

Human capital in Europe, 1830s–1930s: A general survey

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Abstract

Human capital is now widely acknowledged as one of the key determinants of economic growth. Research on how human skills accumulate and evolve through time has grown rapidly in recent years. This paper surveys it with a specific focus on Europe in the period 1830s–1930s. Our contribution is threefold: First, 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. Second, we provide a preliminary taxonomy of European school acts and reforms in the 19th and early-20th century. Finally, we present the first version of a dataset under construction, which aims at providing spatial data covering gross enrollment 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 20th century.

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1 | INTRODUCTION

In a well-known contribution on the determinants of a country's economic performance, Robert Solow (1956) argued that increases in capital and labor alone can hardly explain 20th-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 19th century (Galor, 2005).

Empirical evidence has largely confirmed the hypothesis that human skills and abilities are central to economic performance (see Hanushek & 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, for example, 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). Furthermore, as schooling and education systems have been changing to a large extent in the last two centuries, not least in association with evolving technology (Goldin & Katz, 1998), 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 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. In addition, we provide a preliminary taxonomy of the 19th and early-20th century school acts and reforms in Europe, emphasizing the similarities and differences between the various legislations regulating compulsory education across countries. Although focusing only on Europe leaves out important information on the global spread of education, this focus allows us to implement a new combination of regional and comparative perspectives to study the diffusion of schooling and literacy in the past. Indeed, we present a brand-new, under-construction dataset that aims to provide fine-grain spatial data covering enrollment 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-19th century, both within and across countries. Around 1850, educational clusters were concentrated

across national borders. Instead, by the beginning of the 20th 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 labor 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 center stage of debates on the Industrial Revolution and the transition from pre-industrial to modern economic growth.

One leading 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 coal prices characterizing England in the 18th century rather than the quality of the British labor force. Several studies, however, have challenged this interpretation.

Mokyr argued that the Enlightenment brought about new ways to generate and disseminate knowledge, particularly what the author labels “prescriptive knowledge,” that is, the capability to manipulate natural phenomena for human material needs and production (Mokyr, 2002). Mokyr’s argument 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 labor force has also been highlighted by Kelly et al. (2014). Other scholars have also rekindled the attention towards human capital as a key driver of long run economic growth and have interpreted it as the main factor accounting for the so-called “Little Divergence,” the process whereby the North Sea Area became the most prosperous and dynamic part of Europe from the 16th century onwards (Baten & van Zanden, 2008; De Pleijt & van Zanden, 2016).

Mokyr’s thesis has been recently examined in a variety of contexts, for example, 19th-century Britain (Dowey, 2017), Prussia (Cinnirella & Streb, 2017), France during its early industrialization (Squicciarini & Voigtländer, 2015) as well as Sweden (Ljungberg & Nilsson, 2009). These studies agree on the importance of the rise and diffusion of “useful knowledge” based on growing prescriptive knowledge, but they differ concerning the importance of knowledge elites (so-called upper-tail human capital) versus basic human capital and universal education. Although Squicciarini and Voigtländer (2015) find that the process of industrialization in France was prompted by the diffusion of upper-tail knowledge, the case of Prussia suggests that basic literacy was also crucial during the Second Industrial Revolution (Cinnirella & Streb, 2017). Thus, to date, empirical evidence provides contrasting accounts of the relative importance of different forms of human capital for economic growth depending on the historical context and the period considered.

The importance of human capital for early industrialization is still partially debated (Ogilvie & 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-19th century and up to the present day (Baten & 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 Abramovitz (1986) in his seminal work on “catching up” (or falling behind), where he argued that latecomer countries were able to imitate firstcomer technologies (and then perhaps innovate) only insofar as they acquired a range of “social capabilities”—among which one finds education. Indeed, education and human capital are two different concepts, although we use them here as synonyms following the most common approach in the literature.¹

Education can directly increase the productivity of both capital and labor and help incorporate 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 et al., 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-19th century (see, respectively, Nuvolari & Vasta, 2017 and Cinnirella & Streb, 2017). Education was also one of the most important sources of gender inequality (Bertocchi & Bozzano, 2016; Ciccarelli & Weisdorf, 2019), which in turn 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 19th 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, to render the literature review manageable, we take a somewhat restricted view of the topic. We focus on Europe and cover the period 1830–1930, which corresponds to the spread of mass education across the continent. Furthermore, we concentrate mostly on primary education—as captured by two main metrics, namely gross enrollment rates and literacy rates (a detailed overview on the evolution of methods to measure human capital in a historical perspective is provided by Cappelli et al. 2023). 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.² Nevertheless, at times we briefly touch upon seminal studies concerning the rest of the world and discuss other educational levels. For these reasons, the next section may not be exhaustive, even if it provides a comprehensive overview of the main issues addressed by this literature.

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 formal schooling and education as well as human capital accumulation. Among the factors that can account for the diffusion of education, we distinguish between long-term and short-term determinants. The first will be discussed in Section 3.1 and include religion and institutions which tend to change very slowly over time, while the second will be discussed in Section 3.2 and addresses factors shaping educational trends in the short run—such as industrialization, demography, the political economy of schooling and reforms. We focus on the economic history literature, but we do not consider the so-called “persistence studies,” which have recently emerged in the economic literature to explore how important events in the past have shaped current economic

and non-economic outcomes (Cioni et al., 2021, 2022). Finally, it is worth noting that some of the factors that we list as determinants of education may be, in fact, affected by education itself via reverse-causality mechanisms—the most evident ones being economic activity (like GDP growth) and demography –, even though some other determinants of education are normally seen as relatively exogenous, at least with respect to regional and local dynamics (like school reforms). As we review the literature on the determinants of human capital formation in Europe during the rise of mass education, we do not analyze causality, as this issue has been already addressed in most of the contributions that we cite and discuss in the remainder of this section.

3.1 | Long lasting determinants

3.1.1 | Religion

Religion has been traditionally regarded as an important factor in explaining historical patterns of human capital accumulation. 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 the past. In their seminal contribution, Becker and Woessmann (2009) tested two alternative hypotheses to explain the relative prosperity of Protestant regions. The first, which borrows from the classic Weberian view, argues that the Protestant religion was important for economic growth and long-term development, as it placed special emphasis on the value of work. The second hypothesis, instead, considers a different channel linking religion and economic development. Protestantism, it is argued, insisted on the individual right to directly access the word of God without any intermediation by priests—an important difference compared to Catholicism. As a result, bibles were made widely available and schools were established in large numbers, resulting in high levels of human capital that sustained economic growth in the long run. The spread of Protestantism and the ensuing religious divide it brought about across Europe has offered a natural testing ground to explore these hypotheses and measure their effect on diverging trends of human capital accumulation. By exploiting the concentric diffusion of Protestantism around the city of Wittenberg, where Luther's theses were first exposed in 1517, Becker and Woessmann (2009) showed that Protestantism indeed prompted more rapid human capital accumulation in the 19th century. 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 requiring 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 19th century Swiss districts, Boppert 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 characterized by a non-conservative milieu.

Other studies have 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 19th century Prussia (Becker & Woessmann, 2008).³

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 analyzed the competition between religious and public-school provision. For instance, West and Woessmann (2010) showed that Catholicism is associated with a persistent lower supply of public education. Furthermore, in France, public schooling underwent more cultural resistance in the areas where Catholicism was more widespread, and the population supported local priests against the French revolutionaries during the 1789 Revolution. In these regions, catholic schooling also displayed a high degree of resilience despite several efforts made by the government to promote public education (Franck & 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 1870s. According to the author, this is due to slower adoption of the technical curricula in primary schools and a push for Catholic education driven by parents' preference for religious education. 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 ongoing (see Squicciarini's (2021) reply to Kelly). Indeed, the causal relation between development and religion remains far from clear: on the one hand, religion might hold back development, and hence education; on the other hand, development might weaken Catholicism. Finally, it is worth noting that both development and religiosity might be affected by other factors, for example the Enlightenment, possibly implying the absence of a direct causal effect between the two.

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 et al. (2001, 2002). The authors argued that political institutions, which are considered "state variable" since they change very slowly, economic institutions and democracy are crucial determinants of incomes, prompting sustained economic growth in the long run (Acemoglu et al., 2005). However, comparatively, less has been said about institutions as determinants of human capital accumulation from a 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 19th-20th centuries, while Paglayan (2021) maintained that democratization had no or little impact on primary school enrollment 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 & Koyama, 2016; Carvalho et al., 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.

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 (2021), for instance, have focused on a natural experiment, the occupation of the French troops in Italy, to identify the institutional origins of the large literacy gap characterizing 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 characterized 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 & Moav, 2006; Galor, 2011). However, whether industrialization was skill demanding or skill saving is a long-debated issue in economic history. A natural testing ground for the link between industrialization and human capital formation is offered by Great Britain, 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 & Nicholas, 1992; Mitch, 1999) as well as average years of primary schooling, whereas 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 & 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 comparison 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 characterized by almost universal alphabetization 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 share in the adult population increased in response to inventions in 18th-century England. Similarly, Meisenzahl and Mokyr (2012) found

that the diffusion of new technologies during the Industrial Revolution stimulated a growing class of highly skilled mechanical workers, as suggested by some studies (Mokyr, 2005; Mokyr & Voth, 2009; Zeev et al., 2017; Kelly et al., 2022).

De Pleijt et al. (2020) offered a more nuanced picture of the effect of technology on human capital formation. Specifically, they carried out a systematic quantitative assessment of the effect of steam engines on the average working skills of the workforce in England during the first Industrial Revolution. They showed that steam engine per capita had a negative effect on the accumulation of basic human capital as proxied by literacy and school enrollment rates and led to higher gender inequality in literacy. These findings chime with early studies on the deskilling effects of industrialization 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 showed that steam engine adoption led to a growing share of skilled workers, and the effect was casual, providing support to the notion that the British Industrial Revolution was skill-demanding on average.

The French evidence contrasts, however, with the traditional narrative about the effects of early industrialization in England and the United States. For instance, Franck and Galor (2022) 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 et al. (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 19th century. 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 et al., 2019) and was conducive to the accumulation of intermediate human capital in the second half of the 19th century, 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 et al., 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 19th-century France seemingly through an income effect favored by transfers made by manufactures. However, he found that industrial activities were associated with lower enrolment rates.⁴

3.2.2 | Demography

In recent years, the analysis of long run demographic trends has attracted attention, as economists have begun to incorporate demographic behavior into the theories concerning the nexus between human capital formation and long run economic growth.⁵ Two types of studies have emerged: the first investigating the effect of fertility on education and the second analyzing the impact of mortality on education.

Recent interpretations have highlighted the importance of 18th-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 & Weil, 1996; Diebolt & Perrin, 2013). Some studies have tested these arguments in a historical perspective. For instance, Klemp and Weisdorf (2019) examined the existence of the child quantity-quality trade-off in England using a sample of 26 parishes from the 16th to the 19th century. Exploiting variation in the time span from a couple's marriage

to their first birth as a measure of exogenous variation in family size, they found that children of parents with lower fecundity were more likely to become literate and employed in skilled and high-income professions. This is consistent with the argument that a trade-off between child quantity and quality was present in England during the Industrial Revolution. Additionally, Fernihough (2017) investigated the impact of sibship size on school enrollment in Ireland using individual-level data from the 1911 census. He found strong evidence of a negative impact of extra siblings on school enrollment, particularly in more industrialized areas. In a similar vein, Becker et al. (2010) investigated the relationship between the quantity-quality trade-off of children and fertility restraint based on aggregated regional data for 19th-century Prussia. They suggested that the negative correlation between education and fertility also existed in Prussia during the 19th century. Several studies have also focused on 19th-century France. Diebolt et al. (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 18th century preceded the rise in education by several decades (Blanc & Wacziarg, 2020).⁶ More recently, Le Bris and Tallec (2023) used microdata to examine the links between female age at marriage, economic conditions and human capital formation in early modern France, while Perrin (2022) provided a comprehensive characterization of the demographic transition in France, highlighting the complex interrelationship between cultural, economic and demographic factors.⁷

Another strand of the literature has also analyzed 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 et al., 2002).

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 channeled 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.⁸ Although a large body of literature has analyzed this topic, so far there are only few studies looking at European countries.⁹ 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 tended to block the accumulation of human capital. In a world that was still primarily rural, the economic and political powers were largely dependent on land ownership, so that ruling elites lacked fundamental incentives to support economic growth enhancing educational programs. This depended on 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 labor in agriculture (Engerman & Sokoloff, 2000; Galor et al., 2009). Thus, according to this interpretation, agrarian societies and early industrializing countries were characterized 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 for education by providing lower incentives to 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 19th-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-19th century Spain, Beltrán Tapia and Martínez-Galarraga (2018) have shown that the degree of land access inequality, measured as the proportion of farm laborers over the population engaged in agriculture, had an adverse impact on male literacy rates driven by the reduced demand of education. Goñi (2023) tested the same argument focusing on late-19th century England when the Forster Education Act introduced state-schooling in 1870 to meet the demand for an educated 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.¹⁰ Furthermore, exploiting malaria pervasiveness as a source of exogenous variation, Mariella (2023) has found evidence of an adverse effect of land inequality on literacy rates in post-unification Italy.

Despite this widespread consensus, a number of studies seem to challenge this interpretation. Focusing on 19th century England, Clark and Gray (2014) analyzed differences in literacy rates across a sample of parishes in two northern counties (Lancashire and Northumberland) characterized by dairy farming, and relatively small land concentration and two southern counties (Essex and Somerset) where large-scale farming and landless laborers prevailed. Using these data, they found no connection between large-scale farming and illiteracy and concluded that other cultural factors accounted for these variations.¹¹ 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 favor 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 future industrial workers.

Post-unification Italy provides an interesting testing ground owing to the large regional inequalities that 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.

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 instill civic values in countries characterized by high rates of inward immigration and/or high ethnical fractionalization. For instance, between 1850 and 1914, the United States had amongst the highest attendance rates in the world and was 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. (2019), compulsory schooling laws were introduced to instill 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 shown 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 19th 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.¹² Lindberg et al. (2020) found 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 have shown that the concentration of landownership did not affect the above-mentioned relationship.

Finally, Squicciarini and Voigtländer (2015) showed that the presence of different kinds of elites, *enlightened* versus landowning, can result in different levels of human capital accumulation. In mid-19th century France, for instance, 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 behavior 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 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.”¹³ 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 & Palme, 2005, p. 414). The result is that only few scholars and for only a few European countries have sought to explore the effect of encompassing school reforms on the accumulation of human capital in the period considered in this study.

Cappelli and Vasta (2020) analyzed the effects of a major reform of the Italian educational system, namely the Daneo-Credaro Law (1911), which shifted Italy from a fully decentralized primary

school system towards centralization.¹⁴ 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. In a companion paper, they showed that the reform brought about a decisive improvement in female literacy (Cappelli & 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 identified 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 enrollment and 13% of the increase in the literacy rate of the affected cohorts at the beginning of the 1960s.¹⁵

Finally, a number of studies have 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 for 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 remainder of the paper we offer an overview of the main (often public) school acts introduced across European countries in the 19th century as well as the school reforms that followed them. We provide a preliminary taxonomy of school acts, focusing on aspects such as the role played by the Church (and 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 18th 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 Boli-Bennett & Meyer, 1978; Tröhler, 2019; 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 & Schueler, 2018).¹⁶ 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 19th century. Similarly, some school acts were linked with wars and revolutions. In 19th-century Finland—a grand duchy in the Russian Empire—the defeat of Russia in the Crimean war (1853–1856) 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).¹⁷ 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 et al., 1992).

One important aspect of 18th and 19th 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 19th and early-20th centuries, when important educational reforms were introduced everywhere—at least in Europe.

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 20th 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 19th 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. Although 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 enrollment and attendance (see Table 1).

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 enrollment 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 9 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.¹⁸ In this respect, 19th century schooling is more fittingly described as basic than as compulsory.

TABLE 1 Main features of national school acts.

School act	Year	Political entity	Regulations of educational provision		Organization
			Gender	School age	Enforcement
General School Ordinance	1774	Habsburg Empire	B/G	6–12	No penalties
Stapfer-draft school act	1798	Helvetic Republic	B/G	6–	–
The School Act of 1806	1806	The Batavian Republic (Netherlands)	B/G	None	Refusal of poor relief
The School Acts of 1814	1814	Kingdom of Denmark	B/G	6–13/7–14	Fines
The Guizot Law	1833	Kingdom of France	B	None (6)	No penalties
The Someruelos Act and the Montesino Regulation	1838	Kingdom of Spain	B	6–9	No penalties
The School Act of 1842	1842	Kingdom of Sweden	B/G	9–	Warnings
The Casati Law	1859	Kingdom of Italy	B/G	6–8	Sanctions in school law but not in penal code
The 1864 Education Statute	1864	Russian Empire	B/G	None (6)	No penalties
The Elementary Education Act	1870	England and Wales	B/G	5–12	Optional

Source: Westberg (2020).

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

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 (1879–1880)
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 (1874–1875)

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

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 19th 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, for example, through interest-free mortgages and so forth. (see Table 2).

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

Apart from important variations to begin with, 19th and early-20th 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).

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. 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). In Sweden, the state subsidy reform of 1871 and, in particular, the state subsidy reform of 1913 meant that the central government in 1920 covered half of the total expenditure of local school districts (Westberg, 2017, p. 148). The same shift was introduced by the Ferry Laws in 1881–1882, when central-government subsidies increased to cover 66% of total expenditures in 1882 (Grew & 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 et al., 2005; Cappelli, 2020). 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 20th century) and moved the management of primary schools away from the municipalities, towards a greater role played directly by the Ministry of Education. 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 were 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 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-19th and early-20th 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 their relevance and potential for some of the research areas discussed in this paper.

5 | A NEW DATASET FOR EUROPEAN PRIMARY SCHOOLING

5.1 | Sources and methodology

Our dataset mainly focuses on two variables: enrollment rates and literacy. Although enrollment 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, for example, 6–14. This is the reason why, in this paper, we focus on both enrollment rates and literacy.¹⁹

We collected primary-schooling data for relatively small historical statistical units—roughly today’s NUTS3 and sometimes NUTS2—from a variety of sources to present public and private

gross enrollment rates as well as literacy rates from the 1850s to the 1910s. Gross enrollment 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, including today's International Standard Classification of Education (ISCED) standard levels 1 and 2.²⁰ Therefore, the age bracket for primary schooling is defined as including boys and girls from 6 to 14 years old, meaning that we consider individuals who have celebrated their 14th birthday but not their 15th. Literacy rates are commonly provided for 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 aged more than 10 years. 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 literacy 10+, particularly across spatial units—which is the focus of this paper. We list all exceptions to the baseline literacy measure (6+) in Table A1 of the Data Appendix.

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 in the diffusion of primary education in France, Italy, Spain, and Sweden, c. 1840–1940.²¹ 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 (see Bozzano et al., 2024 for a detailed analysis of school inputs and literacy in Liberal Italy). We obtain enrollment 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.²² 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 enrollment rates and literacy for Prussia are provided by the iPEHD dataset (Becker et al., 2014). Unfortunately, available figures for literacy have been published only for 1871 so far.²³ 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—and digitized some of the material anew—to obtain enrollment and literacy rates.²⁴ Enrollment data for the provinces of the Austrian Empire (excluding Hungary) come from recent research published by Cvrcek (2020).²⁵ Literacy rates for the provinces of the Austrian Empire in 1890 have been drawn from primary sources.²⁶ Literacy rates for provincial England are those published by Stephens (1987). Finally, when we have not yet compiled spatially disaggregated data, we drew on Lindert (2004) to collect enrollment rates at the national level for the United Kingdom and Scotland, Norway, the Netherlands, Switzerland, Ireland, and Portugal. National literacy rates for Portugal concerning the population 7+ were obtained from Cipolla (1969), while those of the United Kingdom come 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. Table A1 in the Data Appendix summarizes the sources and indices used.

Importantly, the regional and the comparative perspectives are combined as a preliminary attempt to isolate the effect of national institutions on schooling and education (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-19th century to the years preceding WWI by focusing on fully-harmonized provincial and regional enrollment and literacy rates. We 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, analyze 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).

5.2 | Results

We mainly focus on public-school enrollment (Figure 1) and literacy rates (Figure 2), given the marginal importance of private enrollment 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 19th century (Cappelli & 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 the Ferry Laws in the 1880s, which marked the consolidation of the role played by the central government in matters concerning primary education (Diebolt et al., 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.

A remarkable difference can be discerned in public-school enrollment rates between the 1850s (and 1860s) and the second half of the 19th century. Whereas in the first period (Figure 1 left-hand side map) education is spatially distributed following seemingly local and transnational clusters—echoing the thesis that economic and religious trends were two fundamental factors driving literacy and therefore schooling before national school acts—the second half of the 19th century (Figure 1 center map) witnessed a striking change in the spatial distribution of primary-education rates, and a growing divide between Northern and Southern Europe. Indeed, in the mid-19th century, a high-education cluster can be discerned including Eastern France, Western 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 (Figure 1 right-hand side map), France, Prussia and Sweden became more homogeneous within them towards high schooling rates, whereas, for example, Italy and Spain lagged behind and were still largely characterized 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 19th 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

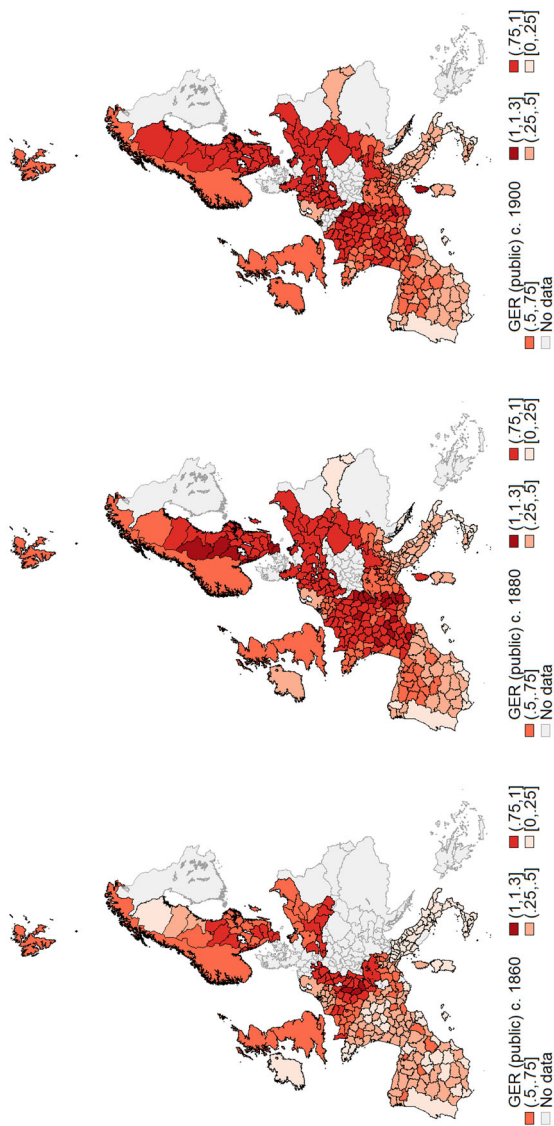


FIGURE 1 Gross enrollment rates in public schools (1860, 1880 and 1900).
[Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]
Sources: see text. Table 1A lists all the sources used to compute gross enrollment rates. The shapefile is provided by the Mosaic Project (<https://censusmosaic.demog.berkeley.edu/data/historical-gis-files>).

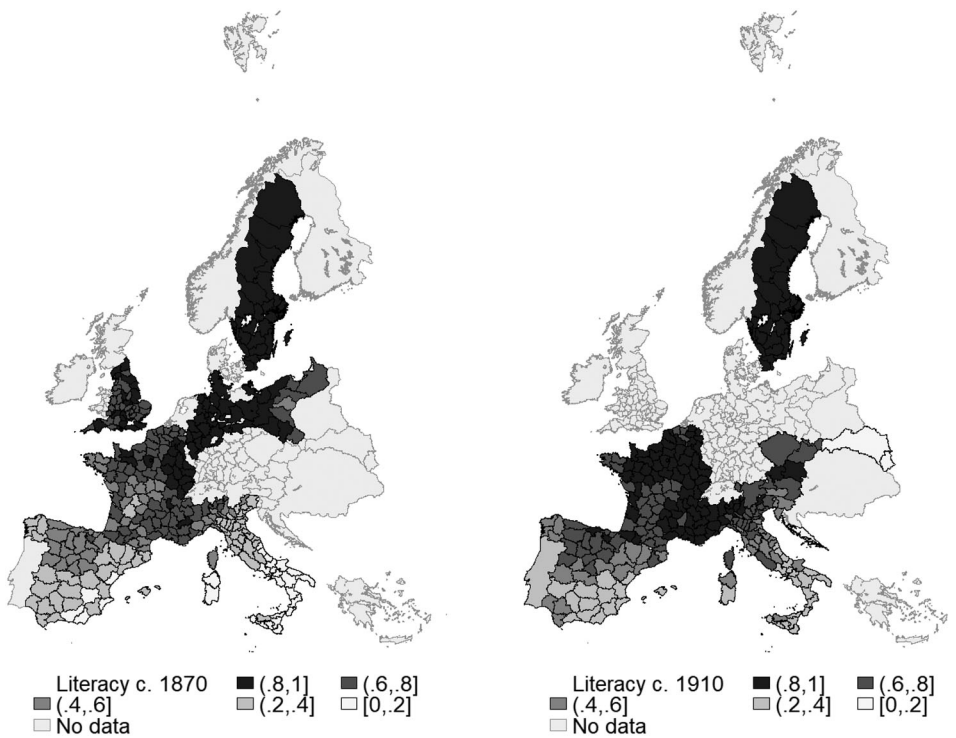


FIGURE 2 Literacy rates (population 6+ with exceptions), c. 1870 and c. 1910.

Sources: see Table 1A.

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+).

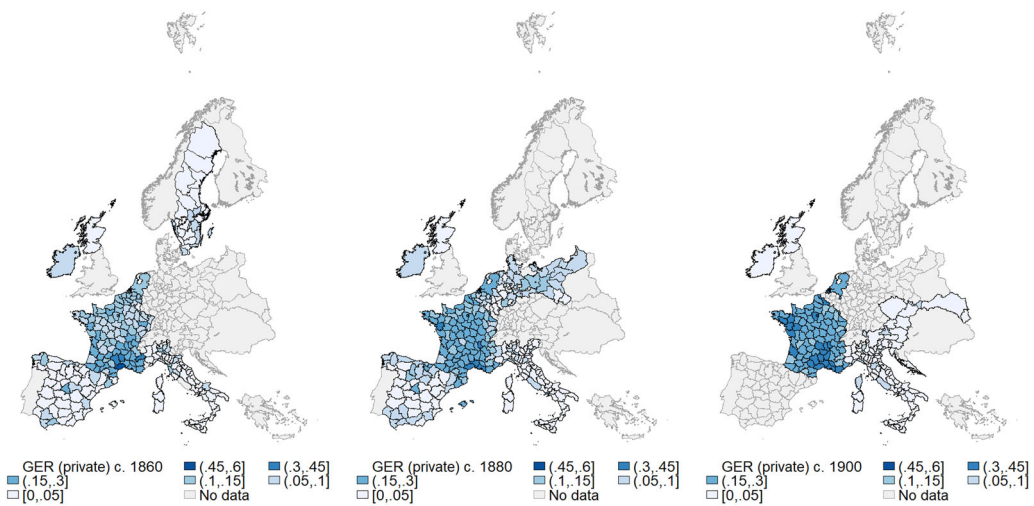


FIGURE 3 Gross enrollment rates in private schools (1860, 1880 and 1900).

[Colour figure can be viewed at wileyonlinelibrary.com]

Sources: see Figure 1.

Notes: idem.

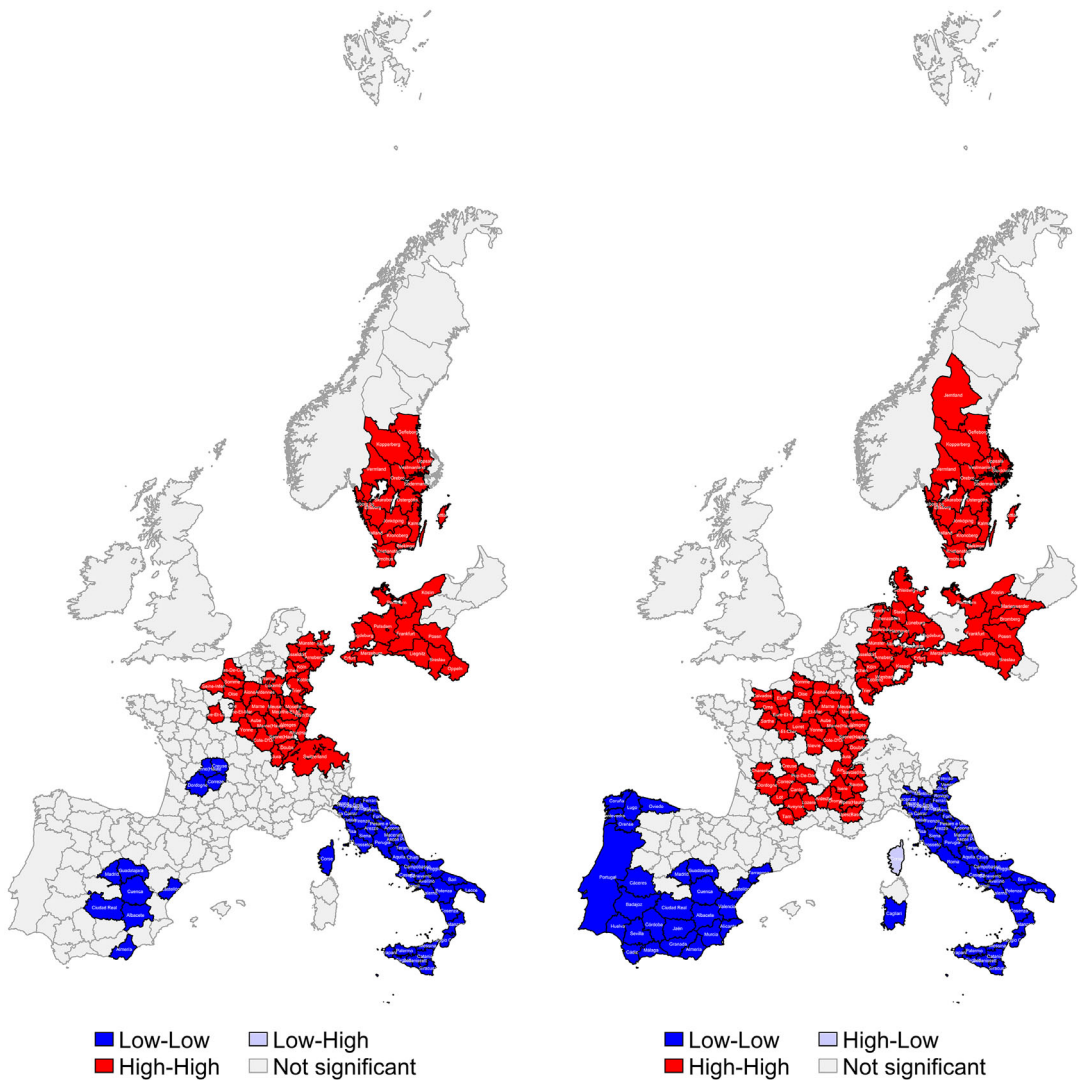


FIGURE 4 Educational clusters based on gross enrollment rates in public schools (1850s/60s versus 1880s). [Colour figure can be viewed at wileyonlinelibrary.com]

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.

on school acts and reforms has shown. Instead, Southern-European countries like Italy and Spain did not introduce such policies until the early 20th 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 & Woessmann, 2009).

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 in some periods, particularly for the Austrian Empire and Prussia, undermines 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-19th century and the early 20th century, while in Italy and Spain the regional divide remained remarkable well into the early 20th century. Indeed, spatial convergence and a more rapid increase in literacy would begin later (see e.g., Cappelli & Vasta, 2020 on Italy). As we mentioned above, adding private enrollment rates does not change the main picture (Figure 3).

We investigate the issue of spatial convergence or divergence 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 (enrollment rates in this case) or high education. The results confirm that the decades of the second half of the 19th century were crucial in the spatial diffusion of primary education across regions and countries in Europe. Whereas 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 20th century, most of France and Prussia, and most of Sweden except for the three most remote Northern counties, for example, Norrbotten, Västerbotten, and Västernorrland.

Such preliminary results open avenues for future research. On the one hand, it is necessary to provide a longer time perspective, particularly by including early-19th century data to offer a more comprehensive analysis of the striking change that 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.²⁷ 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.

6 | 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 center 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 in the economic history literature, 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.

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

Third, 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. 1850s/1860s, both within and across countries. At that time, educational clusters appeared to be concentrated *across* national borders (e.g., relatively large regions that belonged to different nation states). Instead, by the end of the 19th century, the effect of national institutions and regulations seems to have become an important determinant of schooling (and literacy) rates. Although our data are still preliminary, and running a regression analysis goes beyond the scope of this paper, these new regional-comparative figures will allow researchers to further explore the above hypotheses through formal tests, by trying to isolate the impact of national institutions (school acts) from other factors that might have contributed to investments in human capital (technological progress, religion, economic change, etc.).

Future research should also try to expand on this preliminary regional-comparative evidence, along several lines. First, new sources might lead to growing investigation of individual-level data, which might become available and harmonized across countries (Cappelli et al., 2023). Second, other datasets that are currently under construction might be harmonized to further allow the adoption of a regional-comparative perspective. For example, Saaritsa et al. (2023) and Hirvonen (2023) are providing Finnish schooling and educational data since the late 19th century that closely match the figures presented by this paper. Large Eastern European regions, for example the Russian Empire from the 1880s to the 1910s (including Belarus, Estonia, Latvia, Lithuania, and Moldova, as well as parts of Ukraine), have also been studied more in depth in recent years concerning the rise of mass education by providing new spatial data (Malein, 2023). Third, the lack of fine-grain data has made it difficult to understand the effects of school reforms on the quality of education. Future research should aim at connecting the growth of young-people education and literacy (overall and concerning gender inequality) and the quality of education. Indeed, although present-day data on learning outcomes are not normally available for all countries and periods in a historical perspective, cohort-specific literacy rates may be used as variables capturing the outcomes of age-specific enrollment rates as well as expenditure data, thus shedding light on the efficiency and effectiveness of schooling (Lockheed & Hanushek, 1994; see Bozzano et al., 2024 for an application of this perspective to Liberal Italy). Last but not least, future research should also aim at disentangling the impact of overall educational growth from that of a shift in the subjects taught, that is a potential trade-off between the need and will to improve participation in schooling, on the one hand, and the fact that the content of education might have worsened over time during the rise of mass education, on the other hand (Carneiro & Heckman, 2003; Heckman & Krueger, 2003).

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DATA AVAILABILITY STATEMENT

The data is original and compiled by the authors from secondary and primary sources. Please contact the corresponding author for further information.

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ENDNOTES

¹Human capital indicates the set of skills of workers or the general population, while education refers to the process linked to the acquisition of those skills. Although human capital can be accumulated by activities different from education such as learning by doing, the two concepts have been used interchangeably.

²For 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.

³This 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).

⁴The link between industrialization and human capital formation has also been investigated for other countries outside Europe. Evidence from the 19th century United States suggests that early industrialization 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 first stages of US industrialization, technological innovation and human capital were substitutes and became complementary only in the early 20th 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 competencies, such as the ability to read, as a result of the construction of railroads. Interestingly, Saleh (2015) analysing the earliest state industrialization programs taking place in Egypt in 1805–1882 found 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.

⁵One 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 north-western Europe and the rest of the continent after the Black Death (Voigtländer and Voth 2006, de Moor and Van Zanden 2010, Foreman-Peck 2011, Carmichael et al. 2016). 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).

⁶Other studies focusing on China have found contradictory results on 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) analyze the eradication of hookworm disease in southern US (c. 1910) and showed that this episode determined 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 drop in fertility equal to 40% of the entire fertility decline observed in the American South between 1910 and 1920.

⁷The link between fertility behaviour (as proxied by age at marriage) and human capital formation has been also explored by Baten and De Pleijt (2022) using numeracy for a sample of 27 countries and 153 regions in Europe between 1500 and 1900.

- ⁸When demand of schooling is not matched by supply, the vacuum can be filled by other private institutions.
- ⁹Evidence 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) suggests that the extension of the franchise had a positive effect on schooling.
- ¹⁰Several 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 United States 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.
- ¹¹Similarly, 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.
- ¹²Shammas (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 20th century. Exploring the patterns of change in school provision and the political power of Uruguay's president between 1914 and 1954, Azar (2022) 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.
- ¹³Landes 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.
- ¹⁴See also Cappelli (2015) on Italy's move to centralized primary schooling in the 19th century.
- ¹⁵Outside Europe, Chaudhary (2010) analyzed the effects of colonial public investment on literacy in early 20th 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.
- ¹⁶The 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.
- ¹⁷In 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.
- ¹⁸There were also more complicated cases, such as the Norwegian school act of 1827, noting that children should start school either at 7 or 8 years of age, and continue until confirmation – or as long as the parish priest would see it fit (Skningsrud Skjelmo 2014).
- ¹⁹We do not focus on other indicators of human capital and education since enrolment rates and literacy allow us to perform a regional analysis, which is difficult to provide with other indicators (see Baten and Hippe 2018 for an exception concerning numeracy across European regions). Recent work has also focused on other indicators like books per capita across various European countries (Baten and van Zanden 2008).

- ²⁰ ISCED is the UNESCO's reference classification for organising educational programs and related qualifications by education levels and fields. We include such a broad range because compulsory education could vary across countries, from for example 2 or 3 years (age 6 to 8 or 9) in Italy to 7 years in Sweden (age 7–14).
- ²¹ 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).
- ²² 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). 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, enrolment-rate data are obtained from own research based on a combination of school statistics and population as well as census data. We thank Per Pettersson Lidbom for sharing his Swedish data for 1847 and 1862. Concerning literacy in Sweden, we assumed a value of 95% in all counties, except for Norrbotten, Vesterbotten and Västernorrland (90%), based on local and aggregate figures provided by Johansson (1977).
- ²³ We thank Francesco Cinnirella for sharing with us some of the Prussian data concerning the early 20th century.
- ²⁴ We thank Thierry Eggerickx and Sven Vrielinck for sending us digitized primary sources and digitized data.
- ²⁵ Public and private enrolments separately are provided only for the year 1900.
- ²⁶ We thank Anna Missiaia for providing the data, which were digitised from Die Ergebnisse Volkszählung vom Dec 31, 1890, XXXII BAND, 1. HEFT, p. XXII.
- ²⁷ Some countries, though studied by economic and social historians, have not been yet characterised by the broad availability of harmonized primary-schooling and literacy data. Examples include the Netherlands, German states other than Prussia, countries in Eastern and South-eastern Europe, as well as the Nordic countries (see Saariisa and Kaihovaara 2016 on Finland).

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APPENDIX

TABLE A1 Sources and methods.

Panel A: Gross enrollment rates (GERs).			
Country	Unit of analysis	Sources	Methodological notes
Austria	NUTS-3	Secondary source: Cvrcek (2020). Data for 1880 and 1900.	Public and private enrollments are provided separately only for the year 1900. Tyrol and Vorarlberg (one unit in Cvrcek 2020) are separated and assigned the same value to match the statistical divisions of our shapefile. Pupils are listed as “attending primary schools”. The school-age population refers to the age group 6–14.

(Continues)

TABLE A1 (Continued)

Panel A: Gross enrollment rates (GERs).			
Belgium	NUTS-3	Secondary source: Minten et al. (1991). Data on enrollments are for 1863 and 1878, while the denominator refers to 1866 and 1880. Therefore, the GER may be slightly underestimated.	Data include public and private schools. The school-age population refers to the age group 6–14.
France	NUTS-3	Primary source: (i) <i>Données historiques de la Statistique générale de France</i> ; (ii) <i>Annuaire statistique de la France</i> ; (iii) population censuses (https://gallica.bnf.fr)	Data include private and public schools. The school-age population refers to the age group 6–14: if the figure was not directly available from the historical source, it was estimated by assuming constant shares of single ages (e.g., 6–7) within the considered age range. Moselle, and the Upper and Lower Rhin departments in France, have missing values after the 1860s due to their annexation by Prussia. After the 1860s, Meurthe's figure is assigned to Meurthe-et-Moselle, even if the borders were not the same.
Ireland	National	Secondary source: Lindert (2004)	None
Italy	NUTS-3	Secondary source: data digitized by Cappelli and Quiroga (2021).	Data are always provided separately for public and private schooling. Pupils are listed as “enrolled”, and the school-age population refers to the age group 6–14.
Norway	National	Secondary source: Lindert (2004)	None
Portugal	National	Secondary source: Lindert (2004)	None
Prussia	NUTS-2	Secondary source: iPEHD dataset. Some data come from primary sources provided by Francesco Cinnirella. See Becker et al. (2014)	Data have been organized by <i>Regierungsbezirke</i> (NUTS2) to match the statistical divisions of our shapefile. The school-age 6–14 has been reconstructed through own elaborations from the iPEHD dataset. Gumbingenn and Königsberg have been aggregated into one spatial unit to be compatible with the available map displaying 1900 historical borders. The same goes for Stettin and Stralsund.

(Continues)

TABLE A1 (Continued)

Panel A: Gross enrollment rates (GERs).			
Spain	NUTS-3	Secondary source: data digitized by Cappelli & Quiroga (2021).	Data are always provided separately for public and private schooling. Pupils are listed as “enrolled”, and the school-age population refers to the age group 6–14.
Sweden	NUTS-3	Primary source: for data post-1880, we digitized information from educational statistics, which include the school-age population. See, e.g., BiSOS: P. <i>Bidrag till Sveriges officiella statistik. Undervisningsväsendet 1882</i> . Stockholm: Centraltryckeriet 1887. For 1860, data were provided by Per Pettersson Lidbom, based on local school districts report submitted to the Ministry of Education and Ecclesiastical affairs. School data refer to 1862, 1882, and 1900.	Data refer to public schooling only, apart from 1860 (1862). The school-age population refers to the age group 7–14.
Switzerland	National	Secondary source: Lindert (2004).	None
The Netherlands	National	Secondary source: Lindert (2004).	None
The UK and Scotland	National	Secondary source: Lindert (2004).	None
Panel B: Literacy rates.			
Country	Unit of analysis	Sources	Methodological notes
Austria	NUTS-3	Primary source: Die Ergebnisse Volkszählung vom Dec. 31, 1890, XXXII BAND, 1. HEFT, p. XXII. Provided by Anna Missiaia.	Data refer to the share of the population above 6 years old (6+) who could read and write in 1890. Although the spatial distribution would not have changed remarkably in 20 years, literacy rates (Austrian in particular) might have been more in line with those in central and northern Europe compared to what is shown in our maps.
Belgium	NUTS-3	Primary source: population censuses. Both literacy and population data come from digitized censuses that have been provided by Thierry Eggerickx and Sven Vrielinck.	Data refer to literacy for the population 6+.

(Continues)

TABLE A1 (Continued)

Panel B: Literacy rates.			
France	NUTS-3	Primary source: population censuses. Data refer to 1872 and 1906.	Data refer to the age group 6+ for 1872, but to the group 10+ for literacy in 1906. Concerning 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.
Ireland	National	N/A	N/A
Italy	NUTS-3	Secondary source: data digitized by Cappelli & Quiroga (2021).	Data refer to the literacy for the age group 6+.
Norway	National	N/A	N/A
Portugal	National	Cipolla (1969)	N/A
Prussia	NUTS-2	Secondary source: iPEHD dataset. Some data come from primary sources provided by Francesco Cinnirella. See Becker et al. (2014)	Literacy data (population 10+) are available only for 1870 (which is 1871 in the iPEHD dataset).
Spain	NUTS-3	Secondary source: data digitized by Cappelli & Quiroga (2021).	Data refer to the literacy for the age group 6+.
Sweden	NUTS-3	Secondary source: Johanson (1977). The History of Literacy in Sweden. Educational reports Umea no. 12/1977. Umea University.	Literacy has been assumed to be 95 %, apart from the Northernmost counties (90%), based on Johanson (1977). Even in the most backward areas of Sweden (Norrbotten) the reading capacity was 100% already in the 1840s, and the writing capacity reached more than 90% in 1900 (Johanson 1977). So, for all Swedish counties, a value between 90% and 95% can be assumed safely.
Switzerland	N/A	N/A	N/A
The Netherlands	National	Secondary source: Prados de la Escosura (2015)	N/A
The UK and Scotland	NUTS-3 (1870) and national (1910)	Secondary source: Stephens (1987)	N/A

Note: N/A means “not available” in the column referring to sources and “not applicable” in that concerning methodological notes.