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ABSTRACT

The research explores the effect of industrialization on human capital formation. Exploiting exogenous regional variations in the adoption of steam engines across France, the study establishes that, in contrast to conventional wisdom that views early industrialization as a predominantly deskilling process, the industrial revolution was conducive for human capital formation, generating wide-ranging gains in literacy rates and educational attainment.

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1 Introduction

The distributional consequences of technological progress have been central for the understanding of the evolution of inequality and human capital formation in the process of development. While it has been widely recognized that technology-skill complementarity has characterized the nature of technological progress in advanced stages of development (Goldin and Katz, 1998), stimulating human capital formation and fostering inequality, earlier stages of industrialization have been predominantly viewed as a deskilling process (Mokyr, 1993) which has depressed skill formation and diminished inequality.

This deeply entrenched view of the nature of the industrial revolution has been primarily based on anecdotal evidence that has highlighted the adverse effect of the emergence of factories and assembly lines on the demand for artisans and literate workers.[1] Yet, as has been the case in other technological revolutions in the course of human history, the process of creative destruction that was associated with the emergence of the industrial technology have plausibly fostered the demand for new skills while rendering existing ones obsolete.

The research explores the effect of industrialization on human capital formation. In contrast to conventional wisdom that views early industrialization as a predominantly deskilling process, the study establishes that the industrial revolution was conducive to human capital formation, generating broad-based gains in literacy rates and educational attainment. The research therefore lends further credence to the emerging view that human capital was instrumental in the transition from stagnation to growth (Galor and Weil, 2000; Galor and Moav, 2002; Galor, 2011).[2]

The study utilizes French regional data from the first half of the 19th century to explore the impact of the adoption of industrial technology on human capital formation. It establishes that regions that were characterized by more intensive industrialization experienced a larger human capital formation. However, this observed relationship between industrialization and human capital formation may reflect the impact of the process of industrialization on human capital formation as well as the effect of human capital on the advancement and the adoption of industrial technology.[3] Furthermore, the potential impact of institutional, geographical, and cultural characteristics on the joint evolution of industrialization and human capital accumulation may govern the association between these two forces. Hence, given the potential endogeneity of industrialization and human

[1] This view regards literacy as largely a cultural skill or a hierarchical symbol with a limited role in the production process in the first stage of industrialization (Mitch, 1992), and is central to the findings of Allen (2003).

[2] The human capital channel is further underlined by Lagerlöf (2003, 2006), Doepke (2004) and Galor and Mountford (2008).

[3] Indeed, human capital appears to have had an effect on development in the pre-industrial era. Boucekkine et al. (2007) demonstrate the importance of literacy in urbanization and the transition from stagnation to growth. Squicciarini and Voigtländer (2015) suggest that the upper tail of the human capital distribution in the second half of the 18th century had a positive effect on urbanization and wages in some industrial sectors in the subsequent decades. Furthermore, de la Croix et al. (2016) show the importance of apprenticeship institutions in the emergence of industrialization.

capital formation, this research exploits exogenous regional variations in the adoption of the steam engine across France to establish the causal effect of industrialization on human capital.

In light of the intensification in the use of the steam engine in the early phase of industrialization (Mokyr, 1990; Bresnahan and Trajtenberg, 1995; Rosenberg and Trajtenberg, 2004), the study exploits historical evidence regarding the regional diffusion of the steam engine across France (Ballot, 1923; Sée, 1925; Léon, 1976) to identify the impact of the intensive use of the steam engine in the production process on human capital formation. In particular, the analysis exploits the distances between the administrative center of each French department (the administrative division of the French territory created in 1790) and Fresnes-sur-Escaut, where a steam engine was first successfully used for industrial purpose in 1732, as an exogenous source of variations in the potential exposure to the steam engine and its ultimate use in each department.[4] Moreover, in view of the hypothesis that industrialization was more pronounced in departments which experienced a decline in the profitability of agricultural production, variations in the deviation in wheat prices from their historical trends are exploited to identify market conditions which would be conducive for the adoption of steam engines in each department, conditional on the distance from the local geographical origin of the steam engine – Fresnes-sur-Escaut.

The results establish that the intensity in the use of steam engines in industrial production in the 1839- 1847 period had a positive and significant impact on the formation of human capital in the early stages of the industrial revolution in the French departments. In particular, the analysis suggests that a greater number of steam engines in a given department in the 1839-1847 period had a positive and significant effect on: (i) the number of teachers in 1840 and 1863, (ii) the share of children in primary schools in 1840 and 1863, (iii) the share of apprentices in the population in 1863, (iv) the share of literate conscripts over the 1847-1856 and 1859-1868 periods, and (v) public spending on primary schooling over the 1855-1863 period.

The empirical analysis is robust to the inclusion of a wide array of exogenous confounding geographical, institutional and pre-industrial characteristics swhich may have contributed to the relationship between industrialization and human capital formation. First, the study accounts for the potentially confounding impact of exogenous geographical characteristics of each French

[4] An Englishman named John May obtained in 1726 a privilege to operate steam engines that would pump water in the French kingdom, with John Meeres, another Englishman. They set up the first steam engine in Passy (which was then outside but is now within the administrative boundaries of Paris) to raise water from the Seine river to supply the French capital with water. However it appears that this commercial and industrial operation stopped quickly or even never took off. Indeed, when Forest de Bélidor (1737) published his treatise on engineering in 1737-1739, he mentioned that the steam engine in Fresnes-sur-Escaut was the only one operated in France (see, e.g., Lord (1923) and Dickinson (1939)). Moreover, as established below, the diffusion of the steam engines across the French departments is orthogonal to the distances between each department and Paris, the capital and economic center of the country. If anything, this pattern is very similar to what happened in England: Nuvolari et al. (2011) indicate that the first industrial use of the steam engine was in the Wheal Vor tin mine in Cornwall in 1710, but stopped quickly, and that the first successful commercial use of a steam engine took place in 1712 in England, in a coal mine near Wolverhampton (see also Mokyr (1990, p.85)).

department on the relationship between industrialization and investments in education. It captures the potential effect of these geographical factors on the profitability of the adoption of the steam engine and the pace of its regional diffusion, as well as on productivity and human capital formation, as a by-product of the rise in income rather than as an outcome of technology-skill complementarity. Second, the analysis captures the potentially confounding effects of the location of departments (i.e., latitude, average temperature, average rainfall, border departments, maritime departments, share of carboniferous area in the department, and the distance to Paris) on the diffusion of the steam engine as well as the diffusion of development (as captured by the levels income and education). Third, the study accounts for the differential level of development across France in the pre-industrial era that may have had a joint impact on the process of industrialization and the formation of human capital. In particular, it takes into account the potentially confounding effect of the persistence of pre-industrial development and the persistence of pre-industrial literacy rates. Finally, the results are robust to the inclusion of additional potentially confounding factors, such as the presence of raw material, measures of early economic integration, past population density and past fertility rates.

The remainder of this article is as follows. Section 2 provides an overview of schooling and literacy in the process of industrialization in France. Section 3 presents our data. Section 4 discusses our empirical strategy. Section 5 presents our main results and Section 6 our robustness checks. Section 7 provides concluding remarks.

2 Schooling and Literacy in the Process of Industrialization in France

France was one of the first countries to industrialize in Europe in the 18th century and its industrialization continued during the 19th century. However, by 1914, its living standards remained below those of England and it had been overtaken by Germany as the leading industrial country in continental Europe. The slower path of industrialization in France has been attributed to the consequences of the French Revolution (e.g., wars, legal reforms and land redistribution), the patterns of domestic and foreign investment, cultural preferences for public services, as well as the comparative advantage of France in agriculture vis-a-vis England and Germany (see the discussion in, e.g., Lévy-Leboyer and Bourguignon, 1990; Crouzet, 2003).

2.1 Schooling in France before and during the Industrial Revolution

Prior to the French Revolution in 1789, the provision of education in the contemporary French territory was predominantly left to the Catholic Church, reflecting the limited control of the central government and the lack of linguistic unity across the country (Weber, 1976). However, the

evolution of state capacity, national identity, and linguistic uniformity over the centuries intensified the involvement of the state in the provision of education while diminishing the role of the church during the 19th century.

2.1.1 Education Prior to the French Revolution

Until the rise of Protestantism in the 16th century, the Catholic Church mainly provided education to the privileged members of society (Rouche, 2003). However, the spread of Protestantism, and the rise in the emphasis on literacy as a means to understand the Holy Scripture, had altered the attitude of the Catholic Church with respect to the provision of education. The Catholic educational system had progressively become intertwined with its mission of salvation. As such, several religious orders viewed education as their principal mission. The Jesuits had gradually focused their efforts on the education of children from the aristocratic classes while the Frères des Ecoles Chrétiennes (Brothers of Christian Schools) led by Jean-Baptiste de la Salle (1651-1719) sought to provide free education to the masses. Moreover, female religious communities (e.g., Ursulines, Filles de la Charité) provided schooling for girls

The nature of the education provided by the Church over this period was not subjected to interference from the central government. In fact, except for the universities which were controlled by the State from the late 16th century onwards, the various Catholic orders had built an education system which was independent from the French kings.[5] However, the monopoly of the Church in the provision of education ended abruptly during the French Revolution in 1789.

2.1.2 Education in the Aftermath of the French Revolution

The transformation of the French society during the Revolution in 1789 affected the provision of education as well. In particular, article 22 of the Declaration of the Rights of Man and of the Citizen in 1793 explicitly stated that education is a universal right. Nevertheless, the Constitution of the First French Republic (1792-1799) did not underline the role of state-funded secular education. The demise of the Catholic Church (e.g., the confiscation of its property and the imprisonment and execution of priests) during the French Revolution impinged its ability to remain the provider of education, but secular education was nevertheless slow to emerge (Godechot, 1951; Tackett, 1986).

The rise of Napoleon Bonaparte to power (1799-1815) and his interest in preventing hostile relationships with Rome, permitted the Church to regain a prominent position in the provision of education in France.[6] In particular, according to the 17 March 1808 decree on education, the

[5]Nevertheless, some conflicts over the nature of schooling took place between the Jesuits and the Universities as well as between various religious Congregations. In particular, the Jesuits were expelled by King Louis XV in 1764 and their school network was overtaken by the Oratorians.

[6]This state of affairs suited Napoleon Bonaparte because the Concordat (the 1801 treaty which he had signed with Pope Pius VII and which structured the relationship between the French State and the Church), provided him

Frères des Ecoles Chrétiennes were left in charge of primary schooling and of training teachers while school curriculum was to be conform to the teachings of the Catholic Church. However this decree also created a secular body – the *Université* – that was assigned the management of public (secular) education. Throughout the 19th century, the *Université* would try to counter the Church's influence in the education system (Mayeur, 2003).

After Napoleon's fall in 1815 and the accession to power of King Louis XVIII (1815-1824), from the senior branch of the Bourbon family, strengthened initially the educational monopoly of the Church. In particular, the 29 February 1816 law required local priests to certify the morality of primary school teachers. However, after the 1827 parliamentary election of a more liberal government, primary school teachers were placed under the authority of the *Université*, against the wishes of the Church.

The 1830 Revolution which overthrew King Charles X (1824-1830), Louis XVIII's brother and successor, installed King Louis-Philippe I (1830-1848), from the cadet Orléans branch of the Bourbon family and put in power members of the liberal bourgeoisie who were rather hostile to the Catholic Church. This led Catholics to lobby for an educational network of their own outside the control of the State, under the guise of "freedom of education". Ultimately, François Guizot, King Louis-Philippe I's Prime Minister, enacted the 28 June 1833 law which reshaped schooling in France and enabled the Church to organize its own private education system. In addition, the Church retained its influence over the curriculum of public schools (e.g., religious instruction remained mandatory while the Frères des Ecoles Chrétiennes were often employed as teachers in public schools). The organization of secondary schooling then became the main point of contention between the Church and its opponents, and it was only after the fall of Louis-Philippe I in 1848 and the establishment of the Second Republic (1848-1851) that the Church was allowed to organize its own network of secondary schools while obtaining subsidies from the State and local governments (15 March 1850 law enacted by Education minister Alfred de Falloux). Moreover towns were not compelled to fund a public primary school if there was already a private (i.e., Catholic) school in their jurisdiction, and teachers had to fulfill the religious duties prescribed by the Church (27 August 1851 regulation).

Interestingly enough, technical education was less of a battleground between the State and the Church than general primary schooling. This might have been due to the lesser importance of technical education in a period where training on the job was widespread. Nonetheless the 28 June 1833 law which reshaped schooling in France also established "schools of higher primary education"that provided the basics of technical education (Marchand, 2005). But it took another 18 years before the 22 February 1851 law formally established schools for apprentices. Still, a decade later, few students attended these technical schools and most of those who did were enrolled in public schools, not in religious schools (Ministère De l'Instruction Publique, 1865). Conversely, in

control over the appointment of bishops.

the 1850s and early 1860s, enrollment in Catholic primary schools, especially for girls, was growing at the expense of enrollment in public primary schools. This led Victory Duruy, the education minister of Napoleon III (1851-1870) after 1863, to counter the decline in public schooling, thereby initiating a conflict between Catholics and secular politicians which would reach its climax after the establishment of the Third Republic.

2.1.3 Education From the Establishment of the Third Republic to World War I

Following the demise of the Napoleon III's Empire in 1870 and the establishment of Third Republic (1875-1940), France became divided between Republicans and Monarchists. The latter received most of their support from the Catholics who associated the Republicans with the 1789 French Revolution and the anti-religious policies of the revolutionaries. This political stance was shared by the clergy and the laity, as well as by liberal and intransigent Catholics alike. But the Catholic opposition to the Republic was matched by the Republicans' hostility to the Church and their determination to turn France into a more secular society (Franck, 2016).[7] In particular, in an attempt to crowd out Catholic schooling, the Republicans increased spending on primary schooling by the central state in the 1880-1890 period. Moreover, in 1881 and 1882, the Republicans passed laws promoting free, secular and mandatory education until age 13.[8] However enrollment in Catholic schools, especially in primary schools for girls, remained high (Mayeur, 1979).

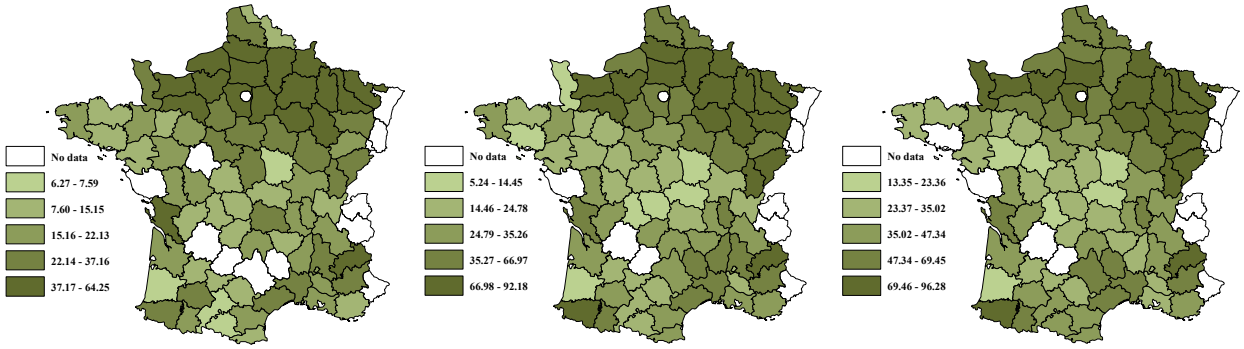
At the turn of the 20th century, the Republicans realized that their attempt to crowd out the schooling system of the Church had failed and used their legal power to renew their attacks (Franck and Johnson, 2016). They passed the 1 July 1901 law which, de facto, prevented monks and nuns from teaching, thereby forcing many Catholic schools to close. Four years later, the Republicans separated Church and State (Franck, 2010): the French state protected freedom of conscience but stopped recognizing official religions and ended subsidies to religious groups. In theory, Catholic schools had become private institutions outside the scope of the French government's reach. In practice, however, the Republicans wanted to control the curricula of Catholic schools. This would be the main point of contention between Republicans and Catholics until World War I. Thus the bishops' opposition in 1909 to the imposition by the State of governmental manuals led Republicans to rally around the "defense of secular education". They passed additional laws pertaining to public schooling attendance and enabled prosecutions against priests who instructed parents not to enroll their children in state-funded secular schools. After World War I, political debates dealing with

[7] For instance, the 27 July 1882 law re-legalized divorce.

[8] Before the 20 June 1881 law, all parents but the poorest ones who wanted to enroll their children in school had to pay fees called *rétribution scolaire* which had been established by the 3 Brumaire An IV (25 October 1795) law. The 20 June 1881 law reestablished free education, which had been first instituted by decrees of the Convention during the French Revolution but had been reversed by the 3 Brumaire An IV law. It should be noted that by the 1870s, the *rétribution scolaire* only remained significant in rural areas and had been replaced by local taxes in urban areas.

private religious schooling and public secular schooling have periodically resurfaced in France. However they did not stir passions as much as in the 1870-1914 period.

2.2 Literacy Rates in France



A. Literacy rates in 1686-1690. B. Literacy rates in 1786-1790. C. Literacy rates in 1816-1820.
Note: Literacy is captured by the share of grooms who signed their marriage license during each period.

Figure 1: Pre-industrial literacy rates of French departments

The evolution of literacy and its distribution across French department is rather notable in the course of industrialization. In 1686-1690, prior to the onset of the industrial revolution in France, 25.9% of grooms could sign their names, reflecting substantial variations in literacy across France as depicted in Panel A of Figure 1.[9] In particular, literacy rates were higher in the regions in the North and East of France.[10]

Literacy rates had steadily increased in the subsequent century and 42% of grooms could sign their names in 1786-1790 and 50.61% in 1816-1820, in spite of the Revolutionary and Napoleonic wars. As depicted in Panels B and C of Figure 1 regional variations across France remained and the domination of the Northern and the Eastern regions persisted. However, literacy rates in some departments had evolved faster than in others, notably in the South (e.g., Aveyron) and the South East along the Mediterranean Sea (Bouches du Rhône, Var). Moreover, the potential association between industrialization and literacy is rather apparent. In particular, Aveyron, Bouches du Rhône and Var were among the most industrialized departments in the South of France.

The increase in literacy rates continued throughout the 19th century so that the share of French conscripts (i.e., 20-year old men reporting for military service in the department where

[9] Data on literacy in France before the mid-19th century is scarce and incomplete. There is however data on the number of Frenchmen who could sign their marriage license in 1686-1690, 1786-1790 and 1816-1820 (Furet and Ozouf, 1977).

[10] For a discussion of the cultural, religious and economic factors which potentially explained the regional differences in the share of literate grooms, see notably Furet and Ozouf (1977), Grew and Harrigan (1991) and Diebolt et al. (2005).

their father lived) who could read and write grew from 54.27% in 1838 to 84.83% in 1881. Thus, a significant fraction of Frenchmen were literate even before the adoption of the 1881-1882 laws on mandatory and free public schooling (Diebolt et al., 2005).

3 Data and Main Variables

This section examines the evolution of industrialization and human capital formation across the 85 mainland French departments, based on the administrative division of France in the 1839-1847 period, accounting for the geographical and the institutional characteristics of these regions. The initial partition of the French territory in 1790 was designed to ensure that the travel distance by horse from any location within the department to the main administrative center would not exceed one day. The initial territory of each department was therefore orthogonal to the pre-industrial wealth levels and literacy rates while the subsequent minor changes in the borders of some departments reflected political forces rather than the effect of industrialization, the adoption of the steam engine and human capital formation. Table A.1 reports the descriptive statistics for the variables in the empirical analysis across these departments.

3.1 Measures of Human Capital

The study explores the effect of industrialization on the evolution of human capital in the early stages of the industrial revolution. It takes advantage of the industrial survey conducted between 1839 and 1847 to assess the short-run impact of industrialization across France on several indicators of human capital accumulation.

3.1.1 Teachers, Pupils and Apprentices

The impact of early industrialization on human capital during the early phase of the industrial revolution is assessed by the effect of the differential level of industrialization across France on the number of teachers, pupils and apprentices in each department.[11]

First, the research examines the effect of industrialization on the number of teachers in each department. Surveys undertaken in 1840 and 1863 by the French bureau of statistics (*Statistique Générale de la France*) indicate that the average number of teachers per department rose from 742 in 1840 to 1243 in 1863. The surveys also show that there was considerable variation in the number of teachers across departments.

[11] The effect of industrialization on the pupils-to-teacher ratio is not necessarily indicative of the effect on human capital formation. In the face of resource constraints, changes in this ratio may reflect the local decision-makers' view about the trade-off between the quality and the quantity of education.

Second, the study explores the impact of industrialization on the number of pupils enrolled in the primary schools of each department (per 10,000 inhabitants). Surveys carried out in 1840 and 1863 by the French bureau of statistics (*Statistique Générale de la France*) show that the average number of pupils in each department (per 10,000 inhabitants) grew from 874 in 1840 to 1179 in 1863, with substantial variation in the number of pupils across France.

Third, the research analyzes the effect of industrialization on technical education as captured by the number of males enrolled in apprentice schools (per 10,000 inhabitants). The data (Ministère De l'Instruction Publique, 1865) show that in 1863, the average number of apprentices in each department (per 10,000 inhabitants) was equal to 2.71 and was therefore an order of magnitude smaller than the number of pupils in primary schools.

3.1.2 Literacy

The impact of early industrialization on literacy during the first phase of the industrial revolution is captured by its effect on the share of French army conscripts (i.e., 20-year-old men who reported for military service in the department where their father lived) who could read and write. The analysis focuses on the share of literate conscripts over the 1859-1868 decade, i.e., individuals who were born between 1839 (when the industrial survey began) and 1848 (a year after the survey was completed).[12] As reported in Table A.1, 74.0% of the French conscripts were literate over the 1859-1868 period.

3.2 Steam Engines

The research explores the effect of the introduction of industrial technology on human capital. In light of the pivotal role played by the steam engine during the first industrial revolution, it exploits variations in the industrial use of the steam engine across France. Specifically, the analysis focuses on the number of steam engines used in each French department as reported in the industrial survey carried out by the French bureau of statistics (*Statistique Générale de la France*) between 1839 and 1847 (Chanut et al., 2000).[13]

As shown in Figure 2, and analyzed further in the discussion of the identification strategy in Section 4, the distribution of the steam engines across French departments in 1839-1847 suggests a regional pattern of diffusion from Fresnes-sur-Escaut (in the Nord department, at the northern

[12] As a robustness check, we explore in the Appendix the impact of industrialization on the literacy rate of French conscripts over the 1847-1856 decade: these 20-year old men were born between 1827 and 1836.

[13] As discussed by Chanut et al. (2000), the survey started in 1839 and was nearly completed in 1841 when it was halted under popular pressure, amid growing fears that the survey data would be used to support the governmental fiscal reforms. It was only in 1844 that the central government restarted the survey which was eventually completed in 1847. It is however unclear whether local administrators began data collection anew in 1844 or simply sent to the central administration in Paris the data collected between 1839 and 1841 with minor or no updates.

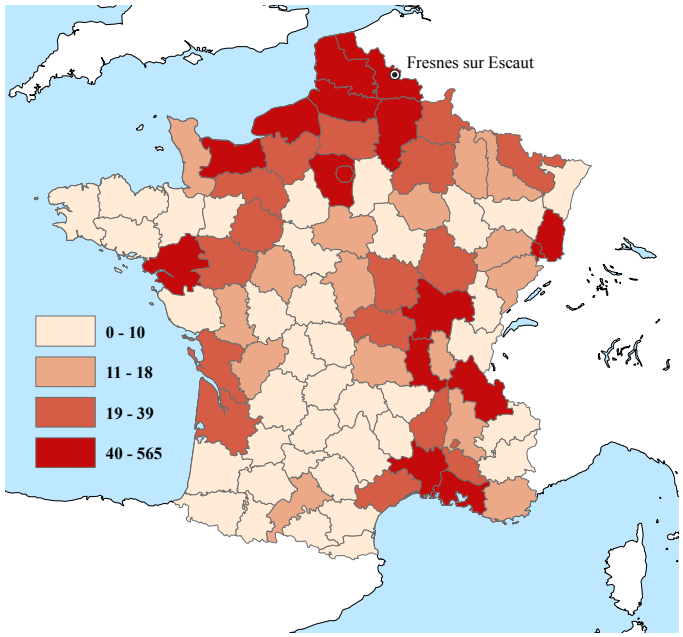


Figure 2: The distribution of the number of steam engines across departments in mainland France, 1839-1847.

tip of continental France) where the first steam engine in France was successfully used for industrial purposes in 1732. The largest number of steam engines was indeed in the northern part of France. There were fewer in the east and in the south-east, and even less so in the south-west. Seven departments had no steam engine in 1839-1847 (i.e., Cantal, Côtes-du-Nord, Creuse, Hautes-Alpes, Haute-Loire, Lot and Pyrénées-Orientales). The potential anomalies which are associated with these departments, and in particular regarding the distance of these departments from the threshold level of development which enables the adoption of steam engines, are accounted for by the introduction of a dummy variable that singles them out.

In Table A.2, we report descriptive statistics for the number of steam engines in each of the 16 sectors listed in the 1839-1847 survey: ceramics, chemistry, clothing, construction, food, furniture, leather, lighting, luxury goods, metal objects, metallurgy, mines, sciences & arts, textile, transportation and wood. The data show that the five sectors with the largest average horse power from steam engines per department are textile, food, mines, metallurgy and metal objects. In this respect, we note that the textile sector had the largest number of steam engines of all the sectors: there were twice as many steam engines in textile than in the food industry and three times more than in the mining sector. Moreover the descriptive statistics on the number of workers in each of the 16 sectors reported in Table A.2 indicate that the chemistry and wood sectors had a larger ratio of steam engines per worker, most likely because the textile sector employed many individuals whose work did not require steam engines.

The distribution of steam engines in 1839-1847, teachers in 1840, pupils in 1840, apprentices

in 1863 and literate conscripts in 1859-1868 across French departments is depicted in Figure 3.

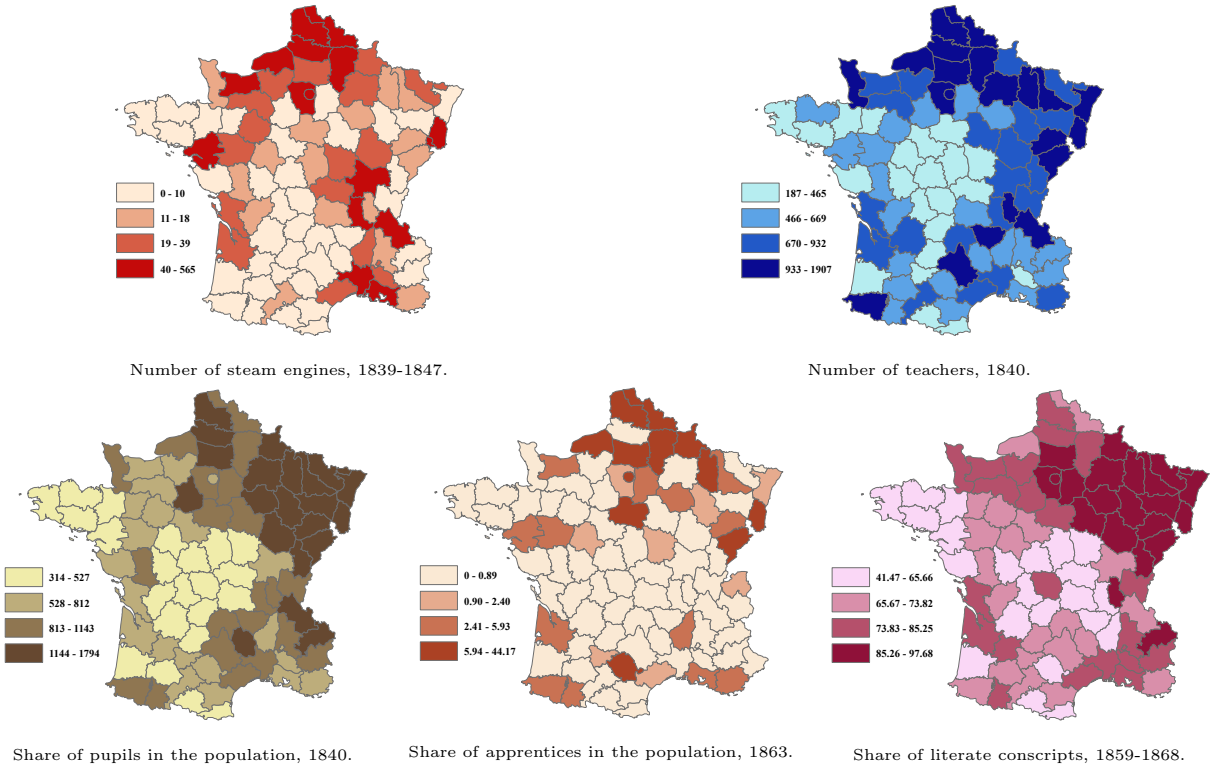


Figure 3: The distribution of steam engines in 1839-1847, teachers in 1840, pupils in 1840, apprentices in 1863 and literate conscripts in 1859-1868 across French departments.

3.3 Confounding Characteristics of the Departments

The empirical analysis accounts for observable exogenous confounding geographical and institutional characteristics of each department, as well as for their pre-industrial development, which may have contributed to the relationship between industrialization and human capital formation. Geography may have impacted agricultural productivity as well as the pace of industrialization, and thus income per capita and investments in education. Institutions may have affected jointly the process of industrialization and the increase in literacy. Besides, geographical and institutional factors may have affected human capital indirectly by governing the speed of the diffusion of steam engines across departments. Finally, pre-industrial development may have affected the onset of industrialization and may have had an independent persistent effect on human capital formation.

3.3.1 Geographic characteristics

The empirical analysis takes into account the potentially confounding impact of the exogenous geographic characteristics of each French department (Figure 4) on the relationship between indus-

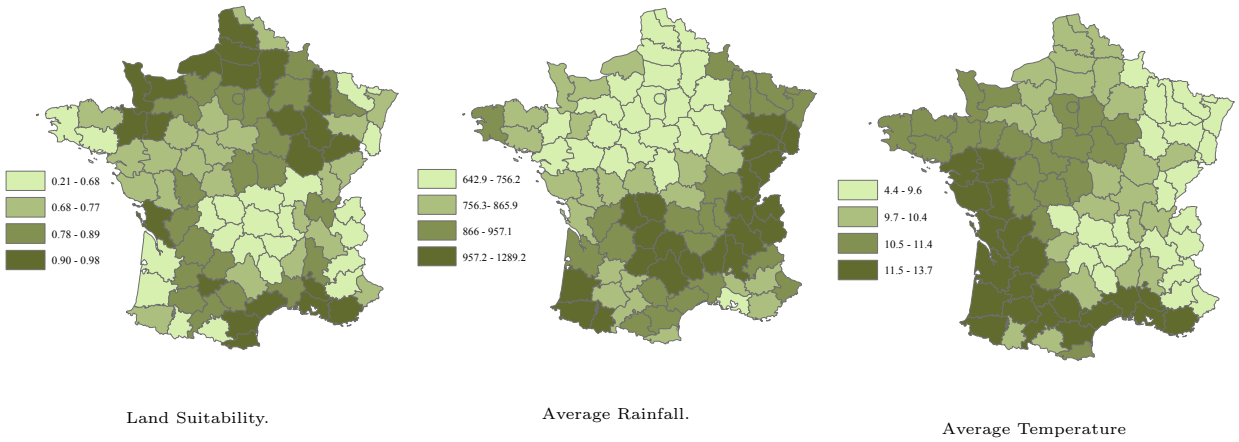


Figure 4: Geographic characteristics of French departments

trialization and human capital. Specifically, it captures the potential effect of these geographical factors on the profitability of the adoption of the steam engine, on the pace of its regional diffusion and thus, on human capital accumulation during the first stages of the industrial revolution.

First, the study accounts for climatic and soil characteristics of each department (i.e., land suitability, average temperature, average rainfall, and latitude (Ramankutty et al., 2002)) that could have affected natural land productivity and therefore, the feasibility and profitability of the transition to the industrial stage of development, as well as income per capita and human capital in each department. Besides, the diffusion of the steam engine across France could have been affected by the presence of raw material required for industrialization. Our regressions thus account for the share of carboniferous area in each department (Fernihough and O'Rourke, 2014).

Second, the analysis captures the confounding effect of the location of each department on the diffusion of development from nearby regions or countries, as well as its effect on the regional diffusion of the steam engine. Namely, it accounts for the effect of the latitude of each department, and maritime departments (i.e., positioned along the sea shore of France) on the pace of this diffusion process.

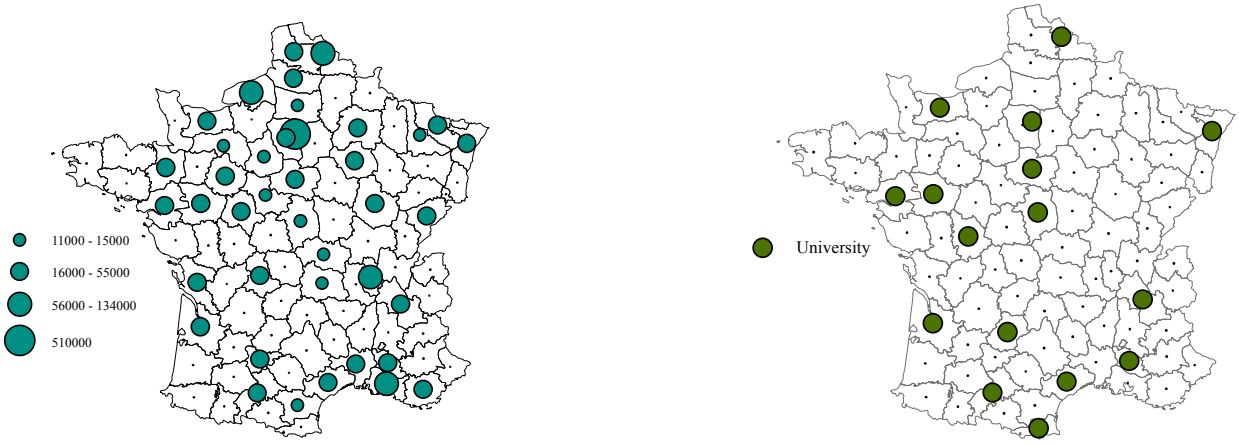
Finally, the research accounts for the potential differential effects of international trade on the process of development as well as on the adoption the steam engine. In particular, it captures the potential effect of maritime departments (i.e., those departments that are positioned along the sea shore of France), via trade, on the diffusion of the steam engine and thus on economic development as well as its direct effect on human capital formation over this time period.

3.3.2 Institutional Characteristics

Since the empirical analysis focuses on the impact of variations in the adoption of the steam engine on human capital formation across French departments, it ensures that institutional factors which were unique to France as a whole over this time period are not the source of the differential pattern of human capital across these regions. Nevertheless, one region of France over this time period had a unique exposure to institutional characteristics that may have contributed to the observed relationship between industrialization and literacy.

The emergence of state centralization in France and the concentration of political power in Paris before the industrial revolution may have had a differential impact on the political culture and economic prosperity in *Paris and its suburbs* (i.e., Seine, Seine-et-Marne and Seine-et-Oise). Hence, the analysis includes a dummy variable for these three departments to control for their potential confounding effects on the observed relationship between industrialization and human capital. Moreover, the analysis accounts for the effect of the aerial distance between the administrative center of each department and Paris, thus capturing the potential decline in the reach of the central government in regions at a greater distance from Paris as well as the diminished potential diffusion of development into these regions.

3.3.3 Pre-industrial Development



A. Urban population in 1700.

B. Universities in 1700.

Figure 5: Urban population and universities in 1700

The empirical analysis accounts for the potentially confounding effects of the level of development in the pre-industrial period. The differential level of development across France in the pre-industrial era may have indeed affected jointly the process of development and human capital formation. Namely, it may have affected the adoption of the steam engine and it may have

generated, independently, a persistent investment on education. First, the early level of development, as captured by the degree of urbanization (i.e., population of urban centers with more than 10,000 inhabitants) in each French department in 1700 as shown in Panel A of Figure 5 (Lepetit, 1994), may have persisted independently of the process of industrialization.[14] Second, the number of universities in 1700 in each department as shown in Panel B of Figure 5 (Bosker et al., 2013) may have affected the adoption of the steam engine while contributing to human capital formation independently of the process of industrialization. Third, early literacy rates, as captured by the share of grooms who could sign their marriage license over the 1686-1690, 1786-1790 and 1816-1820 periods as mapped in Figure 1 (Furet and Ozouf, 1977),[15] may have affected the adoption of the steam engine while contributing to human capital accumulation independently of the process of industrialization.

4 Empirical Methodology

4.1 Empirical strategy

The relationship between industrialization and human capital formation may reflect the impact of the process of industrialization on human capital formation as well as the effect of human capital on the advancement and the adoption of industrial technology. Furthermore, the potential impact of institutional, geographical, and cultural characteristics on the joint evolution of industrialization and human capital accumulation may govern the association between these two forces. Hence, in light of the potential endogeneity of industrialization and human capital formation, this research exploits exogenous regional variations in the adoption of the steam engine across France to establish the causal effect of industrialization on human capital.

The identification strategy has two components. The first component is motivated by the historical account of the gradual regional diffusion of the steam engine in France during the 18^{th} and 19^{th} centuries (Ballot, 1923; Sée, 1925; Léon, 1976).[16] Considering the positive association between industrialization and the use of the steam engine (Mokyr, 1990; Bresnahan and Trajtenberg, 1995; Rosenberg and Trajtenberg, 2004), the study takes advantage of the regional diffusion of the steam engine to identify the effect of local variations in the intensity of the use of the steam engine during the 1839-1847 period on the process of development. In particular, it exploits the distances between each French department and Fresnes-sur-Escaut (in the Nord department), where the first

[14] As we discuss below in Section 6, the qualitative analysis remains intact if the potential effect of past population density is accounted for.

[15] Some observations are missing for these variables. For the 1686-1690 period, there are no observations for Aveyron, Bas-Rhin, Dordogne, Indre-et-Loire, Lot, Lozère, Haut-Rhin, Lot, Seine and Vendée. For the 1786-1790 period, observations are missing for for Bas-Rhin, Dordogne, Haut-Rhin, Lot, Seine and Vendée. For the 1816-1820 period, observations are missing for Bas-Rhin, Dordogne, Haut-Rhin, Lot, Morbihan, Seine and Vendée.

[16] There was also a regional pattern in the diffusion of steam engines in England (Kanefsky and Robey, 1980; Nuvolari et al., 2011).

Table 1: The geographical diffusion of the steam engine

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Number of Steam Engines							
Distance to Fresnes	-0.209***	-0.339**	-0.606***		-0.932***	-0.888***	-0.938***	-0.784***
	[0.0565]	[0.170]	[0.180]		[0.246]	[0.267]	[0.213]	[0.247]
Average Rainfall		-0.653	-0.822	-1.051	-1.259	-1.461	-0.999	-0.373
		[0.849]	[0.822]	[0.893]	[0.766]	[0.888]	[0.776]	[0.802]
Average Temperature		1.089	0.124	-0.785	0.525	0.0646	0.207	0.633
		[0.899]	[1.074]	[1.057]	[1.110]	[1.226]	[1.030]	[0.965]
Latitude		-5.835	-18.70**	4.690	-15.79*	-16.81*	-15.57**	-12.63
		[6.852]	[7.947]	[7.577]	[8.072]	[8.574]	[7.786]	[8.169]
Land Suitability		-0.0847	-0.0728	0.334	-0.226	-0.122	-0.273	-0.214
		[0.405]	[0.370]	[0.389]	[0.370]	[0.408]	[0.326]	[0.325]
Share of Carboniferous Area			0.404	0.279	0.306	0.164	0.585	0.329
			[0.815]	[0.837]	[0.766]	[0.887]	[0.763]	[0.853]
Maritime Department			1.028***	0.740**	0.744**	0.854**	0.724**	0.562*
			[0.310]	[0.342]	[0.343]	[0.388]	[0.332]	[0.307]
Border Department			0.172	0.218	-0.191	-0.276	-0.299	-0.0806
			[0.303]	[0.359]	[0.313]	[0.303]	[0.283]	[0.288]
Distance to Paris				-0.0544	0.515**	0.458*	0.515**	0.410*
				[0.211]	[0.235]	[0.253]	[0.228]	[0.231]
Paris and Suburbs		0.0883	0.0883	0.340	0.533	0.0811	0.461	0.379
		[0.601]	[0.601]	[0.651]	[0.653]	[0.776]	[0.574]	[0.440]
Grooms who Signed their Marriage License, 1786-1790						-0.0778		
						[0.739]		
University							0.757***	
							[0.263]	
Urban Population in 1700								0.191***
								[0.0652]
Adjusted R2	0.426	0.424	0.482	0.417	0.505	0.488	0.549	0.546
Observations	85	85	85	85	85	79	85	85

Note: The dependent variable and the explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

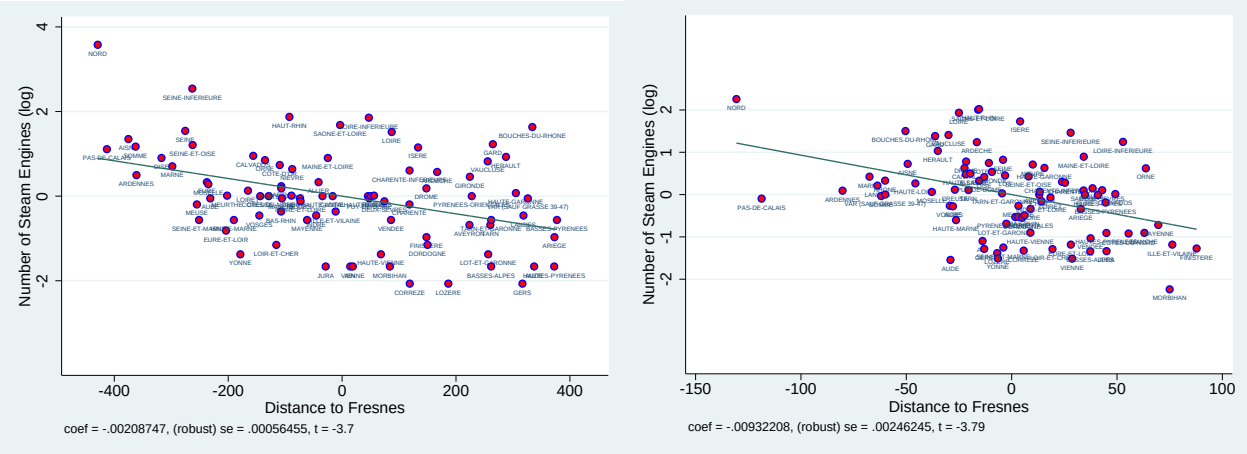
successful commercial application of the steam engine in France was made in 1732, as an instrument for the use of the steam engines in 1839-1847.[17]

Consistent with the diffusion hypothesis, the second steam engine in France that was successfully utilized for commercial purposes was operated in 1737 in the mines of Anzin, also in the Nord department, less than 10 km away from Fresnes-sur-Escaut. Furthermore, in the subsequent decades until the 1789 French Revolution the commercial use of the steam engine expanded predominantly to the nearby northern and north-western regions. Nevertheless, at the onset of the French revolution in 1789, steam engines were less widespread in France than in England. A few additional steam engines were introduced until the fall of the Napoleonic Empire in 1815, notably in Saint-Quentin in 1803 and in Mulhouse in 1812, but it is only after 1815 that the diffusion of steam engines in France accelerated (Sée, 1925; Léon, 1976).

Indeed, in line with the historical account, the distribution of steam engines across French departments, as reported in the 1839-1847 industrial survey, is indicative of a local diffusion process from Fresnes-sur-Escaut. As reported in Column (1) of Table 1 and as depicted in Panel A of Figure 6, there is a highly significant negative unconditional association between the number of

[17]This steam engine was used to pump water in an ordinary mine of Fresnes-sur-Escaut. It is unclear whether Pierre Mathieu, the owner of the mine, built the engine himself after a trip in England or employed an Englishman for this purpose (Ballot, 1923, p.385).

steam engines in each department and the distance of the administrative center of this department from Fresnes-sur-Escaut. Nevertheless, this association may be partly governed by the confounding effects of geographic, institutional and demographic characteristics on the pace of technological diffusion, as well as on the process of development. Thus, in order to mitigate these potential effect of unobserved heterogeneity, the analysis accounts for a wide range of these characteristics (altitude, latitude, rainfall, land suitability, maritime and border departments, Paris and its suburbs, the distance to Paris). Reassuringly, the unconditional negative relationship between the number of steam engines and the distance to Fresnes-sur-Escaut remains highly significant and is larger in absolute value when the analysis accounts for exogenous confounding geographical controls such as land suitability, latitude, rainfall and temperature (Column (2)), as well as institutional factors and pre-industrial development (Column (3)).



A. Unconditional.

B. Conditional on geography and institutions.

Figure 6: The effect of the distance from Fresnes-sur-Escaut on the number of steam engines in 1839-1847

Note: These figures depict the partial regression line for the effect of the distance from Fresnes-sur-Escaut on the number of steam engines in each French department in 1839-1847. Panel A presents the unconditional relationship while Panel B reports the relationship which controls for geographic and institutional characteristics. Thus, the x- and y-axes in Panels A and B plot the residuals obtained from regressing the number of steam engines and the distance from Fresnes-sur-Escaut, respectively with and without the aforementioned set of covariates.

Importantly, the diffusion pattern of steam engines to each department is uncorrelated with the distance between Paris in Column (4) of Table 1. Moreover, as reported in Column (5) of Table 1 and depicted in Panel B of Figure 6 the highly significant negative association between the intensity of the use of steam engines in each department and its distance from Fresnes-sur-Escaut is unaffected when a distance to Paris is accounted for. Moreover, the findings suggest that the persistence effect of pre-industrial economic and human development, as captured by the degree of urbanization and the number of universities in the year 1700, as well as by the literacy rate in 1786-1790 (as proxied by the fraction of grooms who could signed their marriage license), have

no qualitative impact on the negative association between the number of steam engines in each department and its distance from Fresnes-sur-Escaut (Columns (6)-(8) of Table 1).

Table 2: The determinants of the diffusion of the steam engine: the insignificance of distances from other major cities

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	Number of Steam Engines					
Distance to Fresnes	-0.27***	-0.33***	-0.27***	-0.37***	-0.27***	-0.20**
	[0.060]	[0.074]	[0.058]	[0.12]	[0.081]	[0.087]
Distance to Marseille		-0.077				
		[0.096]				
Distance to Lyon			0.016			
			[0.099]			
Distance to Rouen				0.115		
				[0.142]		
Distance to Mulhouse					-0.012	
					[0.084]	
Distance to Bordeaux						0.150
						[0.106]
Adjusted R^2	0.188	0.186	0.178	0.184	0.178	0.201
Observations	85	85	85	85	85	85

Note: The dependent variable is in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

The plausibility of the use of aerial distance from a department to Fresnes-sur-Escaut as an instrumental variable for its number of steam engines is further enhanced by few additional empirical findings. As established in Table 2, the number of steam engines in the 1839-1847 period in each department is uncorrelated with aerial distances from this department and major economic centers. Specifically, conditional on the distance from Fresnes-sur-Escaut, distances between each department and Marseille and Lyon (the second and third largest cities in France), Rouen (a major harbor in the north-west where the steam engine was introduced in 1796), Mulhouse (a major city in the east where the steam engine was introduced in 1812), and Bordeaux (a major harbor in the south-west) are uncorrelated with steam engines in 1839-1847, lending credence to the unique role of the introduction of the first steam engine in Fresnes-sur-Escaut in the diffusion of the steam engine across France. Moreover, as reported in Table B.1 in the Appendix, the qualitative results are unaffected by the use of surface distances, as captured by the time needed for a surface travel between any pair of locations Özak (2013).

Moreover, in contrast to it pivotal role of spillovers from Fresnes-sur-Escaut in the industrial era, this geographical has no importance in the pre-industrial era. In particular, economic development across France in the pre-industrial period is uncorrelated with distances from Fresnes-sur-Escaut. Unlike the highly significant negative relationship between the number of steam engines in 1839-1847 and the distance from Fresnes-sur-Escaut, as established in Table 3, distance from Fresnes-sur-Escaut was uncorrelated with urban development and human capital formation in the pre-industrial era. Specifically, distances from Fresnes-sur-Escaut are uncorrelated with: (i) urbanization rates in 1700 (Column (1)), (ii) literacy rates in the pre-industrial period, as proxied by the

Table 3: Pre-industrial development and the distance from Fresnes-sur-Escaut

	(1) Tobit Urban Population in 1700	(2) OLS Literacy in 1686-1690	(3) Probit University in 1700
Fresnes sur Escaut	-0.25	-2.20	0.12
	[0.51]	[2.30]	[0.28]
Average Rainfall	-7.335***	-11.07	-1.915
	[2.449]	[10.73]	[1.170]
Average Temperature	2.414	-44.74**	0.368
	[3.475]	[18.58]	[2.014]
Latitude	0.827	13.37**	0.785
	[1.500]	[5.738]	[0.789]
Land Suitability	-7.015	-1.118	1.015
	[21.82]	[85.55]	[11.71]
σ	2.529***		
	[0.261]		
Pseudo R^2	0.081		0.083
R^2		0.456	
Left-censored observations	40		
Uncensored observations	45		
Observations	85	76	85

Note: The explanatory variables except the dummies are in logarithm. The aerial distance is measured in kilometers. Literacy in 1786-1790 is captured by the share of grooms who signed their marriage license during that period. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

share of grooms who signed their marriage license in 1686-1690 (Column (2)), and (iii) the presence of a university in 1700 (Column (3)).

The second component of the identification strategy is motivated by the hypothesis that, while the potential exposure to the steam engine would depend on the distance from Fresnessur-Escaut, the intensity of the adoption of this industrial technology would depend on the profitability of the industrial sector relative to the agricultural sector. Thus the analysis exploits cross-departmental variations in the deviation in wheat prices from their historical trends shortly before the 1839-1847 survey to identify market conditions which would be conducive for a production transition from agriculture to industry and therefore for the adoption of the steam engine. In particular, exploiting transitory deviations in wheat prices from their historical trend, permits the analysis to capture the substitution in production (associated with a temporary rise in the relative prices of manufacturing goods), rather than the a-priori ambiguous long-term effect of agricultural productivity on the development of the industrial sector.[18]

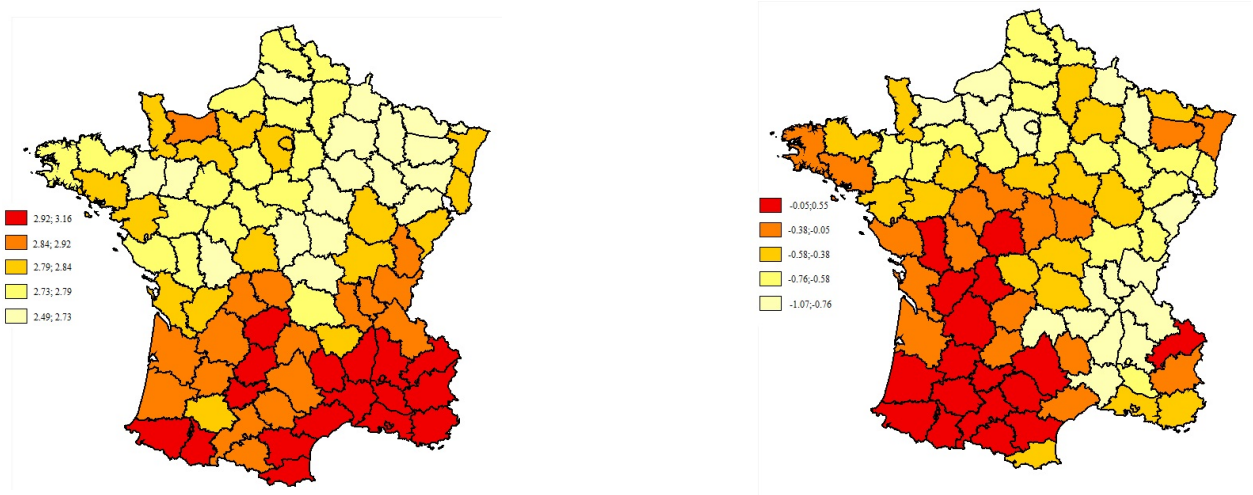
In light of the 1839-1847 survey about the use of the steam engine in each department, the analysis focuses on the deviation in average wheat prices during the five-year period that preceded the start of the survey, $\tilde{P}_{i,1834–1838}$, from their historical trend, as captured by the average prices

[18]It should be noted that deviations from wheat prices in a given department did not only reflect weather conditions in that department, but also weather conditions in nearby departments which would influence wheat prices because of the process of increased market integration that occurred in 19th century France (Chevet and Saint-Amour, 1991; Toutain, 1992; Ejrnæaes and Persson, 2000). In fact, in additional regressions available upon request, we find that historical local weather conditions in each department, as reconstructed by Luterbacher et al. (2004, 2006) and Pauling et al. (2006), are not correlated with the adoption of steam engines in 19th century France.

in the previous 15-year period)[19]

$$\tilde{P}_{i,1834-1838} \equiv \frac{\mu_{i,1834-1838} - \mu_{i,1819-1833}}{\sigma_{i,1819-1833}} \tag{1}$$

where $\mu_{i,1834-1838}$ is the average wheat price in department i over the 1834-1838 period, $\mu_{i,1819-1833}$ is the average wheat price in department i over the baseline period, 1819-1833, and $\sigma_{i,1819-1833}$ is the standard deviation of wheat prices in each year in department i computed over the 1819-1833 baseline period. Panel A of Figure 7 displays the average wheat prices over the 1834-1838 period across the French departments while Panel B of Figure 7 graphs the standardized wheat price deviation in 1834-1838 as formulated in Equation 1, using 1819-1833 as a baseline period.



A. Average wheat prices 1834-1838.

B. Standardized deviation from 1834-1838 wheat prices with 1819-1833 as the baseline period.

Figure 7: Average wheat prices and standardized deviation from wheat prices, 1834-1838.

Indeed, in line with the proposed hypothesis, the distribution of steam engines across French departments, as reported in the 1839-1847 industrial survey, is negatively associated with positive transitory cross-departmental deviations in wheat prices from their historical trend. As reported in Column (1) of Table 4, unconditionally, there exists a highly significant negative association between the use in the steam engine in 1839-1847 across French departments and the deviation in wheat prices over the period 1834-1838 from the historical trend. Moreover, further enhancing the credibility of this instrumental variable, falsification tests reported in Columns (2)-(5) suggest that earlier price deviations (i.e., during the five-year time periods, 1824-1828 and 1829-1833), and more importantly price deviations after the conclusion of the survey (i.e., during the five-year time periods, 1848-1852 and 1853-1857), are not significantly associated with the adoption of steam

[19]The computation is based on the data collected by Labrousse et al. (1970).

Table 4: The determinants of the adoption of the steam engine in 1839-1847: deviations from standard wheat prices in 1834-1838

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
	Number of Steam Engines				
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.337***	-0.916*	-1.725**	-1.139***	-1.280***
	[0.326]	[0.463]	[0.670]	[0.353]	[0.349]
Deviation from Wheat Prices in 1824-1828 (baseline 1809-1823)		0.994			
		[0.651]			
Deviation from Wheat Prices in 1829-1833 (baseline 1814-1828)			0.801		
			[1.288]		
Deviation from Wheat Prices in 1848-1852 (baseline 1833-1847)				0.473	
				[0.295]	
Deviation from Wheat Prices in 1853-1857 (baseline 1838-1852)					-0.191
					[0.329]
Adjusted R^2	0.134	0.153	0.127	0.157	0.127
Observations	85	85	85	85	85

Note: The dependent variable is in logarithm. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

engines in 1839-1847.[20]

Accounting for the confounding effects of geographical, institutional and pre-industrial characteristics, Table 5 reports the first-stage relationship between the number of steam engines and the proposed instrumental variables: (i) the Distance from Fresnes and (ii) Wheat Price Deviation over the 1834-1838 period from the historical trends in 1819-1833 (Column (1)), 1809-1833 (Column (2)), 1814-1833 (Column (3)) and 1824-1833 (Column (4)). In all specifications, the number of steam engines in the 1839-1847 is negative and significant associated with (i) the distance to Fresnes and (ii) a positive deviation in wheat price in the 1834-1838 period.[21] Furthermore, instruments clear the over-identification J-test in all specifications. The analysis suggests that considering the strength of the instrumental variables, the desirable reference period for wheat price deviation over the period 1834-1838 is 1819-1833, where the F-statistic is 16.7.

In particular, as derived from Column (1) of Table 5, a 100-km increase in the distance from Fresnes-sur-Escaut is associated with a 0.702 point decline in the log of the number of steam engines in a given department, relative to a sample mean of 1.47. Hence, in comparison to a department at the 25th percentile of the distance from Fresnes-sur-Escaut (i.e., 327 km), a departments located at the 75th percentile (i.e., 659 km from Fresnes-sur-Escaut) will be expected to have 10.3 fewer steam engines (relative to a sample mean of 29.2 and a standard deviation of 66.1). Furthermore, a one-unit increase in the wheat price deviation is associated with a 1.31-point decrease in the log of the number of steam engines in a department. As such, in comparison to a department at the 25th

[20] Additional regressions indicate that the number of steam engines in the 1839-1847 period is uncorrelated with deviations in yearly wheat prices during this survey, suggesting that the adoption of steam engines occurred with some delay, or that, as discussed above in Section 3, a substantial part of the 1839-1847 survey was carried out in the 1839-1841 period.

[21] The interaction variable between Distance from Fresnes and the Wheat Price Deviation over the 1834-1838 period is insignificant.

Table 5: Steam engine adoption in 1839-1847: the geographical diffusion of the steam engine and deviations from standard wheat prices in 1834-1838

	(1) OLS	(2) OLS	(3) OLS	(4) OLS
	Number of Steam Engines			
Distance to Fresnes	-0.702***	-0.624**	-0.688***	-0.679**
	[0.243]	[0.249]	[0.246]	[0.259]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***			
	[0.329]			
Deviation from Wheat Prices in 1834-1838 (baseline 1809-1833)		-1.866***		
		[0.544]		
Deviation from Wheat Prices in 1834-1838 (baseline 1814-1833)			-1.933***	
			[0.514]	
Deviation from Wheat Prices in 1834-1838 (baseline 1824-1833)				-1.166***
				[0.386]
Average Rainfall	-1.436*	-1.783**	-1.573*	-1.459*
	[0.837]	[0.794]	[0.805]	[0.839]
Average Temperature	1.931	1.675	1.655	1.858
	[1.196]	[1.208]	[1.180]	[1.153]
Latitude	-15.25**	-8.705	-12.50	-14.19*
	[7.564]	[8.079]	[7.793]	[8.071]
Land Suitability	-0.772**	-0.575	-0.654*	-0.640*
	[0.375]	[0.395]	[0.382]	[0.372]
Share of Carboniferous Area	-0.0951	0.0554	-0.0294	-0.0685
	[0.672]	[0.675]	[0.678]	[0.684]
Maritime Department	0.627**	0.584*	0.592*	0.741**
	[0.306]	[0.316]	[0.307]	[0.312]
Border Department	0.313	0.236	0.243	0.265
	[0.348]	[0.341]	[0.340]	[0.349]
Distance to Paris	0.345	0.341	0.355	0.355
	[0.233]	[0.228]	[0.229]	[0.241]
Paris and Suburbs	0.0939	0.120	0.0417	0.177
	[0.600]	[0.612]	[0.608]	[0.650]
F-stat (1^{st} stage)	16.661	12.961	15.527	13.395
Prob J-Stat	0.320	0.552	0.441	0.431
Observations	85	85	85	85

Note: The dependent variable in the second stage in the regression is the number of teachers in 1840. The dependent variable and the explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

percentile of the wheat price deviation over the 1834-1838 period (i.e., -0.72) a departments located at the 75th percentile (i.e., -0.14), will be expected to have 2.1 engines fewer steam engines. Thus, in line with historical evidence, these estimates suggest while the diffusion of the steam engine as well the transition from agriculture to industry contributed to the adoption of steams engines, the effect of gradual diffusion of steam engines from the North of France to the rest of the country dominated the effect of the slower transition of French regions from agriculture to industry in the 19th century.

Moreover, the highly significant negative association between the number of steam engines in each department and the wheat price deviation over the 1834-1838 period as well as with the distance from Fresnes-sur-Escaut to the administrative center of each department is robust to the inclusion of an additional set of confounding geographical, demographic and institutional characteristics, as well as to the forces of pre-industrial development, which as discussed in section 6, may have contributed to the relationship between industrialization and economic development. As established in Table B.2 in the Appendix, these confounding factors, which could be largely viewed

as endogenous to the adoption of the steam engine and are thus not considered as part of the baseline analysis, do not affect the qualitative results.

4.2 Empirical Model

The effect of industrialization on the process of development is estimated using 2SLS. The second stage provides a cross-section estimate of the relationship between the number of steam engines in each department in 1839-1847 to measures of human capital formation at different points in time;

$$Y_{it} = \alpha + \beta E_i + \boldsymbol{X_i'}\omega + \varepsilon_{it}, \tag{2}$$

where Y_{it} represents a measure of human capital in department i in year t, E_i is the log of the number of steam engines in department i in 1839-1847, $\boldsymbol{X_i'}$ is a vector of geographical, institutional and pre-industrial economic characteristics of department i and ϵ_{it} is an i.i.d. error term for department i in year t.

In the first stage, E_i, the log of the number of steam engines in department i in 1839-1847 is instrumented by the aerial distance (in kilometers) between Fresnes-sur-Escaut and the administrative center of department i, D_i, as well as by the wheat price deviation over the 1834-1838 period in department i, $\tilde{P}_{i,1834-1838}$;

$$E_i = \delta_1 D_i + \delta_2 \tilde{P}_{i,1834-1838} + \boldsymbol{X_i'}\delta_3 + \eta_i, \tag{3}$$

where $\boldsymbol{X_i'}$ is the same vector of geographical, institutional and pre-industrial economic characteristics of department i used in the second stage, and η_i is an error term for department i.[22]

5 Industrialization and Human Capital Formation

The study examines the effect of the number of steam engines in the 1839-1847 period on human capital formation in the short-run. As established in Tables 6 - 11, and in line with the proposed hypothesis, the early phase of the industrialization process was conducive to human capital accumulation.

5.1 The Effect of Industrialization on the Number of Teachers

The relationship between industrialization and the number of teachers in 1840 and 1863 is presented in Tables 6 and 7. As shown in Column (1), unconditionally, the number of steam engines in

[22]The aerial distance is a natural proxy for the regional diffusion of the steam engine. In fact, the robustness checks in Section 6 show that accounting for the progressive development of the railroad network in the 19^{th} century does not change the qualitative results.

Table 6: The effect of industrialization on the number of teachers in 1840

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Teachers, 1840									
Number of Steam Engines	0.164***	0.211***	0.190***	0.201***	0.170***	0.193***	0.320***	0.333***	0.319***	0.289***
	[0.0329]	[0.0357]	[0.0387]	[0.0380]	[0.0433]	[0.0402]	[0.0873]	[0.0869]	[0.0936]	[0.0823]
Average Rainfall		1.019***	1.108***	1.086***	1.247***	0.917***	1.244***	1.191***	1.244***	1.065***
		[0.265]	[0.283]	[0.286]	[0.307]	[0.322]	[0.275]	[0.278]	[0.287]	[0.323]
Average Temperature		-0.939***	-1.146***	-1.097***	-1.103***	-0.611	-1.044***	-0.950**	-1.045***	-0.536
		[0.269]	[0.396]	[0.412]	[0.381]	[0.507]	[0.400]	[0.430]	[0.399]	[0.488]
Latitude		1.007	3.729	3.634	3.806	2.813	3.119	2.967	3.123	2.634
		[1.141]	[2.705]	[2.759]	[2.587]	[2.852]	[2.493]	[2.595]	[2.500]	[2.577]
Land Suitability		0.459***	0.378**	0.380**	0.370**	0.249	0.335**	0.342**	0.335**	0.223
		[0.157]	[0.159]	[0.161]	[0.148]	[0.194]	[0.149]	[0.152]	[0.149]	[0.177]
Share of Carboniferous Area			-0.635**	-0.674**	-0.624**	-0.436	-0.672**	-0.747***	-0.671**	-0.468
			[0.318]	[0.317]	[0.311]	[0.342]	[0.282]	[0.281]	[0.283]	[0.303]
Maritime Department			0.0926	0.0873	0.0732	0.0478	-0.00365	-0.00800	-0.00314	-0.0326
			[0.127]	[0.125]	[0.129]	[0.149]	[0.160]	[0.154]	[0.159]	[0.174]
Border Department			-0.0604	-0.0494	-0.0475	-0.146	-0.0887	-0.0644	-0.0885	-0.150
			[0.120]	[0.125]	[0.117]	[0.135]	[0.120]	[0.120]	[0.121]	[0.121]
Distance to Paris			0.0928	0.0939	0.0889	0.0909	0.0999	0.102	0.0999	0.0990
			[0.0834]	[0.0832]	[0.0814]	[0.0874]	[0.0829]	[0.0823]	[0.0827]	[0.0834]
Paris and Suburbs			0.578***	0.584***	0.562***	0.348*	0.534***	0.548***	0.534***	0.372**
			[0.195]	[0.204]	[0.169]	[0.203]	[0.146]	[0.160]	[0.145]	[0.153]
University				-0.0959				-0.195		
				[0.114]				[0.125]		
Urban Population in 1700					0.0360				0.000160	
					[0.0331]				[0.0292]	
Grooms who Signed their Marriage License, 1786-1790						0.639*				0.592*
						[0.329]				[0.312]
Adjusted R2	0.187	0.381	0.431	0.428	0.434	0.457				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.320	0.410	0.318	0.391

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

industrial production in 1839-1847 had a positive and significant association at the 1% level with the number of teachers in 1840 and 1863. This relationship remains positive, mostly smaller in magnitude but with the same level of statistical significance, once one progressively accounts for the confounding effects of exogenous geographical factors (Column (2)), institutional factors (Column (3)) and pre-industrial characteristics (Columns (4)-(7)). Finally, mitigating the effect of omitted variables on the observed relationship, the IV estimations in Columns (8)-(12) suggest that the number of steam engines in 1839-1847 had a positive and highly significant impact on the number of teachers in 1840 and 1863, accounting for the confounding effects of geographical, institutional, and demographic characteristics.[23]

The regressions in Tables 6 and 7 also account for a large number of confounding geographical

[23]In the absence of pre-industrial controls, the F-statistic of the first stage is equal to 16.7. Furthermore, in each specification, the IV estimates of the effect of the log number of steam engines are larger than the OLS coefficients, reflecting possibly measurement errors the number of steam engines. Moreover, the positive and significant effect of industrialization on the number of teachers in 1840 and 1863 in the IV regressions is consistent with the outcome of reduced form regressions reported in Columns (1)-(2) of Table B.3 in the Appendix, where Distance to Fresnes and the Deviation from Wheat Prices in 1834-1838 are negatively and significantly associated with the number of teachers.

Table 7: The effect of industrialization on the number of teachers in 1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Teachers, 1863									
Number of Steam Engines	0.198***	0.214***	0.200***	0.184***	0.170***	0.196***	0.282***	0.280***	0.258***	0.292***
	[0.0248]	[0.0283]	[0.0283]	[0.0269]	[0.0313]	[0.0277]	[0.0517]	[0.0533]	[0.0575]	[0.0543]
Average Rainfall		0.682***	0.759***	0.792***	0.962***	0.678***	0.846***	0.868***	0.960***	0.825***
		[0.223]	[0.221]	[0.217]	[0.261]	[0.254]	[0.226]	[0.218]	[0.240]	[0.272]
Average Temperature		-0.0337	-0.413	-0.487*	-0.349	-0.454	-0.348	-0.380	-0.315	-0.379
		[0.223]	[0.316]	[0.289]	[0.282]	[0.360]	[0.303]	[0.294]	[0.281]	[0.345]
Latitude		1.737**	4.163**	4.305**	4.274**	3.657*	3.775**	3.818**	3.875**	3.480*
		[0.801]	[1.843]	[1.816]	[1.626]	[1.924]	[1.739]	[1.712]	[1.591]	[1.807]
Land Suitability		0.139	0.211	0.208	0.199*	0.187	0.183	0.180	0.179	0.161
		[0.124]	[0.137]	[0.130]	[0.112]	[0.144]	[0.128]	[0.124]	[0.112]	[0.138]
Share of Carboniferous Area			-0.127	-0.0695	-0.111	0.0158	-0.150	-0.123	-0.138	-0.0157
			[0.243]	[0.241]	[0.233]	[0.256]	[0.225]	[0.223]	[0.213]	[0.236]
Maritime Department			0.0686	0.0765	0.0404	0.102	0.00746	0.00698	-0.00428	0.0220
			[0.0859]	[0.0877]	[0.0825]	[0.0976]	[0.0982]	[0.101]	[0.0929]	[0.113]
Border Department			-0.155	-0.171*	-0.136	-0.153	-0.173*	-0.182**	-0.160*	-0.157*
			[0.0936]	[0.0925]	[0.0920]	[0.105]	[0.0903]	[0.0898]	[0.0896]	[0.0923]
Distance to Paris			0.0937*	0.0920	0.0879	0.0856	0.0982*	0.0977*	0.0943*	0.0937
			[0.0556]	[0.0567]	[0.0537]	[0.0592]	[0.0557]	[0.0560]	[0.0539]	[0.0587]
Paris and Suburbs			0.718**	0.710**	0.695**	0.328***	0.690**	0.684**	0.678***	0.352***
			[0.332]	[0.300]	[0.274]	[0.0856]	[0.285]	[0.267]	[0.254]	[0.109]
University				0.143				0.0712		
				[0.0920]				[0.0964]		
Urban Population in 1700					0.0524**				0.0314	
					[0.0262]				[0.0263]	
Grooms who Signed their Marriage License, 1786-1790						0.114				0.0671
						[0.186]				[0.189]
Adjusted R2	0.411	0.464	0.539	0.550	0.568	0.540				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.416	0.360	0.439	0.553

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

and institutional factors, which are discussed above in Section 2.3. First, the climatic and soil characteristics of each department (i.e., land suitability, average temperature, average rainfall, and latitude) could have affected natural land productivity and therefore the feasibility and profitability of the transition to the industrial stage of development, as well as the evolution of income per capita and its potential direct on human capital formation in each department. Second, the location of departments (i.e., latitude, border departments, maritime departments and departments at a greater distance from the concentration of political power in Paris) could have jointly affected the diffusion of the steam engine and human capital formation. However, The IV estimates are rather stable and are largely unaffected by the inclusion of controls for these variables.

Third, the regressions in Tables 6 and 7 take into account the potentially confounding effects of the level of human capital and economic development in the pre-industrial period, as captured by the share of grooms who could sign their marriage license over the 1786-1790 period, the degree of urbanization in each department in 1700 and the number of universities in 1700.[24] The findings

[24] As established in Table B.5, the qualitative results are unaffected if the share of grooms in the 1686-1690 or 1816-1820 period is used instead.

suggest that pre-industrial human capital and development (and the characteristics that may have fostered them) had no significant impact on the number of teachers in 1840 and 1863.

Fourth, the IV estimates in Column (8) of Tables 6 and 7 suggest that the presence of steam engines had large quantitative effects on the number of teachers in primary schools: a one-percent increase in the number of steam engines in a department in 1839-1847 increased the number of teachers in the primary schools by 32.0% in 1840 and 28.2% in 1863. Hence the 675 percent increase in the number of steam engines in 1839-1847 due to a movement from the 25th percentile (i.e., 4 engines) to the 75th percentile (i.e., 31 engines) would have led to an increase in the number of teachers of 216 in 1840 and 190.35 in 1863 (relative to a sample mean of 742 in 1840 and 1243 in 1863).

Finally, the association between the number of steam engines and the number of teachers in 1840 and 1863 is not affected by spatial correlation as established in Tables E.1 and E.2 in the Appendix, accounting for radii of 50km, 100km, 250km and 500km.

5.2 The Effect of Industrialization on the Share of Pupils in the Population

5.2.1 Pupils in Primary Schools

The effect of industrialization on the number of pupils enrolled in the primary schools of each department (per 10,000 inhabitants) in 1840 and 1863 is reported in Tables 8 and 9. In both Tables, the unconditional relationship between the number of steam engines in industrial production in 1839-1847 and the share of pupils in 1840 and in 1863 is positive and significant (Column (1)), and remains so when the confounding effects of exogenous geographical factors (Column (2)), institutional factors (Column (3)) and pre-industrial characteristics (Columns (4)-(6)) are accounted for.

The IV estimates in Columns (7)-(10) in Tables 8 and 9 suggest that the number of steam engines in 1839-1847 had a positive and significant impact on the number of pupils enrolled in the primary schools of each department (per 10,000 inhabitants) in 1840 and 1863, accounting for the confounding effects of geographical, institutional and pre-industrial characteristics.[25] This positive effect appears to diminish between 1840 and 1863. In addition, in the IV regressions in Tables 8 and 9, there is a strongly positive and significant association between early literacy, as captured by the share of grooms who signed their marriage license in 1786-1790, and the number

[25] In the absence of pre-industrial controls, the F-statistic of the first stage is equal to 16.7 . Furthermore, in each specification, the IV estimates of the effect of the log number of steam engines are larger than the OLS coefficients, reflecting possibly measurement errors the number of steam engines. Moreover, the positive and significant effect of industrialization on the number of pupils in 1840 and 1863 in the IV regressions is consistent with the outcome of reduced form regressions reported in Columns (3)-(4) of Table B.3 in the Appendix, where Distance to Fresnes and the Deviation from Wheat Prices in 1834-1838 are negatively and significantly associated the number of pupils in 1840 and 1863.

Table 8: The effect of industrialization on the share of pupils in the population in 1840

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Pupils per 10,000 inhabitants, 1840									
Number of Steam Engines	0.0814**	0.0862**	0.0837**	0.103**	0.0859*	0.0740**	0.268***	0.288***	0.311***	0.206***
	[0.0352]	[0.0378]	[0.0402]	[0.0411]	[0.0437]	[0.0326]	[0.0691]	[0.0660]	[0.0830]	[0.0576]
Average Rainfall		0.663**	0.797***	0.757***	0.781***	0.384	0.990***	0.904***	0.777***	0.586**
		[0.259]	[0.257]	[0.251]	[0.274]	[0.256]	[0.246]	[0.240]	[0.260]	[0.287]
Average Temperature		-2.165***	-1.861***	-1.771***	-1.865***	-0.917**	-1.716***	-1.566***	-1.778***	-0.813**
		[0.377]	[0.367]	[0.380]	[0.369]	[0.383]	[0.410]	[0.425]	[0.413]	[0.390]
Latitude		0.484	2.001	1.831	1.992	0.00508	1.137	0.896	0.962	-0.239
		[0.989]	[2.487]	[2.614]	[2.518]	[2.358]	[2.333]	[2.637]	[2.609]	[2.176]
Land Suitability		0.707***	0.481***	0.484***	0.482***	0.213	0.419***	0.431***	0.428***	0.179
		[0.219]	[0.166]	[0.161]	[0.166]	[0.176]	[0.158]	[0.150]	[0.155]	[0.163]
Share of Carboniferous Area			-0.849***	-0.918***	-0.851***	-0.643**	-0.901***	-1.021***	-0.921***	-0.686***
			[0.312]	[0.311]	[0.314]	[0.283]	[0.285]	[0.290]	[0.298]	[0.262]
Maritime Department			-0.0573	-0.0668	-0.0551	-0.158	-0.194	-0.200*	-0.170	-0.268**
			[0.0903]	[0.0938]	[0.0903]	[0.103]	[0.121]	[0.121]	[0.126]	[0.121]
Border Department			0.0669	0.0867	0.0654	-0.118	0.0268	0.0657	0.00346	-0.123
			[0.0882]	[0.0872]	[0.0884]	[0.0789]	[0.114]	[0.106]	[0.120]	[0.0844]
Distance to Paris			0.0361	0.0381	0.0366	0.0283	0.0461	0.0489	0.0531	0.0394
			[0.0698]	[0.0717]	[0.0709]	[0.0629]	[0.0699]	[0.0736]	[0.0756]	[0.0582]
Paris and Suburbs			0.170	0.181	0.172	0.103	0.108	0.131	0.131	0.136
			[0.227]	[0.200]	[0.224]	[0.141]	[0.293]	[0.245]	[0.247]	[0.189]
University				-0.172*				-0.311***		
				[0.101]				[0.116]		
Urban Population in 1700					-0.00400				-0.0581*	
					[0.0273]				[0.0312]	
Grooms who Signed their Marriage License, 1786-1790						1.147***				1.083***
						[0.278]				[0.293]
Adjusted R2	0.039	0.479	0.515	0.527	0.509	0.661				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Horse Power of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.199	0.288	0.197	0.187

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

of pupils.[26] However, the share of carboniferous area in the department, as well as the presence of a university and the urban population in 1700, are negatively, and in some regressions significantly, correlated with the enrollment of pupils. The other characteristics of departments, i.e., latitude, land suitability, border departments, maritime departments as well as the distance to Paris, are shown to have no effect on the enrollment of pupils in the IV regressions. Overall, the IV estimates in Column (7) of Tables 8 and 9 suggest that a one-percent increase in the number of steam engines in a department in 1839-1847 increased the number of pupils enrolled in the primary schools (per 10,000 inhabitants) by 26.8% in 1840 and 11.2% in 1863.As such, a department that would have experienced an increase in its number of steam engines in the 1839-1847 period from the 25th percentile (i.e., 4 engines) to the 75th percentile (i.e., 31 engines) of the steam engine distribution across department, would have 181 more pupils in 1840 and 75.6 more pupils in 1863 (relative to sample mean of 874 in 1840 and 1179 in 1863, per 10,000 inhabitants).

Finally, the association between intensity of the steam engines and the number of pupils

[26] As established in Table B.5, the qualitative results are not affected if the share of grooms in the 1686-1690 or 1816-1820 period is used instead.

Table 9: The effect of industrialization on the share of pupils in the population in 1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Pupils per 10,000 inhabitants, 1863									
Number of Steam Engines	0.0389*	0.0383*	0.0374*	0.0401*	0.0488**	0.0350*	0.112***	0.119***	0.144***	0.0956***
	[0.0199]	[0.0213]	[0.0220]	[0.0231]	[0.0223]	[0.0201]	[0.0287]	[0.0288]	[0.0355]	[0.0288]
Average Rainfall		0.383***	0.501***	0.495***	0.421***	0.386***	0.579***	0.557***	0.420***	0.479***
		[0.136]	[0.126]	[0.128]	[0.146]	[0.138]	[0.118]	[0.118]	[0.137]	[0.147]
Average Temperature		-1.198***	-1.057***	-1.044***	-1.082***	-0.759***	-0.998***	-0.957***	-1.045***	-0.712***
		[0.222]	[0.206]	[0.213]	[0.204]	[0.198]	[0.222]	[0.228]	[0.221]	[0.212]
Latitude		0.396	-0.278	-0.302	-0.322	-1.344	-0.628	-0.698	-0.760	-1.456
		[0.561]	[1.275]	[1.309]	[1.366]	[1.172]	[1.178]	[1.287]	[1.383]	[1.085]
Land Suitability		0.360***	0.235**	0.236**	0.240***	0.149	0.210**	0.213***	0.217***	0.133
		[0.126]	[0.0925]	[0.0919]	[0.0872]	[0.0938]	[0.0854]	[0.0819]	[0.0761]	[0.0877]
Share of Carboniferous Area			-0.449**	-0.459**	-0.455***	-0.416**	-0.470***	-0.502***	-0.485***	-0.436***
			[0.173]	[0.177]	[0.165]	[0.167]	[0.152]	[0.154]	[0.145]	[0.152]
Maritime Department			0.0103	0.00890	0.0213	-0.0176	-0.0448	-0.0476	-0.0277	-0.0681
			[0.0487]	[0.0502]	[0.0485]	[0.0535]	[0.0557]	[0.0573]	[0.0590]	[0.0578]
Border Department			0.0419	0.0447	0.0345	-0.0256	0.0257	0.0358	0.00821	-0.0279
			[0.0482]	[0.0494]	[0.0488]	[0.0488]	[0.0555]	[0.0554]	[0.0591]	[0.0493]
Distance to Paris			-0.0273	-0.0270	-0.0250	-0.0408	-0.0232	-0.0224	-0.0180	-0.0356
			[0.0365]	[0.0373]	[0.0384]	[0.0339]	[0.0350]	[0.0368]	[0.0387]	[0.0316]
Paris and Suburbs			-0.0311	-0.0297	-0.0218	0.0239	-0.0564	-0.0506	-0.0395	0.0390
			[0.158]	[0.154]	[0.137]	[0.103]	[0.182]	[0.168]	[0.144]	[0.127]
University				-0.0246				-0.0831		
				[0.0533]				[0.0599]		
Urban Population in 1700					-0.0205				-0.0435**	
					[0.0157]				[0.0180]	
Grooms who Signed their Marriage License, 1786-1790						0.351***				0.321**
						[0.130]				[0.135]
Adjusted R2	0.028	0.513	0.544	0.539	0.551	0.610				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Horse Power of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)							-1.309***	-1.200***	-1.170***	-1.279***
							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.124	0.161	0.129	0.135

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

enrolled in the primary schools of each department (per 10,000 inhabitants) in 1840 and 1863 is not affected by spatial correlation, when one accounts for radii of 50km, 100km, 250km and 500km as shown in Tables E.3 and E.4 in the Appendix.

5.2.2 Pupils in Technical Schools

The effect of industrialization on the number of apprentices in each department (per 10,000 inhabitants) in 1863 is reported in Table 10. The unconditional relationship between the number of steam engines in industrial production in 1839-1847 and the share of apprentices in 1863 is positive and significant (Column (1)), and remains so when the confounding effects of exogenous geographical factors (Column (2)), institutional factors (Column (3)) and pre-industrial characteristics (Columns (4)-(6)) are accounted for.

The IV estimates in Columns (7)-(10) in Table 10 suggest that the number of steam engines in 1839-1847 had a positive and significant impact on the number of apprentices in each department (per 10,000 inhabitants) in 1863, accounting for the confounding effects of geographical, institutional

Table 10: The effect of industrialization on the share of apprentices in the population in 1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Apprentices per 10,000 inhabitants, 1863									
Number of Steam Engines	0.376***	0.394***	0.351***	0.349***	0.329***	0.326***	0.473***	0.495***	0.463**	0.448***
	[0.0685]	[0.0921]	[0.0759]	[0.0808]	[0.0823]	[0.0840]	[0.145]	[0.151]	[0.182]	[0.158]
Average Rainfall		0.644	0.797	0.802	0.949	0.610	0.925*	0.918*	0.947*	0.798
		[0.597]	[0.554]	[0.558]	[0.583]	[0.640]	[0.500]	[0.483]	[0.522]	[0.591]
Average Temperature		-0.107	0.927	0.915	0.975	1.020	1.023	1.077	1.027	1.115
		[0.543]	[0.726]	[0.725]	[0.744]	[0.897]	[0.711]	[0.728]	[0.714]	[0.851]
Latitude		2.824	-0.765	-0.742	-0.681	-0.545	-1.335	-1.478	-1.290	-0.771
		[2.323]	[4.520]	[4.495]	[4.646]	[5.567]	[4.084]	[4.022]	[4.081]	[5.027]
Land Suitability		0.476*	0.147	0.146	0.138	0.133	0.106	0.104	0.107	0.101
		[0.283]	[0.344]	[0.346]	[0.339]	[0.407]	[0.324]	[0.330]	[0.322]	[0.379]
Share of Carboniferous Area			-0.379	-0.370	-0.367	-0.279	-0.413	-0.451	-0.409	-0.319
			[0.497]	[0.510]	[0.486]	[0.555]	[0.498]	[0.518]	[0.486]	[0.552]
Maritime Department			0.217	0.218	0.196	0.239	0.127	0.113	0.128	0.138
			[0.265]	[0.268]	[0.271]	[0.320]	[0.252]	[0.252]	[0.250]	[0.301]
Border Department			0.936***	0.933***	0.950***	0.898***	0.909***	0.917***	0.913***	0.893***
			[0.289]	[0.287]	[0.297]	[0.316]	[0.266]	[0.260]	[0.268]	[0.285]
Distance to Paris			-0.141	-0.142	-0.146	-0.127	-0.135	-0.133	-0.136	-0.117
			[0.133]	[0.135]	[0.134]	[0.153]	[0.123]	[0.123]	[0.124]	[0.141]
Paris and Suburbs			0.772	0.771	0.755	0.464	0.731	0.732	0.730	0.494
			[0.557]	[0.561]	[0.565]	[0.710]	[0.543]	[0.560]	[0.544]	[0.714]
University				0.0232				-0.0859		
				[0.246]				[0.246]		
Urban Population in 1700					0.0394				0.00739	
					[0.0574]				[0.0730]	
Grooms who Signed their Marriage License, 1786-1790						0.239				0.179
						[0.583]				[0.536]
Adjusted R2	0.256	0.257	0.366	0.357	0.361	0.303				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Horse Power of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.040	0.039	0.039	0.046

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

and pre-industrial characteristics. Overall, the IV estimates in Column (7) of Table 10 suggest that a one-percent increase in the number of steam engines in a department in 1839-1847 increased the number of apprentices (per 10,000 inhabitants) by 47.3% in 1863.

Finally, spatial correlation does not affect the association between the number of steam engines and the number of apprentices in 1863 as established in Table E.5 in the Appendix when one accounts for radii of 50km, 100km, 250km and 500km.

5.3 The Effect of Industrialization on Literacy

The relationship between industrialization and literacy, as captured by the share of army conscripts who could read and write over the 1859-1868 period, is presented in Table 11.[27] In Column (1), unconditionally, the number of steam engines in 1839-1847 had a significant positive association with the share of literate conscripts. However, in the OLS regressions in Columns (2)-(6), this positive association is not significant once the confounding effects of exogenous geographical, institutional and pre-industrial factors are taken into account. Nevertheless, in the IV regressions in Columns

[27] Regression results using the share of literate conscripts over the 1847-1856 decade are similar to those obtained over the 1859-1868 period and are reported in Table C.1 in the Appendix.

Table 11: The effect of industrialization on the share of literate conscripts, 1859-1868

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Share of Conscripts who could Read and Write, 1859-1868									
Number of Steam Engines	0.0461**	0.0364	0.0401**	0.0464**	0.0349	0.0279*	0.116***	0.123***	0.125***	0.0763***
	[0.0223]	[0.0220]	[0.0200]	[0.0201]	[0.0220]	[0.0154]	[0.0346]	[0.0337]	[0.0390]	[0.0291]
Average Rainfall		0.0867	0.242**	0.229*	0.278**	0.0127	0.321***	0.289**	0.276**	0.0871
		[0.130]	[0.121]	[0.121]	[0.135]	[0.136]	[0.119]	[0.117]	[0.131]	[0.140]
Average Temperature		-0.810***	-0.540***	-0.510***	-0.528***	-0.0942	-0.480**	-0.426**	-0.493***	-0.0563
		[0.211]	[0.175]	[0.178]	[0.176]	[0.212]	[0.190]	[0.191]	[0.188]	[0.207]
Latitude		-0.237	0.234	0.178	0.254	-0.827	-0.121	-0.206	-0.157	-0.916
		[0.613]	[1.410]	[1.444]	[1.381]	[1.375]	[1.229]	[1.322]	[1.285]	[1.186]
Land Suitability		0.367***	0.232***	0.233***	0.230***	0.104	0.207***	0.211***	0.209***	0.0908
		[0.108]	[0.0803]	[0.0794]	[0.0800]	[0.0898]	[0.0740]	[0.0722]	[0.0742]	[0.0823]
Share of Carboniferous Area			-0.475**	-0.498**	-0.473**	-0.364*	-0.496**	-0.540***	-0.501**	-0.380**
			[0.220]	[0.217]	[0.221]	[0.206]	[0.198]	[0.192]	[0.203]	[0.184]
Maritime Department			-0.0788*	-0.0819*	-0.0839*	-0.117**	-0.135**	-0.137**	-0.130**	-0.157***
			[0.0472]	[0.0491]	[0.0469]	[0.0520]	[0.0595]	[0.0613]	[0.0604]	[0.0603]
Border Department			0.0441	0.0506	0.0475	-0.0527	0.0276	0.0420	0.0227	-0.0546
			[0.0530]	[0.0529]	[0.0528]	[0.0433]	[0.0621]	[0.0589]	[0.0633]	[0.0444]
Distance to Paris			0.00795	0.00859	0.00692	0.00291	0.0121	0.0130	0.0135	0.00699
			[0.0413]	[0.0418]	[0.0409]	[0.0383]	[0.0391]	[0.0399]	[0.0403]	[0.0342]
Paris and Suburbs			0.227***	0.230***	0.223***	0.0916	0.201**	0.210**	0.206**	0.104
			[0.0732]	[0.0752]	[0.0754]	[0.0626]	[0.0910]	[0.0881]	[0.0867]	[0.0775]
University				-0.0568				-0.114**		
				[0.0529]				[0.0566]		
Urban Population in 1700					0.00940				-0.0122	
					[0.0141]				[0.0148]	
Grooms who Signed their Marriage License, 1786-1790						0.578***				0.554***
						[0.150]				[0.149]
Adjusted R2	0.046	0.289	0.396	0.397	0.391	0.560				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Horse Power of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage							16.661	16.946	10.918	13.209
Prob J-Stat							0.530	0.663	0.519	0.525

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

(7)-(10) which mitigate the effect of omitted variables on the observed relationship and account for the confounding effects of geographical, institutional and pre-industrial characteristics, the effect of industrialization on the share of literate conscripts is found to be positive and significant.

Moreover, the regressions in Table 11 account for the impact of confounding geographical and institutional factors. In some of the IV regressions in Columns (7)-(10) of Table 11, land suitability had a significant positive association with the share of literate conscripts while temperature had a significant negative relationship, but the coefficients are only significant when the share of grooms who could sign their marriage license in 1786-1790 is excluded from the regressions.[28] In addition, the variables which control for the location of departments (i.e., latitude, border departments, maritime departments, departments at a greater distance from the concentration of political power in Paris) and pre-industrial development (the number of universities and urban population in 1700) appear orthogonal to industrialization and literacy. As could be expected, the dummy variable for Paris and its suburbs, as well as the share of grooms who could sign their marriage license in 1786-

[28] As shown in Table B.5, the qualitative results are not affected if the share of grooms in the 1686-1690 or 1816-1820 period is used instead.

1790, are significantly and positively associated with the share of literate conscripts in 1859-1868. All in all, the IV estimate in Column (7) of Table 11 indicates that a one-percent increase in the number of steam engines in a department in 1839-1847 increased the share of literate conscripts in 1859-1868 by 11.6% percentage point.[29] As such, if a department had increased its number of steam engines in 1839-1847 from the 25th percentile (i.e., 4 engines) to the 75th percentile (i.e., 31 engines), this 675 percent increase in the number of steam engines would have led to a 78.3% increase in the share of literate conscripts in 1859-1868 (relative to sample mean of 73.57 per cent and a standard deviation of 14.96).

Finally, as we establish in Table E.6 in the Appendix, the association between the number of steam engines and the share of literate conscripts is not affected by spatial correlation for radii of 50km, 100km, 250km and 500km.

6 Robustness Analysis

6.1 Confounding Factors

This subsection examines the robustness of the baseline analysis to the inclusion of additional confounding geographical, demographic, institutional and pre-industrial characteristics, which may have contributed to the relationship between industrialization and economic development. These confounding factors could be viewed as endogenous to the adoption of the steam engine and are thus not part of the baseline analysis.

In what follows, the analysis focuses on the potential impact of these confounding factors on the baseline IV regressions in Tables 6 to 11, where the dependent variables are the number of teachers in 1840 and 1863, the share of pupils in the population in 1840 and 1863, the share of apprentices in the population in 1863 and the share of literate conscripts over the 1859-1868 period.

6.1.1 Distance from London

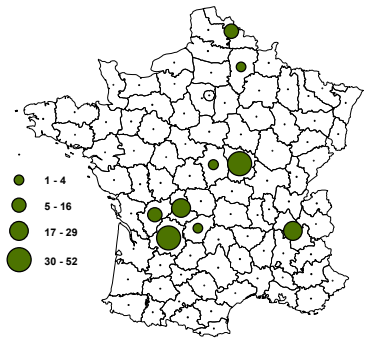
Given the early industrial use of the steam engine in England and the intensive economic relationship between France and England, human capital in French departments could have been affected by their proximity to England. However, as reported in Table B.4 in Appendix B, accounting for the aerial distance from England has no qualitative impact on the estimated effect of industrialization

[29] In the absence of pre-industrial controls, the F-statistic of the first stage is equal to 16.7. Furthermore, in each specification, the IV estimates of the effect of the log number of steam engines are larger than the OLS coefficients, reflecting possibly measurement errors the number of steam engines. Moreover, the positive and significant effect of industrialization on the share of literate conscripts in 1859-1868 in the IV regressions is consistent with the outcome of reduced form regressions reported in Column (6) of Table B.3 in the Appendix, where Distance to Fresnes and the Deviation from Wheat Prices in 1834-1838 are negatively and significantly associated with the share of literate conscripts in 1859-1868.

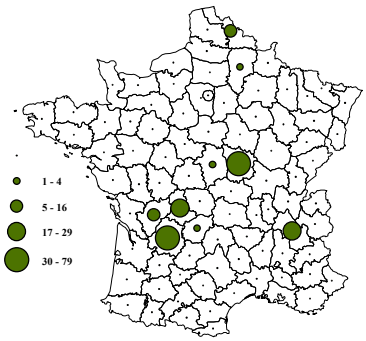
on human capital.

6.1.2 The Presence of Raw Material

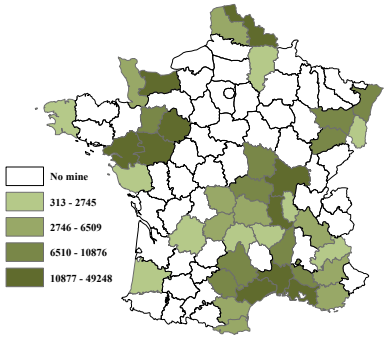
The diffusion of the steam engine across French departments could have been impacted by the presence of raw material required for industrialization. Moreover the wealth generated by this raw material could have affected human capital. As was shown in the baseline regressions in Tables 6 and 11, the statistical impact of industrialization on human capital remains intact when one accounts for the share of carboniferous area in each department (Fernihough and O'Rourke, 2014) Nevertheless, the diffusion of the steam engine across France as well as human capital formation could have been affected by the early use of raw material required for industrialization. Nevertheless, the effect of industrialization on human capital in the first stages of the industrial revolution remains nearly intact, economically and statistically, when the number of iron forges in 1789 and 1811 (Panels A and B of Figure 8) in each department (Woronoff, 1997) are accounted for in Table B.7 or when the area covered by coal mines in 1837 (Panel C of Figure 8) in each department is taken into account in Table B.8.



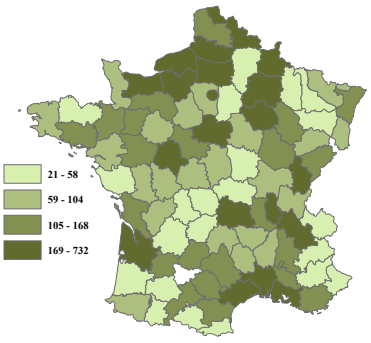
A. Forges in 1789.



B. Forges in 1811.



C. Area Covered by Mines in each department in 1837.



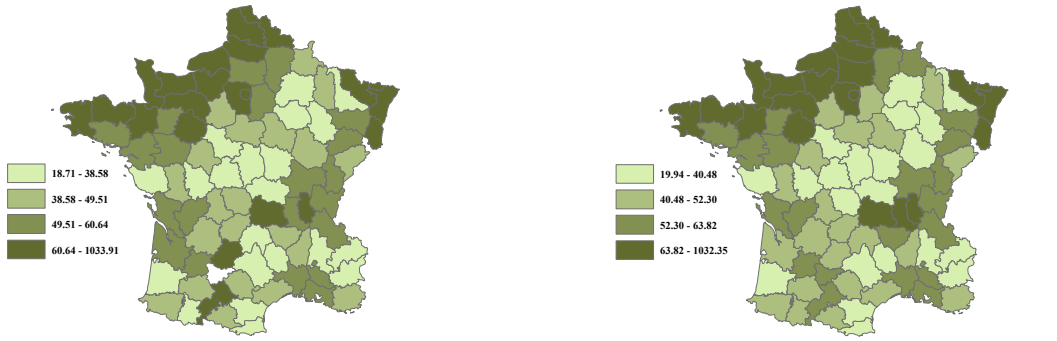
D. Market Integration in the 1790s.

Figure 8: Early economic development across French departments.

6.1.3 Early Economic Integration

Human capital formation and the number of steam engines across French departments could have been affected by the degree of economic integration of each department into the France as a whole. However, as established in Table B.9, the degree of early market integration of each department (depicted in Panel D of Figure 8), as proxied by the number of firms which sold their products outside that home department in the 1790s (Daudin, 2010), has no qualitative impact on the effect of industrialization on human capital formation in the early phase of the industrial revolution. Moreover, as reported in Tables B.10 and B.11, the effect of early industrialization on human capital formation is robust to the inclusion of the share of the road network and of the water network in the territory of each department in 1837, and the existence of a railroad connection in 1860 (Caron, 1997).

6.1.4 Population Density



A. Population Density in 1801

B. Population Density in 1821.

Figure 9: Population Density in 1801 and 1821

In light of the historical evidence that steam engines were more likely to be located in urban centers (Rosenberg and Trajtenberg, 2004), it is plausible that the potentially endogenous level of population density could have been a factor in the adoption of the steam engine and in the formation of human capital, and could have thus contributed to the relationship between industrialization and human capital formation. Reassuringly, as reported in Table B.12 in the Appendix, population density in each French department in 1801 and 1821 (as shown in Figure 9) has no qualitative impact on the estimated effects and the statistical significance of industrialization on human capital.[30]

[30]The Tarn-et-Garonne department was established in 1812 from parts of Aveyron, Gers, Haute-Garonne, Lot and Lot-et-Garonne. Therefore, we lose one observation when population density in 1801 is included in the analysis.

6.1.5 Past Level of Fertility

Human capital formation and the number of steam engines across France could have been affected by differential fertility patterns across French departments (reflecting cultural characteristics as well as economic incentives). In particular, conditional on pre-industrial levels of economic and human capital development, departments in which fertility was higher prior to the 1839-1847 industrial survey may have had characteristics that enhanced fertility and lowered the level of investment in human capital (Galor, 2011). However, as reported in Table B.13, although the level of fertility in 1806 has the predicted negative effect on the various measures of human capital formation in the post-1840 period, it has no qualitative impact on the estimated effect of industrialization on human capital formation.[31]

6.1.6 Investments in Education as a Consumption Good

The documented rise in human capital formation in the first phase of industrialization is not necessarily indicative of technology-skill complementarity. The positive effect of industrialization on income may have generated a demand for human capital as a consumption good rather than as an investment good. Indeed, as shown in Table B.14, the intensity of industrialization was associated with higher average wages for men and women, as well as children (below age 16), in 1839-1847. Nevertheless, as established in Table B.15, the effect of industrialization on the various measures of human capital remains nearly intact, once one accounts for average male, female and child wages. In particular, the rise in parental income is mostly un-associated with human capital formation whereas the number of steam engines retains its positive impact on education. Moreover, the wages of children are unrelated to human capital formation, perhaps reflecting the compliance with the first limitation on child labor imposed by the 22 March 1841 law.

6.1.7 The Upper Tail of the Human Capital Distribution in the 18^{th} century

The number of steam engines and human capital formation in the 19th century might have been affected by the upper tail of the human capital distribution in the previous century. As reported in Table B.16, the upper tail of the human capital distribution in the 18th century, as captured by the number of subscribers to the Quarto edition of the *Encyclopédie* (Darnton, 1973), has no qualitative impact on the estimated impact of steam engines on human capital formation. Moreover, as established in Table B.2, it has no effect on the impact of the distance from Fresnes-sur-Escaut on the intensive use of the steam engine.

[31] 1806 is the earliest year for which the level of fertility is available across French departments (Bonneuil, 1997). Accounting for fertility in subsequent years, including the ones contemporaneous to the survey, does not affect the results.

6.2 Alternative Measures of Human Capital

6.2.1 Public Expenditures on Education

This subsection explores the robustness of the baseline analysis to an alternative proxy of human capital formation, i.e., public expenditures on education. The analysis examines the effect of industrialization on total public expenditures on primary schooling per capita over the 1855-1863 period. As shown in Table D.1 in the Appendix, the OLS regressions in Columns (1)-(6) suggest that the number of steam engines in 1839-1847 mostly has an insignificant association with total public spending on primary schooling. However, in the IV regressions in Columns (7)-(10) which mitigate the effect of omitted variables on the observed relationship and account for the confounding effects of geographical, institutional and pre-industrial characteristics, the effect of industrialization on the share of literate conscripts is found to be positive and significant. All in all, the IV estimate in Column (7) of Table D.1 indicates that a one-percent increase in the number of steam engines in a department in 1839-1847 increased total public spending on education by 1.36% over the 1855-1863 period.

Moreover, Tables D.2-D.4 assess the relationship between industrialization and public spending on primary schooling per capita by distinguishing expenditures from the three tiers of the French government, i.e., the central state, the departments and the communes, over the 1855-1863 period. In those Tables, the IV regressions in Tables D.2-D.4 indicate a positive and significant effect of industrialization on public spending by the the communes and the departments, but not by central state. This is in line with the historical evidence (e.g., Mayeur (2003)). Indeed, as can be seen in the descriptive statistics reported in Table A.1, most of the public spending on primary schooling was undertaken by the communes in mid-19th century France. It was only after the passing of the laws on mandatory and free schooling in 1881-1882 that the central state begun to finance primary schooling (Franck and Johnson, 2016).

6.2.2 School Buildings

This subsection explores the robustness of the baseline analysis to an alternative proxy of human capital formation, i.e., school buildings. The analysis examines the effect of industrialization on the number of school buildings per commune (the lowest tier of the French government) in each department. Surveys carried out in 1850 and 1863 indicate that the average number of school buildings per commune increased from 1.88 in 1850 to 2.19 in 1863, with large variations in the number of school buildings across departments.[32] Since the 1850 and 1863 surveys do not provide information on the size of the school buildings and the number of classrooms, this variable can be viewed as a slightly imprecise measure of human capital formation.

[32] French communes had been compelled by law to host at least one school building in their jurisdiction since 1833.

The relationship between industrialization and the number of school buildings in 1850 and 1863 is presented in Tables D.5 and D.6. In Column (1) of both Tables, the unconditional OLS estimate between the number of steam engines in industrial production in 1839-1847 and the number of school buildings in 1840 and 1863 is positive but insignificant. This relationship remains positive and significant when the confounding effects of exogenous geographical factors (Column (2)), institutional factors (Column (3)) and pre-industrial characteristics (Columns (4)-(6)) are taken into account. Finally, in the IV estimations in Columns (7)-(10) which account for the confounding effects of geographical, institutional, and demographic characteristics, the number of steam engines in 1839-1847 is found to have a positive and mostly significant impact on the number of school buildings in 1850 and 1863. The IV estimates in Column (7) of Tables D.5 and D.6 suggest that a one-percent increase in the number of steam engines in a department in 1839-1847 increased the number of primary schools by 17.4% in 1850 and 15.4% in 1863.

Moreover, in the IV regressions in Tables D.5 and D.6, there is a positive and significant association between the distance to Paris and the number of school buildings. There is also a negative and significant correlation between border departments and the number of school buildings. However other characteristics of departments such as latitude, land suitability, the share of carboniferous area in the department, maritime departments, as well as pre-industrial human capital and economic development, do not have a systematically significant effect on school buildings in the IV regressions.

7 Concluding Remarks

The research explores the effect of industrialization on human capital formation. Exploiting exogenous regional variations in the adoption of steam engines across France, the study establishes that in contrast to conventional wisdom which views early industrialization as a predominantly deskilling process, the industrial revolution was conducive for human capital formation, generating broad increases in literacy rates and education attainment. In particular, the analysis suggests that a greater number of steam engines in a given department in the 1839-1847 period had a positive and significant effect on: (i) the number of teachers in 1840 and 1863, (ii) the share of children in primary schools in 1840 and 1863, (iii) the share of apprentices in the population in 1863, (iv) the share of literate conscripts over the 1847-1856 and 1859-1868 periods, and (v) public spending on primary schooling over the 1855-1863 period.

The research thus lends further credence to the emerging view that human capital was instrumental in the process of industrialization, governing the pace of the transition from stagnation to growth and comparative economic development across the world.

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Supplementary Appendix for Online Publication

Appendix A. Descriptive Statistics

Table A.1: Descriptive statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
Dependent Variables					
Teachers, 1840	85	742	347	187	1907
Teachers, 1863	85	1243	612	515	4903
Pupils Enrolled in Schools (per 10,000 inhabitants), 1840	85	874	414	314	1794
Pupils Enrolled in Schools (per 10,000 inhabitants), 1863	85	1179	301	641	1909
Apprentices (per 10,000 inhabitants),1863	85	2.71	5.98	0	44.17
Share of Conscripts who could Read and Write, 1847-1856	85	0.63	0.18	0.31	0.96
Share of Conscripts who could Read and Write, 1859-1868	85	0.74	0.15	0.41	0.98
School buildings per Commune, 1850	85	1.88	1.34	1.01	12.22
Schools buildings per Commune, 1863	85	2.19	2.56	1.07	24.54
Total Public Spending on Primary Schooling per Inhabitant, 1855-1863 (in French Francs)	85	0.84	0.28	0.07	1.51
Commune Spending on Primary Schooling per Inhabitant, 1855-1863 (in French Francs)	85	0.65	0.24	0.07	1.27
Department Spending on Primary Schooling per Inhabitant, 1855-1863 (in French Francs)	85	0.08	0.05	0	0.33
Central State Spending on Primary Schooling per Inhabitant, 1855-1863 (in French Francs)	85	0.10	0.17	0	0.85
Explanatory Variables					
Number of Steam Engines	85	29.20	66.14	0	565
Number of Steam Engines per Inhabitant in 1841	85	0.00006	0.00007	0	0.0005
Average Rainfall	85	872.23	152.11	642.90	1289.24
Average Temperature	85	10.57	1.50	4.60	13.73
Latitude	85	46.59	2.12	42.60	50.49
Land Suitability	85	0.75	0.18	0.21	0.98
Share of Carboniferous Area	85	0.10	0.15	0	0.71
Maritime Department	85	0.26	0.44	0	1
Border Department	85	0.20	0.40	0	1
Distance to Paris	85	353.73	179.53	1	686.79
Paris and Suburbs	85	0.04	0.19	0	1
Grooms who Signed their Marriage License, 1786-1790	79	0.42	0.24	0.05	0.92
University	85	0.19	0.39	0	1
Urban Population in 1700	85	21.76	58.96	0	510
Instrumental Variables					
Distance to Fresnes (100 km)	85	4.85	2.17	0.43	8.63
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	85	-0.42	0.38	-1.07	0.55
Variables for Robustness Analysis and Falsification Testw					
Early Economic and Human Development					
Encyclopedie subscribers	85	82.84	146.36	0	1078
Fertility, 1806	85	0.41	0.11	0.25	0.84
Grooms who Signed their Marriage License, 1686-1690	76	25.90	14.87	6.27	64.25
Grooms who Signed their Marriage License, 1816-1820	78	50.61	22.14	13.35	96.28
Population Density, 1801	84	0.75	1.55	0.19	13.17
Population Density, 1821	85	0.85	1.94	0.21	17.15
Iron Forges, 1789	85	2.25	8.95	0	52
Iron Forges, 1811	85	2.65	11.34	0	79
Presence of Iron Forges, 1789	85	0.11	0.31	0	1
Presence of Iron Forges, 1811	85	0.11	0.31	0	1
Market Integration during the French Revolution	84	134.68	107.44	21	732
Railroad Connection to Paris, 1860	85	.73	0.45	0	1
Share of department's territory covered by mines, 1837	85	0.008	0.015	0.00009	0.086
Encyclopedie	85	82.84	146.36	0	1078
Share of department's territory covered by road network, 1837	85	1.57	0.97	0.05	5.47
Share of department's territory covered by water network, 1837	85	0.03	0.03	0	0.17
Wages, 1839-1847					
Average Male Wage, 1839-1847	85	194.40	34.02	145.60	342.57
Average Female Wage, 1839-1847	85	90.88	18.14	62.5	155.56
Averagel Child Wage, 1839-1847	85	64.44	13.81	40.96	111.27
Distance Variables					
Distance from London (100 km)	85	6.21	2.19	2.43	10.15
Distance from Marseille (100 km)	85	4.83	2.15	0.01	9.03
Distance from Lyon (100 km)	85	3.35	1.50	0.01	7.23
Distance from Rouen (100 km)	85	4.06	1.99	0.01	7.75
Distance from Mulhouse (100 km)	85	4.56	1.88	0.36	8.53
Distance from Bordeaux (100 km)	85	3.98	1.72	0.01	7.59
Distance from Fresnes (weeks of travel)	85	.471	0.185	0.045	0.862
Distance from Paris (weeks of travel)	85	0.389	0.168	0.003	0.693
Distance from Marseille (weeks of travel)	85	0.509	0.232	0.041	0.999
Distance from Lyon (weeks of travel)	85	0.427	.229	0.029	0.960
Distance from Mulhouse (weeks of travel)	85	0.641	0.292	0.012	1.126
Distance from Rouen (weeks of travel)	85	0.442	0.201	0.022	0.839
Distance from Bordeaux (weeks of travel)	85	0.513	0.265	0.002	1.125
Wheat Prices					
Prices in 1829-1833 (baseline 1814-1828)	85	-0.53	0.21	-0.98	-0.10
Deviation from Wheat Prices in 1824-1828 (baseline 1809-1823)	85	-0.69	0.28	-1.44	-0.25
Deviation from Wheat Prices in 1839-1843 (baseline 1824-1838)	85	0.81	0.95	-0.11	7.80
Deviation from Wheat Prices in 1844-1848 (baseline 1829-1843)	85	0.61	0.34	-0.21	1.23

Table A.2: Steam engines and workers per industrial sector: descriptive statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
Steam Engines per Sector					
Ceramics	85	0.53	2.95	0	25
Chemistry	85	0.84	3.30	0	18
Clothing	85	0.15	0.81	0	6
Construction	85	0.07	0.40	0	3
Food	85	4.33	20.68	0	182
Furniture	85	0	0	0	0
Leather	85	0.04	0.24	0	2
Lighting	85	0.06	0.45	0	4
Luxury Goods	85	0.02	0.22	0	2
Metal objects	85	1.51	5.07	0	32
Metallurgy	85	1.79	5.87	0	42
Mines	85	2.68	11.53	0	81
Sciences & Arts	85	0.22	1.13	0	9
Textile	85	9.94	30.52	0	223
Transportation	85	0.31	2.09	0	18
Wood	85	0.26	1.23	0	9
Number of Steam Engines (total)	85	29.20	66.14	0	565
Workers per Sector					
Ceramics	85	406.02	682.28	0	4186
Chemistry	85	113.74	304.24	0	2073
Clothing	85	320.56	730.68	0	4000
Construction	85	251.54	309.22	0	1302
Food	85	1781.06	2445.28	0	15461
Furniture	85	37.35	221.92	0	2000
Leather	85	105.45	137.88	0	716
Lighting	85	18.67	39.81	0	215
Luxury Goods	85	16.04	69.18	0	576
Metal objects	85	815.78	2204.08	0	14382
Metallurgy	85	607.16	867.90	0	4119
Mines	85	788.15	1441.53	0	10580
Sciences & Arts	85	309.58	406.33	0	2140
Textile	85	8132.78	18793.75	0	128780
Transportation	85	98.98	344.48	0	2791
Wood	85	47.85	127.78	0	812
Workers (All Sectors)	85	13850.71	21289.12	540	135825

Appendix B. Additional Robustness Analysis

Table B.1: The determinants of the diffusion of the steam engine: the insignificance of distances from other major French cities measured in travel weeks

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS
	Number of Steam Engines						
Distance from Fresnes (weeks of travel)	-2.858***	-3.828***	-2.772***	-3.077***	-2.834***	-2.944***	-2.655***
	[0.680]	[1.117]	[0.661]	[0.756]	[0.741]	[0.823]	[0.844]
Distance from Paris (weeks of travel)		1.314					
		[1.242]					
Distance from Marseille (weeks of travel)			0.489				
			[0.686]				
Distance from Lyon (weeks of travel)				0.558			
				[0.700]			
Distance from Rouen (weeks of travel)					-0.0485		
					[0.738]		
Distance from Mulhouse (weeks of travel)						0.129	
						[0.531]	
Distance from Bordeaux (weeks of travel)							0.302
							[0.577]
Adjusted R^2	0.147	0.146	0.144	0.145	0.137	0.137	0.139
Observations	85	85	85	85	85	85	85

Note: The dependent variable is in logarithm. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.2: The geographical diffusion of the steam engine: robustness analysis

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	Number of Steam Engines					
Distance to Fresnes	-0.696***	-0.696***	-0.641***	-0.642***	-0.623**	-0.685***
	[0.243]	[0.242]	[0.220]	[0.220]	[0.244]	[0.244]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.308***	-1.290***	-1.454***	-1.456***	-0.981***	-1.210***
	[0.339]	[0.334]	[0.325]	[0.325]	[0.349]	[0.351]
Average Rainfall	-1.412	-1.429*	-1.619*	-1.620*	-1.281	-1.358
	[0.849]	[0.839]	[0.855]	[0.855]	[0.799]	[0.831]
Average Temperature	1.875	1.862	1.994*	2.000*	1.780	1.841
	[1.206]	[1.199]	[1.148]	[1.149]	[1.187]	[1.158]
Latitude	-15.52**	-15.43*	-13.23*	-13.22*	-12.65	-14.38*
	[7.775]	[7.750]	[7.559]	[7.564]	[7.988]	[7.484]
Land Suitability	-0.783**	-0.767**	-0.832**	-0.836**	-0.752**	-0.791**
	[0.378]	[0.373]	[0.367]	[0.368]	[0.359]	[0.374]
Paris and Suburbs	0.00410	-0.0215	0.141	0.143	0.322	0.0157
	[0.760]	[0.760]	[0.599]	[0.598]	[0.506]	[0.571]
Share of Carboniferous Area	-0.0934	-0.118	-0.293	-0.297	0.387	-0.239
	[0.681]	[0.686]	[0.674]	[0.674]	[0.734]	[0.728]
Maritime Department	0.645**	0.627**	0.617**	0.617**	0.499*	0.609*
	[0.311]	[0.306]	[0.306]	[0.306]	[0.281]	[0.306]
Border Department	0.320	0.304	0.372	0.372	0.426	0.276
	[0.355]	[0.348]	[0.351]	[0.351]	[0.337]	[0.349]
Distance to Paris	0.331	0.339	0.347	0.349	0.312	0.331
	[0.239]	[0.237]	[0.222]	[0.222]	[0.226]	[0.236]
Population Density, 1801	0.121					
	[0.527]					
Population Density, 1821		0.153				
		[0.482]				
Iron Forges, 1789			0.218			
			[0.252]			
Presence of Iron Forges, 1789			-0.0110			
			[0.692]			
Iron Forges, 1811				0.214		
				[0.226]		
Presence of Iron Forges, 1811				-0.0129		
				[0.645]		
Market Integration during the French Revolution					0.405**	
					[0.154]	
Encyclopedie subscribers						0.000721
						[0.000852]
Adjusted R2	0.574	0.575	0.589	0.590	0.605	0.580
Observations	84	85	85	85	84	85

Note: The dependent variable and the explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.3: Industrialization and human capital formation: reduced form regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Reduced Form					
	Teachers 1840	Teachers 1863	Pupils per 10,000 inhabitants 1840	Pupils per 10,000 inhabitants 1863	Apprentices per 10,000 inhabitants 1863	Share of Conscripts who could Read and Write, 1859-1868
Distance to Fresnes	-0.296***	-0.240***	-0.294***	-0.137***	-0.753***	-0.107**
	[0.0823]	[0.0702]	[0.0821]	[0.0340]	[0.221]	[0.0461]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-0.328**	-0.316***	-0.215*	-0.0718	-0.0759	-0.119*
	[0.163]	[0.106]	[0.123]	[0.0661]	[0.326]	[0.0621]
Average Rainfall	1.244***	0.846***	0.990***	0.579***	0.925*	0.321***
	[0.275]	[0.226]	[0.246]	[0.118]	[0.500]	[0.119]
Average Temperature	-1.044***	-0.348	-1.716***	-0.998***	1.023	-0.480**
	[0.400]	[0.303]	[0.410]	[0.222]	[0.711]	[0.190]
Latitude	3.119	3.775**	1.137	-0.628	-1.335	-0.121
	[2.493]	[1.739]	[2.333]	[1.178]	[4.084]	[1.229]
Land Suitability	0.335**	0.183	0.419***	0.210**	0.106	0.207***
	[0.149]	[0.128]	[0.158]	[0.0854]	[0.324]	[0.0740]
Share of Carboniferous Area	-0.672**	-0.150	-0.901***	-0.470***	-0.413	-0.496**
	[0.282]	[0.225]	[0.285]	[0.152]	[0.498]	[0.198]
Maritime Department	-0.00365	0.00746	-0.194	-0.0448	0.127	-0.135**
	[0.160]	[0.0982]	[0.121]	[0.0557]	[0.252]	[0.0595]
Border Department	-0.0887	-0.173*	0.0268	0.0257	0.909***	0.0276
	[0.120]	[0.0903]	[0.114]	[0.0555]	[0.266]	[0.0621]
Distance to Paris	0.0999	0.0982*	0.0461	-0.0232	-0.135	0.0121
	[0.0829]	[0.0557]	[0.0699]	[0.0350]	[0.123]	[0.0391]
Paris and Suburbs	0.534***	0.690**	0.108	-0.0564	0.731	0.201**
	[0.146]	[0.285]	[0.293]	[0.182]	[0.543]	[0.0910]
Number of Steam Engines	0.320***	0.282***	0.268***	0.112***	0.473***	0.116***
	[0.0873]	[0.0517]	[0.0691]	[0.0287]	[0.145]	[0.0346]
R2	0.442	0.562	0.446	0.529	0.435	0.367
Observations	85	85	85	85	85	85

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.4: Industrialization and human capital formation, accounting for the distance between London and each department

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.372***	0.282***	0.360***	0.268***	0.179**	0.112***	0.0614**	0.473***	0.418***	0.116***	0.0843**
	[0.0873]	[0.105]	[0.0517]	[0.0636]	[0.0691]	[0.0735]	[0.0287]	[0.0294]	[0.145]	[0.145]	[0.0346]	[0.0399]
London		-0.0762		-0.119***		0.145**		0.0821**		0.110		0.0505
		[0.0603]		[0.0451]		[0.0706]		[0.0353]		[0.162]		[0.0344]
Average Rainfall	1.244***	1.364***	0.846***	1.029***	0.990***	0.773***	0.579***	0.456***	0.925*	0.773	0.321***	0.245**
	[0.275]	[0.306]	[0.226]	[0.254]	[0.246]	[0.228]	[0.118]	[0.111]	[0.500]	[0.519]	[0.119]	[0.110]
Average Temperature	-1.044***	-1.074**	-0.348	-0.397	-1.716***	-1.651***	-0.998***	-0.962***	1.023	1.082	-0.480**	-0.458***
	[0.400]	[0.419]	[0.303]	[0.318]	[0.410]	[0.361]	[0.222]	[0.195]	[0.711]	[0.706]	[0.190]	[0.175]
Latitude	3.119	1.055	3.775**	0.567	1.137	5.021*	-0.628	1.570	-1.335	1.559	-0.121	1.233
	[2.493]	[2.800]	[1.739]	[2.208]	[2.333]	[2.724]	[1.178]	[1.431]	[4.084]	[6.052]	[1.229]	[1.362]
Land Suitability	0.335**	0.338**	0.183	0.190	0.419***	0.409***	0.210**	0.204***	0.106	0.0940	0.207***	0.203***
	[0.149]	[0.154]	[0.128]	[0.127]	[0.158]	[0.137]	[0.0854]	[0.0753]	[0.324]	[0.332]	[0.0740]	[0.0684]
Share of Carboniferous Area	-0.672**	-0.713**	-0.150	-0.215	-0.901***	-0.823***	-0.470***	-0.426***	-0.413	-0.358	-0.496**	-0.469**
	[0.282]	[0.285]	[0.225]	[0.230]	[0.285]	[0.270]	[0.152]	[0.148]	[0.498]	[0.501]	[0.198]	[0.195]
Maritime Department	-0.00365	-0.0975	0.00746	-0.137	-0.194	-0.0217	-0.0448	0.0524	0.127	0.248	-0.135**	-0.0746
	[0.160]	[0.191]	[0.0982]	[0.131]	[0.121]	[0.123]	[0.0557]	[0.0552]	[0.252]	[0.290]	[0.0595]	[0.0653]
Border Department	-0.0887	-0.0791	-0.173*	-0.157*	0.0268	0.00650	0.0257	0.0143	0.909***	0.891***	0.0276	0.0207
	[0.120]	[0.123]	[0.0903]	[0.0914]	[0.114]	[0.0985]	[0.0555]	[0.0473]	[0.266]	[0.266]	[0.0621]	[0.0565]
Distance to Paris	0.0999	0.150	0.0982*	0.175**	0.0461	-0.0478	-0.0232	-0.0763*	-0.135	-0.206	0.0121	-0.0206
	[0.0829]	[0.104]	[0.0557]	[0.0737]	[0.0699]	[0.0841]	[0.0350]	[0.0395]	[0.123]	[0.163]	[0.0391]	[0.0481]
Paris and Suburbs	0.534***	0.560***	0.690**	0.732***	0.108	0.0552	-0.0564	-0.0862	0.731	0.687	0.201**	0.183**
	[0.146]	[0.149]	[0.285]	[0.277]	[0.293]	[0.255]	[0.182]	[0.158]	[0.543]	[0.532]	[0.0910]	[0.0810]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines											
Distance to Fresnes	-0.702***	-0.846***	-0.702***	-0.846***	-0.702***	-0.846***	-0.702***	-0.846***	-0.702***	-0.846***	-0.702***	-0.846***
	[0.243]	[0.283]	[0.243]	[0.283]	[0.243]	[0.283]	[0.243]	[0.283]	[0.243]	[0.283]	[0.243]	[0.283]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-1.411***	-1.309***	-1.411***	-1.309***	-1.411***	-1.309***	-1.411***	-1.309***	-1.411***	-1.309***	-1.411***
	[0.329]	[0.347]	[0.329]	[0.347]	[0.329]	[0.347]	[0.329]	[0.347]	[0.329]	[0.347]	[0.329]	[0.347]
F-stat (1^{st} stage)	16.661	14.052	16.661	14.052	16.661	14.052	16.661	14.052	16.661	14.052	16.661	14.052
Prob J-Stat	0.320	0.243	0.416	0.215	0.199	0.285	0.124	0.211	0.040	0.065	0.530	0.721

Note: Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance t the 5%-level, * indicates significance at the 10%-level.

Table B.5: Industrialization and human capital formation, accounting for grooms who could sign their marriage license in 1686-1690 and 1816-1820

	(1) IV	(2) IV	(3) IV	(4) IV	(5) IV	(6) IV	(7) IV	(8) IV	(9) IV	(10) IV	(11) IV	(12) IV	(13) IV	(14) IV	(15) IV	(16) IV	(17) IV	(18) IV
		Teachers 1840			Teachers 1863		Pupils (per 10,000 inhabitants) 1840			Pupils (per 10,000 inhabitants) 1863			Apprentices per 10,000 inhabitants 1863			Share of Conscripts who could Read and Write, 1859-1868		
Number of Steam Engines	0.320***	0.351***	0.272***	0.282***	0.315***	0.281***	0.268***	0.282***	0.206***	0.112***	0.125***	0.0896***	0.473***	0.492***	0.468***	0.116***	0.106***	0.0730***
	[0.0873]	[0.0902]	[0.0853]	[0.0517]	[0.0558]	[0.0577]	[0.0691]	[0.0649]	[0.0513]	[0.0287]	[0.0282]	[0.0271]	[0.145]	[0.160]	[0.166]	[0.0346]	[0.0307]	[0.0251]
Grooms who Signed their Marriage License, 1686-1690		0.921***			0.138			1.262***			0.305*			-0.262			0.822***	
		[0.348]			[0.295]			[0.323]			[0.165]			[0.827]			[0.148]	
Grooms who Signed their Marriage License, 1816-1820			1.128***			0.306			1.566***			0.504***			-0.473			0.829***
			[0.273]			[0.220]			[0.227]			[0.126]			[0.608]			[0.114]
Average Rainfall	1.244***	1.411***	0.813**	0.846***	0.856***	0.711**	0.990***	1.225***	0.398	0.579***	0.671***	0.393***	0.925*	1.023*	1.120*	0.321***	0.423***	-0.0331
	[0.275]	[0.298]	[0.338]	[0.226]	[0.247]	[0.287]	[0.246]	[0.272]	[0.312]	[0.118]	[0.124]	[0.145]	[0.500]	[0.545]	[0.664]	[0.119]	[0.133]	[0.160]
Average Temperature	-1.044***	-0.0959	-0.215	-0.348	-0.117	-0.230	-1.716***	-0.450	-0.536	-0.998***	-0.516***	-0.608***	1.023	1.300	0.675	-0.480**	0.0765	0.102
	[0.400]	[0.480]	[0.442]	[0.303]	[0.368]	[0.352]	[0.410]	[0.357]	[0.352]	[0.222]	[0.198]	[0.207]	[0.711]	[0.955]	[0.940]	[0.190]	[0.202]	[0.156]
Latitude	3.119	4.138	1.313	3.775**	4.063**	2.984	1.137	1.745	-2.138	-0.628	-0.636	-1.966*	-1.335	0.698	-0.0236	-0.121	-0.139	-1.794**
	[2.493]	[2.641]	[2.320]	[1.739]	[1.934]	[1.820]	[2.333]	[2.354]	[1.907]	[1.178]	[1.106]	[1.033]	[4.084]	[5.041]	[4.920]	[1.229]	[1.252]	[0.886]
Land Suitability	0.335**	0.264*	0.0577	0.183	0.137	0.0955	0.419***	0.325**	0.0129	0.210**	0.172**	0.0723	0.106	0.199	0.282	0.207***	0.170**	-0.00375
	[0.149]	[0.145]	[0.155]	[0.128]	[0.135]	[0.147]	[0.158]	[0.145]	[0.130]	[0.0854]	[0.0785]	[0.0779]	[0.324]	[0.356]	[0.399]	[0.0740]	[0.0672]	[0.0593]
Share of Carboniferous Area	-0.672**	-0.500	-0.224	-0.150	-0.0656	0.0766	-0.901***	-0.880***	-0.454*	-0.470***	-0.565***	-0.344**	-0.413	-0.643	-0.574	-0.496**	-0.371*	-0.240
	[0.282]	[0.326]	[0.302]	[0.225]	[0.265]	[0.243]	[0.285]	[0.292]	[0.248]	[0.152]	[0.154]	[0.139]	[0.498]	[0.579]	[0.600]	[0.198]	[0.196]	[0.163]
Maritime Department	-0.00365	-0.126	-0.0146	0.00746	-0.0216	0.0247	-0.194	-0.385***	-0.250**	-0.0448	-0.121**	-0.0573	0.127	0.0663	0.146	-0.135**	-0.201***	-0.144***
	[0.160]	[0.198]	[0.165]	[0.0982]	[0.126]	[0.112]	[0.121]	[0.133]	[0.108]	[0.0557]	[0.0578]	[0.0547]	[0.252]	[0.316]	[0.312]	[0.0595]	[0.0616]	[0.0469]
Border Department	-0.0887	-0.0531	-0.184	-0.173*	-0.119	-0.177**	0.0268	0.0123	-0.137*	0.0257	0.0272	-0.0364	0.909***	0.955***	0.962***	0.0276	-0.00569	-0.0655
	[0.120]	[0.111]	[0.121]	[0.0903]	[0.0870]	[0.0897]	[0.114]	[0.102]	[0.0817]	[0.0555]	[0.0548]	[0.0454]	[0.266]	[0.294]	[0.278]	[0.0621]	[0.0515]	[0.0434]
Distance to Paris	0.0999	0.128	0.0718	0.0982*	0.101	0.0855	0.0461	0.0721	-0.006	-0.0232	-0.0260	-0.0477	-0.135	-0.101	-0.115	0.0121	0.0270	-0.0138
	[0.0829]	[0.0924]	[0.0752]	[0.0557]	[0.0635]	[0.0551]	[0.0699]	[0.0719]	[0.0514]	[0.0350]	[0.0349]	[0.0296]	[0.123]	[0.145]	[0.142]	[0.0391]	[0.0388]	[0.028]
Paris and Suburbs	0.534***	0.402***	0.205	0.690**	0.339***	0.286**	0.108	0.218	-0.0455	-0.0564	0.0592	-0.0230	0.731	0.577	0.649	0.201**	0.145	0.0067
	[0.146]	[0.144]	[0.127]	[0.285]	[0.119]	[0.119]	[0.293]	[0.219]	[0.245]	[0.182]	[0.138]	[0.145]	[0.543]	[0.730]	[0.708]	[0.0910]	[0.0902]	[0.104]
Observations	85	76	78	85	76	78	85	76	78	85	76	78	85	76	78	85	76	78
	First stage: the instrumented variable is Number of Steam Engines																	
Distance to Fresnes	-0.702***	-0.691***	-0.595**	-0.702***	-0.691***	-0.595**	-0.702***	-0.691***	-0.595**	-0.702***	-0.691***	-0.595**	-0.702***	-0.691***	-0.595**	-0.702***	-0.691***	-0.595**
	[0.243]	[0.256]	[0.253]	[0.243]	[0.256]	[0.253]	[0.243]	[0.256]	[0.253]	[0.243]	[0.256]	[0.253]	[0.243]	[0.256]	[0.253]	[0.243]	[0.256]	[0.253]
Deviation from Wheat Prices in 1834-1838	-1.309***	-1.229***	-1.265***	-1.309***	-1.229***	-1.265***	-1.309***	-1.229***	-1.265***	-1.309***	-1.229***	-1.265***	-1.309***	-1.229***	-1.265***	-1.309***	-1.229***	-1.265***
(baseline 1819-1833)	[0.329]	[0.340]	[0.338]	[0.329]	[0.340]	[0.338]	[0.329]	[0.340]	[0.338]	[0.329]	[0.340]	[0.338]	[0.329]	[0.340]	[0.338]	[0.329]	[0.340]	[0.338]
F-stat (1^{st} stage)	16.661	13.906	13.554	16.661	13.906	13.554	16.661	13.906	13.554	16.661	13.906	13.554	16.661	13.906	13.554	16.661	13.906	13.554
Prob J-Stat	0.320	0.643	0.523	0.416	0.835	0.633	0.199	0.289	0.205	0.124	0.245	0.170	0.040	0.048	0.025	0.530	0.529	0.723

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.6: Industrialization per inhabitant in 1841 and human capital formation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***		0.282***		0.268***		0.112***		0.473***		0.116***	
	[0.0873]		[0.0517]		[0.0691]		[0.0287]		[0.145]		[0.0346]	
Numer of Steam Engines per 10,000 Inhabitants, 1841		1.041***		0.914***		0.879***		0.369***		1.590***		0.376***
		[0.326]		[0.203]		[0.263]		[0.103]		[0.461]		[0.130]
Average Rainfall	1.244***	1.311***	0.846***	0.903***	0.990***	1.049***	0.579***	0.604***	0.925*	1.043*	0.321***	0.345***
	[0.275]	[0.289]	[0.226]	[0.236]	[0.246]	[0.250]	[0.118]	[0.119]	[0.500]	[0.532]	[0.119]	[0.114]
Average Temperature	-1.044***	-0.977**	-0.348	-0.290	-1.716***	-1.657***	-0.998***	-0.973***	1.023	1.139*	-0.480**	-0.456**
	[0.400]	[0.409]	[0.303]	[0.331]	[0.410]	[0.382]	[0.222]	[0.206]	[0.711]	[0.659]	[0.190]	[0.184]
Latitude	3.119	4.245	3.775**	4.769**	1.137	2.076	-0.628	-0.236	-1.335	0.309	-0.121	0.286
	[2.493]	[2.836]	[1.739]	[2.068]	[2.333]	[2.492]	[1.178]	[1.239]	[4.084]	[3.964]	[1.229]	[1.323]
Land Suitability	0.335**	0.342**	0.183	0.190	0.419***	0.424**	0.210**	0.212**	0.106	0.111	0.207***	0.209**
	[0.149]	[0.171]	[0.128]	[0.147]	[0.158]	[0.172]	[0.0854]	[0.0892]	[0.324]	[0.314]	[0.0740]	[0.0827]
Share of Carboniferous Area	-0.672**	-0.796**	-0.150	-0.259	-0.901***	-1.007***	-0.470***	-0.515***	-0.413	-0.608	-0.496**	-0.541***
	[0.282]	[0.323]	[0.225]	[0.262]	[0.285]	[0.303]	[0.152]	[0.158]	[0.498]	[0.484]	[0.198]	[0.210]
Maritime Department	-0.0037	-0.0053	0.0075	0.0068	-0.194	-0.197	-0.0448	-0.0467	0.127	0.112	-0.135**	-0.135**
	[0.160]	[0.183]	[0.0982]	[0.118]	[0.121]	[0.135]	[0.0557]	[0.0606]	[0.252]	[0.242]	[0.0595]	[0.0666]
Border Department	-0.0887	-0.117	-0.173*	-0.198*	0.0268	0.0020	0.0257	0.0151	0.909***	0.862***	0.0276	0.0172
	[0.120]	[0.146]	[0.0903]	[0.111]	[0.114]	[0.120]	[0.0555]	[0.0543]	[0.266]	[0.252]	[0.0621]	[0.0618]
Distance to Paris	0.0999	0.106	0.0982*	0.104	0.0461	0.0516	-0.0232	-0.0209	-0.135	-0.124	0.0121	0.0144
	[0.0829]	[0.0946]	[0.0557]	[0.0652]	[0.0699]	[0.0754]	[0.0350]	[0.0366]	[0.123]	[0.124]	[0.0391]	[0.042]
Paris and Suburbs	0.534***	0.676***	0.690**	0.816**	0.108	0.227	-0.0564	-0.0064	0.731	0.943	0.201**	0.253***
	[0.146]	[0.209]	[0.285]	[0.377]	[0.293]	[0.229]	[0.182]	[0.153]	[0.543]	[0.604]	[0.0910]	[0.0870]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines											
Distance to Fresnes	-0.702***	-0.237**	-0.702***	-0.237**	-0.702***	-0.237**	-0.702***	-0.237**	-0.702***	-0.237**	-0.702***	-0.237**
	[0.243]	[0.102]	[0.243]	[0.102]	[0.243]	[0.102]	[0.243]	[0.102]	[0.243]	[0.102]	[0.243]	[0.102]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-0.380***	-1.309***	-0.380***	-1.309***	-0.380***	-1.309***	-0.380***	-1.309***	-0.380***	-1.309***	-0.380***
	[0.329]	[0.100]	[0.329]	[0.100]	[0.329]	[0.100]	[0.329]	[0.100]	[0.329]	[0.100]	[0.329]	[0.100]
F-stat (1^{st} stage)	16.661	13.481	16.661	13.481	16.661	13.481	16.661	13.481	16.661	13.481	16.661	13.481
Prob J-Stat	0.320	0.565	0.416	0.703	0.199	0.334	0.124	0.215	0.040	0.070	0.530	0.682

Note: Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance t the 5%-level, * indicates significance at the 10%-level.

Table B.7: Industrialization and human capital formation, accounting for iron forges before 1815

	(1) IV	(2) IV Teachers 1840	(3) IV	(4) IV	(5) IV Teachers 1863	(6) IV	(7) IV Pupils (per 10,000 inhabitants) 1840	(8) IV	(9) IV	(10) IV Pupils (per 10,000 inhabitants) 1863	(11) IV	(12) IV	(13) IV Apprentices per 10,000 inhabitants 1863	(14) IV	(15) IV	(16) IV Share of Conscripts who could Read and Write, 1859-1868	(17) IV	(18) IV
Number of Steam Engines	0.320***	0.307***	0.307***	0.282***	0.271***	0.271***	0.268***	0.233***	0.233***	0.112***	0.0948***	0.0949***	0.473***	0.449***	0.449***	0.116***	0.0984***	0.0984***
	[0.0873]	[0.0830]	[0.0829]	[0.0517]	[0.0488]	[0.0487]	[0.0691]	[0.0528]	[0.0528]	[0.0287]	[0.0237]	[0.0236]	[0.145]	[0.142]	[0.142]	[0.0346]	[0.0265]	[0.0265]
Iron Forges, 1789		0.0854			-0.0196			-0.0178			-0.0062			0.0449			-0.0141	
		[0.139]			[0.0922]			[0.0634]			[0.0354]			[0.151]			[0.0284]	
Presence of Iron Forges, 1789		-0.422			-0.0921			-0.465**			-0.226***			-0.0723			-0.245**	
		[0.395]			[0.252]			[0.193]			[0.0813]			[0.480]			[0.107]	
Iron Forges, 1811			0.0687			-0.0272			-0.0221			0.00053			0.0504			-0.0121
			[0.131]			[0.0863]			[0.0586]			[0.0344]			[0.135]			[0.0259]
Presence of Iron Forges, 1811			-0.382			-0.0704			-0.452**			-0.244***			-0.0899			-0.250**
			[0.375]			[0.241]			[0.183]			[0.0809]			[0.457]			[0.102]
Average Rainfall	1.244***	1.278***	1.279***	0.846***	0.875***	0.875***	0.990***	1.095***	1.095***	0.579***	0.628***	0.628***	0.925*	0.883*	0.883*	0.321***	0.381***	0.381***
	[0.275]	[0.262]	[0.263]	[0.226]	[0.225]	[0.224]	[0.246]	[0.208]	[0.208]	[0.118]	[0.0999]	[0.0998]	[0.500]	[0.511]	[0.511]	[0.119]	[0.101]	[0.101]
Average Temperature	-1.044***	-1.001**	-1.004**	-0.348	-0.337	-0.340	-1.716***	-1.661***	-1.663***	-0.998***	-0.972***	-0.971***	1.023	1.007	1.010	-0.480**	-0.450***	-0.449***
	[0.400]	[0.389]	[0.390]	[0.303]	[0.297]	[0.297]	[0.410]	[0.335]	[0.334]	[0.222]	[0.180]	[0.181]	[0.711]	[0.716]	[0.717]	[0.190]	[0.149]	[0.149]
Latitude	3.119	2.681	2.704	3.775**	3.507**	3.508**	1.137	0.135	0.134	-0.628	-1.101	-1.106	-1.335	-1.141	-1.137	-0.121	-0.681	-0.684
	[2.493]	[2.407]	[2.410]	[1.739]	[1.671]	[1.670]	[2.333]	[2.152]	[2.152]	[1.178]	[1.138]	[1.136]	[4.084]	[4.141]	[4.142]	[1.229]	[1.153]	[1.152]
Land Suitability	0.335**	0.336**	0.336**	0.183	0.190	0.191	0.419***	0.438***	0.439***	0.210**	0.219***	0.219***	0.106	0.111	0.110	0.207***	0.217***	0.217***
	[0.149]	[0.148]	[0.148]	[0.128]	[0.127]	[0.127]	[0.158]	[0.140]	[0.140]	[0.0854]	[0.0790]	[0.0790]	[0.324]	[0.323]	[0.324]	[0.0740]	[0.0634]	[0.0634]
Share of Carboniferous Area	-0.672**	-0.613**	-0.614**	-0.150	-0.108	-0.107	-0.901***	-0.751***	-0.750***	-0.470***	-0.399***	-0.399***	-0.413	-0.418	-0.419	-0.496**	-0.414**	-0.414**
	[0.282]	[0.280]	[0.280]	[0.225]	[0.218]	[0.218]	[0.285]	[0.244]	[0.244]	[0.152]	[0.120]	[0.120]	[0.498]	[0.498]	[0.499]	[0.198]	[0.169]	[0.169]
Maritime Department	-0.0037	0.0055	0.0052	0.0075	0.0147	0.0150	-0.194	-0.171	-0.170	-0.0448	-0.0336	-0.0337	0.127	0.145	0.145	-0.135**	-0.124**	-0.124**
	[0.160]	[0.155]	[0.155]	[0.0982]	[0.0944]	[0.0943]	[0.121]	[0.107]	[0.107]	[0.0557]	[0.0505]	[0.0505]	[0.252]	[0.250]	[0.250]	[0.0595]	[0.0535]	[0.0535]
Border Department	-0.0887	-0.0543	-0.0567	-0.173*	-0.161*	-0.162*	0.0268	0.0763	0.0755	0.0257	0.0496	0.0507	0.909***	0.918***	0.919***	0.0276	0.0538	0.0540
	[0.120]	[0.122]	[0.122]	[0.0903]	[0.0923]	[0.0922]	[0.114]	[0.0871]	[0.0869]	[0.0555]	[0.0443]	[0.0444]	[0.266]	[0.273]	[0.273]	[0.0621]	[0.0472]	[0.0471]
Distance to Paris	0.0999	0.0771	0.0783	0.0982*	0.0850	0.0852	0.0461	-2.62e-05	-2.56e-05	-0.0232	-0.0464	-0.0467	-0.135	-0.134	-0.134	0.0121	-0.0145	-0.0147
	[0.0829]	[0.0791]	[0.0792]	[0.0557]	[0.0528]	[0.0527]	[0.0699]	[0.0609]	[0.0608]	[0.0350]	[0.0328]	[0.0327]	[0.123]	[0.127]	[0.127]	[0.0391]	[0.0348]	[0.0348]
Paris and Suburbs	0.534***	0.486***	0.488***	0.690**	0.664**	0.665**	0.108	0.00731	0.00768	-0.0564	-0.104	-0.105	0.731	0.745	0.745	0.201**	0.146*	0.145*
	[0.146]	[0.144]	[0.145]	[0.285]	[0.285]	[0.285]	[0.293]	[0.272]	[0.272]	[0.182]	[0.174]	[0.174]	[0.543]	[0.546]	[0.546]	[0.0910]	[0.0786]	[0.0785]
Observations	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines																	
Distance to Fresnes	-0.702***	-0.641***	-0.642***	-0.702***	-0.641***	-0.642***	-0.702***	-0.641***	-0.642***	-0.702***	-0.641***	-0.642***	-0.702***	-0.641***	-0.642***	-0.702***	-0.641***	-0.642***
	[0.243]	[0.220]	[0.220]	[0.243]	[0.220]	[0.220]	[0.243]	[0.220]	[0.220]	[0.243]	[0.220]	[0.220]	[0.243]	[0.220]	[0.220]	[0.243]	[0.220]	[0.220]
Deviation from Wheat Prices in 1834-1838	-1.309***	-1.454***	-1.456***	-1.309***	-1.454***	-1.456***	-1.309***	-1.454***	-1.456***	-1.309***	-1.454***	-1.456***	-1.309***	-1.454***	-1.456***	-1.309***	-1.454***	-1.456***
(baseline 1819-1833)	[0.329]	[0.325]	[0.325]	[0.329]	[0.325]	[0.325]	[0.329]	[0.325]	[0.325]	[0.329]	[0.325]	[0.325]	[0.329]	[0.325]	[0.325]	[0.329]	[0.325]	[0.325]
F-stat (1^{st} stage)	16.661	18.991	18.997	16.661	18.991	18.997	16.661	18.991	18.997	16.661	18.991	18.997	16.661	18.991	18.997	16.661	18.991	18.997
Prob J-Stat	0.320	0.118	0.119	0.416	0.197	0.198	0.199	0.003	0.003	0.124	0.003	0.003	0.040	0.043	0.043	0.530	0.018	0.018

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.8: Industrialization and human capital formation, accounting for mines in 1837

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.383***	0.282***	0.315***	0.268***	0.381***	0.112***	0.138***	0.473***	0.449**	0.116***	0.157***
	[0.0873]	[0.127]	[0.0517]	[0.0760]	[0.0691]	[0.0988]	[0.0287]	[0.0385]	[0.145]	[0.214]	[0.0346]	[0.0477]
Share of department's territory covered by mines, 1837		-0.0454		-0.0235		-0.0819***		-0.0189		0.0138		-0.0299**
		[0.0359]		[0.0242]		[0.0314]		[0.0129]		[0.0708]		[0.0148]
Average Rainfall	1.244***	1.206***	0.846***	0.826***	0.990***	0.922***	0.579***	0.563***	0.925*	0.931*	0.321***	0.296**
	[0.275]	[0.285]	[0.226]	[0.228]	[0.246]	[0.287]	[0.118]	[0.128]	[0.500]	[0.503]	[0.119]	[0.134]
Average Temperature	-1.044***	-1.210***	-0.348	-0.434	-1.716***	-2.015***	-0.998***	-1.067***	1.023	1.069	-0.480**	-0.589***
	[0.400]	[0.414]	[0.303]	[0.299]	[0.410]	[0.464]	[0.222]	[0.244]	[0.711]	[0.766]	[0.190]	[0.220]
Latitude	3.119	3.505	3.775**	3.976**	1.137	1.832	-0.628	-0.465	-1.335	-1.428	-0.121	0.132
	[2.493]	[2.655]	[1.739]	[1.827]	[2.333]	[2.810]	[1.178]	[1.277]	[4.084]	[4.137]	[1.229]	[1.418]
Land Suitability	0.335**	0.378**	0.183	0.206	0.419***	0.498***	0.210**	0.229**	0.106	0.0948	0.207***	0.235***
	[0.149]	[0.153]	[0.128]	[0.126]	[0.158]	[0.178]	[0.0854]	[0.0919]	[0.324]	[0.321]	[0.0740]	[0.0803]
Share of Carboniferous Area	-0.672**	-0.473	-0.150	-0.0471	-0.901***	-0.543*	-0.470***	-0.387**	-0.413	-0.471	-0.496**	-0.366*
	[0.282]	[0.327]	[0.225]	[0.240]	[0.285]	[0.301]	[0.152]	[0.166]	[0.498]	[0.595]	[0.198]	[0.206]
Maritime Department	-0.0037	-0.0154	0.0075	0.0014	-0.194	-0.215	-0.0448	-0.0495	0.127	0.134	-0.135**	-0.143**
	[0.160]	[0.172]	[0.0982]	[0.103]	[0.121]	[0.149]	[0.0557]	[0.0624]	[0.252]	[0.253]	[0.0595]	[0.0709]
Border Department	-0.0887	-0.151	-0.173*	-0.205**	0.0268	-0.0847	0.0257	7.12e-05	0.909***	0.929***	0.0276	-0.0131
	[0.120]	[0.135]	[0.0903]	[0.0963]	[0.114]	[0.139]	[0.0555]	[0.0642]	[0.266]	[0.262]	[0.0621]	[0.0720]
Distance to Paris	0.0999	0.143	0.0982*	0.120*	0.0461	0.124	-0.0232	-5.38e-05	-0.135	-0.148	0.0121	0.0403
	[0.0829]	[0.0947]	[0.0557]	[0.0631]	[0.0699]	[0.0822]	[0.0350]	[0.0368]	[0.123]	[0.136]	[0.0391]	[0.0458]
Paris and Suburbs	0.534***	0.551***	0.690**	0.699**	0.108	0.138	-0.0564	-0.0494	0.731	0.728	0.201**	0.212**
	[0.146]	[0.149]	[0.285]	[0.293]	[0.293]	[0.305]	[0.182]	[0.184]	[0.543]	[0.534]	[0.0910]	[0.103]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
First stage: the instrumented variable is Number of Steam Engines												
Distance to Fresnes	-0.702***	-0.530**	-0.702***	-0.530**	-0.702***	-0.530**	-0.702***	-0.530**	-0.702***	-0.530**	-0.702***	-0.530**
	[0.243]	[0.207]	[0.243]	[0.207]	[0.243]	[0.207]	[0.243]	[0.207]	[0.243]	[0.207]	[0.243]	[0.207]
Deviation from Wheat Prices in 1834-1838	-1.309***	-1.020***	-1.309***	-1.020***	-1.309***	-1.020***	-1.309***	-1.020***	-1.309***	-1.020***	-1.309***	-1.020***
(baseline 1819-1833)	[0.329]	[0.317]	[0.329]	[0.317]	[0.329]	[0.317]	[0.329]	[0.317]	[0.329]	[0.317]	[0.329]	[0.317]
F-stat (1^{st} stage)	16.661	12.278	16.661	12.278	16.661	12.278	16.661	12.278	16.661	12.278	16.661	12.278
Prob J-Stat	0.320	0.326	0.416	0.422	0.199	0.212	0.124	0.136	0.040	0.038	0.530	0.521

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.9: Industrialization and human capital formation, accounting for market integration during the French Revolution

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.305***	0.282***	0.217***	0.268***	0.318***	0.112***	0.150***	0.473***	0.492**	0.116***	0.121***
	[0.0873]	[0.111]	[0.0517]	[0.0653]	[0.0691]	[0.100]	[0.0287]	[0.0451]	[0.145]	[0.204]	[0.0346]	[0.0451]
Market Integration during the French Revolution		0.0324		0.132*		-0.0923		-0.0747		0.0321		-0.0096
		[0.0932]		[0.0714]		[0.0972]		[0.0501]		[0.187]		[0.0444]
Average Rainfall	1.244***	1.199***	0.846***	0.762***	0.990***	1.030***	0.579***	0.597***	0.925*	1.027**	0.321***	0.321***
	[0.275]	[0.270]	[0.226]	[0.205]	[0.246]	[0.268]	[0.118]	[0.134]	[0.500]	[0.511]	[0.119]	[0.123]
Average Temperature	-1.044***	-1.006***	-0.348	-0.248	-1.716***	-1.769***	-0.998***	-1.038***	1.023	1.027	-0.480**	-0.483***
	[0.400]	[0.383]	[0.303]	[0.237]	[0.410]	[0.424]	[0.222]	[0.232]	[0.711]	[0.727]	[0.190]	[0.187]
Latitude	3.119	3.386	3.775**	4.252***	1.137	0.930	-0.628	-0.715	-1.335	-1.912	-0.121	-0.116
	[2.493]	[2.469]	[1.739]	[1.484]	[2.333]	[2.571]	[1.178]	[1.313]	[4.084]	[3.963]	[1.229]	[1.267]
Land Suitability	0.335**	0.336**	0.183	0.154	0.419***	0.446***	0.210**	0.237***	0.106	0.0582	0.207***	0.211***
	[0.149]	[0.145]	[0.128]	[0.102]	[0.158]	[0.154]	[0.0854]	[0.0771]	[0.324]	[0.327]	[0.0740]	[0.0730]
Share of Carboniferous Area	-0.672**	-0.654**	-0.150	-0.0272	-0.901***	-1.000***	-0.470***	-0.555***	-0.413	-0.349	-0.496**	-0.509**
	[0.282]	[0.284]	[0.225]	[0.208]	[0.285]	[0.311]	[0.152]	[0.168]	[0.498]	[0.529]	[0.198]	[0.199]
Maritime Department	-0.0037	-0.0286	0.0075	-0.0239	-0.194	-0.192	-0.0448	-0.0485	0.127	0.153	-0.135**	-0.138**
	[0.160]	[0.160]	[0.0982]	[0.0893]	[0.121]	[0.131]	[0.0557]	[0.0605]	[0.252]	[0.252]	[0.0595]	[0.0609]
Border Department	-0.0887	-0.0820	-0.173*	-0.113	0.0268	-0.0235	0.0257	-0.0178	0.909***	0.943***	0.0276	0.0209
	[0.120]	[0.133]	[0.0903]	[0.100]	[0.114]	[0.127]	[0.0555]	[0.0632]	[0.266]	[0.300]	[0.0621]	[0.0645]
Distance to Paris	0.0999	0.112	0.0982*	0.111**	0.0461	0.0454	-0.0232	-0.0204	-0.135	-0.159	0.0121	0.0135
	[0.0829]	[0.0834]	[0.0557]	[0.0506]	[0.0699]	[0.0769]	[0.0350]	[0.0387]	[0.123]	[0.123]	[0.0391]	[0.0402]
Paris and Suburbs	0.534***	0.554***	0.690**	0.764***	0.108	0.0568	-0.0564	-0.0956	0.731	0.729	0.201**	0.196*
	[0.146]	[0.164]	[0.285]	[0.260]	[0.293]	[0.302]	[0.182]	[0.178]	[0.543]	[0.539]	[0.0910]	[0.100]
Observations	85	84	85	84	85	84	85	84	85	84	85	84
	First stage: the instrumented variable is Number of Steam Engines											
Distance to Fresnes	-0.702***	-0.623**	-0.702***	-0.623**	-0.702***	-0.623**	-0.702***	-0.623**	-0.702***	-0.623**	-0.702***	-0.623**
	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-0.981***	-1.309***	-0.981***	-1.309***	-0.981***	-1.309***	-0.981***	-1.309***	-0.981***	-1.309***	-0.981***
	[0.329]	[0.349]	[0.329]	[0.349]	[0.329]	[0.349]	[0.329]	[0.349]	[0.329]	[0.349]	[0.329]	[0.349]
F-stat (1^{st} stage)	16.661	8.854	16.661	8.854	16.661	8.854	16.661	8.854	16.661	8.854	16.661	8.854
Prob J-Stat	0.320	0.252	0.416	0.144	0.199	0.303	0.124	0.222	0.040	0.043	0.530	0.537

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.10: Industrialization and human capital formation, accounting for the share of the road and water network in each department in 1837

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers 1840					Teachers 1863			Pupils (per 10,000 inhabitants) 1840				Pupils (per 10,000 inhabitants) 1863				Apprentices per 10,000 inhabitants 1863				Share of Conscripts who could Read and Write, 1859-1868			
Number of Steam Engines	0.320***	0.319***	0.330***	0.324***	0.282***	0.282***	0.245***	0.242***	0.268***	0.268***	0.340***	0.340***	0.112***	0.112***	0.135***	0.134***	0.473***	0.473***	0.446***	0.447***	0.116***	0.116***	0.138***	0.138***
	[0.0873]	[0.0841]	[0.102]	[0.0984]	[0.0517]	[0.0500]	[0.0612]	[0.0579]	[0.0691]	[0.0689]	[0.0796]	[0.0799]	[0.0287]	[0.0282]	[0.0323]	[0.0323]	[0.145]	[0.145]	[0.166]	[0.168]	[0.0346]	[0.0346]	[0.0375]	[0.0377]
Share of department's territory covered by road network, 1837		0.167**		0.165*		0.0896		0.107*		0.0340		0.0024		0.0336		0.0237		-0.0152		-0.0032		-0.0010		-0.0109
		[0.0842]		[0.0871]		[0.0680]		[0.0596]		[0.0834]		[0.0867]		[0.0439]		[0.0457]		[0.144]		[0.145]		[0.0391]		[0.0422]
Share of department's territory covered by water network, 1837			-0.799	-0.404			2.967*	3.225**			-5.734*	-5.729*			-1.856	-1.800			2.217	2.204			-1.762	-1.789
			[2.203]	[2.332]			[1.579]	[1.609]			[3.002]	[3.003]			[1.278]	[1.296]			[3.333]	[3.402]			[1.219]	[1.221]
Average Rainfall	1.244***	1.207***	1.268***	1.220***	0.846***	0.826***	0.758***	0.726***	0.990***	0.983***	1.161***	1.161***	0.579***	0.572***	0.635***	0.628***	0.925*	0.928*	0.859	0.861	0.321***	0.321***	0.374***	0.377***
	[0.275]	[0.267]	[0.275]	[0.256]	[0.226]	[0.224]	[0.213]	[0.200]	[0.246]	[0.252]	[0.280]	[0.287]	[0.118]	[0.123]	[0.125]	[0.131]	[0.500]	[0.505]	[0.528]	[0.538]	[0.119]	[0.120]	[0.130]	[0.134]
Average Temperature	-1.044***	-1.556***	-1.004**	-1.529***	-0.348	-0.623*	-0.495	-0.837**	-1.716***	-1.820***	-1.431***	-1.438**	-0.998***	-1.101***	-0.906***	-0.981***	1.023	1.070	0.913	0.924	-0.480**	-0.477*	-0.393*	-0.358
	[0.400]	[0.437]	[0.428]	[0.482]	[0.303]	[0.370]	[0.309]	[0.342]	[0.410]	[0.522]	[0.447]	[0.560]	[0.222]	[0.289]	[0.232]	[0.304]	[0.711]	[0.898]	[0.706]	[0.908]	[0.190]	[0.244]	[0.206]	[0.265]
Latitude	3.119	2.875	3.189	2.913	3.775**	3.644**	3.513**	3.333**	1.137	1.087	1.642	1.638	-0.628	-0.677	-0.464	-0.504	-1.335	-1.314	-1.534	-1.530	-0.121	-0.119	0.0348	0.0530
	[2.493]	[2.486]	[2.551]	[2.535]	[1.739]	[1.702]	[1.680]	[1.657]	[2.333]	[2.334]	[2.590]	[2.594]	[1.178]	[1.182]	[1.273]	[1.274]	[4.084]	[4.096]	[4.134]	[4.152]	[1.229]	[1.227]	[1.282]	[1.285]
Land Suitability	0.335**	0.326**	0.327**	0.323**	0.183	0.179	0.210*	0.207**	0.419***	0.417**	0.368**	0.368**	0.210**	0.209**	0.194**	0.193**	0.106	0.107	0.126	0.126	0.207***	0.207***	0.191**	0.191***
	[0.149]	[0.149]	[0.155]	[0.154]	[0.128]	[0.116]	[0.116]	[0.102]	[0.158]	[0.164]	[0.156]	[0.157]	[0.0854]	[0.0910]	[0.0811]	[0.0853]	[0.324]	[0.325]	[0.316]	[0.317]	[0.0740]	[0.0738]	[0.0742]	[0.0730]
Share of Carboniferous Area	-0.672**	-0.761***	-0.685**	-0.767***	-0.150	-0.198	-0.0985	-0.152	-0.901***	-0.919***	-1.000***	-1.001***	-0.470***	-0.488***	-0.502***	-0.514***	-0.413	-0.405	-0.375	-0.373	-0.496**	-0.496**	-0.527***	-0.522***
	[0.282]	[0.287]	[0.285]	[0.286]	[0.225]	[0.213]	[0.211]	[0.195]	[0.285]	[0.286]	[0.306]	[0.302]	[0.152]	[0.148]	[0.154]	[0.150]	[0.498]	[0.498]	[0.508]	[0.505]	[0.198]	[0.202]	[0.200]	[0.202]
Maritime Department	-0.0037	0.0710	-0.0106	0.0664	0.0075	0.0475	0.0328	0.0830	-0.194	-0.178	-0.243*	-0.242	-0.0448	-0.0298	-0.0608	-0.0498	0.127	0.120	0.145	0.144	-0.135**	-0.135**	-0.150**	-0.155**
	[0.160]	[0.167]	[0.169]	[0.178]	[0.0982]	[0.105]	[0.0981]	[0.103]	[0.121]	[0.133]	[0.136]	[0.149]	[0.0557]	[0.0648]	[0.0598]	[0.0690]	[0.252]	[0.264]	[0.256]	[0.272]	[0.0595]	[0.0665]	[0.0645]	[0.0720]
Border Department	-0.0887	-0.120	-0.0871	-0.118	-0.173*	-0.189**	-0.179**	-0.199**	0.0268	0.0205	0.0387	0.0382	0.0257	0.0195	0.0296	0.0251	0.909***	0.912***	0.905***	0.905***	0.0276	0.0278	0.0313	0.0333
	[0.120]	[0.122]	[0.120]	[0.122]	[0.0903]	[0.0886]	[0.0865]	[0.0850]	[0.114]	[0.115]	[0.122]	[0.121]	[0.0555]	[0.0557]	[0.0590]	[0.0586]	[0.266]	[0.268]	[0.265]	[0.267]	[0.0621]	[0.0613]	[0.0644]	[0.0631]
Distance to Paris	0.0999	0.123	0.100	0.123	0.0982*	0.111**	0.0978*	0.113**	0.0461	0.0508	0.0469	0.0473	-0.0232	-0.0186	-0.0229	-0.0197	-0.135	-0.137	-0.135	-0.135	0.0121	0.0119	0.0123	0.0108
	[0.0829]	[0.0816]	[0.0838]	[0.0817]	[0.0557]	[0.0544]	[0.0530]	[0.0511]	[0.0699]	[0.0709]	[0.0749]	[0.0759]	[0.0350]	[0.0347]	[0.0373]	[0.0369]	[0.123]	[0.125]	[0.123]	[0.124]	[0.0391]	[0.0399]	[0.0402]	[0.000411]
Paris and Suburbs	0.534***	0.523***	0.564***	0.538***	0.690**	0.685**	0.578***	0.562***	0.108	0.106	0.324	0.324	-0.0564	-0.0586	0.0136	0.00998	0.731	0.732	0.647	0.648	0.201**	0.201**	0.268**	0.269**
	[0.146]	[0.159]	[0.171]	[0.182]	[0.285]	[0.314]	[0.193]	[0.216]	[0.293]	[0.288]	[0.250]	[0.250]	[0.182]	[0.176]	[0.153]	[0.153]	[0.543]	[0.538]	[0.569]	[0.568]	[0.0910]	[0.0909]	[0.111]	[0.109]
Observations	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines																							
Distance to Fresnes	-0.702***	-0.703***	-0.633***	-0.632***	-0.702***	-0.703***	-0.633***	-0.632***	-0.702***	-0.703***	-0.633***	-0.632***	-0.702***	-0.703***	-0.633***	-0.632***	-0.702***	-0.703***	-0.633***	-0.632***	-0.702***	-0.703***	-0.633***	-0.632***
	[0.243]	[0.243]	[0.232]	[0.230]	[0.243]	[0.243]	[0.232]	[0.230]	[0.243]	[0.243]	[0.232]	[0.230]	[0.243]	[0.243]	[0.232]	[0.230]	[0.243]	[0.243]	[0.232]	[0.230]	[0.243]	[0.243]	[0.232]	[0.230]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-1.307***	-1.174***	-1.168***	-1.309***	-1.307***	-1.174***	-1.168***	-1.309***	-1.307***	-1.174***	-1.168***	-1.309***	-1.307***	-1.174***	-1.168***	-1.309***	-1.307***	-1.174***	-1.168***	-1.309***	-1.307***	-1.174***	-1.168***
	[0.329]	[0.333]	[0.312]	[0.317]	[0.329]	[0.333]	[0.312]	[0.317]	[0.329]	[0.333]	[0.312]	[0.317]	[0.329]	[0.333]	[0.312]	[0.317]	[0.329]	[0.333]	[0.312]	[0.317]	[0.329]	[0.333]	[0.312]	[0.317]
F-stat (1^{st} stage)	16.661	16.466	13.834	13.614	16.661	16.466	13.834	13.614	16.661	16.466	13.834	13.614	16.661	16.466	13.834	13.614	16.661	16.466	13.834	13.614	16.661	16.466	13.834	13.614
Prob J-Stat	0.320	0.298	0.321	0.299	0.416	0.388	0.393	0.362	0.199	0.201	0.201	0.202	0.124	0.125	0.133	0.132	0.040	0.041	0.038	0.039	0.530	0.530	0.527	0.526

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.11: Industrialization and human capital formation, accounting for railroad connection to Paris in 1860

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.328***	0.282***	0.308***	0.268***	0.256***	0.112***	0.108***	0.473***	0.580***	0.116***	0.106***
	[0.0873]	[0.0909]	[0.0517]	[0.0533]	[0.0691]	[0.0715]	[0.0287]	[0.0295]	[0.145]	[0.135]	[0.0346]	[0.0334]
Railroad Connection to Paris, 1860		-0.0406		-0.196***		0.126		0.0454		-0.758***		0.0898
		[0.118]		[0.0748]		[0.114]		[0.0528]		[0.230]		[0.0587]
Average Rainfall	1.244***	1.263***	0.846***	0.924***	0.990***	0.945***	0.579***	0.564***	0.925*	1.234**	0.321***	0.287***
	[0.275]	[0.286]	[0.226]	[0.227]	[0.246]	[0.237]	[0.118]	[0.115]	[0.500]	[0.515]	[0.119]	[0.110]
Average Temperature	-1.044***	-0.997**	-0.348	-0.125	-1.716***	-1.856***	-0.998***	-1.048***	1.023	1.889**	-0.480**	-0.581***
	[0.400]	[0.429]	[0.303]	[0.274]	[0.410]	[0.432]	[0.222]	[0.226]	[0.711]	[0.746]	[0.190]	[0.203]
Latitude	3.119	3.018	3.775**	3.333*	1.137	1.400	-0.628	-0.536	-1.335	-3.083	-0.121	0.0743
	[2.493]	[2.537]	[1.739]	[1.837]	[2.333]	[2.266]	[1.178]	[1.151]	[4.084]	[3.776]	[1.229]	[1.181]
Land Suitability	0.335**	0.338**	0.183	0.205*	0.419***	0.404***	0.210**	0.205**	0.106	0.186	0.207***	0.196***
	[0.149]	[0.151]	[0.128]	[0.118]	[0.158]	[0.143]	[0.0854]	[0.0800]	[0.324]	[0.282]	[0.0740]	[0.0645]
Share of Carboniferous Area	-0.672**	-0.695**	-0.150	-0.259	-0.901***	-0.832***	-0.470***	-0.445***	-0.413	-0.838*	-0.496**	-0.447**
	[0.282]	[0.294]	[0.225]	[0.230]	[0.285]	[0.278]	[0.152]	[0.152]	[0.498]	[0.465]	[0.198]	[0.199]
Maritime Department	-0.00365	-0.0171	0.00746	-0.0497	-0.194	-0.160	-0.0448	-0.0334	0.127	-0.100	-0.135**	-0.110*
	[0.160]	[0.170]	[0.0982]	[0.105]	[0.121]	[0.123]	[0.0557]	[0.0539]	[0.252]	[0.253]	[0.0595]	[0.0576]
Border Department	-0.0887	-0.0845	-0.173*	-0.150*	0.0268	0.0111	0.0257	0.0199	0.909***	0.996***	0.0276	0.0168
	[0.120]	[0.120]	[0.0903]	[0.0903]	[0.114]	[0.114]	[0.0555]	[0.0560]	[0.266]	[0.250]	[0.0621]	[0.0626]
Distance to Paris	0.0999	0.0964	0.0982*	0.0804	0.0461	0.0578	-0.0232	-0.0190	-0.135	-0.203*	0.0121	0.0203
	[0.0829]	[0.0835]	[0.0557]	[0.0580]	[0.0699]	[0.0685]	[0.0350]	[0.0349]	[0.123]	[0.118]	[0.0391]	[0.0382]
Paris and Suburbs	0.534***	0.529***	0.690**	0.668**	0.108	0.120	-0.0564	-0.0522	0.731	0.643	0.201**	0.211**
	[0.146]	[0.146]	[0.285]	[0.276]	[0.293]	[0.286]	[0.182]	[0.180]	[0.543]	[0.567]	[0.0910]	[0.0860]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines											
Distance to Fresnes	-0.702***	-0.722***	-0.702***	-0.722***	-0.702***	-0.722***	-0.702***	-0.722***	-0.702***	-0.722***	-0.702***	-0.722***
	[0.243]	[0.250]	[0.243]	[0.250]	[0.243]	[0.250]	[0.243]	[0.250]	[0.243]	[0.250]	[0.243]	[0.250]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-1.216***	-1.309***	-1.216***	-1.309***	-1.216***	-1.309***	-1.216***	-1.309***	-1.216***	-1.309***	-1.216***
	[0.329]	[0.344]	[0.329]	[0.344]	[0.329]	[0.344]	[0.329]	[0.344]	[0.329]	[0.344]	[0.329]	[0.344]
F-stat (1^{st} stage)	16.661	15.144	16.661	15.144	16.661	15.144	16.661	15.144	16.661	15.144	16.661	15.144
Prob J-Stat	0.320	0.371	0.416	0.884	0.199	0.094	0.124	0.080	0.040	0.059	0.530	0.253

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.12: Industrialization and human capital formation, accounting for population density in the 19^{th} century

	(1) IV	(2) IV Teachers 1840	(3) IV	(4) IV	(5) IV Teachers 1863	(6) IV	(7) IV Pupils (per 10,000 inhabitants) 1840	(8) IV	(9) IV	(10) IV Pupils (per 10,000 inhabitants) 1863	(11) IV	(12) IV	(13) IV Apprentices per 10,000 inhabitants 1863	(14) IV	(15) IV	(16) IV Share of Conscripts who could Read and Write, 1859-1868	(17) IV	(18) IV
Number of Steam Engines	0.320***	0.299***	0.303***	0.282***	0.250***	0.251***	0.268***	0.274***	0.277***	0.112***	0.114***	0.117***	0.473***	0.479***	0.467***	0.116***	0.112***	0.113***
	[0.0873]	[0.0859]	[0.0862]	[0.0517]	[0.0478]	[0.0477]	[0.0691]	[0.0703]	[0.0710]	[0.0287]	[0.0297]	[0.0303]	[0.145]	[0.149]	[0.151]	[0.0346]	[0.0343]	[0.0345]
Population Density, 1801		0.255***			0.432***			-0.106			-0.0592			0.0556			0.0410	
		[0.0987]			[0.0827]			[0.261]			[0.162]			[0.202]			[0.0804]	
Population Density, 1821			0.226**			0.395***			-0.118			-0.0682			0.0861			0.0307
			[0.0995]			[0.0627]			[0.238]			[0.149]			[0.200]			[0.0759]
Average Rainfall	1.244***	1.182***	1.230***	0.846***	0.766***	0.820***	0.990***	1.000***	0.998***	0.579***	0.572***	0.584***	0.925*	1.008**	0.920*	0.321***	0.312***	0.319***
	[0.275]	[0.273]	[0.271]	[0.226]	[0.209]	[0.211]	[0.246]	[0.248]	[0.247]	[0.118]	[0.118]	[0.118]	[0.500]	[0.502]	[0.503]	[0.119]	[0.120]	[0.119]
Average Temperature	-1.044***	-1.109***	-1.110***	-0.348	-0.466*	-0.463	-1.716***	-1.684***	-1.681***	-0.998***	-0.976***	-0.978***	1.023	0.970	0.998	-0.480**	-0.491**	-0.489**
	[0.400]	[0.398]	[0.402]	[0.303]	[0.282]	[0.290]	[0.410]	[0.413]	[0.410]	[0.222]	[0.224]	[0.222]	[0.711]	[0.713]	[0.715]	[0.190]	[0.193]	[0.193]
Latitude	3.119	2.894	2.660	3.775**	3.249**	2.974*	1.137	1.323	1.375	-0.628	-0.451	-0.490	-1.335	-1.956	-1.514	-0.121	-0.163	-0.183
	[2.493]	[2.346]	[2.349]	[1.739]	[1.546]	[1.554]	[2.333]	[2.526]	[2.540]	[1.178]	[1.314]	[1.339]	[4.084]	[4.073]	[4.106]	[1.229]	[1.221]	[1.223]
Land Suitability	0.335**	0.341**	0.328**	0.183	0.185*	0.172	0.419***	0.422***	0.423***	0.210**	0.216***	0.212**	0.106	0.0749	0.103	0.207***	0.207***	0.206***
	[0.149]	[0.146]	[0.145]	[0.128]	[0.109]	[0.112]	[0.158]	[0.156]	[0.155]	[0.0854]	[0.0833]	[0.0828]	[0.324]	[0.324]	[0.321]	[0.0740]	[0.0750]	[0.0744]
Share of Carboniferous Area	-0.672**	-0.707***	-0.708***	-0.150	-0.200	-0.214	-0.901***	-0.892***	-0.882***	-0.470***	-0.470***	-0.459***	-0.413	-0.381	-0.427	-0.496**	-0.502**	-0.501**
	[0.282]	[0.265]	[0.266]	[0.225]	[0.188]	[0.192]	[0.285]	[0.290]	[0.293]	[0.152]	[0.153]	[0.155]	[0.498]	[0.499]	[0.496]	[0.198]	[0.198]	[0.198]
Maritime Department	-0.0037	-0.0106	0.0077	0.0075	0.0079	0.0274	-0.194	-0.198	-0.200	-0.0448	-0.0536	-0.0484	0.127	0.176	0.131	-0.135**	-0.135**	-0.133**
	[0.160]	[0.161]	[0.157]	[0.0982]	[0.0921]	[0.0915]	[0.121]	[0.124]	[0.123]	[0.0557]	[0.0564]	[0.0565]	[0.252]	[0.254]	[0.253]	[0.0595]	[0.0603]	[0.0592]
Border Department	-0.0887	-0.102	-0.0927	-0.173*	-0.190**	-0.180**	0.0268	0.0287	0.0288	0.0257	0.0238	0.0269	0.909***	0.931***	0.908***	0.0276	0.0257	0.0271
	[0.120]	[0.120]	[0.119]	[0.0903]	[0.0856]	[0.0874]	[0.114]	[0.114]	[0.114]	[0.0555]	[0.0553]	[0.0555]	[0.266]	[0.263]	[0.266]	[0.0621]	[0.0625]	[0.0621]
Distance to Paris	0.0999	0.108	0.0946	0.0982*	0.105**	0.0888*	0.0461	0.0472	0.0490	-0.0232	-0.0191	-0.0216	-0.135	-0.161	-0.137	0.0121	0.0130	0.0113
	[0.0829]	[0.0803]	[0.0785]	[0.0557]	[0.0502]	[0.0497]	[0.0699]	[0.0736]	[0.0741]	[0.0350]	[0.0369]	[0.0380]	[0.123]	[0.123]	[0.123]	[0.0391]	[0.0390]	[0.0386]
Paris and Suburbs	0.534***	0.363**	0.363**	0.690**	0.397***	0.392***	0.108	0.181	0.197	-0.0564	-0.0140	-0.00491	0.731	0.682	0.666	0.201**	0.174	0.178
	[0.146]	[0.155]	[0.161]	[0.285]	[0.113]	[0.102]	[0.293]	[0.326]	[0.323]	[0.182]	[0.203]	[0.203]	[0.543]	[0.610]	[0.611]	[0.0910]	[0.115]	[0.116]
Observations	85	84	85	85	84	85	85	84	85	85	84	85	85	84	85	85	84	85
First stage: the instrumented variable is Number of Steam Engines																		
Distance to Fresnes	-0.702***	-0.696***	-0.696***	-0.702***	-0.696***	-0.696***	-0.702***	-0.696***	-0.696***	-0.702***	-0.696***	-0.696***	-0.702***	-0.696***	-0.696***	-0.702***	-0.696***	-0.696***
	[0.243]	[0.243]	[0.242]	[0.243]	[0.243]	[0.242]	[0.243]	[0.243]	[0.242]	[0.243]	[0.243]	[0.242]	[0.243]	[0.243]	[0.242]	[0.243]	[0.243]	[0.242]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-1.308***	-1.290***	-1.309***	-1.308***	-1.290***	-1.309***	-1.308***	-1.290***	-1.309***	-1.308***	-1.290***	-1.309***	-1.308***	-1.290***	-1.309***	-1.308***	-1.290***
	[0.329]	[0.339]	[0.334]	[0.329]	[0.339]	[0.334]	[0.329]	[0.339]	[0.334]	[0.329]	[0.339]	[0.334]	[0.329]	[0.339]	[0.334]	[0.329]	[0.339]	[0.334]
F-stat (1^{st} stage)	16.661	16.060	15.978	16.661	16.060	15.978	16.661	16.060	15.978	16.661	16.060	15.978	16.661	16.060	15.978	16.661	16.060	15.978
Prob J-Stat	0.320	0.239	0.292	0.416	0.227	0.312	0.199	0.204	0.206	0.124	0.112	0.131	0.040	0.048	0.039	0.530	0.503	0.524

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.13: Industrialization and human capital formation, accounting for fertility in 1806

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.287***	0.282***	0.265***	0.268***	0.240***	0.112***	0.0978***	0.473***	0.433***	0.116***	0.100***
	[0.0873]	[0.0824]	[0.0517]	[0.0506]	[0.0691]	[0.0658]	[0.0287]	[0.0275]	[0.145]	[0.145]	[0.0346]	[0.0344]
Fertility, 1806		-1.480***		-0.780**		-1.237***		-0.620***		-1.660**		-0.696***
		[0.445]		[0.331]		[0.445]		[0.224]		[0.738]		[0.205]
Average Rainfall	1.244***	1.289***	0.846***	0.869***	0.990***	1.027***	0.579***	0.598***	0.925*	0.972**	0.321***	0.342**
	[0.275]	[0.277]	[0.226]	[0.225]	[0.246]	[0.255]	[0.118]	[0.123]	[0.500]	[0.479]	[0.119]	[0.135]
Average Temperature	-1.044***	-0.841**	-0.348	-0.241	-1.716***	-1.546***	-0.998***	-0.913***	1.023	1.249**	-0.480**	-0.385**
	[0.400]	[0.328]	[0.303]	[0.242]	[0.410]	[0.334]	[0.222]	[0.190]	[0.711]	[0.622]	[0.190]	[0.186]
Latitude	3.119	3.808*	3.775**	4.138***	1.137	1.715	-0.628	-0.338	-1.335	-0.548	-0.121	0.203
	[2.493]	[2.143]	[1.739]	[1.582]	[2.333]	[2.061]	[1.178]	[1.079]	[4.084]	[4.061]	[1.229]	[1.089]
Land Suitability	0.335**	0.158	0.183	0.0902	0.419***	0.272	0.210**	0.136	0.106	-0.0907	0.207***	0.124
	[0.149]	[0.157]	[0.128]	[0.116]	[0.158]	[0.195]	[0.0854]	[0.105]	[0.324]	[0.297]	[0.0740]	[0.0900]
Share of Carboniferous Area	-0.672**	-0.312	-0.150	0.0396	-0.901***	-0.600*	-0.470***	-0.319*	-0.413	-0.0085	-0.496**	-0.327
	[0.282]	[0.299]	[0.225]	[0.229]	[0.285]	[0.326]	[0.152]	[0.164]	[0.498]	[0.479]	[0.198]	[0.203]
Maritime Department	-0.0037	0.0329	0.0075	0.0268	-0.194	-0.163	-0.0448	-0.0293	0.127	0.170	-0.135**	-0.118**
	[0.160]	[0.143]	[0.0982]	[0.0933]	[0.121]	[0.112]	[0.0557]	[0.0541]	[0.252]	[0.243]	[0.0595]	[0.0549]
Border Department	-0.0887	-0.0867	-0.173*	-0.172*	0.0268	0.0285	0.0257	0.0266	0.909***	0.912***	0.0276	0.0285
	[0.120]	[0.119]	[0.0903]	[0.0900]	[0.114]	[0.104]	[0.0555]	[0.0515]	[0.266]	[0.242]	[0.0621]	[0.0578]
Distance to Paris	0.0999	0.104	0.0982*	0.101**	0.0461	0.0499	-0.0232	-0.0213	-0.135	-0.130	0.0121	0.0142
	[0.0829]	[0.0709]	[0.0557]	[0.0500]	[0.0699]	[0.0607]	[0.0350]	[0.0317]	[0.123]	[0.120]	[0.0391]	[0.0347]
Paris and Suburbs	0.534***	0.535***	0.690**	0.691**	0.108	0.109	-0.0564	-0.0560	0.731	0.733	0.201**	0.202***
	[0.146]	[0.157]	[0.285]	[0.307]	[0.293]	[0.242]	[0.182]	[0.157]	[0.543]	[0.542]	[0.0910]	[0.0711]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
First stage: the instrumented variable is Horse Power of Steam Engines												
Distance to Fresnes	-0.702***	-0.676***	-0.702***	-0.676***	-0.702***	-0.676***	-0.702***	-0.676***	-0.702***	-0.676***	-0.702***	-0.676***
	[0.243]	[0.235]	[0.243]	[0.235]	[0.243]	[0.235]	[0.243]	[0.235]	[0.243]	[0.235]	[0.243]	[0.235]
Deviation from Wheat Prices in 1834-1838	-1.309***	-1.293***	-1.309***	-1.293***	-1.309***	-1.293***	-1.309***	-1.293***	-1.309***	-1.293***	-1.309***	-1.293***
(baseline 1819-1833)	[0.329]	[0.338]	[0.329]	[0.338]	[0.329]	[0.338]	[0.329]	[0.338]	[0.329]	[0.338]	[0.329]	[0.338]
F-stat (1^{st} stage)	16.661	15.496	16.661	15.496	16.661	15.496	16.661	15.496	16.661	15.496	16.661	15.496
Prob J-Stat	0.320	0.384	0.416	0.483	0.199	0.236	0.124	0.145	0.040	0.041	0.530	0.632

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.14: The effect of industrialization on wages, 1839-1847

	(1) OLS Average Male Wage, 1839-1847	(2) OLS Average Female Wage, 1839-1847	(3) OLS Average Child Wage, 1839-1847
Number of Steam Engines	0.0615***	0.0645***	0.0526**
	[0.0132]	[0.0157]	[0.0214]
Average Rainfall	-0.0385	0.292	0.0844
	[0.136]	[0.179]	[0.197]
Average Temperature	-0.0698	0.134	0.0531
	[0.125]	[0.157]	[0.184]
Latitude	-2.136**	0.178	-1.441
	[0.820]	[1.217]	[1.317]
Land Suitability	0.0776	0.0282	0.0772
	[0.0688]	[0.0932]	[0.0924]
Share of Carboniferous Area	-0.0105	-0.192	-0.0479
	[0.158]	[0.240]	[0.238]
Maritime Department	0.0026	-0.0427	-0.0061
	[0.0446]	[0.058]	[0.0586]
Border Department	0.0515	-0.0246	-0.0468
	[0.0497]	[0.0584]	[0.0699]
Distance to Paris	-0.0263	-0.061	-0.0291
	[0.027]	[0.039]	[0.042]
Paris and Suburbs	0.343***	0.363***	0.297***
	[0.0986]	[0.0739]	[0.0891]
Adjusted R2	0.349	0.235	0.163
Observations	85	85	85

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.15: Industrialization and human capital formation, accounting for wages in 1839-1847

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.284**	0.282***	0.288***	0.268***	0.242**	0.112***	0.101**	0.473***	0.608***	0.116***	0.0628
	[0.0873]	[0.130]	[0.0517]	[0.0795]	[0.0691]	[0.114]	[0.0287]	[0.0419]	[0.145]	[0.203]	[0.0346]	[0.0441]
Average Male Wage, 1839-1847		-0.582		-0.693		-0.596		-0.393		-1.814		-0.190
		[0.519]		[0.431]		[0.607]		[0.294]		[1.252]		[0.266]
Average Female Wage, 1839-1847		0.452		0.233		0.227		0.0294		0.101		0.403**
		[0.419]		[0.328]		[0.447]		[0.224]		[1.021]		[0.186]
Average Child Wage, 1839-1847		0.243		0.304		0.431		0.366*		0.693		0.0624
		[0.368]		[0.267]		[0.384]		[0.196]		[0.763]		[0.163]
noengine3947	0.628*	0.515	0.357**	0.346	0.537**	0.465	0.181	0.156	0.898**	1.166**	0.274**	0.131
	[0.326]	[0.416]	[0.166]	[0.215]	[0.258]	[0.317]	[0.113]	[0.118]	[0.417]	[0.539]	[0.116]	[0.135]
Average Rainfall	1.244***	1.038***	0.846***	0.719***	0.990***	0.838***	0.579***	0.509***	0.925*	0.837	0.321***	0.154
	[0.275]	[0.290]	[0.226]	[0.232]	[0.246]	[0.259]	[0.118]	[0.130]	[0.500]	[0.616]	[0.119]	[0.116]
Average Temperature	-1.044***	-1.182***	-0.348	-0.449	-1.716***	-1.831***	-0.998***	-1.060***	1.023	0.898	-0.480**	-0.579***
	[0.400]	[0.391]	[0.303]	[0.300]	[0.410]	[0.379]	[0.222]	[0.199]	[0.711]	[0.709]	[0.190]	[0.175]
Latitude	3.119	2.285	3.775**	2.721	1.137	0.565	-0.628	-0.877	-1.335	-4.542	-0.121	-0.342
	[2.493]	[2.614]	[1.739]	[1.736]	[2.333]	[2.724]	[1.178]	[1.341]	[4.084]	[5.287]	[1.229]	[1.343]
Land Suitability	0.335**	0.358**	0.183	0.209	0.419***	0.434***	0.210**	0.216**	0.106	0.169	0.207***	0.217***
	[0.149]	[0.145]	[0.128]	[0.131]	[0.158]	[0.159]	[0.0854]	[0.0862]	[0.324]	[0.340]	[0.0740]	[0.0694]
Share of Carboniferous Area	-0.672**	-0.571**	-0.150	-0.0962	-0.901***	-0.836***	-0.470***	-0.447***	-0.413	-0.398	-0.496**	-0.408**
	[0.282]	[0.268]	[0.225]	[0.226]	[0.285]	[0.282]	[0.152]	[0.143]	[0.498]	[0.555]	[0.198]	[0.186]
Maritime Department	-0.0037	0.0408	0.0075	0.0257	-0.194	-0.161	-0.0448	-0.0297	0.127	0.0910	-0.135**	-0.0905*
	[0.160]	[0.162]	[0.0982]	[0.0973]	[0.121]	[0.120]	[0.0557]	[0.0518]	[0.252]	[0.269]	[0.0595]	[0.0517]
Border Department	-0.0887	-0.0298	-0.173*	-0.116	0.0268	0.0887	0.0257	0.0669	0.909***	1.023***	0.0276	0.0579
	[0.120]	[0.122]	[0.0903]	[0.0908]	[0.114]	[0.110]	[0.0555]	[0.0517]	[0.266]	[0.272]	[0.0621]	[0.0522]
Distance to Paris	0.0999	0.0928	0.0982*	0.0898*	0.0461	0.0430	-0.0232	-0.0235	-0.135	-0.158	0.0121	-0.0094
	[0.0829]	[0.0752]	[0.0557]	[0.0497]	[0.0699]	[0.0657]	[0.0350]	[0.0335]	[0.123]	[0.127]	[0.0391]	[0.0349]
Paris and Suburbs	0.534***	0.508***	0.690**	0.755**	0.108	0.111	-0.0564	-0.0361	0.731	1.088	0.201**	0.114
	[0.146]	[0.178]	[0.285]	[0.308]	[0.293]	[0.307]	[0.182]	[0.179]	[0.543]	[0.767]	[0.0910]	[0.0918]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Number of Steam Engines											
Distance to Fresnes	-0.702***	-0.650**	-0.702***	-0.650**	-0.702***	-0.650**	-0.702***	-0.650**	-0.702***	-0.650**	-0.702***	-0.650**
	[0.243]	[0.273]	[0.243]	[0.273]	[0.243]	[0.273]	[0.243]	[0.273]	[0.243]	[0.273]	[0.243]	[0.273]
Deviation from Wheat Prices in 1834-1838	-1.309***	-1.054***	-1.309***	-1.054***	-1.309***	-1.054***	-1.309***	-1.054***	-1.309***	-1.054***	-1.309***	-1.054***
(baseline 1819-1833)	[0.329]	[0.365]	[0.329]	[0.365]	[0.329]	[0.365]	[0.329]	[0.365]	[0.329]	[0.365]	[0.329]	[0.365]
F-stat (1^{st} stage)	16.661	7.727	16.661	7.727	16.661	7.727	16.661	7.727	16.661	7.727	16.661	7.727
Prob J-Stat	0.320	0.223	0.416	0.415	0.199	0.135	0.124	0.099	0.040	0.047	0.530	0.164

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table B.16: Industrialization and human capital formation, accounting for the upper tail of the human capital distribution in the 18^{th} century

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
	Teachers				Pupils (per 10,000 inhabitants)				Apprentices per 10,000 inhabitants		Share of Conscripts who could	
	1840		1863		1840		1863		1863		Read and Write, 1859-1868	
Number of Steam Engines	0.320***	0.286***	0.282***	0.231***	0.268***	0.282***	0.112***	0.125***	0.473***	0.509***	0.116***	0.101***
	[0.0873]	[0.0923]	[0.0517]	[0.0516]	[0.0691]	[0.0771]	[0.0287]	[0.0316]	[0.145]	[0.168]	[0.0346]	[0.0340]
Encyclopedie subscribers		0.000466**		0.000694***		-0.000164		-0.000165		-0.000376		0.000196
		[0.000223]		[0.000246]		[0.000310]		[0.000153]		[0.000539]		[0.000121]
Average Rainfall	1.244***	1.246***	0.846***	0.847***	0.990***	0.992***	0.579***	0.580***	0.925*	0.933*	0.321***	0.322***
	[0.275]	[0.271]	[0.226]	[0.221]	[0.246]	[0.250]	[0.118]	[0.123]	[0.500]	[0.501]	[0.119]	[0.113]
Average Temperature	-1.044***	-1.029**	-0.348	-0.326	-1.716***	-1.720***	-0.998***	-1.003***	1.023	1.017	-0.480**	-0.474**
	[0.400]	[0.404]	[0.303]	[0.300]	[0.410]	[0.414]	[0.222]	[0.225]	[0.711]	[0.718]	[0.190]	[0.186]
Latitude	3.119	3.375	3.775**	4.162***	1.137	1.035	-0.628	-0.726	-1.335	-1.582	-0.121	-0.0122
	[2.493]	[2.410]	[1.739]	[1.615]	[2.333]	[2.398]	[1.178]	[1.207]	[4.084]	[4.060]	[1.229]	[1.216]
Land Suitability	0.335**	0.294**	0.183	0.123	0.419***	0.433***	0.210**	0.224**	0.106	0.136	0.207***	0.190***
	[0.149]	[0.141]	[0.128]	[0.123]	[0.158]	[0.163]	[0.0854]	[0.0889]	[0.324]	[0.334]	[0.0740]	[0.0678]
Share of Carboniferous Area	-0.672**	-0.774***	-0.150	-0.302	-0.901***	-0.865***	-0.470***	-0.434***	-0.413	-0.333	-0.496**	-0.540***
	[0.282]	[0.246]	[0.225]	[0.203]	[0.285]	[0.304]	[0.152]	[0.163]	[0.498]	[0.542]	[0.198]	[0.185]
Maritime Department	-0.0037	0.00396	0.0075	0.0197	-0.194	-0.198	-0.0448	-0.0487	0.127	0.114	-0.135**	-0.131**
	[0.160]	[0.154]	[0.0982]	[0.0891]	[0.121]	[0.123]	[0.0557]	[0.0571]	[0.252]	[0.256]	[0.0595]	[0.0559]
Border Department	-0.0887	-0.0904	-0.173*	-0.175**	0.0268	0.0268	0.0257	0.0260	0.909***	0.909***	0.0276	0.0269
	[0.120]	[0.112]	[0.0903]	[0.0766]	[0.114]	[0.116]	[0.0555]	[0.0573]	[0.266]	[0.262]	[0.0621]	[0.0601]
Distance to Paris	0.0999	0.0946	0.0982*	0.0902*	0.0461	0.0482	-0.0232	-0.0212	-0.135	-0.130	0.0121	0.0098
	[0.0829]	[0.0792]	[0.0557]	[0.0512]	[0.0699]	[0.0714]	[0.0350]	[0.0362]	[0.123]	[0.126]	[0.0391]	[0.0371]
Paris and Suburbs	0.534***	0.478***	0.690**	0.608***	0.108	0.127	-0.0564	-0.0371	0.731	0.773	0.201**	0.178*
	[0.146]	[0.143]	[0.285]	[0.212]	[0.293]	[0.282]	[0.182]	[0.171]	[0.543]	[0.580]	[0.0910]	[0.0942]
Observations	85	85	85	85	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Horse Power of Steam Engines											
Distance to Fresnes	-0.702***	-0.685***	-0.702***	-0.685***	-0.702***	-0.685***	-0.702***	-0.685***	-0.702***	-0.685***	-0.702***	-0.685***
	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]	[0.243]	[0.244]
Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833)	-1.309***	-1.210***	-1.309***	-1.210***	-1.309***	-1.210***	-1.309***	-1.210***	-1.309***	-1.210***	-1.309***	-1.210***
	[0.329]	[0.351]	[0.329]	[0.351]	[0.329]	[0.351]	[0.329]	[0.351]	[0.329]	[0.351]	[0.329]	[0.351]
F-stat (1^{st} stage)	16.661	13.258	16.661	13.258	16.661	13.258	16.661	13.258	16.661	13.258	16.661	13.258
Prob J-Stat	0.320	0.227	0.416	0.213	0.199	0.227	0.124	0.172	0.040	0.043	0.530	0.412

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix C. Literacy of Conscripts, 1847-1856

Table C.1: The effect of industrialization on the share of literate conscripts, 1847-1856

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Share of Conscripts who could Read and Write, 1847-1856									
Number of Steam Engines	0.0723**	0.0573**	0.0550**	0.0630**	0.0523*	0.0405**	0.151***	0.160***	0.168***	0.0973***
	[0.0280]	[0.0277]	[0.0259]	[0.0254]	[0.0285]	[0.0189]	[0.0456]	[0.0449]	[0.0513]	[0.0368]
Average Rainfall		0.207	0.374**	0.358**	0.393**	0.0793	0.475***	0.435***	0.391**	0.166
		[0.170]	[0.158]	[0.158]	[0.168]	[0.169]	[0.153]	[0.153]	[0.165]	[0.169]
Average Temperature		-1.071***	-0.776***	-0.738***	-0.770***	-0.134	-0.700***	-0.631***	-0.725***	-0.0895
		[0.261]	[0.207]	[0.205]	[0.206]	[0.264]	[0.215]	[0.208]	[0.213]	[0.246]
Latitude		0.0946	0.870	0.799	0.880	-0.531	0.419	0.308	0.350	-0.636
		[0.703]	[1.752]	[1.814]	[1.749]	[1.575]	[1.605]	[1.746]	[1.706]	[1.398]
Land Suitability		0.482***	0.313***	0.315***	0.312***	0.141	0.281***	0.286***	0.285***	0.127
		[0.131]	[0.0980]	[0.0972]	[0.0975]	[0.108]	[0.0931]	[0.0914]	[0.0936]	[0.0995]
Share of Carboniferous Area			-0.604**	-0.633**	-0.603**	-0.473**	-0.631***	-0.687***	-0.639***	-0.491**
			[0.260]	[0.256]	[0.263]	[0.234]	[0.235]	[0.228]	[0.246]	[0.208]
Maritime Department			-0.0501	-0.0541	-0.0528	-0.120*	-0.121	-0.124	-0.112	-0.168**
			[0.0675]	[0.0687]	[0.0676]	[0.0701]	[0.0790]	[0.0799]	[0.0810]	[0.0766]
Border Department			0.0894	0.0977	0.0912	-0.0511	0.0685	0.0866	0.0593	-0.0533
			[0.0637]	[0.0634]	[0.0635]	[0.0526]	[0.0752]	[0.0714]	[0.0773]	[0.0531]
Distance to Paris			0.0167	0.0175	0.0161	0.0125	0.0219	0.0232	0.0246	0.0173
			[0.0512]	[0.0522]	[0.0510]	[0.0437]	[0.0499]	[0.0517]	[0.0520]	[0.0402]
Paris and Suburbs			0.341***	0.346***	0.339***	0.125	0.309***	0.320***	0.318***	0.140
			[0.0994]	[0.107]	[0.0990]	[0.0823]	[0.117]	[0.121]	[0.114]	[0.101]
University				-0.0720				-0.145**		
				[0.0657]				[0.0735]		
Urban Population in 1700					0.00489				-0.0229	
					[0.0178]				[0.0185]	
Grooms who Signed their Marriage License, 1786-1790						0.810***				0.782***
						[0.195]				[0.190]
Adjusted R2	0.070	0.331	0.436	0.436	0.429	0.625				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Horse Power of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.409	0.509	0.395	0.307

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix D. Schools Buildings and Public Spending on Education

Table D.1: The effect of industrialization on public spending on education, 1855-1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Total Public Spending on Primary Schooling per Inhabitant, 1855-1863									
Number of Steam Engines	-0.0130	-0.0280**	-0.0248*	-0.0148	-0.0123	-0.0232**	0.0136	0.0227	0.0394*	-0.00363
	[0.0132]	[0.0137]	[0.0138]	[0.0127]	[0.0119]	[0.00961]	[0.0178]	[0.0175]	[0.0226]	[0.0151]
Average Rainfall		0.0776	0.190**	0.169**	0.103	0.0485	0.230***	0.199**	0.102	0.0786
		[0.0875]	[0.0809]	[0.0823]	[0.0832]	[0.0842]	[0.0791]	[0.0818]	[0.0814]	[0.0813]
Average Temperature		-0.700***	-0.513***	-0.466***	-0.540***	-0.210	-0.483***	-0.425***	-0.520***	-0.194
		[0.175]	[0.157]	[0.157]	[0.148]	[0.161]	[0.162]	[0.162]	[0.153]	[0.155]
Latitude		-0.360	-1.682***	-1.771***	-1.729**	-2.299***	-1.862***	-1.960***	-1.966***	-2.335***
		[0.367]	[0.599]	[0.666]	[0.666]	[0.598]	[0.553]	[0.671]	[0.672]	[0.549]
Land Suitability		0.248**	0.146*	0.148*	0.151**	0.0439	0.133*	0.137*	0.139**	0.0387
		[0.101]	[0.0817]	[0.0775]	[0.0752]	[0.0760]	[0.0754]	[0.0701]	[0.0658]	[0.0694]
Share of Carboniferous Area			-0.296***	-0.332***	-0.302***	-0.212**	-0.306***	-0.353***	-0.319***	-0.218***
			[0.105]	[0.105]	[0.105]	[0.0859]	[0.0953]	[0.0966]	[0.102]	[0.0789]
Maritime Department			-0.00831	-0.0133	0.00372	-0.0352	-0.0367	-0.0403	-0.0227	-0.0515
			[0.0310]	[0.0339]	[0.0324]	[0.0331]	[0.0341]	[0.0370]	[0.0384]	[0.0333]
Border Department			0.0588**	0.0692**	0.0507*	0.0117	0.0504	0.0649**	0.0365	0.0109
			[0.0289]	[0.0269]	[0.0273]	[0.0294]	[0.0307]	[0.0270]	[0.0316]	[0.0277]
Distance to Paris			-0.0484***	-0.0474**	-0.0460**	-0.0518***	-0.0463***	-0.0452**	-0.0422**	-0.0502***
			[0.0172]	[0.0185]	[0.0183]	[0.0168]	[0.0172]	[0.0191]	[0.0198]	[0.0157]
Paris and Suburbs			-0.100	-0.0951	-0.0903	0.0300	-0.114	-0.105	-0.0999	0.0349
			[0.190]	[0.169]	[0.164]	[0.0352]	[0.190]	[0.163]	[0.154]	[0.0406]
University				-0.0906**				-0.119***		
				[0.0366]				[0.0382]		
Urban Population in 1700					-0.0223**				-0.0348***	
					[0.0104]				[0.0119]	
Grooms who Signed their Marriage License, 1786-1790						0.357***				0.347***
						[0.0724]				[0.0708]
Adjusted R2	0.001	0.346	0.427	0.469	0.464	0.670				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.005	0.007	0.004	0.003

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table D.2: The effect of industrialization on spending by communes, 1855-1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Commune Spending on Primary Schooling per Inhabitant, 1855-1863									
Number of Steam Engines	0.0145	-0.0117	-0.00446	0.00319	0.00308	-0.00267	0.0472**	0.0535***	0.0695***	0.0326*
	[0.0112]	[0.0143]	[0.0132]	[0.0121]	[0.0116]	[0.00959]	[0.0188]	[0.0183]	[0.0257]	[0.0176]
Average Rainfall		0.105	0.204**	0.188**	0.151	0.101	0.258***	0.228***	0.150	0.155**
		[0.0957]	[0.0898]	[0.0912]	[0.103]	[0.0890]	[0.0821]	[0.0853]	[0.104]	[0.0756]
Average Temperature		-0.386***	-0.142	-0.106	-0.159	0.143	-0.102	-0.0505	-0.133	0.171
		[0.139]	[0.120]	[0.116]	[0.118]	[0.127]	[0.122]	[0.116]	[0.118]	[0.121]
Latitude		0.435	-0.593	-0.661	-0.622	-1.091*	-0.835	-0.915	-0.926	-1.156*
		[0.326]	[0.613]	[0.686]	[0.641]	[0.639]	[0.645]	[0.758]	[0.727]	[0.651]
Land Suitability		0.266***	0.173**	0.175**	0.176***	0.0939	0.156**	0.160**	0.160***	0.0846
		[0.0808]	[0.0696]	[0.0680]	[0.0663]	[0.0639]	[0.0656]	[0.0630]	[0.0595]	[0.0587]
Share of Carboniferous Area			-0.228**	-0.256***	-0.232**	-0.185**	-0.242***	-0.284***	-0.253***	-0.197***
			[0.0927]	[0.0905]	[0.0937]	[0.0772]	[0.0793]	[0.0785]	[0.0906]	[0.0643]
Maritime Department			-0.0536	-0.0574	-0.0463	-0.0869**	-0.0918**	-0.0937**	-0.0803*	-0.116***
			[0.0333]	[0.0359]	[0.0343]	[0.0338]	[0.0398]	[0.0430]	[0.0429]	[0.0415]
Border Department			0.0579*	0.0659*	0.0530	0.00973	0.0467	0.0602*	0.0347	0.00837
			[0.0327]	[0.0340]	[0.0330]	[0.0330]	[0.0365]	[0.0358]	[0.0396]	[0.0333]
Distance to Paris			-0.0403**	-0.0395**	-0.0388**	-0.0422**	-0.0375*	-0.0366*	-0.0339	-0.0392**
			[0.0180]	[0.0195]	[0.0189]	[0.0185]	[0.0198]	[0.0219]	[0.0225]	[0.0192]
Paris and Suburbs			-0.0956	-0.0914	-0.0894	0.0376	-0.113	-0.105	-0.102	0.0464
			[0.182]	[0.167]	[0.166]	[0.0414]	[0.191]	[0.166]	[0.160]	[0.0579]
University				-0.0694*				-0.107***		
				[0.0362]				[0.0375]		
Urban Population in 1700					-0.0135				-0.0295**	
					[0.0109]				[0.0136]	
Grooms who Signed their Marriage License, 1786-1790						0.306***				0.289***
						[0.0618]				[0.0628]
Adjusted R2	0.007	0.297	0.386	0.412	0.397	0.650				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.385	0.557	0.367	0.412

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table D.3: The effect of industrialization on spending by departments, 1855-1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Department Spending on Primary Schooling per Inhabitant, 1855-1863									
Number of Steam Engines	0.0126***	0.00559	0.00580	0.00731*	0.00541	0.00689	0.0137*	0.0156**	0.0145*	0.0149*
	[0.00443]	[0.00484]	[0.00439]	[0.00423]	[0.00446]	[0.00478]	[0.00700]	[0.00759]	[0.00825]	[0.00830]
Average Rainfall		0.00873	0.0228	0.0196	0.0255	0.00711	0.0310	0.0262	0.0253	0.0194
		[0.0242]	[0.0269]	[0.0293]	[0.0284]	[0.0312]	[0.0256]	[0.0282]	[0.0266]	[0.0293]
Average Temperature		-0.0104	-0.0491	-0.0420	-0.0483	-0.0364	-0.0430	-0.0329	-0.0447	-0.0302
		[0.0247]	[0.0483]	[0.0470]	[0.0484]	[0.0557]	[0.0419]	[0.0397]	[0.0431]	[0.0472]
Latitude		0.303**	0.221	0.207	0.222	0.0714	0.184	0.165	0.180	0.0566
		[0.117]	[0.218]	[0.228]	[0.216]	[0.253]	[0.205]	[0.221]	[0.210]	[0.238]
Land Suitability		0.0502***	0.0487***	0.0490***	0.0485***	0.0362**	0.0460***	0.0465***	0.0463***	0.0341**
		[0.0159]	[0.0160]	[0.0158]	[0.0161]	[0.0159]	[0.0142]	[0.0139]	[0.0143]	[0.0134]
Share of Carboniferous Area			-0.0430*	-0.0484**	-0.0427*	-0.0271	-0.0451**	-0.0530**	-0.0456**	-0.0298
			[0.0228]	[0.0231]	[0.0230]	[0.0259]	[0.0196]	[0.0208]	[0.0202]	[0.0209]
Maritime Department			0.00759	0.00683	0.00721	0.0117	0.00178	0.000862	0.00253	0.00501
			[0.0177]	[0.0175]	[0.0175]	[0.0206]	[0.0154]	[0.0150]	[0.0155]	[0.0175]
Border Department			-0.0269**	-0.0253**	-0.0267**	-0.0277*	-0.0286**	-0.0263**	-0.0292**	-0.0280**
			[0.0122]	[0.0122]	[0.0124]	[0.0144]	[0.0117]	[0.0114]	[0.0124]	[0.0138]
Distance to Paris			-0.00167	-0.00152	-0.00175	-0.00478	-0.00125	-0.00104	-0.00108	-0.00411
			[0.00650]	[0.00680]	[0.00656]	[0.00731]	[0.00626]	[0.00667]	[0.00646]	[0.00692]
Paris and Suburbs			-0.0212	-0.0204	-0.0215	0.0134	-0.0239	-0.0226	-0.0232	0.0154
			[0.0395]	[0.0365]	[0.0403]	[0.0167]	[0.0397]	[0.0355]	[0.0380]	[0.0180]
University				-0.0137				-0.0199		
				[0.0126]				[0.0143]		
Urban Population in 1700					0.000706				-0.00149	
					[0.00297]				[0.00353]	
Grooms who Signed their Marriage License, 1786-1790						0.0244				0.0205
						[0.0268]				[0.0256]
Adjusted R2	0.121	0.253	0.267	0.269	0.257	0.315				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.098	0.100	0.098	0.146

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table D.4: The effect of industrialization on spending by the central state, 1855-1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Central State Spending on Primary Schooling per Inhabitant, 1855-1863									
Number of Steam Engines	-0.0495***	-0.0304***	-0.0353***	-0.0322***	-0.0273**	-0.0365***	-0.0534***	-0.0502***	-0.0466***	-0.0600***
	[0.0111]	[0.00969]	[0.0103]	[0.0108]	[0.0104]	[0.0112]	[0.0161]	[0.0164]	[0.0174]	[0.0186]
Average Rainfall		-0.0382	-0.0245	-0.0309	-0.0799	-0.0759	-0.0435	-0.0452	-0.0795	-0.112
		[0.0917]	[0.104]	[0.104]	[0.106]	[0.114]	[0.0939]	[0.0932]	[0.0994]	[0.0988]
Average Temperature		-0.470***	-0.473***	-0.458***	-0.490***	-0.423***	-0.487***	-0.478***	-0.498***	-0.441***
		[0.125]	[0.145]	[0.151]	[0.140]	[0.157]	[0.126]	[0.129]	[0.122]	[0.130]
Latitude		-1.349***	-1.649***	-1.676***	-1.679***	-1.689**	-1.564***	-1.586***	-1.591***	-1.646**
		[0.295]	[0.569]	[0.556]	[0.574]	[0.664]	[0.559]	[0.545]	[0.553]	[0.667]
Land Suitability		-0.0389	-0.0649	-0.0643*	-0.0618*	-0.0951**	-0.0589	-0.0591	-0.0572	-0.0889**
		[0.0514]	[0.0399]	[0.0380]	[0.0363]	[0.0453]	[0.0392]	[0.0380]	[0.0363]	[0.0426]
Share of Carboniferous Area			-0.0943	-0.106	-0.0986	-0.0428	-0.0893	-0.0955	-0.0926	-0.0351
			[0.0779]	[0.0806]	[0.0758]	[0.0921]	[0.0707]	[0.0726]	[0.0676]	[0.0786]
Maritime Department			0.0430	0.0415	0.0507*	0.0428	0.0564*	0.0544*	0.0606**	0.0624*
			[0.0283]	[0.0285]	[0.0284]	[0.0299]	[0.0300]	[0.0297]	[0.0289]	[0.0320]
Border Department			0.0351	0.0383	0.0299	0.0324	0.0390	0.0403	0.0352	0.0333
			[0.0367]	[0.0367]	[0.0349]	[0.0376]	[0.0348]	[0.0348]	[0.0336]	[0.0361]
Distance to Paris			-0.0101	-0.00975	-0.00850	-0.00827	-0.0110	-0.0108	-0.00992	-0.0102
			[0.0172]	[0.0168]	[0.0168]	[0.0184]	[0.0168]	[0.0164]	[0.0164]	[0.0184]
Paris and Suburbs			0.0106	0.0123	0.0171	-0.0247	0.0167	0.0171	0.0207	-0.0305
			[0.0352]	[0.0379]	[0.0492]	[0.0396]	[0.0421]	[0.0420]	[0.0497]	[0.0475]
University				-0.0280				-0.0146		
				[0.0216]				[0.0212]		
Urban Population in 1700					-0.0143**				-0.00967	
					[0.00617]				[0.00686]	
Grooms who Signed their Marriage License, 1786-1790						0.0863				0.0977
						[0.0676]				[0.0604]
Adjusted R2	0.243	0.560	0.568	0.568	0.587	0.573				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.003	0.004	0.002	0.006

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table D.5: The effect of industrialization on the number of school buildings in 1850

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Schools per commune, 1850									
Number of Steam Engines	0.0527	0.138***	0.125***	0.111***	0.0970***	0.0932***	0.174***	0.168***	0.143**	0.154***
	[0.0351]	[0.0382]	[0.0365]	[0.0376]	[0.0325]	[0.0320]	[0.0551]	[0.0586]	[0.0639]	[0.0564]
Average Rainfall		-0.0325	-0.128	-0.0981	0.0695	-0.261	-0.0777	-0.0525	0.0686	-0.168
		[0.275]	[0.235]	[0.260]	[0.267]	[0.284]	[0.221]	[0.235]	[0.247]	[0.271]
Average Temperature		-0.283	-0.769**	-0.838**	-0.707*	-0.834**	-0.731**	-0.774**	-0.689**	-0.787**
		[0.292]	[0.346]	[0.345]	[0.357]	[0.325]	[0.348]	[0.358]	[0.349]	[0.335]
Latitude		-3.072***	2.797*	2.928*	2.906*	3.094*	2.571*	2.638*	2.694**	2.983*
		[1.131]	[1.523]	[1.609]	[1.553]	[1.800]	[1.327]	[1.350]	[1.325]	[1.546]
Land Suitability		-0.0983	0.0721	0.0693	0.0610	0.0856	0.0560	0.0526	0.0501	0.0697
		[0.156]	[0.131]	[0.129]	[0.117]	[0.125]	[0.124]	[0.122]	[0.113]	[0.121]
Share of Carboniferous Area			0.148	0.201	0.163	0.218	0.135	0.169	0.149	0.198
			[0.229]	[0.231]	[0.200]	[0.258]	[0.217]	[0.218]	[0.190]	[0.242]
Maritime Department			-0.0232	-0.0159	-0.0507	-0.0114	-0.0589	-0.0573	-0.0744	-0.0616
			[0.0768]	[0.0798]	[0.0837]	[0.0888]	[0.0815]	[0.0832]	[0.0831]	[0.0963]
Border Department			-0.243***	-0.258**	-0.225**	-0.270***	-0.254***	-0.265***	-0.237***	-0.272***
			[0.0906]	[0.0984]	[0.0964]	[0.0991]	[0.0865]	[0.0931]	[0.0882]	[0.0918]
Distance to Paris			0.207***	0.205***	0.201***	0.223***	0.209***	0.209***	0.205***	0.228***
			[0.0444]	[0.0494]	[0.0448]	[0.0488]	[0.0413]	[0.0439]	[0.0414]	[0.0438]
Paris and Suburbs			0.912	0.904	0.889	0.177*	0.896	0.889	0.881*	0.192
			[0.630]	[0.600]	[0.572]	[0.100]	[0.572]	[0.548]	[0.529]	[0.123]
University				0.132				0.0894		
				[0.129]				[0.125]		
Urban Population in 1700					0.0511				0.0400	
					[0.0319]				[0.0348]	
Grooms who Signed their Marriage License, 1786-1790						0.131				0.101
						[0.199]				[0.195]
Adjusted r2	0.021	0.110	0.270	0.277	0.297	0.354				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.752	0.844	0.707	0.829

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table D.6: The effect of industrialization on the number of school buildings in 1863

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
	Schools per commune, 1863									
Number of Steam Engines	0.0465	0.121***	0.109***	0.0869**	0.0646**	0.0749**	0.154***	0.146**	0.0995	0.141**
	[0.0390]	[0.0408]	[0.0390]	[0.0390]	[0.0290]	[0.0308]	[0.0544]	[0.0589]	[0.0616]	[0.0554]
Average Rainfall		-0.264	-0.249	-0.203	0.0596	-0.325	-0.201	-0.156	0.0589	-0.223
		[0.301]	[0.226]	[0.260]	[0.268]	[0.283]	[0.210]	[0.231]	[0.246]	[0.265]
Average Temperature		-0.108	-0.547	-0.650*	-0.450	-0.753**	-0.511	-0.584	-0.436	-0.701**
		[0.303]	[0.373]	[0.356]	[0.376]	[0.326]	[0.368]	[0.367]	[0.361]	[0.333]
Latitude		-2.805**	1.921	2.118	2.090	2.085	1.710	1.819	1.931*	1.962
		[1.074]	[1.366]	[1.425]	[1.310]	[1.689]	[1.193]	[1.191]	[1.103]	[1.443]
Land Suitability		-0.232	-0.0704	-0.0746	-0.0876	-0.00520	-0.0855	-0.0918	-0.0959	-0.0227
		[0.173]	[0.157]	[0.151]	[0.130]	[0.138]	[0.148]	[0.143]	[0.124]	[0.132]
Share of Carboniferous Area			0.128	0.208	0.152	0.174	0.116	0.175	0.141	0.152
			[0.234]	[0.233]	[0.174]	[0.258]	[0.228]	[0.230]	[0.170]	[0.255]
Maritime Department			-0.0139	-0.00294	-0.0568	0.0217	-0.0473	-0.0455	-0.0746	-0.0336
			[0.0728]	[0.0767]	[0.0832]	[0.0846]	[0.0772]	[0.0805]	[0.0810]	[0.0920]
Border Department			-0.221***	-0.244***	-0.193**	-0.239**	-0.231***	-0.251***	-0.202**	-0.241***
			[0.0817]	[0.0910]	[0.0910]	[0.0938]	[0.0777]	[0.0861]	[0.0820]	[0.0861]
Distance to Paris			0.172***	0.170***	0.163***	0.181***	0.175***	0.173***	0.166***	0.187***
			[0.0409]	[0.0464]	[0.0391]	[0.0457]	[0.0380]	[0.0412]	[0.0363]	[0.0408]
Paris and Suburbs			1.060	1.048	1.023	0.168**	1.044	1.032	1.017	0.185**
			[0.783]	[0.737]	[0.691]	[0.0733]	[0.714]	[0.672]	[0.638]	[0.0934]
University				0.199				0.155		
				[0.140]				[0.135]		
Urban Population in 1700					0.0795**				0.0712*	
					[0.0361]				[0.0394]	
Grooms who Signed their Marriage License, 1786-1790						0.00317				-0.0292
						[0.179]				[0.175]
Adjusted r2	0.012	0.082	0.250	0.275	0.323	0.349				
Observations	85	85	85	85	85	79	85	85	85	79
	First stage: the instrumented variable is Number of Steam Engines									
Distance to Fresnes							-0.702***	-0.727***	-0.608**	-0.691**
							[0.243]	[0.207]	[0.238]	[0.261]
Deviation from Wheat Prices in 1834-1838							-1.309***	-1.200***	-1.170***	-1.279***
(baseline 1819-1833)							[0.329]	[0.328]	[0.345]	[0.343]
F-stat (1^{st} stage)							16.661	16.946	10.918	13.209
Prob J-Stat							0.996	0.822	0.919	0.816

Note: The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. Robust standard errors are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix E. Spatial Correlation

Table E.1: The effect of industrialization on the number of teachers in 1840, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	2.050	0.191	0.316	2.050	0.191	0.316	2.050	0.191	0.316	2.050	0.191	0.316
	[0.039]***	[0.010]***	[0.034]***	[0.028]***	[0.007]***	[0.024]***	[0.018]***	[0.005]***	[0.015]***	[0.012]***	[0.003]***	[0.011]***
Average Rainfall		1.050	0.689		1.050	0.689		1.050	0.689		1.050	0.689
		[0.097]***	[0.106]***		[0.069]***	[0.075]***		[0.044]***	[0.048]***		[0.031]***	[0.034]***
Average Temperature		-1.342	-1.781		-1.342	-1.785		-1.342	-1.786		-1.342	-1.787
		[0.130]***	[0.147]***		[0.092]***	[0.105]***		[0.059]***	[0.066]***		[0.042]***	[0.047]***
Latitude		0.548	1.317		0.548	1.319		0.548	1.320		0.548	1.320
		[0.215]**	[0.241]***		[0.153]***	[0.171]***		[0.097]***	[0.108]***		[0.069]***	[0.077]***
Land Suitability		0.409	0.440		0.409	0.435		0.409	0.432		0.409	0.431
		[0.044]***	[0.051]***		[0.031]***	[0.037]***		[0.020]***	[0.024]***		[0.014]***	[0.017]***
Share of Carboniferous Area		-0.574	-0.525		-0.574	-0.525		-0.574	-0.526		-0.574	-0.526
		[0.121]***	[0.096]***		[0.086]***	[0.068]***		[0.055]***	[0.043]***		[0.039]***	[0.030]***
Maritime Department		0.179	0.086		0.179	0.088		0.179	0.089		0.179	0.089
		[0.033]***	[0.048]*		[0.023]***	[0.031]**		[0.015]***	[0.022]***		[0.011]***	[0.016]***
Border Department		-0.016	-0.068		-0.016	-0.069		-0.016	-0.070		-0.016	-0.070
		[0.040]	[0.037]*		[0.029]	[0.026]***		[0.018]	[0.017]***		[0.013]	[0.012]***
Distance to Paris		0.02	0.1		0.01	0.1		0.02	0.1		0.02	0.1
		[0.01]	[0.2]***		[0.01]*	[0.02]***		[0.01]***	[0.01]***		[0.004]***	[0.01]***
Paris and Suburbs		0.493	0.309		0.493	0.308		0.493	0.307		0.493	0.307
		[0.037]***	[0.066]***		[0.026]***	[0.047]***		[0.017]***	[0.030]***		[0.012]***	[0.021]***
Observations	85	85	85	85	85	85	85	85	85	85	85	85

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table E.2: The effect of industrialization on the number of teachers in 1863, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	2.224	0.201	0.291	2.224	0.201	0.291	2.224	0.201	0.291	2.224	0.201	0.291
	[0.045]***	[0.008]***	[0.025]***	[0.032]***	[0.005]***	[0.018]***	[0.020]***	[0.003]***	[0.011]***	[0.014]***	[0.002]***	[0.008]***
Average Rainfall		0.699	0.400		0.699	0.400		0.699	0.400		0.699	0.400
		[0.087]***	[0.134]***		[0.062]***	[0.096]***		[0.039]***	[0.061]***		[0.028]***	[0.043]***
Average Temperature		-0.617	-0.978		-0.617	-0.980		-0.617	-0.980		-0.617	-0.981
		[0.102]***	[0.138]***		[0.073]***	[0.099]***		[0.046]***	[0.063]***		[0.033]***	[0.045]***
Latitude		0.842	1.487		0.842	1.487		0.842	1.487		0.842	1.487
		[0.187]***	[0.292]***		[0.133]***	[0.209]***		[0.085]***	[0.133]***		[0.060]***	[0.094]***
Land Suitability		0.244	0.266		0.244	0.265		0.244	0.264		0.244	0.264
		[0.028]***	[0.026]***		[0.020]***	[0.018]***		[0.013]***	[0.012]***		[0.009]***	[0.008]***
Share of Carboniferous Area		-0.063	-0.017		-0.063	-0.020		-0.063	-0.021		-0.063	-0.022
		[0.073]	[0.067]		[0.052]	[0.047]		[0.033]*	[0.029]		[0.023]***	[0.021]
Maritime Department		0.159	0.096		0.159	0.095		0.159	0.095		0.159	0.095
		[0.020]***	[0.021]***		[0.015]***	[0.015]***		[0.009]***	[0.009]***		[0.007]***	[0.007]***
Border Department		-0.108	-0.148		-0.108	-0.149		-0.108	-0.149		-0.108	-0.149
		[0.028]***	[0.024]***		[0.020]***	[0.017]***		[0.012]***	[0.011]***		[0.009]***	[0.008]***
Distance to Paris		0.02	0.1		0.02	0.1		0.02	0.1		0.02	0.1
		[0.01]	[0.02]***		[0.01]	[0.02]***		[0.01]**	[0.01]***		[0.004]***	[0.01]***
Paris and Suburbs		0.629	0.481		0.629	0.482		0.629	0.483		0.629	0.484
		[0.036]***	[0.059]***		[0.025]***	[0.042]***		[0.016]***	[0.027]***		[0.011]***	[0.019]***
Observations	85	85	85	85	85	85	85	85	85	85	85	85

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table E.3: The effect of industrialization on the share of pupils in the population in 1840, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	2.083	0.084	0.226	2.083	0.084	0.226	2.083	0.084	0.227	2.083	0.084	0.227
	[0.040]****	[0.013]***	[0.019]***	[0.028]***	[0.009]***	[0.013]***	[0.018]***	[0.006]***	[0.008]***	[0.013]***	[0.004]***	[0.006]***
Average Rainfall		0.787	0.520		0.787	0.512		0.787	0.508		0.787	0.507
		[0.093]***	[0.079]***		[0.066]***	[0.056]***		[0.042]***	[0.035]***		[0.030]***	[0.025]***
Average Temperature		-1.892	-2.247		-1.892	-2.252		-1.892	-2.254		-1.892	-2.254
		[0.123]***	[0.114]***		[0.088]***	[0.080]***		[0.056]***	[0.050]***		[0.039]***	[0.036]***
Latitude		1.486	2.031		1.486	2.046		1.486	2.053		1.486	2.056
		[0.228]***	[0.174]***		[0.163]***	[0.122]***		[0.103]***	[0.077]***		[0.073]***	[0.054]***
Land Suitability		0.486	0.497		0.486	0.495		0.486	0.493		0.486	0.493
		[0.069]***	[0.082]***		[0.050]***	[0.059]***		[0.032]***	[0.038]***		[0.022]***	[0.027]***
Share of Carboniferous Area		-0.840	-0.816		-0.840	-0.812		-0.840	-0.809		-0.840	-0.809
		[0.101]***	[0.080]***		[0.072]***	[0.056]***		[0.046]***	[0.035]***		[0.032]***	[0.025]***
Maritime Department		-0.043	-0.155		-0.043	-0.151		-0.043	-0.150		-0.043	-0.149
		[0.053]***	[0.062]**		[0.038]	[0.045]***		[0.024]*	[0.029]***		[0.017]***	[0.020]***
Border Department		0.074	0.014		0.074	0.016		0.074	0.017		0.074	0.017
		[0.028]***	[0.036]		[0.020]***	[0.026]		[0.013]***	[0.017]		[0.009]***	[0.012]
Distance to Paris		0.02	0.1		0.02	0.1		0.02	0.1		0.02	0.001
		[0.01]**	[0.01]***		[0.01]***	[0.01]***		[0.004]***	[0.01]***		[0.003]***	[0.004]***
Paris and Suburbs		0.157	-0.010		0.157	-0.014		0.157	-0.016		0.157	-0.016
		[0.039]***	[0.067]		[0.028]***	[0.048]		[0.018]***	[0.030]		[0.013]***	[0.022]

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table E.4: The effect of industrialization on the share of pupils in the population in 1863, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	2.191	0.037	0.075	2.191	0.037	0.074	2.191	0.037	0.074	2.191	0.037	0.074
	[0.047]***	[0.007]***	[0.009]***	[0.033]***	[0.005]***	[0.006]***	[0.021]***	[0.003]***	[0.004]***	[0.015]***	[0.002]***	[0.003]***
Average Rainfall		0.532	0.490		0.532	0.483		0.532	0.479		0.532	0.477
		[0.041]***	[0.042]***		[0.029]***	[0.031]***		[0.018]***	[0.020]***		[0.013]***	[0.014]***
Average Temperature		-0.949	-1.014		-0.949	-1.019		-0.949	-1.023		-0.949	-1.024
		[0.051]***	[0.053]***		[0.037]***	[0.038]***		[0.023]***	[0.024]***		[0.016]***	[0.017]***
Latitude		1.471	1.550		1.471	1.565		1.471	1.574		1.471	1.577
		[0.098]***	[0.097]***		[0.070]***	[0.070]***		[0.044]***	[0.045]***		[0.031]***	[0.032]***
Land Suitability		0.218	0.218		0.218	0.218		0.218	0.218		0.218	0.218
		[0.028]***	[0.031]***		[0.020]***	[0.022]***		[0.013]***	[0.014]***		[0.009]***	[0.010]***
Share of Carboniferous Area		-0.483	-0.479		-0.483	-0.478		-0.483	-0.478		-0.483	-0.478
		[0.058]***	[0.049]***		[0.042]***	[0.035]***		[0.026]***	[0.022]***		[0.019]***	[0.016]***
Maritime Department		-0.037	-0.062		-0.037	-0.063		-0.037	-0.064		-0.037	-0.064
		[0.030]	[0.028]**		[0.021]*	[0.020]***		[0.014]***	[0.013]***		[0.010]***	[0.009]***
Border Department		0.017	0.004		0.017	0.004		0.017	0.004		0.017	0.004
		[0.012]	[0.016]		[0.009]**	[0.011]		[0.006]***	[0.007]		[0.004]***	[0.005]
Distance to Paris		0.01	0.03		0.014	0.03		0.01	0.03		0.01	0.03
		[0.004]***	[0.01]***		[0.003]***	[0.004]***		[0.002]***	[0.003]***		[0.001]***	[0.002]***
Paris and Suburbs		0.016	-0.021		0.016	-0.022		0.016	-0.023		0.016	-0.024
		[0.021]	[0.024]		[0.015]	[0.017]		[0.009]*	[0.011]**		[0.007]**	[0.008]***
Observations		85	85	85	85	85	85	85	85	85	85	85

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table E.5: The effect of industrialization on the share of apprentices in the population in 1863, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	0.300	0.352	0.317	0.300	0.352	0.313	0.300	0.352	0.311	0.300	0.352	0.310
	[0.020]***	[0.027]***	[0.048]***	[0.014]***	[0.019]***	[0.034]***	[0.009]***	[0.012]***	[0.022]***	[0.006]***	[0.009]***	[0.015]***
Average Rainfall		0.777	-0.923		0.777	-0.967		0.777	-0.993		0.777	-1.001
		[0.106]***	[0.390]**		[0.075]***	[0.280]***		[0.047]***	[0.179]***		[0.033]***	[0.127]***
Average Temperature		0.861	-1.022		0.861	-1.074		0.861	-1.104		0.861	-1.114
		[0.163]***	[0.481]**		[0.116]***	[0.348]***		[0.074]***	[0.223]***		[0.052]***	[0.159]***
Latitude		-1.851	2.175		-1.851	2.282		-1.851	2.345		-1.851	2.366
		[0.0238]***	[0.944]**		[0.170]***	[0.0682]***		[0.108]***	[0.437]***		[0.077]***	[0.310]***
Land Suitability		0.158	0.408		0.158	0.403		0.158	0.401		0.158	0.400
		[0.064]**	[0.111]***		[0.045]***	[0.079]***		[0.028]***	[0.051]***		[0.020]***	[0.036]***
Share of Carboniferous Area		-0.358	-0.022		-0.358	-0.032		-0.358	-0.038		-0.358	-0.040
		[0.097]***	[0.158]		[0.069]***	[0.112]		[0.044]***	[0.071]		[0.031]***	[0.050]
Maritime Department		0.246	0.307		0.246	0.307		0.246	0.306		0.246	0.306
		[0.068]***	[0.069]***		[0.048]***	[0.049]***		[0.030]***	[0.031]***		[0.022]***	[0.022]***
Border Department		0.951	0.884		0.951	0.879		0.951	0.876		0.951	0.875
		[0.108]***	[0.099]***		[0.077]***	[0.071]***		[0.049]***	[0.045]***		[0.035]***	[0.032]***
Distance to Paris		-0.2	0.01		-0.2	0.02		-0.2	0.02		-0.2	0.02
		[0.02]***	[0.1]		[0.02]***	[0.04]		[0.01]***	[0.02]		[0.01]***	[0.02]
Paris and Suburbs		0.743	0.247		0.743	0.241		0.743	0.238		0.743	0.237
		[0.075]***	[0.185]		[0.053]***	[0.131]*		[0.034]***	[0.083]***		[0.024]***	[0.059]***
Observations	85	85	85	85	85	85	85	85	85	85	85	85

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table E.6: The effect of industrialization on the share of literate conscripts in 1859-1868, accounting for spatial autocorrelation

	(1) OLS	(2) OLS	(3) GMM	(4) OLS	(5) OLS	(6) GMM	(7) OLS	(8) OLS	(9) GMM	(10) OLS	(11) OLS	(12) GMM
	Spatial std. errors, 50 km radius			Spatial std. errors, 100km radius			Spatial std. errors, 250km radius			Spatial std. errors, 500km radius		
Number of Steam Engines	-0.093	0.040	0.108	-0.093	0.040	0.108	-0.093	0.040	0.108	-0.093	0.040	0.108
	[0.008]***	[0.007]***	[0.010]***	[0.006]***	[0.005]***	[0.007]***	[0.004]***	[0.003]***	[0.004]***	[0.003]***	[0.002]***	[0.003]***
Average Rainfall		0.235	0.218		0.235	0.204		0.235	0.194		0.235	0.191
		[0.042]***	[0.062]***		[0.030]***	[0.047]***		[0.019]***	[0.031]***		[0.014]***	[0.022]***
Average Temperature		-0.563	-0.615		-0.563	-0.626		-0.563	-0.633		-0.563	-0.636
		[0.046]***	[0.067]***		[0.033]***	[0.049]***		[0.021]***	[0.031]***		[0.015]***	[0.022[***
Latitude		-0.150	-0.148		-0.150	-0.117		-0.150	-0.097		-0.150	-0.089
		[0.091]	[0.137]		[0.065]**	[0.103]		[0.041]***	[0.067]		[0.029]***	[0.048]*
Land Suitability		0.236	0.226		0.236	0.227		0.236	0.227		0.236	0.228
		[0.032]***	[0.035]***		[0.023]***	[0.025]***		[0.015]***	[0.016]***		[0.010]***	[0.011]***
Share of Carboniferous Area		-0.468	-0.485		-0.468	-0.477		-0.468	-0.472		-0.468	-0.470
		[0.065]***	[0.049]***		[0.046]***	[0.036]***		[0.029]***	[0.023]***		[0.021]***	[0.017]***
Maritime Department		-0.068	-0.129		-0.068	-0.124		-0.068	-0.121		-0.068	-0.120
		[0.025]***	[0.026]***		[0.018]***	[0.020]***		[0.011]***	[0.013]***		[0.008]***	[0.009]***
Border Department		0.049	0.022		0.049	0.025		0.049	0.026		0.049	0.027
		[0.014]***	[0.017]		[0.010]***	[0.012]**		[0.006]***	[0.008]***		[0.005]***	[0.006]***
Distance to Paris		-0.001	0.02		-0.001	0.02		-0.001	0.02		-0.001	0.02
		[0.004]	[0.05]***		[0.003]	[0.004]***		[0.002]	[0.002]***		[0.001]	[0.002]***
Paris and Suburbs		0.217	0.171		0.217	0.166		0.217	0.163		0.217	0.162
		[0.013]***	[0.027]***		[0.009]***	[0.020]***		[0.006]***	[0.013]***		[0.004]***	[0.009]***
Observations	85	85	85	85	85	85	85	85	85	85	85	85

Note: The table reports spatial Conley (1999) standard errors with radii of 50km, 100km, 250km and 500km. The explanatory variables except the dummies are in logarithm. The aerial distances are measured in kilometers. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix F. Variable Definitions and Sources

Dependent variables

Teachers.

Teachers, 1840 and 1863. Number of teachers in primary schools. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/index2891.html.

Pupils.

Pupils, 1840 and 1863. Number of pupils enrolled in primary schools, per 10,000 inhabitants in the department. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

Apprentices.

Apprentices, 1863. Number of apprentices enrolled in apprentice schools, per 10,000 inhabitants in the department. Source: Ministère De l'Instruction Publique (1865).

Literate conscripts

Share of literate individuals among conscripts, 1847-1856 and 1859-1868. The average share of French army conscripts, i.e., 20-year-old men who reported for military service in the department where their father lived, who could read and write, computed over the 1847-1856 and 1859-1868 periods. Source: France. Ministère de la guerre (1791-1936) - Compte rendu sur le recrutement de l'armée.

Public Spending on Education

Total Public Spending on Primary Schooling per Inhabitant, 1855-1863. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

Commune Spending on Primary Schooling per Inhabitant, 1855-1863. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

Department Spending on Primary Schooling per Inhabitant, 1855-1863. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

Central State Spending on Primary Schooling per Inhabitant, 1855-1863. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

School buildings.

Buildings, 1850 and 1863. Number of buildings per *commune* in each department. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/index2891.html.

Explanatory variables

Horse power of steam engines. This variable reports the number of steam *Engines* in the firms of each department, which is computed from the industrial survey carried out by the French government between 1839 and 1847. See Chanut et al. (2000) for details on the implementation of this survey.

Maritime department. This dummy variable takes the value one if a French department borders the coastline and zero otherwise.

Border department. This dummy variable takes the value one if a French department borders one of the foreign countries around France (Belgium, Luxembourg, Germany, Switzerland, Italy and Spain) and zero otherwise.

Distance to Paris. The great circle distance as "the crow flies"from Paris, the capital of France, to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Paris and suburbs. This dummy variable takes the value one for the three departments, i.e., Seine, Seine-et-Marne and Seine-et-Oise, which encompass *Paris and its suburbs* and zero otherwise.

Alsace-Lorraine. This dummy variable takes the value one for the Bas-Rhin, Haut-Rhin and Moselle departments and zero otherwise in all the regressions on post-WWI outcomes since these three departments were under German rule between 1871 and 1918.

Average rainfall. The average rainfall in cm^3, reported at a half-degree resolution by Ramankutty et al. (2002), across the French departments.

Average temperature. The average temperature (in celsius), reported at a half-degree resolution by Ramankutty et al. (2002), across the French departments.

Latitude. The latitude of the centroid of each French department.

Land Suitability The land suitability index, reported at a half-degree resolution by Ramankutty et al. (2002), across the French departments.

Share of carboniferous area in department. The share of carboniferous area in each department. Source: Fernihough and O'Rourke (2014).

Share of Grooms who Signed their Wedding Licenses, 1786-1790. The share of grooms who signed their wedding licenses with their names over the 1786-1790 period (as opposed to those who marked it with a cross). Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/index2891.html.

University. Number of universities in 1700 in each department. Source: Bosker et al. (2013).

Urban population in 1700 (thousand of inhabitants). This variable reports the total population of the major urban centers, i.e., with more than 10,000 inhabitants, in each French department in 1700 using the data in Lepetit (1994, Appendix B).

Instrumental variables

Distance to Fresnes sur Escaut. The great circle distance as "the crow flies"from Fresnes-sur-Escaut, where the first steam engine was operated in France in 1732, to the administrative center of each department. This aerial distance is computed in kilometers.

Deviation from Wheat Prices in 1834-1838 (baseline 1819-1833). Yearly wheat prices in each department. Source: Labrousse et al. (1970).

Variables for robustness analysis

Economic development and market integration before 1839

Market integration during the French Revolution. The number of external suppliers for each department in the 1790s for the following categories of products: cotton, hosiery, hardware, misc. production goods, misc. consumption goods, linen and hemp, wool and wool cloth, leather products hides and hats, iron, Food items, drinks, paper, wood for industry, fuel (wood and coal). Source: Daudin (2010).

Iron forges, 1789 and 1811. The number of iron forges in each department in 1789 and 1811. Source: Woronoff (1997).

Presence of iron forges, 1789 and 1811. The dummy variable takes the value 1 if there was at least one iron forge in a department in 1789. Source: Woronoff (1997).

Area covered by mines in department. The area covered by coal mines in 1837 in each department. Source: France - Ministère des Travaux Publics (1838). Statistique de l'industrie minérale et des appareils à vapeur en France et en Algérie, Paris.

Share of department's territory covered by road network, 1837. The area covered by roads in 1837 in each department. Source: Tableau 12, Table général par départements, de l'étendue des communications, par terre et par eau, existant en France, au commencement de 1837, in, France - Ministère des Travaux Publics (1837). Statistique de la France, Paris.

Share of department's territory covered by watern network, 1837. The area covered by the water network in 1837 in each department. Source: Tableau 12, Table général par départements, de l'étendue des communications, par terre et par eau, existant en France, au commencement de 1837, in, France - Ministère des Travaux Publics (1837). Statistique de la France, Paris.

Human capital before 1820

Share of Grooms who Signed their Wedding Licenses, 1686-1690 and 1816-1820. The share of grooms who signed their wedding licenses with their names over the 1686-1690 and 1816-1820 periods (as opposed to those who marked it with a cross). Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/ index2891.html.

Encyclopédie subscribers. The number of subscribers to the Quarto edition of the Encyclopédie in the second half of the 18th century in the French towns aggregated at the department level. Source: Darnton (1973) and Squicciarini and Voigtländer (2015).

Population density

Population density, 1801, 1831 and 1861. Source: Béaur, Gérard, and Béatrice Marin. 2011. La Statistique Générale de la France Présentation. L'Atelier du Centre de recherches historiques. http:acrh.revues.org/index2891.html.

Railroad connection

Railroad connection to Paris in 1860. The dummy variable takes the value 1 if the administrative center of the department was connected to the railroad network in 1860. Source: Caron (1997).

Distance to London

Distance to London. The great circle distance as "the crow flies"from London, the capital of England, to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Past level of fertility

Fertility, 1806. Fertility in each department, computed following the methodology of the Coale fertility index. 1806 is the earliest year available. Source: Bonneuil (1997).

Distance to French cities

Distance to Marseille. The great circle distance as "the crow flies"from Marseille to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Distance to Lyon. The great circle distance as "the crow flies"from Lyon to the administrative center of each department. This aerial distance is computed in 100 kilometers.

*Distance to Rouen.*The great circle distance as "the crow flies"from Rouen to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Distance to Mulhouse. The great circle distance as "the crow flies"from Mulhouse to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Distance to Bordeaux. The great circle distance as "the crow flies"from Bordeaux to the administrative center of each department. This aerial distance is computed in 100 kilometers.

Distance from Paris (weeks of travel). The time needed for a surface travel from Paris to the administrative center of each department measured in weeks of travel. Source: Özak (2013).

Distance from Marseille (weeks of travel). The time needed for a surface travel from Marseille to the administrative center of each department measured in weeks of travel. Source: Özak (2013).

Distance from Lyon (weeks of travel). The time needed for a surface travel from Lyon from Lyon to the administrative center of each department measured in weeks of travel. Source: Özak (2013).

Distance from Rouen (weeks of travel). The time needed for a surface travel from Rouen to the administrative center of each department measured in weeks of travel. Source: Özak (2013).

*Distance from Mulhouse (weeks of travel).*The time needed for a surface travel from Mulhouse to the administrative center of each department measured in weeks of travel. Source: Özak (2013).

Distance from Bordeaux (weeks of travel). The time needed for a surface travel from Bordeaux to the administrative center of each department measured in weeks of travel. Source: Özak (2013).