets: Apprenticeship institutions and growth in the preindustrial economy. *Quarterly Journal of Economics*, 133(1), 1133–1165.
- de Pleijt, A. (2018). Human capital formation in the long run: Evidence from average years of schooling in England, 1300–1900. *Cliometrica*, 12(1), 99–126.
- de Pleijt, A., Nuvolari, A., & Weisdorf, J. (2020). Human capital formation during the First Industrial Revolution: Evidence from the use of steam engines. *Journal of the European Economic Association*, 18(2), 829–889.
- de Pleijt, A., & Weisdorf, J. (2017). Human capital formation from occupations: The ‘deskilling hypothesis’ revisited. *Cliometrica*, 11(1), 1–30.
- Dell, M. (2010). The persistent effects of Peru’s mining mita. *Econometrica*, 78(6), 1863–1903.
- Demeulemeester, J. L., & Diebolt, C. (2011). Education and growth: What links for which policy? *Historical Social Research*, 36(4), 323–346.
- Diario de sesiones de Cortes. Congreso de los Diputados. Sesión 14 de diciembre* (Vol. 154). (1906). Establecimiento tipográfico de los hijos de J.A. García.
- Diebolt, C., & Hippe, R. (2019). The long-run impact of human capital on innovation and economic development in the regions of Europe. *Applied Economics*, 51(5), 542–563.
- Diebolt, C., Le Chapelain, C., & Menard, A. R. (2019). Neither the elite, nor the mass. The rise of intermediate human capital during the French industrialization process. *Cliometrica*, 13(3), 1–36.
- Dittmar, J. E. (2011). Information technology and economic change: The impact of the printing press. *Quarterly Journal of Economics*, 126(3), 1133–1172.
- Dittmar, J. E., & Meisenzahl, R. R. (2020). Public goods institutions, human capital, and growth: Evidence from German history. *Review of Economic Studies*, 87(2), 959–996.
- Dorel-Ferré, G. (2003). La qüestió de les colònies industrials: Un fenomen discutit de la història industrial de la Catalunya dels segles XIX-XX. *Butlletí de La Societat Catalana d’Estudis Històrics*, 1, 97–112.
- Duran Sanpere, A. (1977). *Llibre de Cervera*. Curial.
- Easterly, W., & Levine, R. (2016). The European origins of economic development. *Journal of Economic Growth*, 21(3), 225–257.
- Engerman, S., & Sokoloff, K. (1994). Factor endowments: Institutions, and differential paths of growth among New World economies: A view from economic historians of the United States. In *Working Paper Series, Historical Paper* (Vol. 66).

- Epstein, S. R. (2004). Property rights to technical knowledge in premodern Europe, 1300-1800. *American Economic Review*, 94(2), 382–387.
- Ettinger, C. R. (2010). Una nueva domesticidad. Los indígenas de la Alta California y la vivienda misional. *Nuevo Mundo Mundos Nuevos-Nouveaux Mondes Mondes Nouveaux-Novo Mundo Mundos Novos-New World New Worlds*.
- Ewbank, D. C. (1981). *Age misreporting and age-selective underenumeration: Sources, patterns, and consequences for demographic analysis*. The National Academies Press.
- Expósito i Amagat, R. (2014). *Informació i persuasió: en els orígens de la premsa catalana (c. 1500-1720)*. Universitat de Girona.
- Expósito i Amagat, R. (2015). Nivells d'alfabetització i pràctiques de cultura escrita a la Catalunya moderna urbana i rural. Aprendre i saber de llegir, escriure, comptar i altres arts. *Revista de Llengua i Dret*, 63, 113–143.
- Feliu, G. (2012). *Historia econòmica de Catalunya*. Editorial Base.
- Fernández Clarés, M. L. (2007). L'alfabetització i l'ensenyament de primeres lletres a Terrassa durant el segle XVIII. *Manuscrits: Revista d'Història Moderna*, 25, 273–276.
- Ferrer i Alòs, L. (1983). Censals, vendes a carta de gràcia i endeutament pagès al Bages (s. XVIII). *Estudis d'història Agrària*, 1(4), 101–128.
- Ferrer i Alòs, L. (2012). El creixement divers de la Catalunya del segle XVIII. Protoindustrialització? *Catalan Historical Review*, 5(2012), 195–209.
- Ferrer i Alòs, L. (2017). Més enllà dels gremis i de les fàbriques d'indianes. La diversitat de formes de produir a la Catalunya del segle XVIII i primera meitat del s. XIX. *Treballs de La Societat Catalana de Geografia*, 2190(83), 183–211.
- Ferrer i Alòs, L. (2019). Especialitzacions de conreus a la Catalunya de la primera meitat del segle XIX. In *X Congrés sobre Sistemes Agraris, Organització i Poder Local*.
- Földvári, P., van Leeuwen, B., & van Leeuwen-Li, J. (2012). How did women count? A note on gender-specific age heaping differences in the sixteenth to nineteenth centuries. *Economic History Review*, 65(1), 304–313.
- Fourie, J., & Swanepoel, C. (2015). When selection trumps persistence. The lasting effect of missionary education in South Africa. *Tijdschrift Voor Sociale En Economische Geschiedenis/ The Low Countries Journal of Social and Economic History*, 12(1), 1–29.
- Fradkin, R., & Garavaglia, J. C. (2009). *La Argentina colonial. El Río de la Plata entre los siglos XVI y XIX*. Siglo XXI Editores.
- Franck, R., & Galor, O. (2017). Technology-skill complementarity in early phases of industrialization. In *NBER Working Paper* (Issue 23197).
- Frankema, E. H. P. (2012). The origins of formal education in sub-Saharan Africa: Was British rule more benign? *European Review of Economic History*, 16(4), 335–355.
- Frederick, J. C. (2000). *Luis De Unzaga and Bourbon Reform in Spanish*. Louisiana State

University.

- Gallego, F. A. (2010). Historical origins of schooling: The role of democracy and political decentralization. *Review of Economics and Statistics*, 92(2), 228–243.
- Gallego, F. A., & Woodberry, R. (2010). Christian missionaries and education in former african colonies: How competition mattered. *Journal of African Economies*, 19(3), 294–329.
- Galor, O. (2011). *Unified growth theory*. Princeton University Press.
- Galor, O., Moav, O., & Vollrath, D. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *Review of Economic Studies*, 76(1), 143–179.
- Galor, O., & Weil, D. N. (2000). Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond. *American Economic Review*, 90(4), 806–828.
- Ganson, B. A. (2005). *The Guaraní under Spanish rule in the Río de la Plata*. Stanford University Press.
- García España, E. (1991). Censos de población españoles. *Estadística Española*, 128, 441–500.
- Garrabou, R., & Ramon-Muñoz, J.-M. (2011). Aigua, agricultura i regadiu a la Catalunya contemporània, 1800-2010. *Estudis d'Història Agrària*, 23, 27–57.
- Gennaioli, N., Lopez-de-silanes, F., & Shleifer, A. (2013). Human capital and regional development. *The Quarterly Journal of Economics*, 128(1), 105–164.
- Giménez y Guitied, F. (1862). *Guía fabril e industrial de España*. Librería Española.
- Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth? *Journal of Economic Growth*, 9(3), 271–303.
- Glaeser, E. L., & Sacerdote, B. I. (2008). Education and religion. *Journal of Human Capital*, 2(2), 188–215.
- Glennie, P., & Whyte, I. (2000). Towns in an agrarian economy 1540–1700. In *The Cambridge urban history of Britain* (Vol. 2). Cambridge University Press Cambridge.
- Go, S., & Lindert, P. (2010). The uneven rise of american public schools to 1850. *Journal of Economic History*, 70(1), 1–26.
- Godayol Puig, M. T. (2006). Història social de l'escola a la Catalunya central. Vic 1830-1900. In *Universitat de Girona*. Universitat de Girona.
- Goerlich Gisbert, F. J., Mas Ivars, M., Azagra Ros, J., & Chorén Rodríguez, P. (2006). *La localización de la población española sobre el territorio. Un siglo de cambios (Un estudio basado en series homogéneas 1900-2001)*. Fundación BBVA.
- Goldin, C. (2014). Human Capital. In C. Diebolt & M. Hauptert (Eds.), *Handbook of Cliometrics* (pp. 1–27). Springer Berlin Heidelberg.

- Gómez-i-Aznar, È. (2019). Human capital at the beginnings of the 18th Century Catalonia: Age-heaping and numeracy in a changing economy. In *Documentos de Trabajo AEHE* (Vol. 1904).
- Gómez-i-Aznar, È. (2020). Ad maiorem Dei gloriam. Numeracy levels in the Guarani Jesuit missions. In *EHES Working Paper* (Issue 181).
- Goñi, M. (2018). Landed elites and education provision in England: Evidence from school boards, 1871-99. *Mimeograph*.
- Guereña, J.-L., Ruiz Berrio, J., & Tiana Ferrer, A. (1994). *Historia de la educación en la España contemporánea: Diez años de investigación* (Investigac). Centro de Publicaciones del Ministerio de Educación y Ciencia.
- Guereña, J.-L., & Viñao, A. (1999). Estadística escolar, proceso de escolarización y sistema educativo nacional en España (1750-1850). *Revista de Demografía Histórica*, 17(2), 115–140.
- Gurrera i Lluch, M. (2005). La inspecció de l'ensenyament primari de 1841 a Mataró, feta per Laureà Figuerola. *Sessió d'Estudis Mataronins*, 22, 147–161.
- Gutiérrez-Poch, M. (2018). “Oh, industria madre fecundísima”. La “doble revolución”: Revolución Liberal, cambio político y Revolución Industrial en España (1808-1874). *Areas. Revista Internacional de Ciencias Sociales*, 37, 44–59.
- Hall, G. M. (1986). Raza y libertad: La manumisión de los esclavos rurales de la Luisiana bajo la jurisdicción del capitán general de Cuba. *Anuario de Estudios Americanos*, 43, 365–376.
- Hampe Martínez, T. (1985). Visita de los indios originarios y forasteros de Paucarcolla en 1728. *Revista Española de Antropología Americana*, XV(15), 209–240.
- Hanushek, E. A., & Woessmann, L. (2010). *The high cost of low educational performance: The long-run economic impact of improving PISA outcomes*. OECD Publishing.
- Hébrard, J. (1989). La escolarización de los saberes elementales en la época moderna. *Revista de Educación*, 288, 63–104.
- Hippe, R. (2013). *Human capital formation in Europe at the regional level – implications for economic growth*. Universität Tübingen & Université de Strasbourg.
- Hippe, R., & Baten, J. (2012). Regional inequality in human capital formation in Europe, 1790-1880. *Scandinavian Economic History Review*, 60(3), 254–289.
- Hippe, R., & Fouquet, R. (2019). The human capital transition and the role of policy. In C. Diebolt & M. Hauptert (Eds.), *Handbook of Cliometrics* (pp. 1–47). Springer Berlin Heidelberg.
- Huizinga, M. M., Carlisle, A. J., Cavanaugh, K. L., Davis, D. L., Gregory, R. P., Schlundt, D. G., & Rothman, R. L. (2009). Literacy, numeracy, and portion-size estimation skills. *American Journal of Preventive Medicine*, 36(4), 324–328.
- Hull, C. H. (1899). *Economic writings of Sir William Petty. Vol. 1*. Augustus M Kelley.

- Humphries, J. (2011). English Apprenticeship: A neglected factor in the first industrial revolution. In P.A. David (Ed.), *The economic future in historical perspective* (pp. 73–102). Oxford University Press.
- Humphries, J. (2013). Childhood and child labour in the British industrial revolution. *The Economic History Review*, 66(2), 395–418.
- Iglésies, J. (1974). *Estadístiques de població de Catalunya el primer vicenni del segle XVIII (Vol. 3)*. Fundació Vives i Casajuana.
- Ingersoll, T. N. (1996). The slave trade and the ethnic diversity of Louisiana’s slave community. *The Journal of the Louisiana Historical Association*, 37(2), 133–161.
- Jackson, R. H. (1999). Agriculture, drought and Chumash congregation in the California missions (1782-1834). *Estudios de Historia Novohispana*, 19, 69–90.
- Jackson, R. H. (2004). Una mirada a los patrones demográficos de las misiones jesuitas de Paraguay. *Fronteras de La Historia*, 9, 129–178.
- Jacob, M. C. (2014). *The first knowledge economy: Human capital and the European economy, 1750–1850*. Cambridge University Press.
- Jones, C. I. (1995). R & D-based models of economic growth. *Journal of Political Economy*, 103(4), 759–784.
- Juif, D. T., & Baten, J. (2013). On the human capital of Inca Indios before and after the Spanish Conquest. Was there a “Pre-Colonial legacy”? *Explorations in Economic History*, 50(2), 227–241.
- Juif, D. T., Baten, J., & Pérez-Artés, M. C. (2020). Numeracy of religious minorities in Spain and Portugal during the inquisition era. *Revista de Historia Económica - Journal of Iberian and Latin American Economic History*, 38(1), 147–184.
- Kelly, M., Mokyr, J., & Gráda, C. Ó. (2014). Precocious albiion: A new interpretation of the British industrial revolution. *Annual Review of Economics*, 6(1), 363–389.
- Kiker, B. F. (1966). The historical roots of the concept of human capital. *Journal of Political Economy*, 74(5), 481–499.
- Kirby, P. (2005). A brief statistical sketch of the child labour market in mid-nineteenth-century London. *Continuity and Change*, 20(2), 229–245.
- Klein, H. S. (1995). *Haciendas y ayllus en Bolivia: ss. XVIII y XIX. Estudios históricos, vol. 18*. Instituto de Estudios Peruanos.
- Labrador Herráiz, M. D. C. (2006). Las reducciones del Paraguay, una experiencia educativa singular. *Educa: Revista Galega Do Ensino*, 48, 325–350.
- Le Chapelain, C. (2019). Cliometrics and the concept of human capital. In C. Diebolt & M. Hauptert (Eds.), *Handbook of Cliometrics* (pp. 1–25). Springer Berlin Heidelberg.
- Lewis, W. A. (1954). The economics of underdevelopment. *The Manchester School*, 22(2), 139–151.

- Lindert, P. (2004). *Growing public: Volume 1, the story. Social spending and economic growth since the eighteenth century*. Cambridge University Press.
- Livi-Bacci, M., & Maeder, E. J. A. (2004). The missions of Paraguay: The demography of an experiment. *Journal of Interdisciplinary History*, 35(2), 185–224.
- Llonch, M., & Sancho, S. (1990). La movilidad en el marco de la transición demográfica: la Cataluña interior 1755-1900. In *Actas del II Congreso de la Asociación de Demografía Histórica*. Centre d'Estudis Demogràfics.
- Lloret i Carbó, C. (1991). *Escola i infància a Catalunya a finals del segle XVIII*. Universitat de Barcelona.
- Lluch, E. (1973). *El pensament econòmic a Catalunya (1760-1840). Els orígens ideològics del proteccionisme i la presa de consciència de la burgesia catalana* (2009th ed.). Edicions 62.
- Lluch, E. (1981). La revolució industrial a la Garrotxa (1777-1822). *Annals de l'Institut d'Estudis Gironins*, 25, 193–230.
- Lozano López De Medrano, C. (2008). El gasto público en formación profesional industrial en España (1857–1935). *Investigaciones de Historia Económica*, 4(11), 39–73.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42.
- Lustig, W. (1996). Mba'eichapa oiko la guarani? Guaani y jopara en el Paraguay. *Papia-Revista Brasileira de Estudos Do Contato Linguístico*, 4(2), 19–43.
- Maeder, E. J. A. (1995). Asimetría demográfica entre las reducciones franciscanas y jesuíticas de guaraníes. *Revista Complutense de Historia de América*, 21, 71–84.
- Maloney, W. F., & Valencia Caicedo, F. (2016). The persistence of (subnational) fortune. *Economic Journal*, 126(598), 2363–2401.
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407–437.
- Manzel, K. (2007). *Human capital development and the impact of the Hungry Forties in Spain*. mimeo.
- Manzel, K., Baten, J., & Stolz, Y. (2012). Convergence and divergence of numeracy: The development of age heaping in Latin America from the seventeenth to the twentieth century. *Economic History Review*, 65(3), 932–960.
- Marfany, J. (2001). Migración e industrialización en Cataluña a mediados del siglo XIX: Igualada, 1847-59. In *Papers de Demografia (Centre d'Estudis Demogràfics)* (Vol. 200).
- Marfany, J. (2010). Is it still helpful to talk about proto-industrialization? Some suggestions from a Catalan case study. *Economic History Review*, 63(4), 942–973.
- Marfany, J. (2016). *Land, proto-industry and population in Catalonia, c. 1680-1829. An alternative transition to capitalism?* Routledge.

- Marino, C. D. (1998). Consideraciones sobre la utilización de fuentes fiscales coloniales para un estudio sociodemográfico, Alto Perú 1750-1810. *Papeles de Población*, 4(17), 209–224.
- Marsden, W. E. (1977). Historical geography and the history of education. *History of Education*, 6(1), 21–42.
- Marshall, A. (1925). *The principles of economics*. MacMillan.
- Martinez-Galarraga, J., & Prat, M. (2016). Wages, prices, and technology in early Catalan industrialization. *Economic History Review*, 69(2), 548–574.
- Martinez-Galarraga, J., Rodríguez Miranda, A., & Willebald, H. (2020). Patterns of regional income distribution in Uruguay (1872-2012): A story of agglomeration, natural resources and public policies. In D. A. Tirado-Fabregat, M. Badia, & H. Willebald (Eds.), *Time and space. Latin American regional development in historical perspective* (pp. 271–307). Palgrave Macmillan.
- Martínez i Rodríguez, M. À. (1987). *La població de Vilanova i la Geltrú en el segle XVIII (estudi demogràfic)*. Institut d'Estudis Penedesencs.
- Martínez Martin, C. (2003). El padrón de Larrazábal en las misiones del Paraguay (1772). *Revista Complutense de Historia de América*, 29, 25–50.
- Mateu, J. G. (2015). El català, llengua de govern: La política lingüística de la Mancomunitat de Catalunya (1914-1924). *Revista de Llengua i Dret*, 64, 86–101.
- McCleary, R. M., & Barro, R. J. (2006). Religion and economy. *Journal of Economic Perspectives*, 20(2), 49–72.
- McCloskey, D. N. (2010). *Bourgeois dignity: Why economics can't explain the modern world*. University of Chicago Press.
- Medina-Albaladejo, F. J., Añón Higón, D., Díez-Minguela, A., & Lana-Berasain, J.-M. (2020). Old wine in new wineskins? Understanding the cooperative movement: Catalonia, 1860-1939. *European Review of Economic History*, 14(3), 1–27.
- Meier zu Selhausen, F. (2019). Missions, education and conversion in Colonial Africa. In D. Mitch & G. Cappelli (Eds.), *Globalization and the rise of mass education* (pp. 25–59). Palgrave Macmillan.
- Meisenzahl, R. R., & Mokyr, J. (2012). The rate and direction of invention in the British Industrial Revolution. In J. Lerner & S. Stern (Eds.), *The rate and direction of inventive activity revisited* (pp. 443–479). Chicago University Press.
- Mill, J. S. (1848). *Principles of political economy with some of their applications*. D. Appleton.
- Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy*, 66(4), 281–302.
- Mitch, D. (1993a). Educación y crecimiento económico: ¿Otro axioma de indispensabilidad?. Del capital humano a las capacidades humanas. In C. E. Nuñez & G. Tortella (Eds.), *La maldición divina: Ignorancia y atraso económico en perspectiva histórica* (pp. 41–60). Alianza.

- Mitch, D. (1993b). The role of human capital in the first industrial revolution. In J. Mokyr (Ed.), *The British Industrial Revolution: An economic perspective* (pp. 267–307). Westview Press.
- Mitch, D. (1999). The role of education and skill in the British industrial revolution. In J. Mokyr (Ed.), *The British Industrial Revolution* (pp. 241–279). Routledge.
- Mokyr, J. (1985). *Why Ireland starved: A quantitative and analytical history of the Irish economy, 1800-1850*. Allen and Unwin.
- Mokyr, J. (2002). *The gifts of Athena: Historical origins of the knowledge economy*. Princeton University Press.
- Mokyr, J. (2005). The intellectual origins of modern economic growth. *The Journal of Economic History*, 65(2), 285–351.
- Mokyr, J. (2010). *The Enlightened economy: An economic history of Britain 1700-1850*. Yale University Press.
- Mokyr, J., & Voth, H.-J. (2009). Understanding growth in early modern Europe. In S. Broadberry & K. O'Rourke (Eds.), *Cambridge economic history of Europe* (Vol. 1, pp. 7–42). Cambridge University Press.
- Monés i Pujol-Busquets, J. (1987). *L'obra educativa de la Junta de Comerç, 1769-1851*. Cambra Oficial de Comerç, Industria i Navegació de Barcelona.
- Montalbo, A. (2020). Industrial activities and primary schooling in early nineteenth-century France. *Cliometrica*, 14(2), 325–365.
- Moraes, M. I. (2008). *La pradera perdida: Historia y economía del agro uruguayo. Una visión de largo plazo, 1760-1970*. Linardi y Risso.
- Moraes, M. I. (2012). *Las economías agrarias del litoral rioplatense en la segunda mitad del siglo XVIII: Paisajes y desempeño*. Universidad Complutense de Madrid.
- Moreno Claverías, B. (2004). Les condicions materials de vida dels rabassers penedesencs al segle XVIII: treball, mercat i consum. *Estudis d'Història Agrària*, 17(17), 615–630.
- Morgan, K., Mokyr, J., & O'Grada, C. (2020). The mechanics of the Industrial Revolution. In *CEPR Discussion Paper* (DP14884, Issue June).
- Moriconi, M. (2012). Administración borbónica de pueblos de indios en el Río de la Plata: Matriculas de pueblos de Santa Fe (1785). *Prohistoria: Historia, Políticas de La Historia*, 18, 144–197.
- Muratori, L. A. (1999). *El cristianismo feliz en las misiones de los padres de la Compañía de Jesús en Paraguay* (Traducción). Centro de Investigaciones Diego Barros Arana, DIBAM / Archivo Nacional / Universidad Alberto Hurtado.
- Nadal, J. (1971). *La población española (siglos XVI a XX)* (2a Edición). Ariel.
- Nadal, J. (1975). *El fracaso de la revolución industrial en España: 1830-1914*. Ariel.

- Nadal, J. (1995). *El factor humà en el retard econòmic espanyol: El debat entre els historiadors. Inauguració del curs acadèmic 1995-1996.*
- Nadal, J., Benaul, J. M., & Sudrià, C. (ed. . (2012). *Atles de la industrialització de Catalunya, 1750-2010.* Vicens Vives.
- Nadal, J., & Catalan, J. (1994). *La cara oculta de la industrialización española: la modernización de los sectores no líderes, siglos XIX y XX.* Alianza.
- Naritomi, J., Soares, R. R., & Assunção, J. J. (2012). Institutional development and colonial heritage within Brazil. *Journal of Economic History*, 72(2), 393–422.
- Nicholas, S. J., & Nicholas, J. M. (1992). Male literacy, “deskilling,” and the industrial revolution. *The Journal of Interdisciplinary History*, 23(1), 1–18.
- North, D. C. (1990). *Institutions, institutional change, and economic performance.* Cambridge University Press.
- Núñez, C. E. (1992). *La fuente de la riqueza. Educación y desarrollo económico en la España Contemporánea.* Alianza.
- Núñez, C. E. (2003). Literacy, schooling and economic modernization: a historian’s approach. *Paedagogica Historica*, 39(5), 535–558.
- Núñez, C. E. (2005). A modern human capital stock. Spain in the 19th and 20th centuries. In M. Jerneck, G. Morner, G. Tortella, & S. Akerman (Eds.), *Different paths to modernity: A Nordic and Spanish perspective* (p. 122). Nordic Academic Press.
- Nunn, N. (2008). The long-term effects of Africa’s slave trades. *The Quarterly Journal of Economics*, 123(1), 139–176.
- O’Rourke, K. H., & Williamson, J. G. (1997). Around the European periphery 1870-1913: Globalization, schooling and growth. *European Review of Economic History*, 1(2), 153–190.
- Ó Gráda, C. (2016). Did science cause the industrial revolution? *Journal of Economic Literature*, 54(1), 224–239.
- Ojala, J., Pehkonen, J., & Eloranta, J. (2016). Deskilling and decline in skill premium during the age of sail: Swedish and Finnish seamen, 1751–1913. *Explorations in Economic History*, 61, 85–94.
- Oreopoulos, P., & Salvanes, K. G. (2011). Priceless: The nonpecuniary benefits of schooling. *Journal of Economic Perspectives*, 25(1), 159–184.
- Oriol Moncanut, A. M. (1959). *La enseñanza en Barcelona a fines del siglo XVIII.* Consejo Superior de Investigaciones Científicas, Instituto " San José de Calasanz" de pedagogía.
- Ortega Soto, M. (1999). Colonización de Alta California: Primeros asentamientos españoles. *Signos Históricos*, 1(1), 85–103.
- Osante, P. (2010). Poblar la inmensidad: Sociedades, conflictividad y representación en los márgenes del Imperio Hispánico (siglos XV-XIX). In S. Bernabéu Albert (Ed.), *El*

septentrión novohispano: Una secular colonización (pp. 43–105). Ediciones Rubeo.

- Oto-Peralías, D., & Romero-Ávila, D. (2016). The economic consequences of the Spanish Reconquest: the long-term effects of Medieval conquest and colonization. *Journal of Economic Growth*, 21(4), 409–464.
- Peréz Artés, M. del C. (2020). *Essays on the economic history of numeracy in Spain*. University of Tübingen.
- Pérez i Molina, I. (1988). Dona i legislació a la Catalunya del segle XVIII. *Pedralbes: Revista d'Història Moderna*, 8, 259–266.
- Postigliola, M., & Rota, M. (2020). Institutions and literacy rates: The legacy of Napoleonic reforms in Italy. *European Review of Economic History*, 24(4), 1–23.
- Prados de la Escosura, L., & Rosés, J. R. (2010). Human capital and economic growth in Spain, 1850-2000. *Explorations in Economic History*, 47(4), 520–532.
- Prat Forga, J. M. (2012). La població i les activitats econòmiques de la Cerdanya a l'últim quart del segle XVIII (1775-1800). *Treballs de La Societat Catalana de Geografia*, 2190, 167–192.
- Puig i Reixach, M. (1988). La població d'Olot el 1716. *Annals Del Patronat d'Estudis Històrics d'Olot i Comarca*, 8, 145–176.
- Puig i Reixach, M. (2010). L'ensenyament de les nenes al segle XVIII als corregiments de Girona i Vic: Entre la caritat i la indústria popular. *Annals Del Patronat d'Estudis Històrics d'Olot i Comarca*, 21, 11–34.
- Pujadas-Mora, J.-M., Romero Marín, J., & Villar, C. (2014). Propuestas metodológicas para la aplicación de HISCO en el caso de Cataluña, siglos XV-XX. *Revista de Demografía Histórica*, 32(1), 181–220.
- Quarleri, L. (2013). Lógicas y concepciones sobre trabajo, acumulación y bienestar en los pueblos de indios guaraníes (Siglos XVII y XVIII). *Anos 90*, 20(37), 177–212.
- Rebelo, S. (1991). Long-run policy analysis and long-run growth. *Journal of Political Economy*, 99(3), 500–521.
- Reis, J. (2004). Human capital and industrialization: The case of a latecomer - Portugal, 1890. In J. Ljungberg & J. Smits (Eds.), *Technology and human capital in historical perspective* (pp. 22–48). Palgrave Macmillan.
- Reis, J. (2005). Economic growth, human capital formation and consumption in western Europe before 1800. In R. C. Allen, T. Bengtsson, & M. Dribe (Eds.), *Living standards in the past. New perspectives on well-being in Asia and Europe* (pp. 195–225). Oxford University Press.
- Reis, J. (2008). How helpful is age heaping? An exploration using the portuguese census of 1940. *VII Congress of the International Institute of Social History*.
- Rex Galindo, D. (2007). Franciscanos e indios en la Alta California española, 1769-1822. *Espacio, Tiempo y Forma - Serie IV - Historia Moderna*, 20, 157–170.

- Rizzo, A. (2014). La importancia de la imprenta en las misiones de guaraníes (Siglos XVII y XVIII). *Signos Universitarios*, 25(2), 127–140.
- Romer, P. M. (1986). Increasing returns and long-run growth. *The Journal of Political Economy*, 94(5), 1002–1037.
- Romer, P. M. (1987). Growth based on increasing returns due to specialization. *American Economic Association*, 77(2), 56–62.
- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), 71–102.
- Rosés, J. R. (1998). Measuring the contribution of human capital to the development of the Catalan factory system (1830-61). *European Review of Economic History*, 2(1), 25–48.
- Rubin, J. (2014). Printing and protestants: An empirical test of the role of printing in the reformation. *Review of Economics and Statistics*, 96(2), 270–286.
- Ruíz Gutiérrez, A., & Sorroche Cuerva, M. Á. (2014). Jesuitas, franciscanos y dominicos. La frontera litoral de las Californias en el siglo XVIII. In M. I. Montoya Ramírez & M. Á. Sorroche Cuerva (Eds.), *Espacios de tránsito. Procesos culturales entre el Atlántico y el Pacífico* (pp. 133–154). Editorial Universitaria.
- Saeger, J. S. (1985). Another view of the mission as a frontier institution: The guaycuruan reductions of Santa Fe, 1743-1810. *Hispanic American Historical Review*, 65(3), 493–517.
- Saleh, M. (2015). The reluctant transformation: State industrialization, religion, and human capital in nineteenth-century Egypt. *Journal of Economic History*, 75(1), 65–94.
- Salinas, M. L. (2008). Población y encomiendas en el nordeste argentino. El caso de Corrientes en el Siglo XVII y principios del XVIII según las visitas de indios. *Folia Histórica Del Nordeste*, 17, 111–136.
- Sánchez, A. (2000). Crisis económica y respuesta empresarial. Los inicios. *Revista de Historia Económica - Journal of Iberian and Latin American Economic History*, 18(3), 485–523.
- Sandberg, L. G. (1979). The case of the impoverished sophisticate: Human capital and Swedish economic growth before World War. *The Journal of Economic History*, 39(1), 225–241.
- Sanderson, M. (1972). Literacy and social mobility in the industrial revolution in England. *Past and Present*, 56, 75–104.
- Sanllehy i Sabi, M. À. (1996). Comunitats, veïns i arrendataris a la Val d’Aran (s. XVII-XVIII): Dels usos comunals a la dependència econòmica. *Pedralbes: Revista d’Història Moderna*, 16, 189–197.
- Sarasúa, C. (2002). El acceso de niñas y niños a los recursos educativos en la España rural del siglo XIX. In J. M. Martínez-Carrión (Ed.), *El nivel de vida en la España rural, siglos XVIII-XX* (pp. 549–609). Publicaciones de la Universidad de Alicante.
- Sarreal, J. (2014). *The Guaraní and their missions: A socioeconomic history*. Stanford University Press.

- Say, J. B. (1836). *A treatise on political economy: Or the production, distribution, and consumption of wealth*. John Grigg's.
- Schultz, T. W. (1961). Investment in human capital. *American Economic Association*, 51(5), 1035–1039.
- Serra i Rotés, R. (2011). Les colònies industrials a Catalunya. *Catalan Historical Review*, 255(4), 241–255.
- Sheets-Johnstone, M. (2010). *The roots of thinking*. Temple University Press.
- Silvestre, J., Ayuda, M. I., & Pinilla, V. (2015). The occupational attainment of migrants and natives in Barcelona, 1930. *Economic History Review*, 68(3), 985–1015.
- Simon i Tarrés, A. (1996). *La població catalana a l'Edat Moderna*. Universitat Autònoma de Barcelona.
- Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. W. Strahan and T. Cadell.
- Solà, P. (2011). *Educació i societat a Catalunya* (Biblioteca). Eumo Editorial.
- Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics*, 39(3), 312–320.
- Soubeyroux, J. (1985). Niveles de alfabetización en la España del siglo XVIII. Primeros resultados de una encuesta en curso. *Revista de Historia Moderna. Anales de La Universidad de Alicante*, 5, 159–172.
- Spennemann, D. H. R. (2017). Age heaping among Indian Hawkers in South-eastern Australia and their source communities in the Punjab. *Journal of Sikh and Punjab Studies*, 24(1–2), 149–202.
- Squicciarini, M. P., & Voigtlander, N. (2015). Human capital and industrialization: Evidence from the age of Enlightenment. *The Quarterly Journal of Economics*, 130(4), 1825–1883.
- Stolz, Y., Baten, J., & Reis, J. (2013). Portuguese living standards, 1720-1980, in European comparison: Heights, income, and human capital. *Economic History Review*, 66(2), 545–578.
- Szołtysek, M., Poniak, R., & Gruber, S. (2018). Age heaping patterns in Mosaic data. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 51(1), 13–38.
- Takeda, K. (2014). Cambio y continuidad del liderazgo indígena en el cacicazgo y en la milicia de las misiones jesuíticas: Análisis cualitativo de las listas de indios guaraníes Transition and continuity of the. *Tellus*, 23, 59–79.
- Takeda, K. (2016). Los padrones de indios guaraníes de las misiones jesuíticas (1656- 1801): Análisis dinámico y comparativo desde la óptica de los cacicazgos. *Surandino Monográfico*, 1, 66–105.
- Tello i Aragay, E. (1990). Vendre per pagar. La comercialització forçada a l'Urgell i a la Segarra al final del segle XVIII. *Recerques: Història, Economia i Cultura*, 23, 141–160.

- Terrades i Saborit, I. (1985). Colònies industrials: Ideologia i experiència. *Dovella*, 1, 26–30.
- Tollnek, F., & Baten, J. (2017). Farmers at the heart of the ‘human capital revolution’? Decomposing the numeracy increase in early modern Europe. *Economic History Review*, 70(3), 779–809.
- Torras i Ribé, J. M. (1974). Trajectòria d’un procés d’industrialització frustrat (Contribució a l’estudi de la relació entre infraestructura econòmica y transformacions industrials). *Miscellanea Aqualatensia*, 2, 151–198.
- Torras i Ribé, J. M. (1994). L’economia catalana abans de 1800. Un esquema. In J. Nadal, J. Maluquer de Motes, & C. Sudrià (Eds.), *Història econòmica de la Catalunya Contemporània* (pp. 13–38). Enciclopèdia Catalana.
- Tortella, G., & Núñez, C. E. (1993). Educación, capital humano y desarrollo: Una perspectiva histórica. In C. E. Núñez & G. Tortella (Eds.), *La maldición divina: Ignorancia y atraso económico en perspectiva histórica* (pp. 15–38). Alianza.
- Valencia Caicedo, F. (2019a). Missionaries in Latin America and Asia: A first global mass education wave. In D. Mitch & G. Cappelli (Eds.), *Globalization and the rise of mass education* (pp. 61–97). Palgrave Macmillan.
- Valencia Caicedo, F. (2019b). The Mission: Human capital transmission, economic persistence and culture in South America. *The Quarterly Journal of Economics*, 507–556.
- Valencia Caicedo, F., & Voth, H.-J. (2018). Christ’s shadow: Non-cognitive skills and prosocial behavior amongst the Guarani. *Bonn University, Mimeograph*.
- Valls Junyent, F. (2004). *La Catalunya atlàntica: aiguardent i teixits a l’arrencada industrial catalana*. Eumo Editorial.
- Van Leeuwen, M. H. D., & Maas, I. (2011). *HISCLASS: A historical international social class scheme*. Universitaire Pers Leuven.
- Van Leeuwen, M. H. D., Maas, I., & Miles, A. (2002). *HISCO: Historical international standard classification of occupations*. Leuven: Leuven University Press.
- van Lottum, J., & Poulsen, B. (2011). Estimating levels of numeracy and literacy in the maritime sector of the North Atlantic in the late eighteenth century. *Scandinavian Economic History Review*, 59(1), 67–82.
- van Lottum, J., & van Zanden, J. L. (2014). Labour productivity and human capital in the European maritime sector of the eighteenth century. *Explorations in Economic History*, 53(1), 83–100.
- Venini i Redín, E. (1990). El magisteri femení a Barcelona a les darreries del segle XVIII. *Educació i Cultura: Revista Mallorquina de Pedagogia*, 8, 63–70.
- Ventura i Munné, M. (1986). Lletrats i il·letrats en una ciutat de la Catalunya moderna: Mataró, 1750-1800. *Pedralbes: Revista d’Història Moderna*, 6, 257–263.
- Vergara, J. (1993). La Iglesia y la educación: la aportación del concilio de Trento. In B. Delgado Criado (Ed.), *Historia de la Educación en España y América*, vol. 2 (pp. 47–56).

Morata.

- Vicario, C. (2014a). Human capital in South Latin America: The Río de la Plata region between 1744 and 1860. *Revista Uruguaya de Historia Económica*, IV(5), 11–33.
- Vicario, C. (2014b). *The formation of human capital in pre-modern Latin America*. Eberhard Karls Universität Tübingen.
- Vilar, P. (1974). La Catalunya industrial: Reflexions sobre una arrencada i sobre un destí. *Recerques: Història, Economia i Cultura*, 3, 7–22.
- Viñao, A. (1990). The History of literacy in Spain: Evolution, traits, and questions. *History of Education Quarterly*, 30(4), 573.
- Viñao, A. (1999). Alfabetización y primeras letras (siglos XVI-XVII). In A. Castillo (Ed.), *Escribir y leer en el siglo de Cervantes* (pp. 39–84). Gedisa.
- Viñao, A. (2009). La alfabetización en España: Un proceso cambiante de un mundo multiforme. *Perspectivas Históricas de La Educación de Personas Adultas*, 3(1), 5–19.
- Vollrath, D. (2013). Inequality and school funding in the rural United States, 1890. *Explorations in Economic History*, 50(2), 267–284.
- Von Tunzelmann, G. N. (1993). Technological and organizational change in industry during the early Industrial Revolution. In P. K. O'Brien & R. Quinault (Eds.), *The industrial revolution and British society* (pp. 254–277). Cambridge University Press.
- Waldinger, M. (2014). *Missionaries in Venezuela* (Manuscript).
- Waldinger, M. (2017). The long-run effects of missionary orders in Mexico. *Journal of Development Economics*, 127(1), 355–378.
- Wallis, P. (2008). Apprenticeship and training in premodern England. *Journal of Economic History*, 68(3), 832–861.
- Walras, L. (2013). *Elements of pure economics*. Routledge.
- Webre, S. (1984). The problem of indian slavery in Spanish Louisiana, 1769-1803. *The Journal of the Louisiana Historical Association*, 25(2), 117–135.
- Westberg, J. (2020). The transnational dissemination of the infant school to the periphery of Europe: The role of primary schools, religion, travels, and handbooks in the case of nineteenth-century Sweden. *Paedagogica Historica*, 56(5), 1–21.
- Wilde, G. (2001). Los guaraníes después de la expulsión de los jesuitas: Dinámicas políticas y transacciones simbólicas. *Revista Complutense de Historia de América*, 27, 69–106.
- Wilde, G. (2016). *Religión y poder en las misiones de guaraníes*. Sb editorial.
- Woessmann, L. (2003). Specifying human capital. *Journal of Economic Surveys*, 17(3), 239–270.
- Woodberry, R. (2004). *The shadow of empire: Christian missions, colonial policy, and*

democracy in postcolonial societies. University of North Carolina at Chapel Hill.

Wrigley, E. A. (2006). *Categorising occupations: The primary, secondary, tertiary (PST) System*.

Zavala, S. (1978). *El servicio personal de los indios en el Perú (extractos del siglo XVI)*. El Colegio de México.

Zeev, N. Ben, Mokyr, J., & Beek, K. Van Der. (2017). Flexible supply of apprenticeship in the British Industrial Revolution. *Journal of Economic History*, 77(1), 208–250.

Zucchitello, M. (2013). *En mar i en terra. Una història de Tossa i la seva gent (1186-1835)*. Centre d'Estudis Tossencs.

