



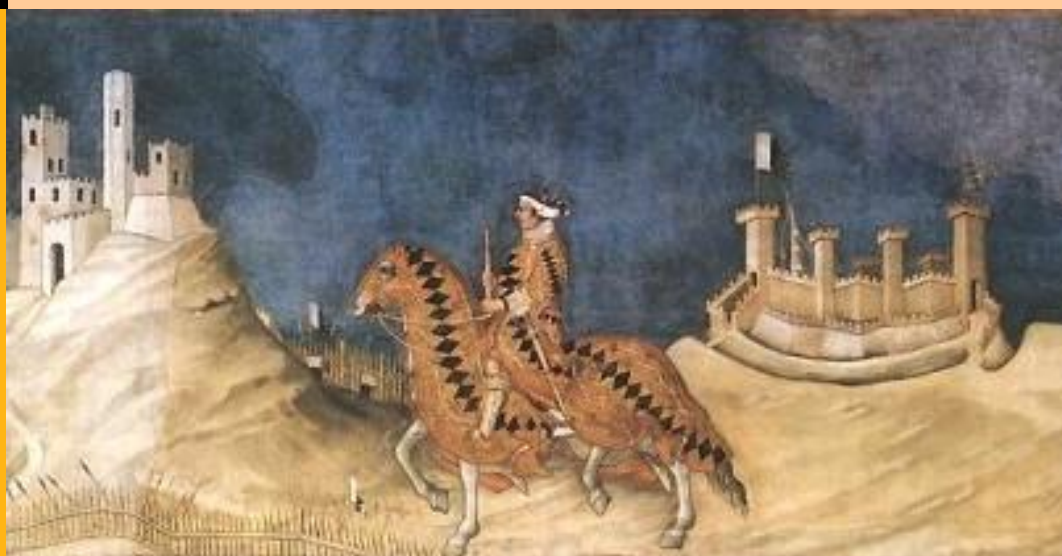
UNIVERSITÀ  
DI SIENA  
1240

**QUADERNI DEL DIPARTIMENTO  
DI ECONOMIA POLITICA E STATISTICA**

**Gabriele Cappelli  
Leonardo Ridolfi  
Michelangelo Vasta  
Johannes Westberg**

Human capital in Europe, 1830s – 1930s: towards  
a new spatial dataset

**n. 873 – Marzo 2022**



# Human capital in Europe, 1830s – 1930s: towards a new spatial dataset

Gabriele Cappelli ([gabriele.cappelli@unisi.it](mailto:gabriele.cappelli@unisi.it))

University of Siena, Department of Economics and Statistics

Leonardo Ridolfi ([leonardo.ridolfi@unisi.it](mailto:leonardo.ridolfi@unisi.it))

University of Siena, Department of Economics and Statistics

Michelangelo Vasta ([michelangelo.vasta@unisi.it](mailto:michelangelo.vasta@unisi.it))

University of Siena, Department of Economics and Statistics

Johannes Westberg ([b.a.j.westberg@rug.nl](mailto:b.a.j.westberg@rug.nl))

University of Groningen, Department of History and Philosophy of Education

**Abstract:** The literature on the causes of economic growth has emphasized the major role played by human capital accumulation. This survey shows that education and human capital are at the centre stage of the historical literature on industrialization and long-term economic development. Our contribution is threefold: first, we review the literature on the determinants of educational levels focusing on Europe in the period 1830 – 1930. We find that the lack of fine-grain spatial and (at the same time) harmonized data is preventing research on some important aspects of rising education. Secondly, we provide a preliminary taxonomy of European school acts and reforms in the 19<sup>th</sup> and early-20<sup>th</sup> century. Finally, we present the first version of a dataset under construction, which aims at providing spatial data covering gross enrolment rates and literacy across European regions from c. 1830 to 1930. Our preliminary results show that, in c. 1850, educational clusters appear to have often crossed national borders. By contrast, the effect of national institutions and regulations seems to have become an important determinant of schooling (and literacy) rates on the eve of the 20<sup>th</sup> century.

**JEL codes:** N30, O43, O52.

**Keywords:** Education, literacy, Europe, regional, comparative.

**Acknowledgements:** We are indebted with many people, particularly concerning the construction of the harmonized dataset. We would like to thank Francesco Cinnirella, Tomas Cvrcek, Thierry Eggerickx, Maria José Fuentes Vásquez, Kirti John, Vania Licio, Per Pettersson-Lidbom, Anna Missiaia, Sara Pecchioli, Mårten Viberg, and Sven Vrielinck for their precious help. We thank the participants at the workshop on “Metrics and Drivers of Well-Being in the Long-Run” (October 28<sup>th</sup>, 2021) organized by Daniel Gallardo Albarrán and Michail Moatsos. This work was supported by the Swedish Research Council under Grant 2016-05230.

## 1. Introduction

In the 1950s, Solow (1956) attempted to shed light on the factors that determine a country's economic performance, finding that increases in capital and labour alone can hardly explain 20<sup>th</sup>-century economic growth. Since then, more sophisticated theoretical models have focused on the role played by technological progress and human capital in long-term development (Lucas 1988, Romer 1990). Unified Growth Theory has recently connected today's economic performance to long-run human capital accumulation and, in turn, to historical trends in fertility and schooling dating back to the 19<sup>th</sup> century (Galor 2005).

Empirical evidence has largely confirmed the hypothesis that human skills and abilities are central to economic performance (see Hanushek and Woessmann 2020 for a short, yet comprehensive review). Hanushek and Woessmann argue that, when measures of learning outcomes are used to capture actual human capital formation beyond, e.g., years of education, the latter is found to be one of the most important determinants of economic growth and development across countries.

The persistence of educational disparities across countries and regions up to the present day is linked to historical educational inequality (Waldinger 2017, Valencia Caicedo 2019). Due to this, and because schooling and education systems have been changing to a large extent in the last two centuries, not least in association with evolving technology (Goldin and Katz 2008), the analysis of human capital accumulation and its relationship with socioeconomic development happens to be, to use Claudia Goldin's words, "inherently historical" (Goldin 2016).

Although there has been a growing number of contributions on this issue, the lack of fine-grain spatial and (at the same time) harmonized data has prevented research within economic history on some important aspects of rising education. For example, the impact of national school acts and reforms on schooling and human capital accumulation has remained under researched for several European countries.

In this paper, we present a comprehensive survey on the determinants of education and human capital accumulation in Europe from c. 1830 to 1930. Furthermore, we provide a preliminary taxonomy of European school acts and reforms in the 19<sup>th</sup> and early-20<sup>th</sup> century, emphasizing similar and different features of legislations regulating compulsory education across countries.

Finally, we present a brand-new dataset under construction, which aims at providing spatial fine-grain data covering gross enrolment rates and literacy across European regions (roughly today's NUTS3 statistical divisions) from c. 1830 to 1930.

Our results show a large variety of educational levels across European regions in the mid-19<sup>th</sup> century, both within and across countries. Around 1850, educational clusters were concentrated across national borders. Instead, by the beginning of the 20<sup>th</sup> century, the effect of national institutions and regulations had become an important determinant of schooling and literacy rates.

## 2. Human capital and economic growth: a historical perspective

Human capital may be defined as the set of skills that the labour force (the population) possesses and is generally regarded as a major resource or asset prompting long-term economic development (Goldin 2016). Human capital accumulation is also at the centre stage of debates on the Industrial Revolution and the transition from pre-industrial to modern economic growth.

One interpretation defended by Allen is that modern economic growth was largely due to international trade, while human capital as proxied by literacy “was generally unimportant for growth” (Allen 2009, p. 433). According to this view, the Industrial Revolution was British because of the peculiar structure of wages and energy prices characterising England in the 18<sup>th</sup> century rather than the quality of the British labour force. A number of studies, however, has challenged this interpretation.

Mokyr argued that the Enlightenment brought about new ways to generate and disseminate knowledge, particularly what the author labels “prescriptive knowledge”, i.e. the capability to manipulate natural phenomena for human material needs and production (Mokyr 2004, 2012). Mokyr’s thesis does not necessarily imply that general education – or widespread vocational training – sustained the Industrial Revolution; yet, it assumes that at least a restricted elite, as well as perhaps a small portion of the working population, became acquainted with connecting the world they observed (and interacted with) to the new notions and laws that they could learn thanks to the diffusion of Enlightenment ideas. The crucial role played by the quality of the labour force has also been highlighted by Kelly, Mokyr and Ó Gráda (2014). Other scholars have also rekindled the attention towards human capital as a key driver of long run economic growth and have interpret it as the main factor accounting for the little divergence, the process whereby the North-Sea Area became the most prosperous and dynamic part of Europe from the 16<sup>th</sup> century onwards (Baten and van Zanden 2008, De Pleijt and van Zanden 2016).

Mokyr’s thesis has been recently examined with regards to several specific countries, e.g., 19<sup>th</sup>-century Britain (Dowey 2017), Prussia (Cinnirella and Streb 2017), France during its early industrialization (Squicciarini and Voigtländer 2015), as well as Sweden (Ljungberg and Nilsson 2009). These studies agree on the importance of the rise and diffusion of useful knowledge based on growing prescriptive knowledge; yet, they differ concerning the importance of knowledge elites (so-called upper-tail human capital) vs basic human capital and universal education. While Squicciarini and Voigtländer (2015) argued that the French industrial revolution was prompted by the diffusion of upper-tail knowledge, the case of Prussia shows that basic literacy was also crucial during the Second Industrial Revolution (Cinnirella and Streb 2017). To date, empirical results on the relative weight of these two aspects remain linked to specific historical contexts and periods.

The importance of human capital for early industrialization is still partially debated (Ogilvie and Küpker 2015); yet a broad consensus has emerged that sees human capital accumulation as a major determinant of economic growth at least since the late-19<sup>th</sup> century and up to the present day (Baten and Juif 2014). In his survey of global economic history, Allen (2011) considered the creation of an effective system of “mass education” as one of the four “pillars” of the “standard model” of industrialization adopted by the Western countries which contributed to speed up the adoption and further development of modern industrial technologies. This view echoes the one

provided by the seminal work on “catching up” (or falling behind) by Abramovitz (1986), who argued that latecomer countries are able to imitate firstcomer technologies (and then perhaps innovate) only insofar as they possess a range of “social capabilities” – among which one finds education.

Education can directly increase the productivity of both capital and labour, and help incorporating new technologies into existing production processes. However, education has been associated with other proximate determinants of economic growth, historically. For example, education has been found to have substantially raised workers’ wages in the past (Federico Nuvolari and Vasta 2019). Similarly, education – even basic schooling and literacy – is argued to have been an asset for farmers during the agrarian revolution (Nilsson et al. 1999) and found to have increased inventive activity in both Italy and Prussia in the late-19<sup>th</sup> century (see, respectively, Nuvolari and Vasta 2017 and Cinnirella and Streb 2017). Education was also one of the most important sources of gender inequality (Bertocchi and Bozzano 2016, Ciccarelli and Weisdorf 2019), which has been found to hamper economic growth (Klasen 2002).

Due to the importance of education for economic development, research on social and economic history has sought to shed light on the determinants of educational trends since the early 19<sup>th</sup> century, if not before (see Mitch 2013 for an overview). Our literature review, below, addresses historical research on the social, political, cultural, demographic, economic and institutional determinants of education.

Covering all scholarly contributions that have addressed historical patterns of change in human capital accumulation is a rather intimidating task. Thus, in order to render the literature review tractable within this paper, we take a somewhat restricted view of the topic. We focus on Europe from c. the 1830s to the 1930s, which by far and large correspond to the spread of mass education across the continent. Furthermore, we concentrate mostly on primary education – as captured by two main metrics, namely gross enrolment rates and literacy rates. We therefore do not discuss informal schooling and productive skills derived from apprenticeship to crafts or on the job training as well as other important skills such as numeracy.<sup>1</sup> Nevertheless, at times we briefly touch upon seminal studies concerning the rest of the world and discuss other educational levels. Due to this, the next Section may not be exhaustive, even if it provides a comprehensive overview of the main issues addressed by this literature both concerning Europe and in more general terms.

### **3. The determinants of education and human capital accumulation: a selected literature review**

This section provides a broad review of the literature that has explored the different determinants of human capital accumulation. The aim of this review is twofold. We first discuss relevant works addressing the link between two factors that typically change very slowly over time, namely religion and institutions, and the rise of mass education (Section 3.1). We concentrate attention on the literature focusing on the past and the long run, yet we do not consider the so-called “persistence studies”, recently emerged as a related but separate field, addressing how important events in the past have shaped economic, and sometime also non-economic, present-

---

<sup>1</sup> For the role of the apprenticeship system in human capital formation see Humphries (2003), Wallis (2008) and Zeev, Mokyr and van Der Beek (2017). For numeracy see Crayen and Baten (2010), Baten and Hippe (2018). Baten and Van Zanden (2008) also analysed books production to unveil long run patterns in advanced literacy skills across Europe.

day outcomes (Cioni, Federico and Vasta 2021a, 2021b). Then, we turn the attention to factors that typically change in the short run – such as industrialization, demography, the political economy of schooling and reforms – while shaping educational trends (Section 3.2).

### 3.1 Long lasting determinants

#### 3.1.1 Religion

A potential determinant of human capital accumulation is religion. Three main aspects of this topic have been addressed in the literature.

The first important issue is how different religions, or religious denominations, have affected investments in human capital in a historical perspective. In their seminal contribution, Becker and Woessmann (2009) have tested Weber's hypothesis of the high prosperity of Protestant regions due to the diffusion of an ethic stressing the value of work. Indeed, they provided an alternative theory which considers the crucial role played by human capital accumulation, showing that the prosperity of the Protestant economy is related to the spread of basic mass education due to the direct access to the word of God, without any intermediation by priests that, instead, occurred in the Catholic world. The spread of Protestantism and the ensuing religious divide it brought about across Europe has offered a natural testing ground to explore this aspect. The authors have measured its effect on the diverging patterns of human capital accumulation across Prussia. They exploited the concentric diffusion of Protestantism around the city of Wittenberg, where first Luther's theses were exposed in 1517, confirming that Protestantism had a strong effect on 19<sup>th</sup> century prosperity via human capital accumulation. In a similar vein, Botticini and Eckstein (2005, 2007) emphasized the greater investments in human capital of Jews compared to other religions and linked this difference to the centuries-old Judaic rule prescribing males to read the Torah in the synagogue and to teach the reading of the text to their sons.

In their analysis of the effect of religious denomination on human capital formation in 19<sup>th</sup> century Swiss districts, Boppart et al. (2013) highlighted a different channel through which religion affected human capital formation. Indeed, at least in the Swiss context, educational outcomes were not related to religion *per se* but reflected the interaction between religion and sociocultural characteristics. Thus, while average public education spending per pupil and educational performance were lower in Catholic districts than in Protestant ones, the negative impact of Catholicism did not seem to have affected areas characterised by a non-conservative milieu.

A second strand of the literature has investigated the relationship between religion and gender inequality in education. The few studies available suggest that Protestantism, with its special emphasis on the individual study of the Bible for both boys and girls, is associated with lower rates of gender inequality in education. This occurred, for example, in 19<sup>th</sup> century Prussia (Becker and Woessmann 2008).<sup>2</sup>

A third stream of literature has investigated how the emergence of state-sponsored mass education vis à vis traditional religious bodies affected human capital formation in the long run. Some studies have analysed the competition between religious and public-school provision. For

---

<sup>2</sup> This correlation has been observed also for colonial Africa where the location and activities of Protestants had positive long-term effects on the educational attainment of females (Nunn 2014).

instance, West and Woessmann (2010) showed that Catholicism is associated with a persistent lower supply of public education. Furthermore, in the areas of France where Catholicism was stronger and the population supported local priests against the French revolutionaries during the 1789 French Revolution, public schooling underwent more cultural resistance and catholic schooling displayed a high degree of resilience despite several efforts made by government to promote public education (Franck and Johnson 2016). Similarly, Squicciarini (2020) examined Catholicism in France during the Second industrial Revolution, showing that more religious locations had lower economic development after the 1870. According to the author, this is due to a slower adoption of the technical curricula in primary schools and a push for Catholic education driven by parents' preference for religious education.<sup>3</sup>

### 3.1.2 Institutions

Institutions have long been a central concern for economic historians, particularly for their role as a fundamental cause of economic growth (North 1991). In the same vein, economists have explored the issue of the colonial roots of underdevelopment, which has become one of the most fashionable topics in all economics journals at least since the path-breaking contributions by Acemoglu, Johnson and Robinson (2001, 2002). The authors argued that political institutions, which are considered "state variable" since they change very slowly, economic institutions and democracy are crucial and determinants of incomes, prompting sustained economic growth in the long run (Acemoglu Johnson and Robinson 2005). However, comparatively, less has been said about institutions as determinants of human capital accumulation in historical perspective.

Interestingly, several studies have questioned the idea that the growth of more democratic institutions (democratization) was a leading force driving the expansion of primary schooling. State-controlled primary schooling indeed typically emerged before democratization, and in most democratic countries, a large share of the population already had access to primary education before democratization (Paglayan 2021). Quantitative analyses confirm this interpretation. For instance, Aghion et al. (2019) concluded that democracies tended to invest less in elementary education than autocracies in the 19<sup>th</sup>-20<sup>th</sup> centuries, while Paglayan (2021) maintained that democratization had no or little impact on primary school enrolment rates examining a sample of 109 countries from 1800 to the present day. Similarly, other studies have argued that authoritarian regimes were more effective than democracies in spreading mass education. One interpretation is that investments in human capital were primarily determined by the cultural or political distance between individuals and the government which supplied education. Due to the cultural role played by education, some members of society experienced these state educational policies as a threat to their identity and thus resisted education (Carvalho and Koyama 2016; Carvalho, Koyama and Sacks 2017). For instance, according to Palma and Reis (2021), the *Estado Novo*, the authoritarian regime governing Portugal from 1933 to 1974, was far more successful than the previous democratic regime in the spread of primary education because the anti-Catholic nature of the democratic government discouraged parents from sending their children to public school.

---

<sup>3</sup> This view has been criticized by Kelly (2021) who maintained that the relationship is spurious because the poorest regions were also the most devout and thus the effect disappears when considering the different living standards. However, the debate is still on going, see Squicciarini (2021) reply to Kelly.

A second strand of the literature has focused on key critical junctures, such as the French Revolution, to understand the long run effects of institutional change on human capital formation. Postigliola and Rota (2020), for instance, have focused on a natural experiment, the occupation of French troops in Italy, to identify the institutional origins of the large literacy gap characterising North and South Italy in 1861, at the time of the unification. Exploiting exogenous variation in the length of French political control across Italy's provinces as a proxy for educational reforms, they conclude that the human capital divide was a legacy of the Napoleonic educational reforms implemented between 1801 and 1814. Relative to 1861, indeed, literacy rates in the South would have been up to 70% higher had this area experienced the same duration of French dominance as the North. Similarly, according to Lupo (1999) the school reforms that radically redesigned the public school system in the Kingdom of Naples during the French period had a positive long-lasting effect, and were accompanied by a complete change in mentality characterised by a widespread and well-articulated desire for education.

## 3.2 Changing determinants

### 3.2.1 *Economic activity*

One of the leading interpretations of the transition from Malthusian to modern economic growth has argued that industrialization and technical change increased the demand for skills and fostered human capital accumulation (e.g., Galor and Moav 2006, Galor 2011). However, whether industrialisation was skill demanding or skill saving is a long-debated issue in economic history. A natural testing ground for the link between industrialisation and human capital formation is offered by England, the cradle of the Industrial Revolution.

Classic studies about the evolution of basic human capital over the early stages of industrialization in Britain support the deskilling hypothesis. Male literacy rates were found to be stagnant (Schofield 1973, Nicholas and Nicholas 1992, Mitch 1999), like average years of primary schooling, while a dramatic decline in attainment rates in secondary and tertiary schooling occurred after c. 1720 (de Pleijt 2018). Evidence of a growing share of unskilled workers (de Pleijt and Weisdorf 2017) coupled with the broad stability of the skill premium (Clark 2005, Allen 2009, Van Zanden 2009) also gave sustenance to this argument, leading to the widespread view that basic human capital did not play an important role in the British Industrial Revolution. This claim was reinforced by making comparisons with other European countries, which displayed relatively high levels of literacy and schooling but low levels of industrialization such as Sweden, the Europe's 'impoverished sophisticate' – In the words of Sandberg (1979) – which was characterised by almost universal alphabetisation but low income per capita.

Basic human capital and formal schooling, however, offer only a partial picture as informal schooling and more advanced forms of human capital could have played an important role as well (Humphries 2003, Wallis 2008, Mokyr 2009). For instance, Feldman and van der Beek (2016) showed that the number of apprentices and their weight in the adult population increased in response to inventions in 18<sup>th</sup> century England. Similarly, Meisenzahl and Mokyr (2012) found that the diffusion of new technology during the Industrial Revolution stimulated a growing class of highly skilled mechanical workers, as suggested by some studies (Mokyr 2005, Mokyr and Voth 2009, Zeev, Mokyr and Van Der Beek 2017).



De Pleijt Nuvolari and Weisdorf (2020) offered a more nuanced picture of the effect of technology on human capital formation. They carried out a systematic quantitative assessment of the effect of industrialisation, captured by the number of steam engines per capita installed in England by 1800, on the average working skills of the workforce at the time. They show that steam engine per capita had a negative effect on the accumulation of basic human capital as proxied by literacy and school enrolment rates and led to higher gender inequality in literacy. These findings chime with early studies on the deskilling effects of industrialisation on basic human capital and agree with Sanderson's (1972) observation that female industrial employees had markedly lower rates of literacy compared with their female agricultural and male industrial counterparts. Nevertheless, the authors show that steam engine adoption led to a growing share of skilled workers and the effect was casual providing support to the notion that England's Industrial Revolution was skill demanding on average.

The French evidence contrasts, however, with the traditional narrative about the effects of early industrialisation in England and the United States. Franck and Galor (2017) showed that the number of steam engines per department in 1839–1847 had a significant impact on the number of teachers later in the century, on the share of apprentices and literate conscripts, and on the number of schoolhouses and pupils enrolled in primary schools. Diebolt, Menard and Perrin (2017) found that the number of steam engines within French departments was positively associated with literacy rates and primary schools' presence in the first half of the 19<sup>th</sup>. The association became non-significant after 1850 but a positive relation emerged with adult education and higher levels of schools. Steam engine adoption also significantly contributed to the development of lifelong training during the 1850–1881 period (Diebolt, Le Chapelain and Menard 2019) and was conducive to the accumulation of intermediate human capital in the second half of the 19<sup>th</sup>, namely intermediate skills which incorporate basic scientific and technical knowledge (linear drawing, geometry, mechanics, etc.), foreign languages and basic knowledge in law and trade (accounting) (Diebolt, Le Chapelain and Menard 2021). Finally, Montalbo (2020) maintained that the presence of industrial activities in a given municipality had a positive effect on the presence of primary schools in early 19<sup>th</sup> century France seemingly through an income effect favoured by transfers made by manufactures. However, he finds that industrial activities were associated with lower enrolment rates.<sup>4</sup>

### 3.2.2 Demography

In recent years, the analysis of long run demographic trends has attracted the attention, as economists have begun to incorporate demographic behaviour into the theories concerning the

---

<sup>4</sup> The link between industrialization and human capital formation has also been investigated for other countries outside Europe. Evidence from the 19<sup>th</sup> century United States, suggested that industrialisation tended to favour unskilled rather than skilled employment as the factory system began to replace the artisanal workshop (Goldin and Sokoloff 1982, Attack, Bateman and Margo 2004, 2008). Ultimately, during the early stages of US industrialisation, technological innovation and human capital were substitutes and became complementary only in the early 20<sup>th</sup> century when technology shifted from steam power to electricity (Goldin and Katz 1998). Nevertheless, as shown by Katz (2018), the process of industrialization in the US could have boosted the accumulation of basic competences, such as the ability to read, as result of the construction of railroads. Interestingly, Saleh (2015) analysed the earliest state industrialization programs taking place in Egypt in 1805–1882 by showing that the first state industrialization wave was “de-skilling” among Muslims but “up-skilling” among Christians, while the second wave was “up-skilling” for both groups.

nexus between human capital formation and long run economic growth.<sup>5</sup> Two types of studies have emerged: the first investigating the effect of fertility on education and the second analysing the impact of mortality on education.

Recent interpretations have highlighted the importance of 18<sup>th</sup> century industrialization which marked a fundamental transition in parental attitudes from investment in child quantity to investments in child quality, eventually leading to fertility reductions and human capital accumulation in various European countries (Galor and Weil 1996, Diebolt and Perrin 2013). Despite their importance, only few studies have tested these arguments in historical perspective. Based on individual level data from 15 Anglican parishes within the period 1700-1830, Klemp and Weisdorf (2016) examined the existence of the child quantity-quality trade-off for historical England. Using time interval from marriage to first birth (number of siblings who survive to age five) as a measure of exogenous variation in family size, they find a negative causal effect of family size on individual literacy. Additionally, Fernihough (2011) investigated the impact of sibship size on school enrolment in Belfast and Dublin using individual level data from the 1911 census. He found strong evidence of a negative impact of extra sibling on school enrolment, particularly in more industrialized areas. In a similar vein, Becker, Cinnirella and Woessmann (2010) investigated the relationship between the quantity-quality trade-off of children and fertility restraint based on aggregated regional data for nineteenth century Prussia. They suggested that the negative correlation between education and fertility also existed in Prussia during the nineteenth century. Several studies have also focused on nineteenth century France. Diebolt, Menard and Perrin (2017) found that a decrease in fertility was strongly associated with greater schooling in France. A micro-level study focusing on the city of Saint-Germain-d'Anxure between 1730 and 1895, also suggests that the fall in fertility in the late 18<sup>th</sup> century preceded the rise in education by several decades (Blanc and Wacziarg 2020).<sup>6</sup>

Another strand of the literature has also analysed the effect of mortality on the accumulation of human capital arguing that lower mortality induced higher investment in human capital, therefore paving the way to future growth (Boucekkine, De La Croix and Licandro 2002).

---

<sup>5</sup> One influential argument connects differential patterns in human capital accumulation across pre-industrial Europe to the so-called European Marriage Pattern, a demographic system, originally identified by Hajnal (1965), involving late marriage for women, high proportions never marrying, and predominantly nuclear families (above c. 80%). According to de Moor and van Zanden (2010), this demographic regime emerged in the North Sea region in the late Medieval period promoting female autonomy, limited fertility, thereby increasing real wages and human capital formation (Voigtländer and Voth 2013). These patterns led to the "Little Divergence" between northwest Europe and the rest of the continent after the Black Death (Voigtländer and Voth 2006, de Moor and Van Zanden 2010, Carmichael et al. 2016, Foreman-Peck 2011). Other studies have questioned this interpretation arguing that female autonomy in the North Sea area did not substantially differ from other parts of Europe (Dennison and Ogilvie 2014).

<sup>6</sup> Other studies focusing on China have found contradictory results of the effect of family size on school attainment. Using multiple births and variation in China's one-child policy, Qian (2009) has found a positive effect of the increase in family size on the child enrolment rate. Conversely, Rosenzweig and Zhang (2009) show that having extra-child significantly decreases endowment in human capital of all children in the family. Bleakley and Lange (2009) analyse the eradication of hookworm disease in southern US (c. 1910) and showed that this episode determined the simultaneous observed increases in human capital investments and declines in fertility rates. A decline in the hookworm-infection rate from 40% to 20% is associated with a decline in fertility that amounts to 40% of the entire fertility decline observed in the American South between 1910 and 1920.

### 3.2.3 Political economy

An important strand of literature has looked at the relationship between the distribution of decision-making power and the rise of mass education. The prevailing interpretation is that a greater political voice and widespread voting rights allowed local demands for schooling to be expressed and eventually channelled into actual policies by means of tax-based school programs (Lindert 2004). According to this view, the level of investment in education is the result of the interaction between the choices of ruling elites and the decisions of individuals and households. The first typically determine the supply of education, while the second set the aggregate demand of schooling.<sup>7</sup> While a large body of literature has analysed this topic, so far there are only few studies looking at European countries.<sup>8</sup> Within this framework, two alternative interpretations of the historical role played by ruling elites in fostering human capital accumulation have emerged.

The first interpretation, focusing on pre-industrial rural societies and, particularly, on their transition towards modern economic growth, maintained that ruling elites have generally tended to block the accumulation of human capital. In a world that was still primarily rural, and economic and political power were largely dependent on land ownership, ruling elites lacked fundamental economic incentives to support growth enhancing educational programs owing to the low degree of complementarity between human capital and agriculture as well as the decreasing return to land associated with migration and the rise in the cost of labour in agriculture (Engerman and Sokoloff, 2000, Galor, Moav and Vollrath 2009). Thus, according to this interpretation, agrarian societies and early industrialising countries were characterised by a conflict between landed elites on the one side and the masses and the emerging capitalist elites on the other. To the extent that in pre-industrial societies land ownership was a major source of power, an unequal land structure led to a high concentration of economic and political power in the hands of few large landowners and this in turn could hamper the accumulation of human capital in the long run. Nevertheless, an unequal land property structure may affect education via different channels. For instance, greater land inequality can reduce the demand of education by providing lower incentives to the households and individuals. Several historical studies have tested these arguments.

Cinnirella and Hornung (2016) have documented a negative association between landownership concentration and schooling outcomes in 19<sup>th</sup> century Prussia by identifying the key mechanism in the diminished private demand for education induced by landownership concentration and serfdom. Similarly, by employing district level information on mid-19<sup>th</sup> century Spain, Beltrán Tapia and Martínez-Galarraga (2017) have shown that the degree of land access inequality, measured as the proportion of farm labourers over the population engaged in agriculture, had an adverse impact on male literacy rates driven by the reduced demand of education. Goñi (2018) tests the same argument focusing on late-19<sup>th</sup> century England when the Forster Education Act introduced state-schooling in 1870 to meet the demand for an educated

---

<sup>7</sup> When demand of schooling is not matched by supply, the vacuum can be filled by other private institutions.

<sup>8</sup> Evidence from the BRIC countries (Chaudhary et al. 2012), Brazil (Musacchio, Fritscher and Viarengo 2014), former American colonies (Engerman and Sokoloff 1997, Mariscal and Sokoloff 2000, Gallego 2010), the US (Go and Lindert 2010, Ramcharan 2010, Naidu 2012), and Russia (Nafziger 2011) suggested that extension of the franchise had a positive effect on schooling.

workforce. While the study again provides support for a negative relationship between landownership concentration and various measures of state-sponsored education, its results indicate that the political opposition of landed elites to fund education was the key channel through which land inequality undermined state education.<sup>9</sup>

Despite this widespread consensus, few studies have challenged this interpretation. Focusing on 19<sup>th</sup> century England, Clark and Gray (2014) analysed differences in literacy rates across a sample of parishes in two northern counties (Lancashire and Northumberland) characterised by dairy farming, and relatively small land concentration and two southern counties (Essex and Somerset) where large-scale farming and landless labourers prevailed. Using these data, they find that there is no connection between large-scale farming and illiteracy and conclude that other cultural factors account for these variations.<sup>10</sup> Cvrcek and Zajicek (2019) investigated the Austrian primary school reform of 1869 and how the various political and social actors supported or opposed it. Unsurprisingly, greater support came from urban and industrial districts. However, contrary to prevailing interpretations, in rural areas the strongest opposition did not come from large landowners who were mildly in favour of school modernization, but from the rural masses. According to the authors, this occurred because rural districts, at a time in which rural urban migration was limited, expected more costs than benefits from the reform and eventually perceived it as an implicit subsidy to be paid to educate industrial future industrial workers.

Post-unification Italy provides an interesting testing ground owing to the large regional inequalities which have characterized the whole history of the country. A'Hearn and Vecchi (2017) argued that political voice played the largest role in explaining differences in educational outcomes between the North and the South: limited electoral franchise in the South reduced the commitment to fund schools and other public goods, leading to little local taxation on land and property and, eventually, poor fiscal capacity. In contrast, a wider voting franchise in the North, by pushing ruling elites to act in the interest of the majority, was associated with higher supply of schooling at the local level. However, Cappelli (2016) suggested that the different distribution of political voice (local electoral franchise) within Italy's municipalities did not determine the persistence of regional inequalities in schooling in the long run. Political voice indeed was strongly correlated with local surtaxes to fund public goods but had only a limited impact on school inputs as proxied by school expenditure per child and the child-teacher ratio implying that wider voting rights and political voice did not automatically translate into more schooling.

---

<sup>9</sup> Several studies have also explored the relationship between land inequality and human capital accumulation outside the European context and found general support to the idea that the former negatively affects educational outcomes. For instance, Galor, Moav and Vollrath (2009) showed that greater land inequality had a negative effect on education expenditures in the US over the period 1900-1940. Ramcharan (2010) showed that greater land inequality (measured by the Gini coefficient) was strongly associated with less redistribution and therefore with less expenditure on education in the U.S over the period 1890–1930. Similarly, Vollrath (2013) maintained that landownership inequality predicts taxes for local school funding at the US county level in 1890. Kourtellos, Stylianou and Tan (2013) provided cross-sectional evidence based on a sample of 53 countries covering the period 1700-1998 that land inequality is a key determinant of delays in schooling.

<sup>10</sup> Similarly, Summerhill (2010) provides evidence that high levels of land inequality were not associated with lower investment in education in Sao Paulo. Conversely, supply of schooling was higher in areas that wished to attract more immigrants. Finally, Acemoglu et al. (2008) found that for Colombian localities the land Gini was positively related to long-run education outcomes, including a measure of literacy.

A second interpretation provided a positive assessment of the role played by elites in fostering education. This literature has highlighted the role of elites in promoting education as a nation-building tool pursued to foster cultural homogeneity and instil civic values in countries characterised by high rates of inward immigration and/or high ethnical fractionalisation. For instance, between 1850 and 1914 the US had amongst the highest attendance rates in the world and were already investing large amounts of money in education. However, quite surprisingly, a set of compulsory schooling laws was passed in these years. According to Bandiera et al. (2018), compulsory schooling laws were introduced to instil civic values to the culturally diverse migrants who moved to America during the 'Age of Mass Migration'. The adoption of compulsory schooling laws indeed took place significantly earlier in the states with a larger share of migrants from European countries without historic exposure to compulsory state schooling in their country of origin. In a similar vein, drawing on evidence from the Habsburg Empire, Cvrcek and Zajicek (2013) have displayed that the spread of schooling was driven by local elites that subsidized schooling where it aligned with their ethnic preferences. Furthermore, a mechanism through which elites tended to promote mass schooling, historically, was the consolidation of political power and social order. Andersson and Berger (2019), for instance, have highlighted the proactive role played by landed elites in the spread of mass schooling in 19<sup>th</sup> century Sweden as part of their historical role as patrons of the local communities and as a response to the proletarianization of the rural population.<sup>11</sup> Erik, Pettersson-Lidbom and Tyrefors (2021), find that school spending is higher where the non-agrarian (industrialists) interest controls all of the votes compared to when landowners have more than a majority of votes. Interestingly, they find that the concentration of landownership did not affect the above relationship.

Finally, Squicciarini and Voigtländer (2015) showed that different kind of elites, *enlightened* vs. landowning, can provide different outcomes for human capital accumulation. Indeed, they maintained that, in mid-19<sup>th</sup> century France, the presence of an *enlightened* elite – proxied by the share of subscribers to the *Encyclopédie* of Diderot and d'Alembert – was positively associated with the rise of upper-tail human capital, which however must be distinguish from basic human capital accumulation.

#### 3.2.4 School Reforms

The effect of legislation and reforms in relation to human capital formation is not yet well understood from a historical perspective. As Landes and Solmon (1972) pointed out, one reason is that “too often the efforts at social reform and the intended consequences of legislation are accepted as proof that behaviour has been significantly altered. A case in point is legislation that compels children to attend school. Although it is commonly believed that such laws have been

---

<sup>11</sup> Shammass (2015) argued that in the US school investment did not correlate with the extension of the franchise, rather with Whig and antislavery party share of vote. Elites were seemingly important in explaining investments in universal schooling also in Latin America. For instance, Elis (2011) maintained that the expansion of public primary education in Argentina was fuelled by the oligarchy targeting investments in rural, poor areas to boost political consensus. This process came to an end when the country transitioned to a democracy in the early 20<sup>th</sup> century. Exploring the patterns of change in school provision and the political power of Uruguay's president between 1914 and 1954, Azar (2020) also showed that the provision of schooling was used as a political tool aimed to reward regions where government had lower political support, possibly to generate consensus in the electorate at less safe constituencies.

effective in increasing the participation of children in schooling systems in the United States over the last 100 years, there is little evidence to support or reject this belief.”<sup>12</sup> Part of the difficulty lies in the fact that the impact of such reforms is very problematic to evaluate, because school laws are often implemented “nationwide simultaneously and thus evaluations have to rely on before-and-after comparisons which may confound the effects of the policy with other macro-aggregate or cohort effects” (Meghir and Palme 2005: 414). The result is that only few scholars and for only few European countries have sought to explore the effect of comprehensive school reforms on the accumulation of human capital in the period considered in this study.

Cappelli and Vasta (2020) analysed the effects of the Daneo-Credaro reform which shifted Italy from a fully decentralized primary school system towards centralization in 1911.<sup>13</sup> Using a quasi-experimental design, based on propensity score matching, they show that compared to municipalities that retained school autonomy, treated municipalities were characterized by a 0.43 percentage-point premium on the average annual growth of literacy between 1911 and 1921. They also show that the reform brought about a decisive improvement in female literacy (Cappelli and Vasta 2021). Gomes and Machado (2020) studied the effects of the so called Centenários plan (Plano dos Centenários in Portuguese), a massive primary school construction program that projected a 60% increase in the number of primary schools. They identify the causal impact of the variation in the supply of schools per resident and conclude that it was responsible for 80% of the increase in enrolment and 13% of the increase in the literacy rate of the affected cohorts at the beginning of the 1960s.<sup>14</sup>

Finally, a number of studies has also focused on the UK’s 1870 Education Act, which introduced a public education system in England and Wales. Previous work has provided contrasting accounts of the effects of the reform ranging from the positive assessments of Middleton (1970) and Armytage (1970), which interpreted it as a crucial turning point resulting in a massive expansion of English school supply, to West (1970) who denied the role of the reform. Nevertheless, Milner’s (2021) recent quantitative analysis provides support to the former, showing that the reform had a positive effect on school supply and attendance, as well as a significant impact on intergenerational mobility.

Given the positive recent assessment of educational acts and reforms, in the reminder of the paper we offer an overview of the main (often public) school acts introduced across European countries in the 19<sup>th</sup> century, as well as the school reforms that followed them. We offer a preliminary taxonomy of school acts, focusing on aspects such as the role played by the Church (and

---

<sup>12</sup> Landes and Solmon (1972) found no causal relation between school laws and the increases in the levels of schooling as these largely preceded the passage of compulsory school laws.

<sup>13</sup> See also Cappelli (2015) on Italy’s move to centralized primary schooling in the nineteenth century.

<sup>14</sup> Outside Europe, Chaudhary (2010) analysed the effects of colonial public investment on literacy in early 20<sup>th</sup> century British India. Using an instrumental-variable approach she found that a 10% increase in 1911 per-capita spending, or 44 additional primary schools would have translated into a 2.6% increase in 1921 literacy in the population aged 15–20. The findings, however, differ by gender: the IV estimates on spending are statistically significant only for male literacy. In a related article, (Chaudhary and Gang 2015), she also showed that the effects of the 1911 public spending were significant up to 1971. Saleh (2015) analyses the impact of Egypt’s transformation in 1951–1953 of traditional elementary schools (*kuttabs*) into modern primary schools on the Christian-Muslim educational and occupational differentials, which were in favour of Christians.

thus private education), gender inequality, enforcement of compulsory attendance (and what “compulsory” meant), governing bodies and, finally, the extent of state funding and intervention.

#### **4. The rise of mass education: school acts and reforms**

Starting in the 18<sup>th</sup> century, the expansion of primary schooling and its national and regional variations were increasingly regulated by school acts covering regions, nations and – sometimes – empires. This legislation differed substantially across countries concerning a variety of aspects, depending on the historical and educational context (for an overview, see Westberg et al. 2019).

The literature suggests that school acts were enacted for various reasons. There is surely a link between school acts and state-formation processes: normally a legislation on schooling was implemented in order to reinforce the idea of a state based on a nation and, therefore, a common nationality – which could be constructed through education (on the impact of such dynamics, see Cinnirella and Schueler 2018).<sup>15</sup> This was even more important in attempting at harmonizing schooling rates across regions in countries that had long been politically fragmented – like Germany and Italy at the end of the 19<sup>th</sup> century. Similarly, some school acts were linked with war and revolutions. In 19<sup>th</sup>-century Finland – a grand duchy in the Russian Empire – the defeat of Russia in the Crimean war (1853 – 56) provoked a series of reforms, including education, which resulted in the Decree on Elementary Education of 1866. Likewise, the liberation from Russia in 1917 and the following civil war resulted in a new constitution in 1919 and a compulsory- education act in 1921 (Westberg et al. 2018).<sup>16</sup> This selection of cases clearly shows that national school systems formalized in school acts became a necessary tool for the rise and consolidation of new nation states (Meyer, Ramirez and Soysal 1992).

One important aspect of 18<sup>th</sup> and 19<sup>th</sup> century school acts is the fact that they were decentralized (Lindert 2004). This meant that the main responsibility for decisions on the quantity and quality of schooling were made at the local level, within governing bodies pertaining to towns, villages, municipalities, school districts, as well as various voluntary organizations. The decentralization of education was normally associated with local and regional variations in the norms that regulated the school system – an aspect that remains understudied. Such variations include the different strength of the relationship with the church, the varying demands placed on the local schools, differing definitions of what was meant with “compulsory schooling”, and heterogeneity concerning funding sources. Furthermore, these features changed to a large extent during the 19<sup>th</sup> and early-20<sup>th</sup> centuries, when important educational reforms were introduced virtually everywhere – at least in Europe.

---

<sup>15</sup> The constitution of the Helvetic Republic in 1798 was followed by the school law of 1799, and the Austro-Hungarian Compromise of 1867 was followed by the school law of 1869 (Tröhler 2016). France is the classic example, with new constitutions created in 1791, 1793, 1795, 1799, 1814, and 1830, which were followed by school acts in 1792, 1794, 1795, 1802, 1816, and 1833.

<sup>16</sup> In Turkey, a series of defeats suffered by the Ottoman Empire resulted in a range of modernization attempts, including the Regulation for General Education in 1869. When new nation states were created out of the empire, new school acts followed. For example, the creation of the Republic of Turkey in 1923 was followed by a new school curriculum in the very same year.

A salient feature of the first decentralized national school acts and school systems was the varying relationship between schooling and the church – which was one of the main providers of private education but often played an important role in connection to public schooling. Until the early 20<sup>th</sup> century this was the case in both the north and the south of Europe. For example, in Sweden, the school act of 1842 stated that parishes (either alone or in cooperation) were to establish school districts managed by a school board, chaired by the vicar. In Denmark, the school acts of 1814 created local school boards in rural areas, chaired by the parish priest. In Netherlands, by contrast, the school act of 1801 reproduced the separation between the state and the church in the Batavian republic of 1795. In France, the Guizot Law of 1833 established a system of public schools to be sustained by the municipalities with their own taxation and resources, yet church-related schools continued to play a relevant role until the end of the 19<sup>th</sup> century. The Italian Casati Law of 1859 gave the responsibility for promoting schooling to the municipalities, yet the first inquiries on primary education carried out in the 1860s clearly show that many of the teachers in public schools were priests or nuns, given the relatively limited availability of adults who could read and write – and thus teach (Westberg 2020).

Apart from the organization, the demands placed on the local schools varied. While all European school acts entailed quite limited learning objectives focusing on reading, writing, arithmetic and religious knowledge, they featured notable differences in terms of expectations on enrolment and attendance (see Table 1).



*Table 1. Features of national school acts: gender inequality, compulsory-school age, enforcement of compulsory attendance, and local governing bodies*

School Act	Year	Political entity	Regulations of educational provision			Organization
			Gender	School age	Enforcement	Local governing body
General School Ordinance	1774	Habsburg Empire	B/G	6-12	No penalties	Monasteries, manorial lords, towns, villages etc.
Stapfer-draft school act	1798	Helvetic Republic	B/G	6-	-	Municipalities
The School Act of 1806	1806	The Batavian Republic (Netherlands)	B/G	None	Refusal of poor relief	Public and private organizations
The School Acts of 1814	1814	Kingdom of Denmark	B/G	6-13/7-14	Fines	Church-based school districts
The Guizot Law	1833	Kingdom of France	B	None (6)	No penalties	Municipalities
The Someruelos Act and the Montesino Regulation	1838	Kingdom of Spain	B	6-9	No penalties	Municipalities
The School Act of 1842	1842	Kingdom of Sweden	B/G	9-	Warnings	Church-based school districts
The Casati Law	1859	Kingdom of Italy	B/G	6-8	Sanctions in school law but not in penal code	Municipalities
The 1864 Education Statute	1864	Russian Empire	B/G	None (6)	No penalties	State organizations, <i>zemstvos</i> , local initiatives
The Elementary Education Act	1870	England and Wales	B/G	5-12	Optional	Voluntary organizations or public-school board

Source: Westberg 2020. Notes: B/G indicates whether compulsory schooling was addressed to boys and girls, or boys only. The column concerning school age shows “open” age brackets when the latter were not explicitly defined by the education act.

Most school acts required both boys and girls to attend school, with some notable exceptions. The duration of compulsory primary education was also an important feature that differed greatly across countries. It is important to note that, in the past, school acts did not necessarily prescribe compulsory schooling like in the present day – that is, as a number of years of mandatory regular school attendance. Instead, for example, part-time attendance was tolerated and even encouraged, particularly in rural places, in order for education to be compatible with agricultural work (Westberg 2020).

The school age concerning compulsory enrolment into primary schooling differed to a large extent, ranging from 6-8 (Italy 1859) and 6-9 (Spain 1838) to 6-12 (Habsburg Empire 1774) up to 6-13 / 7-14 (Denmark 1814). Curiously, although it was an important matter to the government, there were also school acts that did not provide a precise definition of school age. These included school age as “youth of all ages” according to the Dutch school act of 1806, and the open-ended definition used in the Swedish school act of 1842, where schooling was supposed to start at nine years of age

“at the latest”, coupled with the fact that neither an age span nor a number of years were indicated as far as compulsory education was concerned.<sup>17</sup> In this respect, nineteenth century schooling is more fittingly described as basic than as compulsory.

Primary schools, and the demands set on them, were funded in various ways according to different school acts. The early school acts implemented different rules on school fees: while the latter never formed the basis for 19<sup>th</sup> century primary school funding, fees were indeed applied to different extents across countries. A striking feature was the varying extent to which schools relied on central-government grants, subsidies and other ways of providing state funding, e.g., through interest-free mortgages etc. (see Table 2).

*Table 2. School fees and central-government expenditure across different school acts*

School Act	Year	Political entity	School fees	Central government expenditure (%)
General School Ordinance	1774	Habsburg Empire	Yes	-
Stapfer-draft school act	1798	Helvetic Republic	No	0.0 (c. 1870)
The School Act of 1806	1806	The Batavian Republic (Netherlands)	Yes	14.5 (1879-80)
The School Acts of 1814	1814	Kingdom of Denmark	No	9.1 (1891-1892)
The Guizot Law	1833	Kingdom of France	Yes	13.7 (1870)
The Someruelos Act and the Montesino Regulation	1838	Kingdom of Spain	Yes	3 (c. 1900)
The School Act of 1842	1842	Kingdom of Sweden	Yes	29 (1874)
The Casati Law	1859	Kingdom of Italy	No	1 (1870)
The 1864 Education Statute	1864	Russian Empire	Yes	11.3 (1879)
The Elementary Education Act	1870	England and Wales	Yes	35.5 (1874-75)

Sources: Lindert (2004), Eklof (1984) and Westberg (2017).

By the 1870s, significant differences may be identified between the low levels of state expenditure, which were below 5 percent of total revenues in Spain and Italy, and as high as 30 percent or more in Sweden (29%) and England and Wales (35.5%). Other countries ranged from 9 (Denmark) to c. 14 percent (France and the Netherlands) of educational resources funded by the state.

Apart from important variations to begin with, 19<sup>th</sup> and early-20<sup>th</sup> century school acts were also subject to crucial reform through the implementation of new laws, circulars, regulations and supplements – depending on the country and period. Several reforms concerned the relationship between schooling and the church, such as the French Ferry Laws and the educational policy of the Spanish constitution of 1931 (Flecha Garcia 2011).

Generally speaking, though, the reforms aimed at expanding the role of public authorities and, in particular, the one played by the central governments – by increasing state funding and administrative centralization. In Sweden, the state subsidy reform of 1871 and, in particular, the

<sup>17</sup> There were also more complicated cases, such as the Norwegian school act of 1827, noting that children should start school either at seven or eight years of age, and continue until confirmation – or as long as the parish priest would see it fit (Skinningsrud Skjelmo 2014).

state subsidy reform of 1913 meant that the central government in 1920 covered half of the total expenditure of local school districts (Westberg 2017, 148). In Italy, the centralization of primary education was brought about by the Daneo-Credaro Reform of 1911, which dramatically increased central-government support to local primary schools (which had begun in the first years of the 20<sup>th</sup> century) and moved the management of primary schools away from the municipalities, towards a greater role played directly by the Ministry of Education. The same shift was introduced by the Ferry Laws in 1881–1882, when central-government subsidies increased to cover 66 percent of total expenditures in 1882 (Grew and Harrigan 1991, 212). Although the Ferry Laws were important, research has highlighted the relevance of previous reforms, particularly concerning more centralized funding and regional educational convergence (Diebolt, Jaoul and San Martino 2005, Cappelli 2020). The Elementary Education Act of 1870 in England and Wales meant a drastic increase in share of revenues provided by the central government, which was further reinforced by the 1918 act: it implied that about 60% of primary school spending was placed on the central government (see Milner 2021 for an analysis of the impact of such reforms, which are found to be positive, and significant). The Primary Education Act of 1920 in the Netherlands implied a significant step towards centralization, since all teacher salaries were determined and entirely paid for by the Dutch central government from that moment on (van Giljswijk 2016).

In addition, the new school reforms created stricter definitions of school-age, and the age spans of mandatory schooling was lengthened. The revised school act of 1882 in Sweden defined school age as spanning from 7 to 14, and in 1900 school age was defined as 7–13 in the Netherlands. In Spain, the school age was prolonged from 6–9 to 6–12 in 1909 (Beltrán Tapia et al. 2021), and in 1918, the Fisher Act extended the school-leaving age from 12 to 14 in the England and Wales.

To sum up, school acts during the investigated period created a framework for schooling that varied across countries and changed over time. A robust taxonomy may be consolidated by analyzing the varying relationships to private education (i.e. the church), differing demands on the local governing bodies, definitions of compulsory schooling, and varying sources of funding and the extent of centralization. A dataset that covers regional variations coupled with the analysis of national (country-level) specificities offers excellent opportunities to study how such national frameworks were actually implemented – and whether they made a difference, beyond local and transnational trends that were prompting the rise of education linked to religion, culture and economic development. Furthermore, such a new framework for quantitative analyses will shed new light on the impact of the major educational reforms of the late-19<sup>th</sup> and early-20<sup>th</sup> centuries, some of which we have briefly discussed above. Indeed, it is often very difficult to provide an assessment of such reforms, given the absence of a “control” group: typically, the whole universe of a country’s schools and student population were affected by a new reform. Although there are exceptions – we discussed some of them – we argue that a more thorough assessment of educational reforms must rely on new data. In the Section below, we present a new dataset including regional educational figures fully-harmonized across European countries for different periods (here, roughly from the 1850s to the 1910s), and discuss its relevance and potential for some of the research areas discussed in this paper.

## 5. Sources and methodology

We collected primary-schooling data for relatively small historical statistical divisions – roughly today’s NUTS3 and sometimes NUTS2 – from a variety of sources to present public and private gross enrolment rates as well as literacy rates from the 1850s to the 1910s. Gross enrolment rates are defined as the total number of pupils enrolled in all primary schools (regardless of age and repetition) divided by the school-age population. We adopted a definition of school-age population common to all countries, in line with today’s ISCED standard levels 1 and 2.<sup>18</sup> Therefore, the age bracket for primary schooling is defined as including boys and girls from 6 to 14 years old, meaning that we consider the population who have celebrated their 14<sup>th</sup> birthday but not their 15<sup>th</sup>. Literacy rates are commonly provided concerning the population older than 6 years. However, in some cases, we had to retain a different definition of literacy rates, depending on the sources. For example, literacy rates for Portugal refer to the population older than 7 years, and that of Prussia includes the population more than 10 years old. It is worth noting that such small discrepancies will not affect the evolution of the spatial distribution of literacy rates to a large extent, since there is an almost-perfect correlation between literacy 6+ and e.g. literacy 10+, particularly across spatial units – which is the focus of this paper. We list all exceptions to the baseline literacy measure (6+) in the notes to our tables and figures below.

The material that we present is a subset of variables from a large new dataset provided through a project funded by the Swedish Research Council and aimed at reconstructing regional patterns concerning the diffusion of primary education in France, Italy, Spain and Sweden, c. 1840 – 1940.<sup>19</sup> Fully-harmonized figures including literacy rates, teachers, schools and enrolments have been provided by Cappelli and Quiroga (2021) for Italy and Spain in the period 1860 – 1921 using primary sources. We obtain enrolment and literacy rates for the 69 Italian and the 50 Spanish provinces from this dataset. We add figures for French departments and Swedish counties from primary sources – part of which were already digitized and available online.<sup>20</sup> Most of the available figures are about public education, whereas little information is available on private schools – even though, below, we briefly discuss the available figures in light of their relative weight compared to public schooling.

Data on enrolment rates and literacy for Prussia is provided by the iPEHD dataset (Becker et al. 2014). Unfortunately, available figures for literacy have been published only for 1871 so far.<sup>21</sup> The original data have been aggregated at an administrative level that, historically, roughly corresponds to today’s NUTS2 divisions (*Regierungsbezirke*). Figures for Belgium have been obtained primarily from Minten et al. (1991). However, both the school-age population and literacy figures were not available through this source. We therefore elaborated on the available censuses

---

<sup>18</sup> Further information: .

<sup>19</sup> The project is titled “How did education policy shape the race towards mass education? A comparative perspective based on France, Italy, Spain and Sweden, c. 1840–1940.” PI: Johannes Westberg (Örebro University), 2017 – 2021. Grant no. 2016-05230.

<sup>20</sup> Owed thanks to Kirti John, Maria José Fuentes Vázquez and Sara Pecchioli for their help in organizing (and at times digitizing) the new data. See Fuentes Vázquez (2021). We also thank Peter Lidbom for sharing his data on Sweden in 1847 and 1862.

<sup>21</sup> We thank Francesco Cinnirella for sharing with us some of the Prussian data concerning the early 20<sup>th</sup> century.

– and digitized some of the material anew – to obtain enrolment and literacy rates.<sup>22</sup> The data for the provinces of the Austrian Empire (excluding Hungary) come from recent research published by Cvrcek (2020). Literacy rates for the provinces of the Austrian Empire in 1890 have been drawn from primary sources.<sup>23</sup> Finally, when we have not yet compiled spatially disaggregated data, we drew on Lindert (2004) to collect enrolment rates at the national level. National literacy rates for Portugal concerning the population 7+ were obtained from Cipolla (1969), while literacy rates (15+) for the United Kingdom are from Prados de la Escosura (2015). Countries and regions that are not covered by our data are reported as missing in the maps and elaborations below.

Although enrolment rates are not an educational outcome like literacy – though this represents basic human capital – they are particularly interesting to investigate what determined long-term trends in education. Indeed, schooling rates are expected to react quickly to changing conditions, both concerning demand (a changing economic context) and supply (educational reforms). Literacy rates, particularly those calculated for the whole or most population, somehow represent a stock measure of past educational investments. Future research should, indeed, focus on literacy for the age groups directly affected by primary schooling, e.g. 6 to 14. This is the reason why, in this paper, we focus on both enrolment rates and literacy.

Importantly, the regional and the comparative perspectives are combined as a preliminary attempt to isolate the effect of national institutions on schooling and education (namely and particularly school acts and reforms) from that of local (e.g. geography, political economy, economic development) and transnational (e.g. religion) factors.

We present the regional pattern of diffusion of schooling and education from the mid-19<sup>th</sup> century to the years preceding WWI by focusing on fully-harmonized provincial and regional enrolment and literacy rates. We then also explore whether – and to what extent – different regions formed educational clusters. By exploring clusters, we can shed light on whether national school acts and reforms determined educational trends, against the hypothesis that education simply followed patterns of economic development and other (political and religious) determinants.

We therefore analyse, visually, how the spatial diffusion of education changed over time in the period that witnessed the rise of mass education (1850 – 1910) and whether national school acts might have had a significant impact on such trends. We couple the visual analysis by investigating Local Indices of Spatial Autocorrelation in the period concerned (see Hippe 2013 for an application to a similar dataset concerning numeracy).

## 6. Results

We mainly focus on public-school enrolment (Figure 1) and literacy rates (Figure 2), given the marginal importance of private enrolment rates (Figure 3) – with the exception of France and the Netherlands, where private institutes played a non-trivial role. Interestingly, the Spanish education system has been known for its reliance on private schools in the 19<sup>th</sup> century (Cappelli and Quiroga 2021). Yet, in a comparative perspective, a larger share of pupils within the French school system was enrolled in private institutes compared to Spain (or Italy), even following the introduction of

---

<sup>22</sup> We thank Thierry Eggerickx and Sven Vrielinck for sending us digitized primary sources and digitized data.

<sup>23</sup> We thank Anna Missiaia for providing the data.

the Ferry Laws in the 1880s, which marked the consolidation of the role played by the central government in matters concerning primary education (Diebolt, Jaoul, and San Martino 2005, Cappelli 2020). The role played by private (religious) education and its long-term impact on development in France has been extensively debated, recently (Squicciarini 2020; Kelly 2021). Therefore, this line of research may also benefit from a more thorough comparative analysis of the link connecting private schools and education, and in turn economic growth.

[Figure 1 here]

A remarkable difference can be discerned in public-school enrolment rates between the 1850s (and 1860s) and the second half of the 19<sup>th</sup> century. Whereas in the first period education is spatially distributed following seemingly local and transnational clusters – echoing the thesis that religion and economic trends were two fundamental factors driving literacy and therefore schooling before national school acts –, the second half of the 19<sup>th</sup> century witnessed a striking change in the spatial distribution of primary-education rates, and a growing divide between Northern and Southern Europe. In the mid-19<sup>th</sup> century, a high-education cluster can be discerned including Eastern France, West Prussia, Switzerland and part of Belgium, as well as Southern Sweden across the Baltic Sea. The Southwest of France, Northwest Italy and the Iberian Peninsula remained – despite some regional variation within them – quite similar in terms of educational levels. Instead, after a mere 20-30 years, national borders seem to have played a more decisive role in affecting the spatial diffusion of education. Indeed, by 1900, France, Prussia and Sweden became more homogeneous within them towards high schooling rates, while e.g. Italy and Spain remained behind and were still largely characterised by large regional disparities.

Our results suggest an important role played by the building of nation states in fostering education via augmented government funding and – to some extent – centralization policies since the second half of the 19<sup>th</sup> century, particularly in the countries that strengthened regional educational convergence, like France, Prussia and Sweden. All such countries share a history of early educational reforms towards centralized funding and/or administration, as the previous section on school acts and reforms has shown. Instead, Southern-European countries like Italy and Spain did not introduce such policies until the early 20<sup>th</sup> century. Further research is needed to disentangle the effect of such national factors from that of local and transnational determinants of education. Among the former, as we have discussed in the literature review, one may list local politics and the political economy of schooling, as well as geography (often mountains and rivers do coincide with national borders) while, for example, the spread of Protestantism might have been a cohesive force fostering education across different regions and countries (Becker and Woessmann 2009).

[Figure 2 here]

Although subject to a slower rate of change compared to enrolment rates, the spatial distribution of literacy rates seems to back up the above considerations (Figure 2). Unfortunately, the paucity of spatial data, particularly for the Austrian Empire and Prussia in some of the concerned time periods, undermine the reliability of such interpretations. Nevertheless, some spatial patterns

and their change over time are rather clear: in the case of France, regional convergence seems to have taken place between the mid-19<sup>th</sup> century and the early 20<sup>th</sup> century, while in Italy and Spain the regional divide remained remarkable well into the early 20<sup>th</sup> century. Indeed, spatial convergence and a more rapid increase in literacy would begin later (see e.g., Cappelli and Vasta 2020 on Italy). As we mentioned above, adding private enrolment rates does not change the main picture (Figure 3).

[Figure 3 here]

We investigate this issue through maps based on Local Indices of Spatial Autocorrelation. In a nutshell, the maps (Figure 4) show whether each administrative unit is part of a cluster characterized by low education (enrolment rates in this case) or high education. This result confirms that the decades of the second half of the 19<sup>th</sup> century were crucial in the spatial diffusion of primary education across regions and countries in Europe. While Italian and Spanish provinces converged towards a low-low educational cluster in the South, Central-European regions converged towards a high-high educational cluster, which included, by the eve of the 20<sup>th</sup> century, most of France and Prussia, and most of Sweden with the exception of the three most remote counties, i.e. Norrbotten, Vesterbotten and Vesternorrland.

[Figure 4 here]

Such preliminary results open avenues for future research. On the one hand, it is necessary to provide a more long-term perspective, particularly by including the early-19<sup>th</sup> century to offer a more comprehensive analysis of the striking change occurred in the mid of the century. On the other hand, it is also crucial to include more regions and provinces from other countries, in order to fully exploit the potential of the regional and comparative analyses combined. The Netherlands, German states other than Prussia, most countries in Eastern and South-eastern Europe, as well as Finland and Norway among the Nordic countries and Portugal in the Iberian Peninsula have been neglected so far by social and economic historians interested in the evolution of the education-development nexus. This gap should be filled in the nearest future, to shed new light on existing questions concerning economic and human development in the long run, but also to (partially) rewrite the social and economic history of Europe as a history of its diverse regions.

## **7. Conclusions**

The stream of literature on the causes of economic growth has emphasized the major role played by human capital accumulation. This survey shows that education and human capital are at the centre stage of the historical literature on industrialization processes and long-term economic development.

Our contribution is threefold: first, we review the literature on the determinants of educational levels focusing on Europe over the period 1830 – 1930. Despite the growing number of contributions on this issue within economic history, we find that the lack of fine-grain spatial and

(at the same time) harmonized data is preventing research on some important aspects of rising education, for example the impact of national school acts and reforms on schooling and human capital accumulation.

Secondly, we provide a preliminary taxonomy of European school acts and reforms in the 19<sup>th</sup> and early-20<sup>th</sup> century, highlighting common and diverging aspects of the introduction of compulsory-schooling legislation.

Thirdly, we present the first version of a dataset under construction, which aims at providing spatial fine-grain data covering gross enrolment rates and literacy across European regions (roughly today's NUTS3 statistical divisions) from c. 1830 to 1930.

Our preliminary results show the large heterogeneity of educational levels in c. 1850, both within and across countries. At that time, educational clusters appeared to be concentrated *across* national borders (i.e. relatively large regions that belonged to different nation states). Instead, by the end of the 19<sup>th</sup> century, the effect of national institutions and regulations seems to have become an important determinant of schooling (and literacy) rates.

## References

- Abramovitz, M. (1986). Catching up, forging ahead, and falling behind. *Journal of Economic History*, 46 (2), pp. 385-406.
- Acemoglu, D., Bautista, M.A., Querubin, P., & Robinson, J.A. (2008). Economic and political inequality in development: The case of Cundinamarca, Colombia. *Institutions and Economic Performance*. Cambridge: Harvard University Press, 181-245.
- Acemoglu, D., Johnson, S., & Robinson, J.A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91 (5), 1369-1401.
- Acemoglu, D., Johnson, S., & Robinson, J.A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *The Quarterly Journal of Economics*, 117 (4), 1231-1294.
- Acemoglu, D., Johnson, S., & Robinson, J.A. (2005). Institutions as a fundamental cause of long-run growth. *Handbook of economic growth*, Elsevier, pp. 385-472.
- Aghion, P., Jaravel, X., Persson, T. & Rouzet, D. (2019). Education and Military Rivalry. *Journal of the European Economic Association*, 17(2), 376-412.
- A'Hearn, B., & G. Vecchi, G. (2017). Education. *Measuring wellbeing: a history of Italian living standards*. Oxford University Press, pp. 175-214.
- Allen, R.C. (2009). *The British industrial revolution in global perspective*. Cambridge.
- Allen, R.C. (2011). *Global economic history: a very short introduction*. Oxford.
- Andersson, J., & Berger, T. (2019). Elites and the expansion of education in nineteenth-century Sweden. *The Economic History Review*, 72 (3), 897-924.
- Armytage, W.H. (1970). The 1870 education act. *British Journal of Educational Studies*, 18 (2), 121-133.



- Atack, J., Bateman, F., & Margo, R.A. (2004). Skill intensity and rising wage dispersion in nineteenth-century American manufacturing. *The Journal of Economic History*, 64 (1), 172-192.
- Atack, J., Bateman, F., & Margo, R.A. (2008). Steam power, establishment size, and labor productivity growth in nineteenth century American manufacturing. *Explorations in Economic History*, 45 (2), 185-198.
- Azar, P. (2021). Politics as a determinant of primary school provision: the case of Uruguay. *Cliometrica*, available at: <https://doi.org/10.1007/s11698-021-00228-3>
- Bandiera, O., Mohnen, M., Rasul, I., & Viarengo, M. (2019). Nation-building through compulsory schooling during the age of mass migration. *The Economic Journal*, 129 (617), 62-109.
- 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., & Juif, D. (2014). A story of large landowners and math skills: Inequality and human capital formation in long-run development, 1820–2000. *Journal of comparative economics*, 42 (2), 375-401.
- 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, S.O., Cinnirella, F., Hornung, E., & Woessmann, L. (2014). iPEHD—the Ifo Prussian economic history database. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 47 (2), 57-66.
- 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., & Woessmann, L. (2008). Luther and the girls: Religious denomination and the female education gap in nineteenth-century Prussia. *Scandinavian Journal of Economics*, 110 (4), 777-805.
- Becker, S.O., & Woessmann, L. (2009). Was Weber wrong? A human capital theory of Protestant economic history. *The Quarterly Journal of Economics*, 124 (2), 531-596.
- Beltrán Tapia, F.J., & Martínez-Galarraga, J. (2018). Inequality and education in pre-industrial economies: evidence from Spain. *Explorations in Economic History*, 69, 81-101.
- Beltrán Tapia, F.J., Díez-Minguela, A., Martínez-Galarraga, J., & Tirado-Fabregat, D. A. (2021). The uneven transition towards universal literacy in Spain, 1860–1930. *History of Education*, 0 (0), 1-23.
- Bertocchi, G., & Bozzano, M. (2016). Women, medieval commerce, and the education gender gap. *Journal of Comparative Economics*, 44 (3), 496-521.
- Blanc, G., & Wacziarg, R. (2020). Change and persistence in the Age of Modernization: Saint-Germain-d'Anxure, 1730–1895. *Explorations in Economic History*, 78, 101352.
- Bleakley, H., & Lange, F. (2009). Chronic disease burden and the interaction of education, fertility, and growth. *The Review of Economics and Statistics*, 91 (1), 52-65.
- Boppart, T., Falkinger, J., Grossmann, V., Woitek, U., & Wüthrich, G. (2013). Under which conditions does religion affect educational outcomes?. *Explorations in Economic History*, 50 (2), 242-266.
- Botticini, M., & Eckstein, Z. (2005). Jewish occupational selection: education, restrictions, or minorities?. *The Journal of Economic History*, 65 (4), 922-948.
- 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., & Licandro, O. (2002). Vintage human capital, demographic trends, and endogenous growth. *Journal of Economic Theory*, 104 (2), 340-375.
- Cappelli, G. (2015). 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. (2016). One size that didn't fit all? Electoral franchise, fiscal capacity and the rise of mass schooling across Italy's provinces, 1870–1911. *Cliometrica*, 10 (3), 311-343.
- Cappelli, G. (2020). Quite a Visible Hand? State Funding and Primary Education in 19th-century France and Italy. *Revue d'economie politique*, 130 (1), 77-105.
- Cappelli, G., & Quiroga Valle, G. (2021). Female teachers and the rise of primary education in Italy and Spain, 1861–1921: evidence from a new dataset. *The Economic History Review*, 74 (3), 754-783
- Cappelli, G., & Vasta, M. (2020). Can school centralization foster human capital accumulation? A quasi-experiment from early twentieth-century Italy. *The Economic History Review*, 73 (1), 159-184.
- Cappelli, G., & Vasta, M. (2021). A "Silent Revolution": school reforms and Italy's educational gender gap in the Liberal Age (1861–1921). *Cliometrica*, 15 (1), 203-229.
- Carmichael, S. G., de Pleijt, A., Van Zanden, J. L., & De Moor, T. (2016). The European marriage pattern and its measurement. *The Journal of Economic History*, 76 (1), 196-204.
- Carvalho, J.P., & Koyama, M. (2016). Resisting education. No. 48048. MPRA Paper.
- Carvalho, J.P., Koyama, M., & Sacks, M. (2017). Education, identity, and community: lessons from Jewish emancipation. *Public Choice*, 171 (1-2), 119-143.
- Chaudhary, L. (2010). Taxation and educational development: Evidence from British India. *Explorations in Economic History*, 47 (3), 279-293.
- Chaudhary, L., & Garg, M. (2015). Does history matter? Colonial education investments in India. *The Economic History Review*, 68 (3), 937-961.
- Chaudhary, L., Musacchio, A., Nafziger, S., & Yan, S. (2012). Big BRICs, weak foundations: The beginning of public elementary education in Brazil, Russia, India, and China. *Explorations in Economic History*, 49 (2), 221-240.
- Ciccarelli, C., & Weisdorf, J. (2019). Pioneering into the past: regional literacy developments in Italy before Italy. *European Review of Economic History*, 23 (3): 329-364.
- Cinnirella, F., & Hornung, E. (2016). Landownership concentration and the expansion of education. *Journal of Development Economics*, 121, 135-152.
- Cinnirella, F., & Streb, J. (2017). The role of human capital and innovation in economic development: evidence from post-Malthusian Prussia. *Journal of Economic Growth*, 22 (2), 193-227.
- Cinnirella, F. & Schueler, R. (2018). Nation Building: The Role of Central Spending in Education. *Explorations in Economic History* 67, 18-39.
- Cioni, M., Federico, G. & Vasta, M. (2021a), The two Revolutions in Economic History, *Handbook of Historical Economics*. Academic Press, pp. 17-40.
- Cioni, M., Federico, G. & Vasta, M. (2021b), Persistence studies: a new kind of economic history?. No. 859. WP Department of Economics and Statistics, University of Siena.
- Cipolla, C. M. (1969). *Literacy and Development in the West*. London.

- Clark, G. (2005). The condition of the working class in England, 1209–2004. *Journal of Political Economy*, 113 (6), 1307-1340.
- Clark, G., & Gray, R. (2014). Geography is not destiny: geography, institutions and literacy in England, 1837–63. *Oxford Economic Papers*, 66 (4), 1042-1069.
- 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.
- Cvrček, T. (2020). *Schooling under control: The origins of public education in Imperial Austria 1769-1869*. Tuebingen.
- Cvrcek, T., & Zajicek, M. (2013). School, what is it good for? Useful Human Capital and the History of Public Education in Central Europe. No. w19690. *National Bureau of Economic Research*.
- Cvrcek, T., & Zajicek, M. (2019). The making of a liberal education: Political economy of the Austrian school reform, 1865–1880. *Explorations in Economic History*, 73, 101251.
- De Moor, T., & Van Zanden, J. L. (2010). Girl power: the European marriage pattern and labour markets in the North Sea region in the late medieval and early modern period. *The Economic History Review*, 63 (1), 1-33.
- De Pleijt, A.M. (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.M., 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.M., & Van Zanden, J. L. (2016). Accounting for the “Little Divergence”: What drove economic growth in pre-industrial Europe, 1300–1800?. *European Review of Economic History*, 20 (4), 387-409.
- De Pleijt, A.M., & Weisdorf, J. L. (2017). Human capital formation from occupations: the ‘deskilling hypothesis’ revisited. *Cliometrica*, 11 (1), 1-30.
- Dennison, T., & Ogilvie, S. (2014). Does the European marriage pattern explain economic growth?. *The Journal of Economic History*, 74 (3), 651-693.
- Diebolt, C., Jaoul, M., & San Martino, G. (2005). Le mythe de Ferry une analyse cliométrique. *Revue d'économie politique*, 115 (4), 471-497.
- Diebolt, C., Le Chapelain, C., & Menard, A.R. (2021). Neither the elite, nor the mass. The rise of intermediate human capital during the French industrialization process. *Cliometrica*, 15 (1), 167-202.
- Diebolt, C., Le Chapelain, C., & Menard, A.R. (2019). Learning outside the factory: a cliometric reappraisal on the impact of technological change on human capital accumulation. *The European Journal of the History of Economic Thought*, 26 (4), 775-800.
- Diebolt, C., Menard, A.R., & Perrin, F. (2017). Behind the fertility–education nexus: what triggered the French development process?. *European Review of Economic History*, 21(4), 357-392.
- Diebolt, C., & Perrin, F. (2013). From stagnation to sustained growth: the role of female empowerment. *American Economic Review*, 103 (3), 545-49.
- Dowey, J. (2017). *Mind over matter: access to knowledge and the British Industrial Revolution*. Doctoral dissertation, The London School of Economics and Political Science (LSE).

- Eklof, B. (1984). The myth of the Zemstvo school: The sources of the expansion of rural education in imperial Russia: 1864–1914. *History of Education Quarterly*, 24 (4), 561-584.
- Elis R (2011). Redistribution under oligarchy: trade, regional inequality and the origins of public schooling in Argentina, 1862–1912. Ph.D. Dissertation, Department of Political Science, Stanford University.
- Engerman, S.L., & Sokoloff, K.L. (2000). Institutions, factor endowments, and paths of development in the new world. *Journal of Economic perspectives*, 14 (3), 217-232.
- Engerman, S.L., Sokoloff, K.L., 1997. Factor endowments, institutions, and differential paths of growth among new world economies: a view from economic historians of the United States. *How Latin America Fell Behind: Essays on the Economic Histories of Brazil and Mexico, 1800-1914*. Stanford University Press, pp. 260–304.
- Federico, G., Nuvolari, A., & Vasta, M. (2019). The origins of the Italian regional divide: evidence from real wages, 1861–1913. *The Journal of Economic History*, 79 (1), 63-98.
- Feldman, N.E., & Van der Beek, K. (2016). Skill choice and skill complementarity in eighteenth century England. *Explorations in Economic History*, 59, 94-113.
- Fernihough, A. (2017). Human capital and the quantity–quality trade-off during the demographic transition. *Journal of Economic Growth*, 22 (1), 35-65.
- Flecha García, C. (2011). Education in Spain: Close-up of its history in the 20th century. *Analytical Reports in International Education*, 4 (1), 17-42.
- Foreman-Peck, J. (2011). The Western European marriage pattern and economic development. *Explorations in Economic History*, 48 (2), 292-309.
- Franck, R., & Galor, O. (2017). *Technology-skill complementarity in early phases of industrialization*. No. w23197. *National Bureau of Economic Research*.
- Franck, R., & Johnson, N.D. (2016). Can public policies lower religiosity? Evidence from school choice in France, 1878–1902. *The Economic History Review*, 69 (3), 915-944.
- Fuentes Vazques, M.J. (2021). Did education sustain economic growth during the Industrial Revolution? New evidence from a regional perspective, 1870-1950. Working paper, mimeo.
- Gallego, F.A. (2010). Historical origins of schooling: The role of democracy and political decentralization. *The Review of Economics and Statistics*, 92 (2), 228-243.
- Galor, O. (2005). From stagnation to growth: unified growth theory. *Handbook of economic growth*. Elsevier pp. 171-293.
- Galor, O. (2011). *Unified Growth Theory*. Princeton.
- Galor, O., & Moav, O. (2006). Das human-kapital: A theory of the demise of the class structure. *The Review of Economic Studies*, 73 (1), 85-117.
- Galor, O., Moav, O., & Vollrath, D. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *The Review of economic studies*, 76 (1), 143-179.
- Galor, O., & Weil, D.N. (1996). The Gender Gap, Fertility, and Growth. *American Economic Review* 86 (3): 374-87.
- Go, S., & Lindert, P. (2010). The uneven rise of American public schools to 1850. *The Journal of Economic History*, 70 (1), 1-26.

- Goldin, C. (2016). Human Capital. *Handbook of Cliometrics*. Springer Verlag pp.55-86.
- Goldin, C., & Katz, L.F. (1998). The origins of technology-skill complementarity. *The Quarterly Journal of Economics*, 113 (3), 693-732.
- Goldin, C., & Katz, L.F. (2010). *The race between education and technology*. Harvard.
- Goldin, C., & Sokoloff, K. (1982). Women, children, and industrialization in the early republic: Evidence from the manufacturing censuses. *The Journal of Economic History*, 42 (4), 741-774.
- Gomes, P., & Machado, M.P. (2020). Literacy and primary school expansion in Portugal: 1940-62. *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, 38 (1), 111-145.
- Goñi, M. (2018). Landed Elites and Education Provision in England and Wales. Evidence from School Boards, 1870–99. *Working Paper* available at: <https://extranet.sioe.org/uploads/sioe2018/goni.pdf>
- Grew, R., & Harrigan, P. (1991). *School, state, and society: The growth of elementary schooling in nineteenth-century France: A quantitative analysis*. Michigan.
- Hajnal, J. (1965). European Marriage Patterns in Perspective. *Population in History: Essays in Historical Demography*. Arnold pp. 101–43.
- Hanushek, E. A., & Woessmann, L. (2020). Education, knowledge capital, and economic growth. *The economics of education*. Academic Press pp.171-182.
- Hippe, R. (2013). Human capital formation in Europe at the regional level-implications for economic growth. Strasbourg. PhD thesis.
- Humphries J. (2003). English apprenticeships: a neglected factor in the first industrial revolution. *The economic future in historical perspective*. Oxford University Press pp 73–102.
- Johansson, E. (1977). The history of literacy in Sweden in comparison with some other countries. No. 12 1977, *Educational reports Umea*.
- Katz, O. (2018). Railroads, economic development, and the demographic transition in the United States. No. 88869. *MPRA Paper*.
- Kelly, M. (2021). Devotion or Deprivation: Did Catholicism Retard French Development?. No. DP16241. *CEPR Discussion Paper*.
- Kelly, M., Mokyr, J., & Ó Gráda, C. (2014). Precocious Albion: a new interpretation of the British industrial revolution. *Annual Review Economics*, 6 (1), 363-389.
- Klasen, S. (2002). Low schooling for girls, slower growth for all? Cross-country evidence on the effect of gender inequality in education on economic development. *The World Bank Economic Review*, 16 (3), 345-373.
- Klemp, M., & Weisdorf, J. (2019). Fecundity, fertility and the formation of human capital. *The Economic Journal*, 129 (618), 925-960.
- Kourtellos, A., Stylianou, I., & Tan, C. M. (2013). Failure to launch? The role of land inequality in transition delays. *European Economic Review*, 62, 98-113.
- Landes, W. M., & Solmon, L. C. (1972). Compulsory schooling legislation: An economic analysis of law and social change in the nineteenth century. *The Journal of Economic History*, 32 (1), 54-91.
- Ljungberg, J., & Nilsson, A. (2009). Human Capital and Economic Growth: Sweden 1870–2000. *Cliometrica* 3 (1), 71-95.

- Lindert, P. H. (2004). *Growing public: Social spending and economic growth since the eighteenth century*. Cambridge.
- Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22 (1), 3-42.
- Lupo, M. (1999). Reorganization of the public education system in the Kingdom of Naples during the French period. *Journal of Modern Italian Studies*, 4 (3), 329-349.
- Mariscal, E., Sokoloff, K.L., 2000. *Schooling, suffrage, and inequality in the Americas, 1800–1945. Political Institutions and Economic Growth in Latin America. Essay in Policy, History, and Political Economy*. Hoover Institution Press pp. 159–218.
- Meghir, C., & Palme, M. (2005). Educational reform, ability, and family background. *American Economic Review*, 95 (1), 414-424.
- Meisenzahl, R. R., & Mokyr, J. (2012). The Rate and Direction of Invention in the British Industrial Revolution. *The Rate and Direction of Inventive Activity Revisited*. University of Chicago Press pp. 443-482.
- Meyer, J. W., Ramirez, F. O., & Soysal, Y. N. (1992). World expansion of mass education, 1870-1980. *Sociology of Education*, 65 (2), 128-149.
- Middleton, N. (1970). The Education Act of 1870 as the Start of the Modern Concept of the Child. *British Journal of Educational Studies*, 18 (2), 166-179.
- Milner, B. (2020). *Essays on British Labour Markets during the Second Industrial Revolution*. University of British Columbia. PhD thesis.
- Milner, B. (2021). The impact of state-provided education: Evidence from the 1870 education act. *Job Market Paper*.
- Minten, L., Depaepe M., De Vroede M., Lory J., Frank S., Mertens R., & Vreugde C. (1991). *Les Statistiques de l'enseignement En Belgique. L'enseignement Primaire 1830-1842*. Vol. 3. 1 vols. Bruxelles.
- Mitch, D. (1999). The Role of Education and Skill in the British Industrial Revolution. *The British Industrial Revolution: An Economic Perspective*. Routledge pp. 241-279.
- Mitch, D. (2013). The Economic History of Education. *Routledge Handbook of Major Events in Economic History*. Routledge pp.247-264.
- Mokyr, J. (2005). Long-Term Economic Growth and the History of Technology. *The Handbook of Economic Growth*. Elsevier pp.1113-1180.
- Mokyr J (2009) *The Enlightened economy: an economic history of Britain, 1700–1850*. New Haven.
- Mokyr, J. (2010). *The Enlightened economy an economic history of Britain 1700-1850*. Yale.
- Mokyr, J. (2011). *The gifts of Athena*. Princeton.
- Mokyr, J. & Voth H.J. (2009). Understanding Growth in Early Modern Europe. *The Cambridge Economic History of Europe*. Cambridge University Press pp. 7-42.
- Montalbo, A. (2020). Industrial activities and primary schooling in early nineteenth-century France. *Cliometrica*, 14 (2), 325-365.
- Murtin, F. (2013). Long-term determinants of the demographic transition, 1870–2000. *Review of Economics and Statistics*, 95 (2), 617-631.

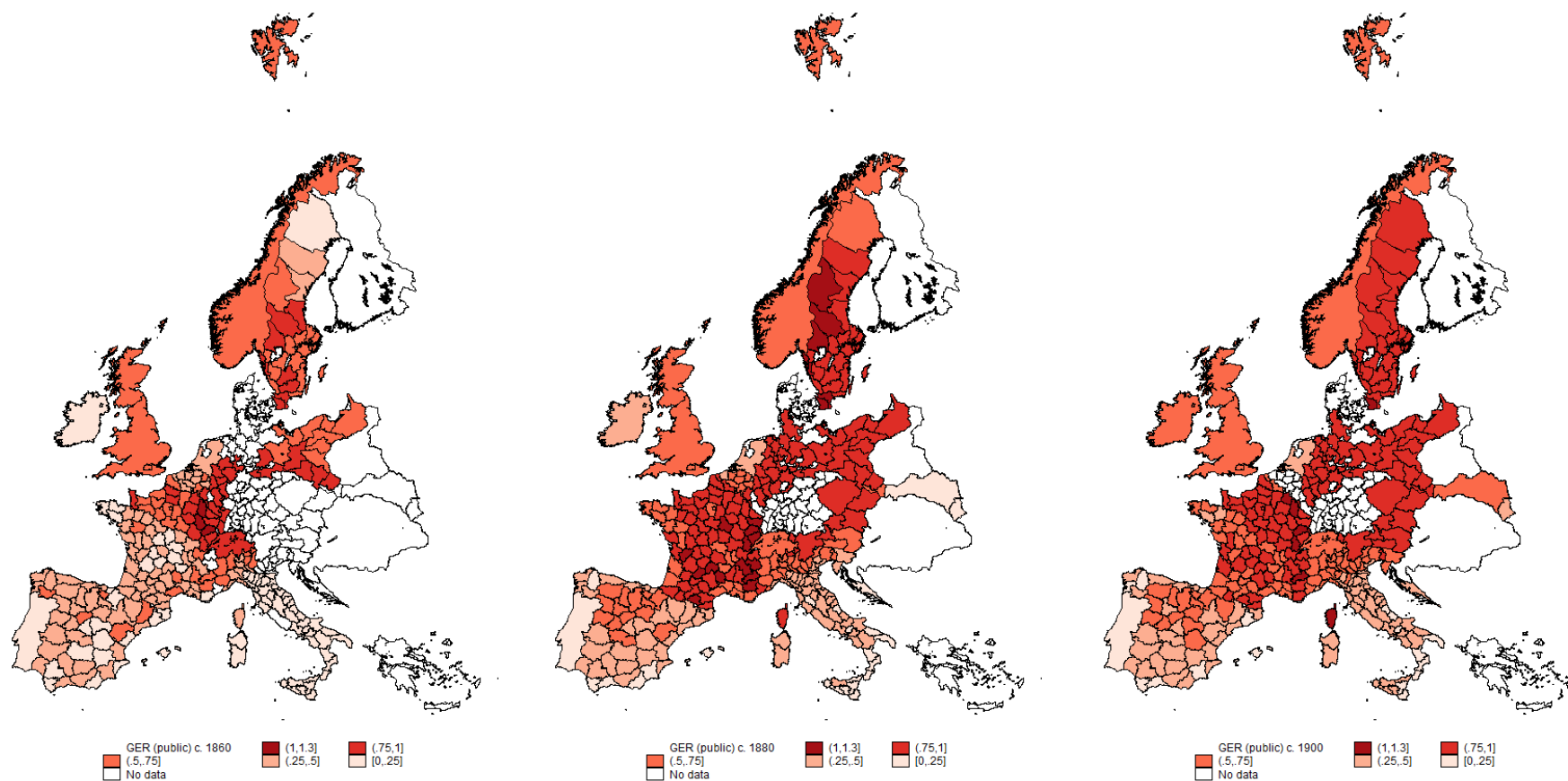
- Musacchio, A., Fritscher, A. M., & Viarengo, M. (2014). Colonial institutions, trade shocks, and the diffusion of elementary education in Brazil, 1889–1930. *The Journal of Economic History*, 74 (3), 730-766.
- Nafziger, S. (2011). Did Ivan's vote matter? The political economy of local democracy in Tsarist Russia. *European Review of Economic History*, 15 (3), 393-441.
- Naidu, S. (2012). Suffrage, schooling, and sorting in the post-bellum US South. No. w18129. *National Bureau of Economic Research*.
- Nicholas, S. J., & Nicholas, J. M. (1992). Male literacy, "deskilling," and the Industrial Revolution. *The Journal of Interdisciplinary History*, 23 (1), 1-18.
- Nilsson, A., Pettersson, L., & Svensson, P. (1999). Agrarian Transition and Literacy: The Case of Nineteenth Century Sweden. *European Review of Economic History* 3 (1), 76-96.
- North, D. C. (1991). Institutions. *Journal of economic perspectives*, 5 (1), 97-112.
- Nunn N. (2014). Gender and Missionary Influence in Colonial Africa. *Africa's Development in Historical Perspective*. Cambridge University Press pp. 489-512.
- Nuvolari, A., & Vasta, M. (2017). The geography of innovation in Italy, 1861–1913: evidence from patent data. *European Review of Economic History*, 21 (3), 326-356.
- Ogilvie, S., & Küpker, M. (2015). Human Capital Investment in a Late-Developing Economy: Evidence from Württemberg, c. 1600–c. 1900. *Cambridge Working Papers in Economics*. Faculty of Economics, University of Cambridge.
- Paglayan, A. S. (2021). The non-democratic roots of mass education: evidence from 200 years. *American Political Science Review*, 115 (1), 179-198.
- Palma, N., & Reis, J. (2021). Can autocracy promote literacy? evidence from a cultural alignment success story. *Journal of Economic Behavior & Organization*, 186, 412-436.
- Postigliola, M., & Rota, M. (2020). Institutions and literacy rates: the legacy of napoleonic reforms in Italy. *European Review of Economic History* heaa021, <https://doi.org/10.1093/ereh/heaa021>
- Prados de la Escosura, L. (2015). World human development: 1870–2007. *Review of Income and Wealth*, 61 (2), 220-247.
- Qian, N. (2009). Quantity-quality and the one child policy: The only-child disadvantage in school enrollment in rural China. No. w14973. *National Bureau of Economic Research*.
- Ramcharan, R. (2010). Inequality and redistribution: Evidence from US counties and states, 1890–1930. *The Review of Economics and Statistics*, 92 (4), 729-744.
- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98 (5, Part 2), S71-S102.
- Rosenzweig, M. R., & Zhang, J. (2009). Do population control policies induce more human capital investment? Twins, birth weight and China's "one-child" policy. *The Review of Economic Studies*, 76 (3), 1149-1174.
- Saleh, M. (2015). The reluctant transformation: State industrialization, religion, and human capital in nineteenth-century Egypt. *The Journal of Economic History*, 75 (1), 65-94.
- Sandberg, L. G. (1979). The case of the impoverished sophisticate: human capital and Swedish economic growth before World War I. *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.
- Schofield, R. (1973). Dimensions of illiteracy, 1750-1850. *Explorations in Economic History*, 10 (4), 437.
- Shammas, C. (2015). Did Democracy Give the United States an Edge in Primary Schooling?. *Social Science History*, 39 (3), 315-338.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70 (1), 65-94.
- Skinningsrud, T., and Skjelmo R. (2014). Fra Dansk Provins Til Konstitusjonell Stat: Arbeidet for En Norsk Skolelovgivning 1814 Til 1827, *Uddannelseshistorie*, 48, 31-51
- Squicciarini, M.P. (2021). Reply to Kelly. Available at: [https://d0588f21-3f05-484e-93b7-532977ce2186.filesusr.com/ugd/08a88f\\_e728d853a2c74cb191cfa6b8bcacfe1a.pdf](https://d0588f21-3f05-484e-93b7-532977ce2186.filesusr.com/ugd/08a88f_e728d853a2c74cb191cfa6b8bcacfe1a.pdf)
- Squicciarini, M.P. (2020). Devotion and development: religiosity, education, and economic progress in nineteenth-century France. *American Economic Review*, 110 (11), 3454-91.
- Squicciarini, M.P., & Voigtländer, N. (2015). Human capital and industrialization: Evidence from the age of enlightenment. *The Quarterly Journal of Economics*, 130 (4), 1825-1883.
- Summerhill, W. (2010). Colonial institutions, slavery, inequality, and development: Evidence from São Paulo, Brazil. *Slavery, Inequality, and Development: Evidence from Sao Paulo, Brazil (April 14, 2010)*.
- Tröhler, D. (2016). Curriculum history or the educational construction of Europe in the long nineteenth century. *European Educational Research Journal*, 15 (3), 279-297.
- Valencia Caicedo, F. (2019). The mission: Human capital transmission, economic persistence, and culture in South America. *The Quarterly Journal of Economics*, 134 (1), 507-556.
- van Gijlswijk, D. (2016). Early central regulation, slow financial participation: relations between primary education and the Dutch state from ±1750–1920. *Paedagogica Historica*, 52 (4), 364-379.
- Van Zanden, J.L. (2009). The skill premium and the 'Great Divergence'. *European Review of Economic History*, 13 (1), 121-153.
- Voigtländer, N., & Voth, H.J. (2006). Why England? Demographic factors, structural change and physical capital accumulation during the Industrial Revolution. *Journal of Economic Growth*, 11 (4), 319-361.
- Voigtländer, N., & Voth, H.J. (2013). How the West "Invented" fertility restriction. *American Economic Review*, 103 (6), 2227-64.
- Vollrath, D. (2013). Inequality and school funding in the rural United States, 1890. *Explorations in Economic History*, 50 (2), 267-284.
- Waldinger, M. (2017). The long-run effects of missionary orders in Mexico. *Journal of Development Economics*, 127, 355-378.
- Wallis, P. (2008). Apprenticeship and training in premodern England. *The Journal of Economic History*, 68 (3), 832-861.



- West, E.G. (1970). *Education and the state: A study in political economy*. London.
- West, M.R., & Woessmann, L. (2010). 'Every Catholic child in a Catholic school': Historical resistance to state schooling, contemporary private competition and student achievement across countries. *The Economic Journal*, 120 (546), F229-F255.
- Westberg, J. (2017). *Funding the Rise of Mass Schooling: The Social, Economic and Cultural History of School Finance in Sweden, 1840–1900*. Cham.
- Westberg, J., Boser, L. & Brühwiler, I. (eds) (2019) *School Acts and the Rise of Mass Schooling : Education Policy in the Long Nineteenth Century*. Cham: Palgrave Macmillan.
- Westberg, J. (2020). What Were the Main Features of Nineteenth Century School Acts? Local School Organization, Basic Schooling, a Diversity of Revenues and the Institutional Framework of an Educational Revolution. *Rivista di storia economica*, 26 (2), 139-173.
- Westberg, J., İncirci, A., Paksuniemi, M., & Turunen, T. (2018). State formation and the rise of elementary education at the periphery of Europe: the cases of Finland and Turkey 1860–1930. *Journal of Educational Administration and History*, 50 (3), 133-144.
- Zeev, N.B., Mokyr, J., & Van Der Beek, K. (2017). Flexible supply of apprenticeship in the British industrial revolution. *The Journal of Economic History*, 77 (1), 208-250.

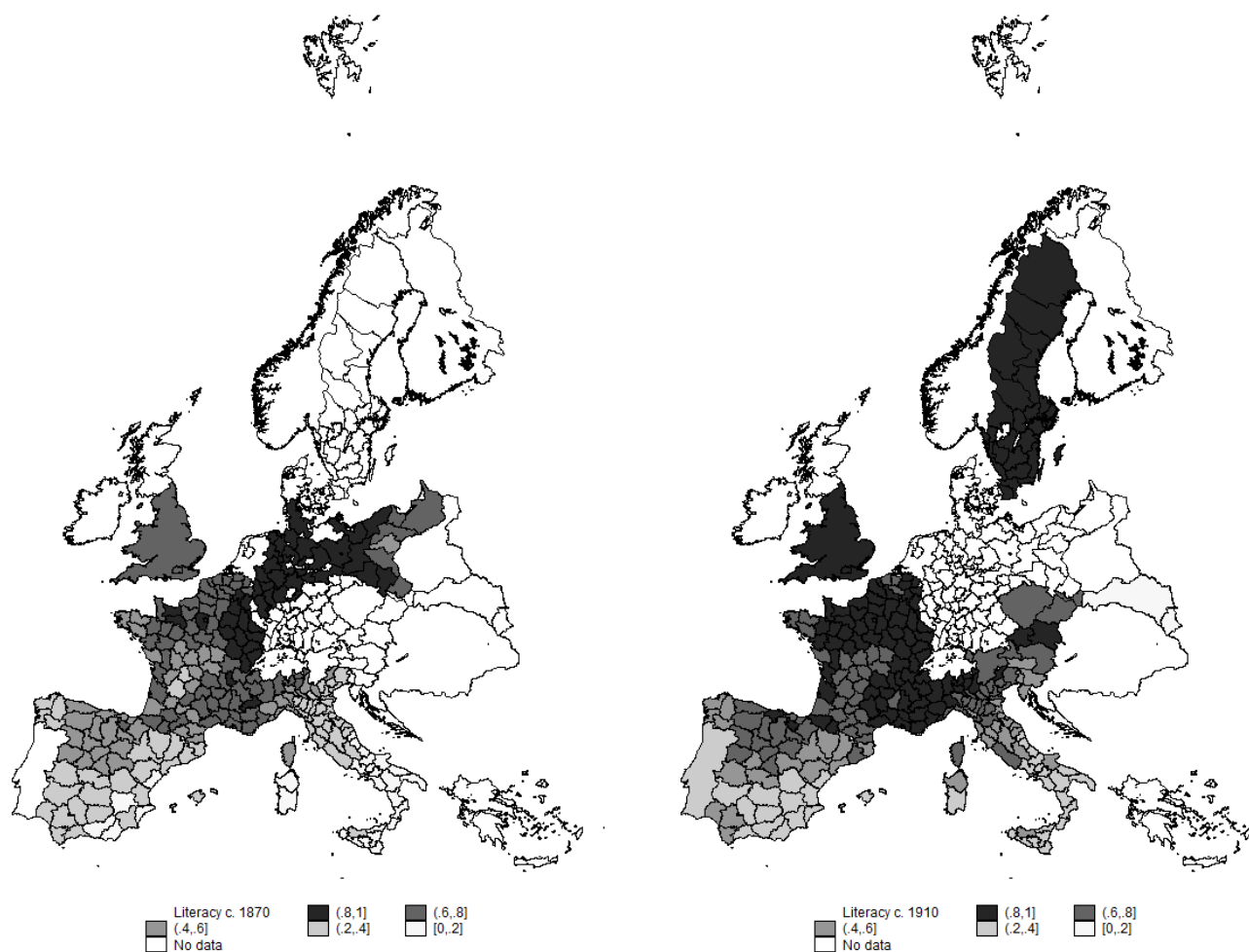
Figure 1 – Gross enrolment rates in public schools, 1860, 1880 and 1900.



Sources: Cappelli and Quiroga (2021) for Italy and Spain. For France, data were obtained from the «Données historiques de la Statistique générale de France», which contains digitized data from educational statistics and the *Annuaire statistique de la France* as well as population censuses (<https://gallica.bnf.fr>). For Sweden, the data are obtained from own research based on a combination of school statistics and population as well as census data. For Prussia, see iPEHD (<https://www.ifo.de/en/iPEHD>). For Austrian provinces, see CvrCek (2020). For Belgium, we relied on Minten et al. (1991) and national censuses. National enrolment rates for the United Kingdom and Scotland, Norway, the Netherlands, Switzerland, Ireland and Portugal come from Lindert (2004).

Notes: for Prussia, Gumbingenn and Königsberg have been aggregated into one spatial unit (the same goes Stettin and Straslund) to be compatible with the available map displaying 1900 historical borders, which is provided by the Mosaic Project (<https://censusmosaic.demog.berkeley.edu/data/historical-gis-files>). The same was done for Tyrol and Vorarlberg among the Austrian provinces. Canarias in Spain are not reported in this map. Moselle, and the Upper and Lower Rhin departments in France display missing values after the 1860s due to their annexation by Prussia. Following the 1860s, Meurthe's figure is assigned to Meurthe-et-Moselle, even if the borders were not the same. The school-age population is always 6-14, even though in some cases it had to be estimated from different age brackets, e.g. 5-15 (France and Belgium). Enrolment rates in Sweden refer to the age group 7-14. The denominators for Belgium refer to 1863 and 1878, respectively.

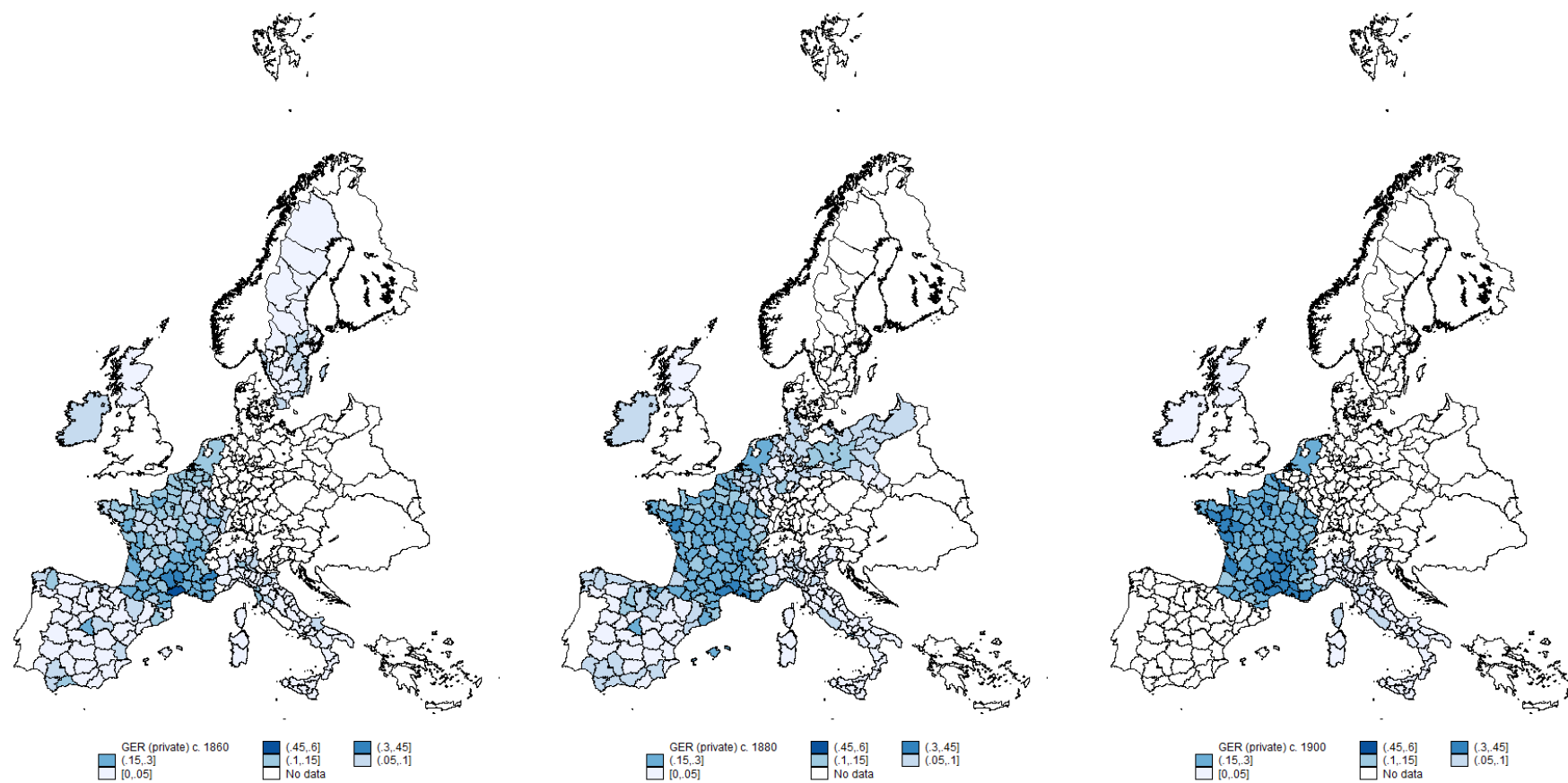
Figure 2 – Literacy rates (population 6+ with exceptions), c. 1870 and c. 1910.



Sources: see Figure 1 for France, Italy and Spain, as well as Prussia. For Sweden, we assumed a value of 95 percent in all counties, with the exception of Norrbotten, Vesterbotten and Vesternorrland (90 percent), based on local and aggregate figures provided by Johansson (1977). For Belgium, data come from population censuses. Provincial literacy rates for the Austrian provinces have been computed from *Die Ergebnisse Volkszahlung vom Dec 31 1890*, XXXII BAND, 1. HEFT, p. XXII. Data for Portugal are from Cipolla (1969), while those of the United Kingdom come from Prados de la Escosura (2015).

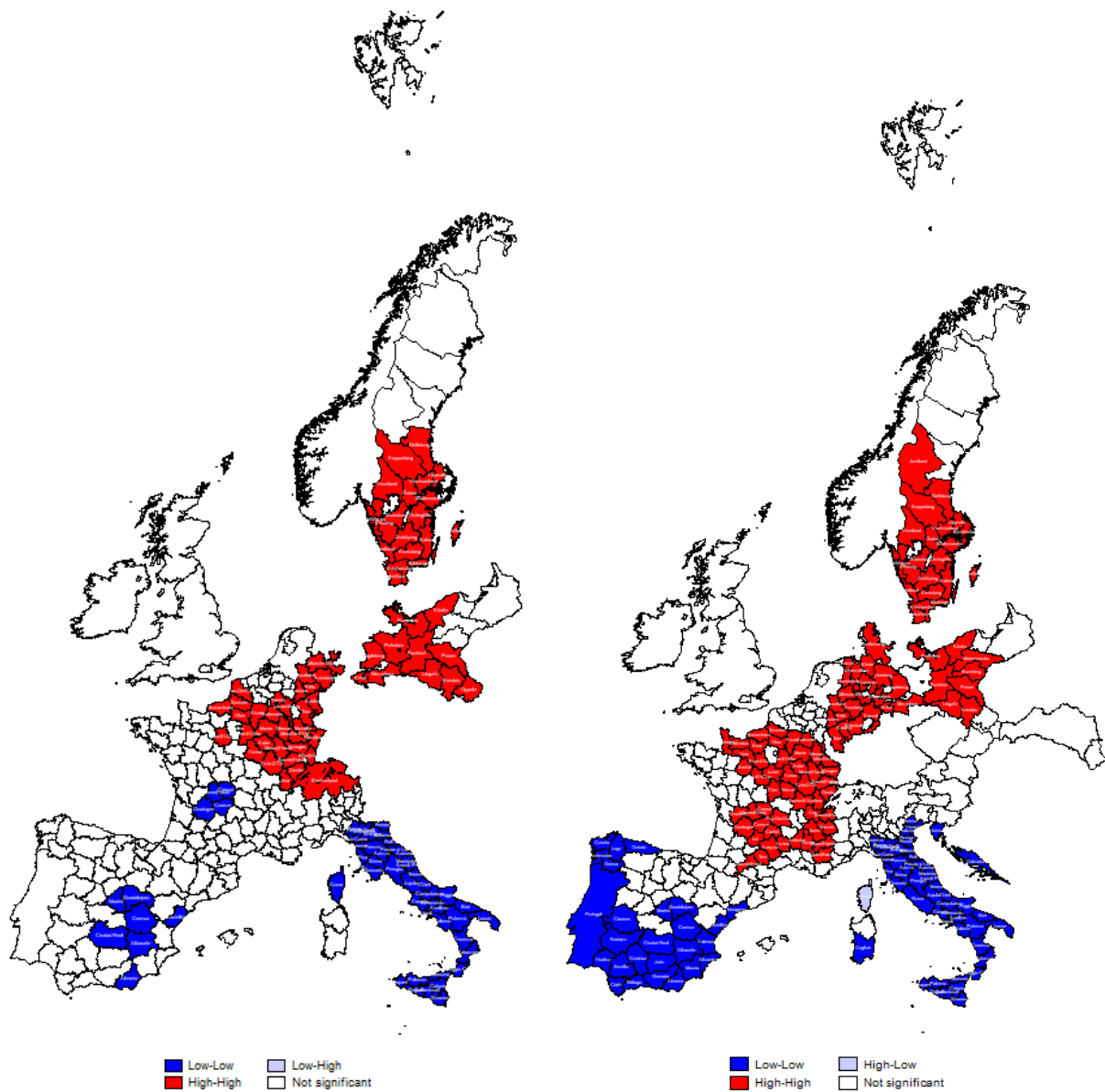
Notes: Data concern the population 6+. In the case of Prussia, this is 10+. Portuguese literacy refers to the population 7+, while that of the United Kingdom refers to the adult population (15+). For France in the 1872 data, someone literate is counted if they could just read as well as read and write. The people whose literacy the data leave unknown are just included in the denominator.

Figure 3 – Gross enrolment rates in private schools, 1860, 1880 and 1900.



Sources: see Figure 1. Notes: idem.

Figure 4 – Educational clusters based on gross enrolment rates in public schools, 1850s/60s vs 1880s.



Sources: see Figure 1. Notes: Some spatial units are dropped due to the unavailability of data. See Hippe (2013) for an overview of the methodology, and its application to historical numeracy data across European countries.