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# Is Industrialization Conducive to Long-Run Prosperity?\*

Raphaël Franck<sup>†</sup> and Oded Galor<sup>‡</sup>

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## Abstract

This research explores the long-run effect of industrialization on the process of development. In contrast to conventional wisdom that views industrial development as a catalyst for economic growth, highlighting its persistent effect on economic prosperity, the study establishes that while the adoption of industrial technology was initially conducive to economic development, it has had a detrimental effect on standards of living in the long-run. Exploiting exogenous source of regional variation in the adoption of steam engines during the French industrial revolution, the research establishes that regions which industrialized earlier experienced an increase in literacy rates more swiftly and generated higher income per capita in the subsequent decades. Nevertheless, early industrialization had an adverse effect on income per capita, employment and equality by the turn of the 21<sup>st</sup> century. This adverse effect reflects neither higher unionization and wage rates nor trade protection, but rather underinvestment in human capital and lower employment in skilled-intensive occupations. These findings suggest that the characteristics that permitted the onset of industrialization, rather than the adoption of industrial technology *per se*, have been the source of prosperity among the currently developed economies that experienced an early industrialization.

**Keywords:** Economic Growth, Industrialization, Steam Engine.

**JEL classification:** N33, N34, O14, O33.

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# 1 Introduction

The process of development has been marked by reversals as well as persistence in the relative wealth of nations. While some geographical characteristics that were conducive for economic development in the agricultural stage had detrimental effects on the transition to the industrial stage of development, conventional wisdom suggests that prosperity has persisted among societies that experienced an earlier industrialization (Acemoglu et al., 2002; Galor, 2011).

Regional development within advanced economies, nevertheless, appears far from being indicative of the presence of a persistent beneficial effect of early industrialization. In particular anecdotal evidence suggests that regions which were prosperous industrial centers in Western Europe and in the Americas in the 19<sup>th</sup> century (e.g., the Rust Belt in the USA, the Midlands in the UK, and the Ruhr valley in Germany) have experienced a reversal in their comparative development.

These conflicting observations about the long-run effect of industrialization on the prosperity of regions and nations may suggest that factors which fostered industrial development in the Western world, rather than the forces of industrialization *per se*, are associated with the observed persistence of fortune across these industrial nations. In particular, the delayed industrialization of some leading economies in the agricultural stage of development (e.g., China) suggests that it is not inconceivable that the process of industrialization, despite its earlier virtues, has had detrimental effects on the transition of economies into the post-industrial stage of development.

The research explores the long-run effect of industrialization on the process of development. In contrast to conventional wisdom that views industrial development as a catalyst for economic growth, highlighting its persistent effect on economic prosperity, the study establishes that while the adoption of industrial technology was initially conducive for economic development, it has had a detrimental effect on standards of living in the long-run.

The study utilizes French regional data from the second half of the 19<sup>th</sup> century until the beginning of the 21<sup>st</sup> century to explore the impact of the adoption of industrial technology on the evolution of income per capita and human capital formation.<sup>1</sup> It establishes that regions which industrialized earlier experienced an increase in literacy rates more swiftly and generated higher income per capita in the subsequent decades. Nevertheless, early industrialization had an adverse effect on income per capita, employment and equality by the turn of the 21<sup>st</sup> century.

The observed relationship between industrialization and economic development may reflect the potential effect of industrialization on economic prosperity, the impact of development on industrialization, as well as the influence of additional factors (e.g., institutional, cultural and human capital characteristics). Thus, the research exploits exogenous regional variations in the

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<sup>1</sup>France was one of the first countries to industrialize, but was neither the first one to experience the Industrial Revolution (England) nor the leading industrial country in continental Europe (Germany) by the turn of the twentieth century.

adoption of steam engines across France to establish the effect of industrialization on the process of development.<sup>2</sup>

In light of the association between industrialization and the intensity of the use of the steam engine (Mokyr, 1990; Bresnahan and Trajtenberg, 1995; Rosenberg and Trajtenberg, 2004), the study takes advantage of historical evidence regarding the regional diffusion of the steam engine (Ballot, 1923; Sée, 1925; Léon, 1976) to identify the effect of regional variations in the intensity of the use steam engine in 1860-1865 on the process of development. In particular, it exploits the distances of each French department from Fresnes-sur-Escaut, where a steam engine was first operated for commercial use in 1732, as exogenous source of variations in industrialization across French regions.<sup>3</sup>

The study establishes that the horse power of steam engines in industrial production in the 1860-1865 period had a positive and significant impact on income per capita in 1872, 1901 and 1930. Nevertheless, industrialization had an adverse effect on income per capita, human capital formation, employment and equality in the post-2000 period. These findings suggest that the characteristics that permitted the early onset of industrialization, rather than the adoption of industrial technology *per se*, have been the source of prosperity among the currently developed economies that experienced an early industrialization.

The empirical analysis accounts for a wide range of exogenous confounding geographical and institutional characteristics, as well as for pre-industrial development, which may have contributed to the relationship between industrialization and economic development. First, it accounts for the potentially confounding impact of exogenous geographical characteristics of each of the French departments on the relationship between industrialization and economic development. In particular, it captures the potential effect of these geographical factors on the profitability of the adoption of the steam engine, the pace of its regional diffusion, as well as on productivity and thus the evolution of income per capita in the process of development. Second, it captures the potentially confounding effects of 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 those that were temporarily under German domination) on the diffusion of the steam engine and the diffusion of development. Third, the analysis accounts for the differential level of development across France in the pre-industrial era that may have affected jointly the process of development and the process of industrialization. In particular, it controls for the effect of pre-industrial development on the adoption of the steam engine and, independently, on the persistence of development.

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<sup>2</sup>Mokyr (1990, p.85) documents that a steam engine was first used for industrial purpose in 1712 to England, in a coal mine near Wolverhampton. In the two following decades, steam engines were progressively employed in various parts of continental Europe.

<sup>3</sup>As will become apparent, the diffusion of the steam engines across the French departments, i.e., the administrative divisions of the French territory created in 1790, cannot be captured by the distance between each department and Paris, the capital and economic center of the country.

The research further explores the mediating channels through which earlier industrial development has an adverse effect of the contemporary level of development. It establishes that the adverse effect of early industrialization on the formation of human capital in the long-run is the underlining force that brought about the relative demise of the industrial regions. In contrast, greater unionization, higher wages and trade protection in these industrial regions during their economic prosperity did not contribute to their current decline. Moreover, their decline cannot be attributed to variations in employment rates in the service sector, but rather to the detrimental effect on the share of employment in skilled-intensive occupations.

The remainder of this paper is as follows. Section 2 presents our data. Section 3 discusses our empirical strategy. Section 4 presents our main results and our robustness checks. Section 5 assesses the relevance of potential mechanisms for these findings and Section 6 concludes.

## 2 Data and main variables

The analysis accounts for the geographical characteristics of the 89 French departments, based on the administrative division of France in this time period. 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 process of development and the subsequent minor changes in the borders of some departments reflected political forces rather than the effect of industrialization and the adoption of the steam engine.

In particular, several departments that were split into smaller units are aggregated into their historical territorial borders and regions that were temporarily removed from the French territory are excluded from the analysis during those time periods.<sup>4</sup> In light of the changes in the internal and external boundaries of the French territory during the period of study, the number of departments that is included in different stages of the analysis varies from 81 to 89. Table A.1 reports the descriptive statistics for the variables in the empirical analysis across these departments.

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<sup>4</sup>The Parisian region encompassed three departments (Seine, Seine-et-Marne and Seine-et-Oise) before 1968 and it was split into eight (Essonne, Hauts-de-Seine, Paris, Seine-et-Marne, Seine-Saint-Denis, Val-de-Marne, Val d'Oise and Yvelines) afterwards. Likewise, the Corsica department was split in 1975 into Corse-du-Sud and Haute-Corse. The three departments (i.e., Bas-Rhin, Haut-Rhin and Meurthe) which were under German rule between 1871 and 1918 are excluded from the analysis of economic development over that time period. In addition, in the examination of the robustness of the analysis with data prior to 1860, the three departments (i.e., Alpes-Maritimes, Haute-Savoie and Savoie) that were not part of France are excluded from the analysis.

## 2.1 Past and present measures of income, workforce and human capital

### 2.1.1 Income, unemployment and inequality

This study seeks to examine the effect of industrialization on the evolution of income per capita in the process of development. Given that the industrial survey which is the basis for our analysis was conducted between 1860 and 1865, the relevant data to capture the short-run and medium-run effects of industrialization on income per capita are provided at the departmental level prior to WWII for the years 1872, 1886, 1901, 1911 and 1930 by (Combes et al., 2011; Caruana-Galizia, 2013). Thus, for the sake of brevity, and equal spacing between those years, the analysis focuses on income per capita in 1872, 1901 and 1930.

To assess the effects of early industrialization on income per capita in the long-run, the analysis is restricted to the 2001-2010 period, since data on income per capita at the departmental level is only available in the post-1995 period and the corresponding data for the other indicators of the standards of living only in the post-2001 period (INSEE - *Institut National de la Statistique et des Etudes Economiques*).<sup>5</sup> Moreover, to lessen the potential impact of fluctuations in income per capita, the effect of industrialization in the long-run is captured by its differential impact on the average GDP per capita across departments over the 2001-2010 period.

Furthermore, the analysis examines the effect of industrialization on additional indicators of economic development, unemployment and inequality. The data on unemployment are available across departments over the 2002-2011 period, those on inequality over the 2001-2008 period, and those on the main quartiles of the income distribution over the 2001-2010 period.<sup>6</sup> Hence, to lessen the potential impact of yearly fluctuations, the effect of industrialization on these economic indicators is captured by their average values over the relevant time periods.

### 2.1.2 Workforce

The effect of industrialization on the sectoral composition of the workforce in the post-1860 period is captured by the impact on the shares of employment in the agricultural, industrial and service sectors. The surveys which capture the short-run and mid-run effects of industrialization are those undertaken in 1872, 1901 and 1930 (Statistique Générale de la France). Similarly, to assess the effects of early industrialization on the sectoral composition in the post-WWII period, all available surveys of the French population across departments (i.e., 1968, 1975, 1982, 1990, 1999 and 2010) are used (INSEE - *Institut National de la Statistique et des Etudes Economiques*).

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<sup>5</sup>The qualitative results remain unchanged if one considers the average income per capita over the entire sample period available, 1995-2010.

<sup>6</sup>The income data are based on gross income, prior to state benefits, per person in a household.

### 2.1.3 Human capital

The study further explores the effect of industrialization on the evolution of human capital in the process of development. The effect of early industrialization on human capital formation in the pre-WWI period is captured by its impact on the literacy rates of French army conscripts (i.e., 20-year-old men who reported for military service in the department where their father lived - *Annuaire Statistique De La France* (1878-1939)). In particular, given the data limitations, the analysis focuses on the share of the literate conscripts over the 1874-1883 and 1894-1903 decades. As reported in Table A.1, 82.0% of the French conscripts were literate over the 1874-1883 period and 94.1% over the 1894-1903 period.<sup>7</sup>

The effect of early industrialization on human capital formation in the post-WWII period is captured by its impact on the share of men and women (age 25 and above) who completed high-school as reported in the available surveys of the French population across departments (i.e., 1968, 1975, 1982, 1990, 1999 and 2010). As can be seen in Table A.1, there was a continuous increase in the educational achievements of the French population during this period. Indeed the shares of men and women (age 25 and above) who completed high-school, respectively, rose from 8.8% and 6.0% in 1968 to 36.3% and 39.1% in 2010.

Furthermore, to examine the role of the composition of human capital in the non-monotonic evolution of income per capita, the study explores the impact of industrialization on the evolution of high-, medium- and low-levels of human capital in France after WWII . This composition is captured by the division of the workforce (age 25-54) between executives and other intellectual professions, middle management professionals, and employees, in the available surveys of the French population across departments (1968, 1975, 1982, 1990, 1999 and 2010).

Moreover, to capture the effect of industrialization on human capital formation in the contemporary period, in which school attendance is mandatory until the age of 16, the study explores its impact on the shares of men and women in the 15-17 and 18-24 age categories attending school or any other (post-secondary) learning institution as reported in the 2010 census. As indicated in Table A.1, in 2010, most men and women age 15-17 (respectively 95.5% and 96.7%) attended school but fewer (44.3% and 48.0%) pursued post-secondary studies .

## 2.2 Steam engines

The research explores the effect of the introduction of industrial technology on the process of development. In light of the pivotal role played by the steam engine in the process of industrialization, it exploits variations in the industrial use of the steam engine across the French regions during

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<sup>7</sup>In line with the historical evidence (e.g., Grew and Harrigan, 1991; Diebolt et al., 2005), as reported in Table A.1, a sizeable share of the French population was literate even before the passing of the 1881-1882 laws which made primary school attendance “free” and mandatory for boys and girls until age 13.

its early stages of industrialization to capture the intensity of industrialization. In particular, the analysis focuses on the horse power of steam engines used in each of the French departments as reported in the industrial survey carried out by the French government between 1860 and 1865.<sup>8</sup>

As depicted in Figure 1, and analyzed further in the discussion of the identification strategy in Section 3, the distribution of the steam engines across French departments in 1860-1865 suggests a regional pattern of diffusion from Fresnes-sur-Escaut (in the Nord department, at the northern tip of continental France) where the first steam engine in France was introduced in 1732. The most intensive use of the steam engine over this period was in the Northern part of France. The intensity diminished somewhat in the East and in the South East, and declined further in the South West

Three departments had not used the steam engine in 1860-1865 (i.e., Ariège and Lot in the South-West and Hautes-Alpes in the South-East). Potential anomalies associated with these departments are accounted for by the introduction of a dummy variable that represents them. In particular, potential concerns about the distance of these departments from the threshold level of development that permits the adoption of the steam engines is accounted for by this dummy variable.

## **2.3 Confounding characteristics of each department**

The empirical analysis accounts for a wide range of exogenous confounding geographical and institutional characteristics, as well as for pre-industrial development, which may have contributed to the relationship between industrialization and economic development. Institutions may have affected jointly the process of development and the process of industrialization. Geographical characteristics may have impacted the pace of industrialization as well as agricultural productivity and thus income per capita. Moreover, geographical and institutional factors may have affected the process of development indirectly by governing the pace of the diffusion of steam engines across departments. Finally, pre-industrial development may affect the onset of industrialization and have an independent persistent effect on the process of development.

### **2.3.1 Geographic characteristics**

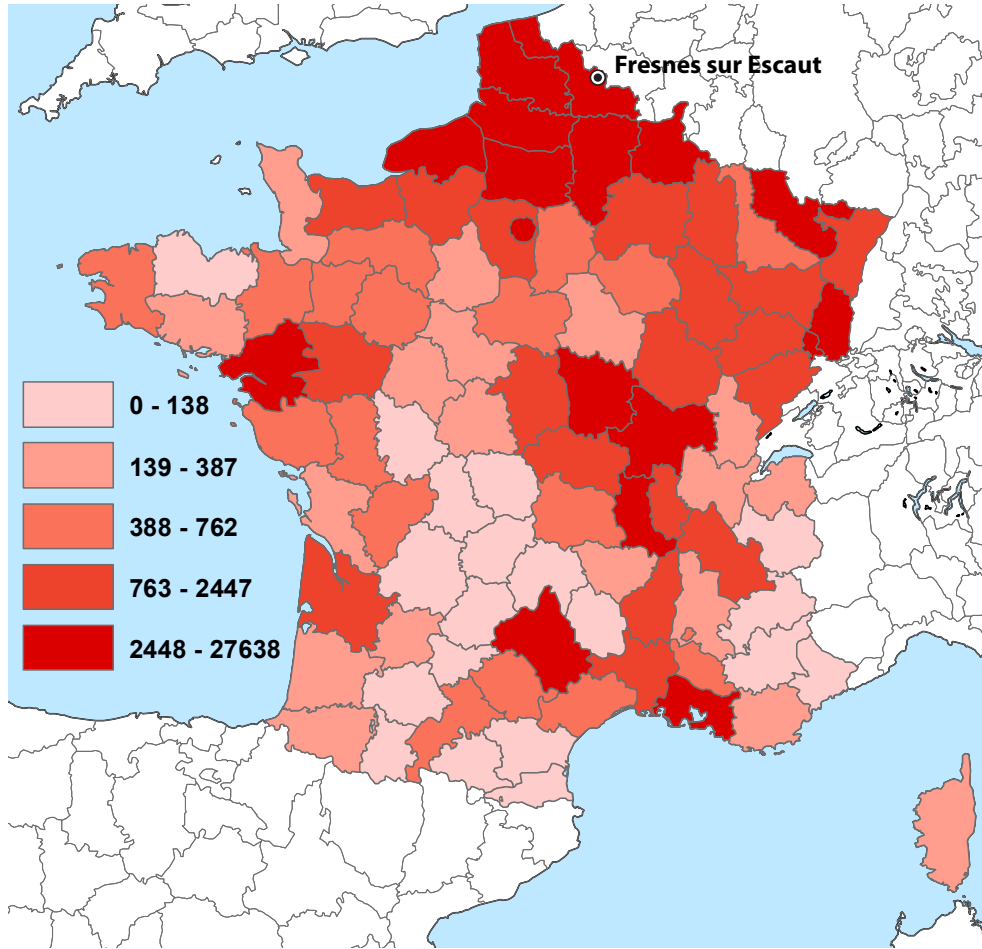
The empirical analysis accounts for the potentially confounding impact of exogenous geographical characteristics of each of the French departments on the relationship between industrialization and economic development. In particular, it captures the potential effect of these geographical factors on the profitability of the adoption of the steam engine, the pace of its regional diffusion, as well as on productivity and thus the evolution of income per capita in the process of development.

First, the study accounts for climatic and soil characteristics of each department (i.e., land

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<sup>8</sup>For details on the implementation of this survey, see Chanut et al. (2000).





**Figure 1:** The distribution of the total horse power of steam engines across departments in France, 1860-1865.

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 the evolution of aggregate productivity in each department.

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. In particular, it accounts for the effect of the latitude of each department, border departments (i.e., positioned along the border with Belgium, Luxembourg, Germany, Switzerland, Italy and Spain), 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 process of development as well as on the adoption the steam engine. In particular, it captures by the potential effect of maritime departments (i.e., those department that are positioned along the

sea shore of France) via trade on the diffusion of the steam engine and thus economic development as well as its direct effect on the evolution of income per capita over this time period.

### 2.3.2 Institutional characteristics

The analysis focuses on the effect of variations in the adoption of the steam engine across departments within France on their comparative development. This empirical strategy ensures that institutional factors that were unique to France as a whole over this time period are not the source of the differential pattern of development across these regions. Nevertheless, two regions of France over this time period had a unique exposure to institutional characteristics that may have contributed to the observed relationship between industrialization and economic development.

First, the emergence of state centralization in France, centuries prior to the process of industrialization, and the concentration of political power in Paris, may have affected differentially the political culture and economic prosperity in *Paris and its suburbs* (i.e., Seine, Seine-et-Marne and Seine-et-Oise). Hence, the empirical analysis includes a dummy variable for these three departments, accounting for their potential confounding effects on the observed relationship between industrialization and economic development, in general, and the adoption of the steam engine, in particular. Moreover, the analysis captures the potential decline in the grip of the central government in regions at a greater distance from Paris, and the diminished potential diffusion of development into these regions, accounting for the effect of the aerial distance between the administrative center of each department and Paris.

Second, the relationship between industrialization and development in the *Alsace-Lorraine* region (i.e., the Bas-Rhin, Haut-Rhin and the Moselle departments) that was under German domination in the 1871-1918 period may represent the persistence of institutional and economic characteristics that reflected their unique experience.<sup>9</sup> Hence, the empirical analysis includes a dummy variable for these regions, accounting for the confounding effects of the characteristics of the region.

### 2.3.3 Pre-industrial development

The differential level of development across France in the pre-industrial era may have affected jointly the process of development and the process of industrialization. In particular, it may have affected the adoption of the steam engine and it may have generated, independently, a persistent effect on the process of development. Hence, the empirical analysis accounts for the potentially confounding effects of the level of development in the pre-industrial period, more than 150 years prior to the 1860-1865 industrial survey. This early level of development is captured by the degree

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<sup>9</sup>Differences in the welfare laws and labor market regulations in Alsace-Lorraine and the rest of France persisted throughout most of the 20<sup>th</sup> century (see, e.g., Chemin and Wasmer, 2009). The laws on the separation of Church and State are also different, and these differences were reaffirmed by a decision of the Supreme French Constitutional Court in 2013 (Decision 2012-297 QPC, 21 February 2013).

of urbanization (i.e., population of urban centers with more than 10,000 inhabitants) in each French department in 1700 (Lepetit, 1994).<sup>10</sup>

### 3 Empirical methodology

#### 3.1 Empirical strategy

The observed relationship between industrialization and economic development is not necessarily indicative of the causal effect of industrialization on economic prosperity. It may reflect the impact of economic development on the process of industrialization as well as the influence of institutional, geographical, cultural and human capital characteristics on the joint evolution of process of development and the onset of industrialization. In light of the endogeneity of industrialization and economic development, this research exploits exogenous regional variations in the adoption of the steam engine across France to establish the effect of industrialization on the process of development.

The identification strategy is motivated by the historical account of the gradual regional diffusion of the steam engine in France during the 18<sup>th</sup> and 19<sup>th</sup> century (Ballot, 1923; Sée, 1925; Léon, 1976).<sup>11</sup> Considering the positive association between industrialization and the intensity in 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 1860-1865 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 commercial application of the steam engine across France was made in 1732, as an instrument for the use of the steam engines in 1860-1865.<sup>12</sup>

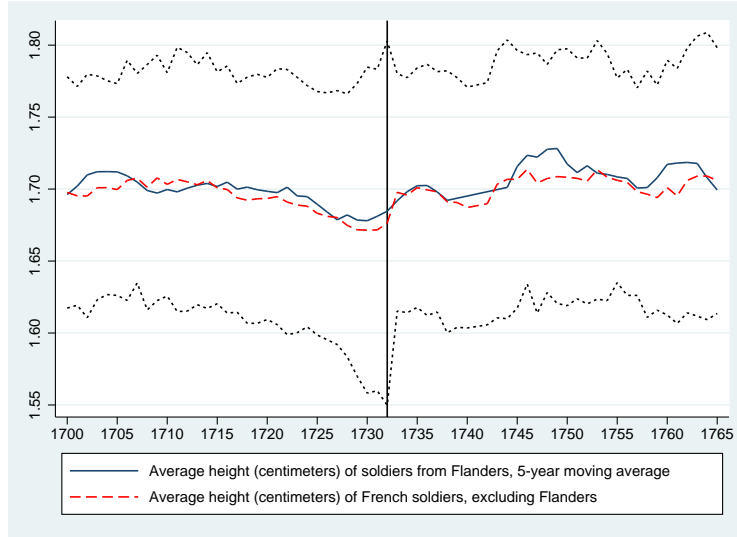
Consistent with the diffusion hypothesis, the second steam engine in France that was utilized for commercial purposes was operated in 1737 in the mines of Anzin, also in the Nord department, less than 10 km away from Fresnes-sur-Escaut. Furthermore, in the subsequent decades till the French Revolution 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).

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<sup>10</sup>The qualitative analysis remains intact if the potential effect of past population density is accounted for.

<sup>11</sup>There was also a regional pattern in the diffusion of steam engines in England (Kanefsky and Robey, 1980; Nuvolari et al., 2011) and in the USA (Atack, 1979).

<sup>12</sup>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).



**Figure 2:** Average height of soldiers in France, 1700-1765

Note: This figure displays the average mean height of soldiers from Flanders and from the rest of France. The interval between the dotted lines reflects the standard deviation around the national average (excluding Flanders). The vertical line marks the year 1732 when the first commercial application of the steam engine was made in France.

It appears that the Nord department had neither superior human capital characteristics nor higher standard of living in comparison to the average department in France. An imperfect measure of literacy (i.e., men who could sign their wedding contract over the 1686-1690 period) prior to the introduction of the first steam engine in 1732, suggests that if anything, Nord’s literacy rate was below the French average. Specifically, only 10.45% of men in Nord could sign their wedding contract over the 1686-1690 period while the average for the rest of France was 26.10% (with a standard deviation of 14.86%) (Furet and Ozouf, 1977). Furthermore, using height as an indicator for the standard of living suggests that the standard living in Flanders, the province of the French kingdom prior to 1789 which contained Fresnes-sur-Escaut, was nearly identical to that of the rest of France.(Komlos, 2005).<sup>13</sup> As depicted in Figure 2, variations in the average height of French army soldiers from Flanders over the 1700-1765 period were not different from those of the soldiers from other parts of France.

Nevertheless, in light of the confounding effects of geographic, institutional and demographic characteristics on the pace of technological diffusion, as well as on the process of development, in order to mitigate the potential effect of unobserved heterogeneity, the econometric model accounts for a wide range of these characteristics (altitude, latitude, rainfall, land suitability, maritime and border departments, Paris and its suburbs, Alsace-Lorraine, the distance to Paris).

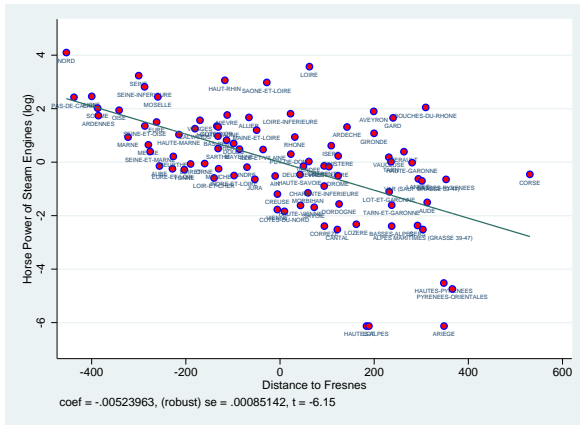
<sup>13</sup>Concerns regarding selection bias suggest that the height of soldiers may not always be representative of the height of the general population (see, e.g., Weir, 1997; Baten, 2000) but there is no reason to think that this selection bias would be more or less intense in Flanders than in the rest of France.

Indeed, in line with the historical account, the distribution of steam engines across French departments, as reported in the 1860-1865 industrial survey, is indicative of a local diffusion process from Fresnes-sur-Escaut. As reported in Column 1 of Table 1 and shown in Panel A of Figure 3, there is a highly significant negative correlation between the distance from Fresnes-sur-Escaut to the administrative center of each department and the intensity of the use of steam engines in the department. Nevertheless, as discussed in Section 2.3, pre-industrial development and a wide range of confounding geographical and institutional characteristics may have contributed to the adoption of the steam engine. Reassuringly, the unconditional negative relationship remains highly significant and is larger in absolute value when exogenous confounding geographical controls i.e., land suitability, latitude, rainfall and temperature (Column 2), as well as institutional factors and pre-industrial development (Column 3), are accounted for. In particular, the findings suggest that pre-industrial development, as captured by the degree of urbanization in each department in 1700 and the characteristics that may have brought this early prosperity, had a persistent positive and significant association with the adoption of the steam engine. Importantly, the diffusion pattern of steam engines is not significantly correlated with the distance between Paris and the administrative center of each department when the distance from Fresnes to each department's administrative center is excluded from the analysis (Column 4). Moreover, Column 5 of Table 1 and Panel B of Figure 3 indicate that there is still a highly significant negative correlation between the distance from Fresnes-sur-Escaut to the administrative center of each department and the intensity of the use of steam engines in the department when the distance to Paris is included. In particular, a 100-km increase in the distance from Fresnes is associated with a 1.33 point decrease in the log of the total horse power of the steam engines in a given department, relative to the departmental average of log horse power of 3.26.

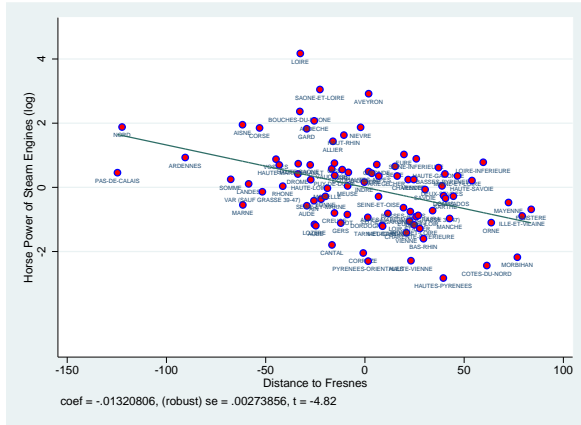
**Table 1:** The geographical diffusion of the steam engine

|                              | (1)<br>OLS            | (2)<br>OLS           | (3)<br>OLS           | (4)<br>OLS           | (5)<br>OLS          | (6)<br>OLS           |
|------------------------------|-----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| Horse Power of Steam Engines |                       |                      |                      |                      |                     |                      |
| Distance to Fresnes          | -0.005***<br>[0.0008] | -0.008***<br>[0.002] | -0.009***<br>[0.002] | -0.008***<br>[0.002] |                     | -0.013***<br>[0.003] |
| Distance to Paris            |                       |                      |                      |                      | 0.001<br>[0.003]    | 0.009***<br>[0.003]  |
| Average Rainfall             |                       | 2.017<br>[1.258]     | 0.997<br>[1.110]     | 1.834<br>[1.157]     | 1.592<br>[1.150]    | 1.173<br>[1.064]     |
| Average Temperature          |                       | 4.875***<br>[1.328]  | 2.003*<br>[1.109]    | 2.197**<br>[1.018]   | 1.469<br>[0.983]    | 2.545**<br>[0.983]   |
| Latitude                     |                       | -4.314<br>[9.103]    | -19.63*<br>[11.35]   | -13.92<br>[10.91]    | 23.75**<br>[10.80]  | -6.527<br>[10.77]    |
| Land Suitability             |                       | -0.773<br>[0.710]    | -0.402<br>[0.667]    | -0.545<br>[0.643]    | -0.0915<br>[0.600]  | -0.743<br>[0.590]    |
| Maritime Department          |                       |                      | 0.790**<br>[0.377]   | 0.530<br>[0.353]     | -0.156<br>[0.403]   | 0.0136<br>[0.400]    |
| Border Department            |                       |                      | -0.407<br>[0.417]    | -0.240<br>[0.408]    | -0.166<br>[0.485]   | -0.797*<br>[0.442]   |
| Paris and Suburbs            |                       |                      | 0.225<br>[0.730]     | 0.159<br>[0.442]     | 0.633<br>[0.483]    | 0.956*<br>[0.512]    |
| Alsace-Lorraine              |                       |                      | 1.979***<br>[0.597]  | 1.505**<br>[0.751]   | 0.907<br>[1.018]    | 0.785<br>[0.848]     |
| Urban Population in 1700     |                       |                      |                      | 0.224**<br>[0.094]   | 0.283***<br>[0.098] | 0.208**<br>[0.091]   |
| Adjusted $R^2$               | 0.326                 | 0.405                | 0.570                | 0.583                | 0.548               | 0.624                |
| Observations                 | 89                    | 89                   | 89                   | 89                   | 89                  | 89                   |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.



Panel A. Unconditional.



Panel B. Conditional on geography, institutions & distance from Paris.

**Figure 3:** The geographical diffusion of the steam engine – the negative relationship between the distance from Fresnes-sur-Escaut and the intensity in the use of the steam engine.

Note: These figures depict the partial regression line for the effect of the distance from Fresnes-sur-Escaut on the horse power in steam engines in each French department in 1860-1865. Panel A presents the unconditional relationship while Panel B reports the relationship which controls for geographic and institutional characteristics, as well as for pre-industrial development. Thus, the x- and y-axes in Panels A and B plot the residuals obtained from regressing steam engine intensity and the distance from Fresnes, respectively with and without the aforementioned set of covariates.

The highly significant negative correlation between the use of the steam engine in each department and 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, political and institutional characteristics, as well as to the forces of pre-industrial development, which as discussed in section 4.2, may have contributed to the relationship between industrialization and economic development. As established in Table B.12 in Appendix B, these confounding factors, which could be largely viewed as endogenous to the adoption of the steam engine and are thus not part of the baseline analysis, do not affect the qualitative results.

### 3.2 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 total horse power of steam engines in each department in 1860-1865 to measures of income per capita, human capital formation and other economic outcomes at different points in time;

$$Y_{it} = \alpha + \beta E_i + \mathbf{X}'_i \omega + \varepsilon_{it}, \quad (1)$$

where  $Y_{it}$  represents one measure of economic outcomes in department  $i$  in year  $t$ ,  $E_i$  is the log of total horse power of steam engines in department  $i$  in 1860-1865,  $\mathbf{X}'_i$  is a vector of geographical, institutional and pre-industrial economic characteristics of department  $i$  and  $\varepsilon_{it}$  is an i.i.d. error term for department  $i$  in year  $t$ .

In the first stage,  $E_i$ , the log of total horse power of steam engines in department  $i$  in 1860-1865 is instrumented by  $D_i$ , the aerial distance (in kilometers) between the administrative center of department  $i$  and Fresnes-sur-Escaut;

$$E_i = \delta_1 D_i + \mathbf{X}'_i \delta_2 + \mu_i, \quad (2)$$

where  $\mathbf{X}'_i$  is the same vector of geographical, institutional and pre-industrial economic characteristics of department  $i$  used in the second stage, and  $\mu_i$  is an error term for department  $i$ .

## 4 Industrialization and the evolution of income per capita

### 4.1 Baseline regressions

The study examines the effect of the intensity in the use of steam engines in the 1860-1865 period on the evolution of income per capita in the process of development. As established in Tables 2 and 3, and depicted in Figure 4, consistently with the proposed hypothesis, industrialization was

conducive for economic development in the short-run and in the medium-run but had a detrimental effect on standards of living in the long-run.<sup>14</sup> In particular, the horse power of steam engines in industrial production in the 1860-1865 period had a positive and significant impact on income per capita in 1872, 1901 and 1930 but a negative and significant effect on income per capita during the 2001-2010 period.

The relationship between industrialization and income per capita in the short-run and in the medium-run is presented in Table 2 and in the first five Columns of Table 3. As shown in Columns (1) and (6) in Table 2 and in Column (1) in Table 3, unconditionally, the horse power of steam engines in industrial production in the 1860-1865 period had a highly significant positive association with income per capita in 1872, 1901 and 1930. Moreover, this relationship remains positive, although somewhat smaller and less significant, once one progressively accounts for the confounding effects of exogenous geographical factors (Columns (2) and (7) in Table 2 and Column (2) in Table 3), institutional factors (Columns (3) and (8) in Table 2 and Column (3) in Table 3) and pre-industrial characteristics (Columns (4) and (9) in Table 2 and Column (4) in Table 3). Finally, mitigating the effect of omitted variables on the observed relationship, the IV estimation in Columns (5) and (10) in Table 2 and Column (5) in Table 3 suggests that the horse power of steam engines in 1860-1865 had a positive and significant impact on income per capita in 1872, 1901 and 1930, accounting for the confounding effects of geographical, institutional, and demographic characteristics.<sup>15</sup>

The relationship between industrialization and income per capita in the long-run is presented in the last 5 columns of Table 3. As shown in Column (6), unconditionally, the horse power of steam engines in industrial production in 1860-1865 has a significant positive association with the average level of income per capita across departments over the 2001-2010 period. Moreover, this relationship remains positive, although smaller and ultimately insignificant, once one progressively accounts for the confounding effects of exogenous geographical factors (Column (7) in Table 3), institutional factors (Column (8) in Table 3) and pre-industrial characteristics (Column (9) in Table 3). However, once the effect of omitted variables is accounted for, the IV estimation in Column (10) in Table 3, suggests that the horse power of steam engines in 1860-1865 had a negative and significant impact on the average level of income per capita across departments over the 2001-2010 period.

It is important to note that the IV estimation reverses the OLS estimates of the relation-

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<sup>14</sup>Given data limitation on income per capita across departments in the post-industrial survey period (as elaborated in section 2), the short-run effect of industrialization on income per capita is captured by its impact in 1872 and 1901, its medium-run effect by its impact in 1930, while its long-run effect is captured by its impact on the average level of income per capita across departments over the 2001-2010 period.

<sup>15</sup>The F-statistic in the first stage is superior to the critical values reported by Stock and Yogo (2005), thus suggesting that the instrument is not weak. Furthermore, the IV coefficient in each specification is larger than the OLS coefficient, which can probably be attributed to measurement error in the independent variable – the horse power of steam engines.



**Table 2:** Industrialization and income per capita, 1872 & 1901

|                              | (1)                  | (2)                  | (3)                | (4)                | (5)                 | (6)                  | (7)                  | (8)                 | (9)                 | (10)                |
|------------------------------|----------------------|----------------------|--------------------|--------------------|---------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
|                              | OLS                  | OLS                  | OLS                | OLS                | IV                  | OLS                  | OLS                  | OLS                 | OLS                 | IV                  |
|                              | GDP per capita, 1872 |                      |                    |                    |                     | GDP per capita, 1901 |                      |                     |                     |                     |
| Horse Power of Steam Engines | 0.070***<br>[0.012]  | 0.038*<br>[0.020]    | 0.035*<br>[0.021]  | 0.025<br>[0.018]   | 0.121**<br>[0.052]  | 0.053***<br>[0.013]  | 0.054**<br>[0.025]   | 0.055**<br>[0.024]  | 0.049*<br>[0.027]   | 0.244***<br>[0.072] |
| Average Rainfall             |                      | -0.613***<br>[0.214] | -0.420*<br>[0.213] | -0.312<br>[0.211]  | -0.505**<br>[0.239] |                      | -0.584***<br>[0.215] | -0.471**<br>[0.203] | -0.407*<br>[0.208]  | -0.795**<br>[0.338] |
| Average Temperature          |                      | 0.283<br>[0.256]     | 0.178<br>[0.285]   | 0.212<br>[0.294]   | 0.109<br>[0.315]    |                      | -0.486<br>[0.313]    | -0.350<br>[0.320]   | -0.330<br>[0.331]   | -0.537<br>[0.361]   |
| Latitude                     |                      | 0.113<br>[0.151]     | 0.150<br>[0.128]   | 0.135<br>[0.126]   | 0.118<br>[0.127]    |                      | 0.358**<br>[0.166]   | 0.321**<br>[0.148]  | 0.312**<br>[0.151]  | 0.279*<br>[0.156]   |
| Land Suitability             |                      | 0.740<br>[1.339]     | -3.021<br>[3.266]  | -2.623<br>[3.117]  | -4.899<br>[3.123]   |                      | -1.343<br>[1.409]    | -4.362<br>[3.756]   | -4.124<br>[3.820]   | -8.713**<br>[3.849] |
| Maritime Department          |                      |                      | 0.113<br>[0.097]   | 0.0891<br>[0.104]  | 0.108<br>[0.111]    |                      |                      | 0.0188<br>[0.111]   | 0.00464<br>[0.119]  | 0.0438<br>[0.138]   |
| Border Department            |                      |                      | -0.0326<br>[0.134] | -0.0264<br>[0.140] | 0.006<br>[0.138]    |                      |                      | 0.086<br>[0.127]    | 0.090<br>[0.130]    | 0.155<br>[0.163]    |
| Distance to Paris            |                      |                      | -0.001<br>[0.0008] | -0.001<br>[0.0008] | -0.001<br>[0.0007]  |                      |                      | -0.0009<br>[0.0009] | -0.0009<br>[0.0009] | -0.001<br>[0.0008]  |
| Paris and Suburbs            |                      |                      | 0.040<br>[0.111]   | 0.037<br>[0.114]   | -0.016<br>[0.116]   |                      |                      | -0.080<br>[0.151]   | -0.082<br>[0.159]   | -0.189<br>[0.171]   |
| Urban Population in 1700     |                      |                      |                    | 0.025<br>[0.022]   | -0.006<br>[0.030]   |                      |                      |                     | 0.015<br>[0.025]    | -0.049<br>[0.039]   |
| Adjusted R2                  | 0.174                | 0.377                | 0.390              | 0.395              |                     | 0.088                | 0.185                | 0.173               | 0.165               |                     |
| Observations                 | 85                   | 85                   | 85                 | 85                 | 85                  | 85                   | 85                   | 85                  | 85                  | 85                  |

First stage: the instrumented variable is Horse Power of Steam Engines

|                                |  |  |  |  |                      |  |  |  |  |                      |
|--------------------------------|--|--|--|--|----------------------|--|--|--|--|----------------------|
| Distance to Fresnes            |  |  |  |  | -0.012***<br>[0.003] |  |  |  |  | -0.012***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage) |  |  |  |  | 19.526               |  |  |  |  | 19.526               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. The *Alsace-Lorraine* variable is omitted from the regressions since the Alsace-Lorraine region was not part of France between 1871 and 1914. 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.

ship between industrialization and the long-run level of income per capita from a positive to a negative one. This reversal suggests that factors which fostered industrial development, rather than industrialization per se, contributed to the positive association between industrialization and long-run development. In particular, once one accounts for the effect of these omitted factors, industrialization has an adverse effect on the standard of living in the long-run.

In particular, as discussed in Section 2.3, the regressions in Tables 2 and 3 account for a large number of confounding geographical and institutional factors. 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 aggregate productivity in each department. Indeed, as predicted, land suitability had a significantly negative association with income per capita in 1901 and 1930 in the IV regressions (Column (10) in Table 2 and Column (5) in Table 3), suggesting that indeed more productive land had an adverse effect on

**Table 3:** Industrialization and income per capita, 1930 & 2001-2010

|                              | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  | (6)                               | (7)                 | (8)                 | (9)                 | (10)                |
|------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------------------|---------------------|---------------------|---------------------|---------------------|
|                              | OLS                  | OLS                  | OLS                  | OLS                  | IV                   | OLS                               | OLS                 | OLS                 | OLS                 | IV                  |
|                              | GDP per capita, 1930 |                      |                      |                      |                      | GDP per capita, 2001-2010 average |                     |                     |                     |                     |
| Horse Power of Steam Engines | 0.063***<br>[0.010]  | 0.078***<br>[0.014]  | 0.075***<br>[0.012]  | 0.060***<br>[0.012]  | 0.102***<br>[0.026]  | 0.021**<br>[0.0097]               | 0.031**<br>[0.013]  | 0.026**<br>[0.011]  | 0.009<br>[0.007]    | -0.061**<br>[0.026] |
| Average Rainfall             |                      | -0.361***<br>[0.106] | -0.302***<br>[0.095] | -0.123<br>[0.105]    | -0.211*<br>[0.125]   |                                   | -0.250*<br>[0.126]  | -0.150<br>[0.094]   | 0.0539<br>[0.089]   | 0.164<br>[0.128]    |
| Average Temperature          |                      | -0.525***<br>[0.096] | -0.453***<br>[0.105] | -0.396***<br>[0.106] | -0.444***<br>[0.113] |                                   | -0.232**<br>[0.099] | -0.244**<br>[0.122] | -0.155<br>[0.121]   | -0.0530<br>[0.143]  |
| Latitude                     |                      | 0.288***<br>[0.053]  | 0.277***<br>[0.047]  | 0.249***<br>[0.050]  | 0.244***<br>[0.049]  |                                   | 0.012<br>[0.055]    | 0.029<br>[0.054]    | -0.017<br>[0.057]   | -0.024<br>[0.066]   |
| Land Suitability             |                      | -2.066***<br>[0.467] | -2.955**<br>[1.174]  | -2.445**<br>[1.125]  | -3.325***<br>[1.160] |                                   | -0.706*<br>[0.416]  | -0.724<br>[1.004]   | 0.0547<br>[0.903]   | 1.702<br>[1.136]    |
| Maritime Department          |                      |                      | 0.037<br>[0.053]     | 0.002<br>[0.055]     | 0.007<br>[0.056]     |                                   |                     | 0.037<br>[0.047]    | -0.011<br>[0.046]   | -0.022<br>[0.053]   |
| Border Department            |                      |                      | 0.077<br>[0.047]     | 0.089**<br>[0.043]   | 0.102**<br>[0.046]   |                                   |                     | 0.015<br>[0.055]    | 0.039<br>[0.042]    | 0.027<br>[0.045]    |
| Distance to Paris            |                      |                      | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  |                                   |                     | 0.00003<br>[0.0003] | 0.0001<br>[0.0002]  | 0.0002<br>[0.0003]  |
| Paris and Suburbs            |                      |                      | 0.269*<br>[0.145]    | 0.259**<br>[0.101]   | 0.239***<br>[0.0877] |                                   |                     | 0.398*<br>[0.206]   | 0.393***<br>[0.145] | 0.437***<br>[0.154] |
| Alsace-Lorraine              |                      |                      | 0.180**<br>[0.079]   | 0.138**<br>[0.067]   | 0.0920<br>[0.083]    |                                   |                     | 0.0474<br>[0.091]   | -0.0334<br>[0.088]  | 0.0295<br>[0.106]   |
| Urban Population in 1700     |                      |                      |                      | 0.0403***<br>[0.012] | 0.028**<br>[0.013]   |                                   |                     |                     | 0.051***<br>[0.011] | 0.071***<br>[0.015] |
| Adjusted R2                  | 0.339                | 0.499                | 0.566                | 0.636                |                      | 0.059                             | 0.069               | 0.210               | 0.415               |                     |
| Observations                 | 87                   | 87                   | 87                   | 87                   | 87                   | 89                                | 89                  | 89                  | 89                  | 89                  |

First stage: the instrumented variable is Horse Power of Steam Engines

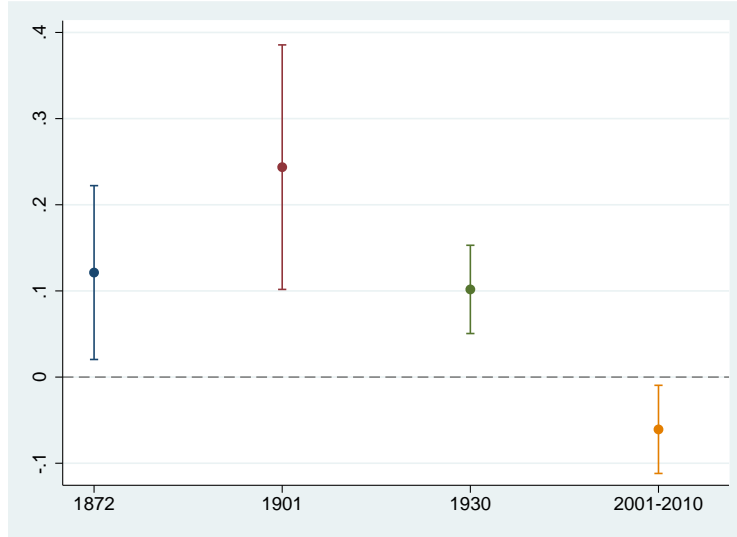
|                                |  |  |  |  |                      |  |  |  |  |                      |
|--------------------------------|--|--|--|--|----------------------|--|--|--|--|----------------------|
| Distance to Fresnes            |  |  |  |  | -0.013***<br>[0.003] |  |  |  |  | -0.013***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage) |  |  |  |  | 20.617               |  |  |  |  | 23.261               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 incentive to adopt the industrial technology. Moreover, the latitude of each department had a positive and significant relationship with income per capita in 1901 and 1930 (Columns (7) to (10) in Table 2 and Columns (2) to (5) in Table 3), capturing characteristics of northern departments which were conducive to economic prosperity.

Second, 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 those that were temporarily under German domination) could have affected the diffusion of the steam engine and the diffusion of development. However, most of these factors appear orthogonal to the evolution of income per capita, except for the dummy variable for Paris and its suburbs that is significantly associated with income per capita in 1930 and in the 2001-2010 period (Columns (3) to (5) and (8) to (10) in Table 3).

Third, the regressions account for the potentially confounding effects of the level of development in the pre-industrial period, as captured by the degree of urbanization in each department



**Figure 4:** The effect of the horse power of steam engines in 1860-1865 on GDP per capita

Note: This figure displays the estimated coefficients of *Horse Power of Steam Engines* in the IV regressions in Columns 5 and 10 of Tables 2 and 3. Intervals reflect 95%-confidence levels.

in 1700. The findings suggest that pre-industrial development (and the characteristics that may have brought this early prosperity) had a persistent positive and significant effect on later stages of development, as captured by the level of income per capita in 1930 and 2001-2010 (Columns (4), (5), (9) and (10) in Table 3), but no impact on the early phases of industrialization, as captured by income per capita in 1872 and 1901 (Columns (4), (5), (9) and (10) in Table 2).

Fourth, the regressions account for potential anomalies associated with the three departments that had no steam engine in 1860-1865, as discussed in Section 2.3. Finally, as established in Appendix F, the association between intensity of the steam engines and income per capita in 1872, 1901, 1930 and 2001-2010 is not affected by spatial correlation.

## 4.2 Robustness analysis

This section examines the robustness of the baseline analysis to the inclusion of an additional set of confounding geographical, demographic, political and institutional characteristics, as well as for the forces of pre-industrial development, which may have contributed to the relationship between industrialization and economic development. The analysis focuses on the potential impact of these confounding factors on the baseline IV regressions in Tables 2 and 3, where the dependent variables are income per capita in 1872, 1901, 1930 and 2001-2010. As will become apparent, most of these confounding factors could be viewed as endogenous to the adoption of the steam engine and are thus not part of the baseline analysis.<sup>16</sup>

<sup>16</sup>Some of these characteristics could be viewed as “bad controls” (Angrist and Pischke, 2009).

### 4.2.1 Population density

The empirical analysis accounts for a wide range of exogenous confounding geographical and institutional characteristics, as well as for pre-industrial development, which may have contributed to the relationship between industrialization and economic development. Nevertheless, in light of the evidence that steam engines were more likely to be located in urban centers (Rosenberg and Trajtenberg, 2004), it appears plausible that the adoption of the steam engine was influenced by the contemporaneous but potentially endogenous level of population density at the time.

Reassuringly, as established in Table B.1 in Appendix B, the inclusion of population density in each French department in 1801, 1831 and 1861 has no qualitative impact on the estimated effects of industrialization or on the statistical significance of these effects. Accounting for the confounding effects of exogenous geographical, institutional, and pre-industrial characteristics, the horse power of steam engines in industrial production in the 1860-1865 period had a positive and significant impact on income per capita in 1872, 1901 and 1930, and a negative and significant impact on income per capita in the years 2001-2010.

In addition, the qualitative results are robust for the estimation of the effect of steam engine intensity (i.e., horse power of steam engine per labor in 1861) on the process of development.<sup>17</sup> As reported in Table B.2 in Appendix B, accounting for the confounding effects of exogenous geographical, institutional, and pre-industrial characteristics, steam engine intensity in industrial production in the 1860-1865 period had a positive and significant impact on income per capita in 1872, 1901 and 1930, and a negative and significant impact on income per capita in 2001-2010.

### 4.2.2 Distance from London

In light of the earlier use of the steam engine in England and the intensive trade relationship between France and England, the diffusion of the steam engine in France as well as its process of development could have been affected by geographic proximity to England (proxied by the aerial distance between London and the administrative center of each department). As reported in Table B.3 in Appendix B, accounting for distance from England has largely no qualitative impact on the results. In particular, accounting for the confounding effects of exogenous geographical, institutional, and pre-industrial characteristics, industrialization had an insignificant positive effect on income per capita in 1872, a positive and significant impact on income per capita in 1901 and 1930, and a negative and significant impact on income per capita in 2001-2010.

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<sup>17</sup>Given the endogeneity of population, these estimates are likely to be biased.

### 4.2.3 Human Capital

Considering evidence about capital-skill complementarity as well as the comparative advantage of educated individuals in adopting new technologies (Nelson and Phelps, 1966; Jovanovic and Rousseau, 2005), the diffusion of the steam engine could have been affected by the level of human capital in each department. Using data on the percentage of French army conscripts who could at least read in 1827-1829, 1831-1835 and 1836-1840, (which could be endogenous to the process of industrialization), it appears in Table B.4 that this measure of human capital had no qualitative impact on the estimated effects of industrialization or on the statistical significance of these effects. In particular, accounting for the confounding effects of exogenous geographical, institutional, and pre-industrial characteristics, industrialization had a positive and significant impact on income per capita in 1872, 1901 and 1930, and a negative and significant impact on income per capita in 2001-2010.

### 4.2.4 Migrations

Internal as well as international migration in response to the differential impact of industrialization on income per capita across departments could have mitigated the effect of industrialization on income per capita that would have been observed in the absence of internal and external migration. Indeed, as reported in Table B.5, migration mitigated the positive effect of industrialization in the short-run as well as the negative effect of industrialization in the long-run. Accounting for the share of the native population in each department in 1901 and 2001-2010,<sup>18</sup> the positive effect of industrialization on income per capita in the year 1901 is larger and highly significant (i.e., the coefficient on steam engine in Column (2) in comparison to that in Column (1)), whereas the negative effect of industrialization on income per capita in the 2001-2010 period is significant and smaller in absolute value (i.e., the coefficient on steam engine in Column (4) in comparison to that in Column (3)). Moreover, since migration flows are likely to be towards more prosperous departments, a higher percentage of natives in the departmental population is indicative of a less attractive migration destination, and indeed in both time periods higher percentage of native population is associated with lower income per capita (Column (2) and (4)), although the relationship is not significant in the modern period.

### 4.2.5 The presence of raw material - iron forges

The diffusion of the steam engine across French departments as well as the process of development could have been affected by the presence of raw material required for industrialization. Nevertheless, as established in Table B.6, accounting for the number of iron forges in 1789 and 1811 in each

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<sup>18</sup>The 1872 and 1931 censuses do not provide information on the native population in each department.

department (Woronoff, 1997), the effect of industrialization on income per capita in the process of development remains nearly intact, economically and statistically.

#### 4.2.6 Economic integration

The diffusion of the steam engine across French departments as well as the process of development could have been affected by the degree of geographical and economic integration of each department into the French economy. First, as reported in Table B.7, the degree of market integration of each department, as captured by the number of its external suppliers in the 1790s (Daudin, 2010), has no qualitative impact on the effect of industrialization on income per capita in the process of development. Second, as reported in Table B.8, accounting for the presence of railroad connection in 1860 (Caron, 1997),<sup>19</sup> the effect of industrialization on income per capita in the process of development remains nearly intact, economically and statistically.

#### 4.2.7 Industrial concentration

The degree of industrial concentration in each department could have affected the diffusion of the steam engine across French departments as well as the process of development. Nevertheless, as reported in Table B.9, accounting for the degree of industrial concentration in the 1860-1865 period, proxied by the Hirfendahl index of the 16 different industries listed in the 1860-1865 industrial survey (textile, mines, metallurgy, metal objects, leather, wood, ceramics, chemistry, construction, lighting, furniture, clothing, food, transportation, sciences & arts, and luxury goods), the effect of industrialization on income per capita in the process of development remains nearly intact, economically and statistically.<sup>20</sup>

#### 4.2.8 World War I and World War II

World War I and World War II, and the associated destruction of physical and human capital, may have affected the process of industrialization as well as the future course of development. While there is no accurate dataset on the destruction of physical capital at the departmental level, accounting for the destruction of human capital, as proxied by the number of soldiers from each department who died in each war, does not affect the qualitative results. In particular, casualties in each war has no qualitative impact on the effect of industrialization on income per capita in 1930

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<sup>19</sup>The early network was built around seven lines in order to connect Paris to the main economic centres of the country (Caron, 1997).

<sup>20</sup>The Herfindahl index of industry concentration is defined as,  $H_d = \sum_{i=1}^{16} (E_{i,d}/E_d)^2$ , where  $H_d$  is the Herfindahl concentration index for department  $d$ ,  $E_{i,d}$  is the horse power of the steam engines in the firms in sector  $i$  of department  $d$  and  $E_d$  is the horse power of the steam engines in the firms of department  $d$ .

and 2001-2010 (Table B.10) as well as on the share of employment in the industrial sector (Table B.11).

### **4.3 Industrialization, employment and inequality**

#### **4.3.1 Industrialization and the evolution of sectoral employment**

The effect of the intensity in the use of the steam engine on the evolution of income per capita corresponds to its effect on the share of employment in the industrial sector. As established in the IV regressions in Columns (3), (6), and (9) of Table C.1 in Appendix C, and as depicted in panel A of Figure 5, an intensive use of the steam engine in 1860-1865 had a highly significant positive effect on the share of employment in the industrial sector in 1872, 1901, and 1930. Moreover, as shown in the IV regressions in Column (3), (6), and (9) of Table C.2 in Appendix C, this effect remains positive and highly significant in 1968, 1975, and 1982. However, as established in the IV regressions in Column (12), (15), and (18) of Table C.2 in Appendix C, this effect dissipates in 1990 and 1999 and it becomes significantly negative in 2010. Furthermore, as established in the corresponding IV regressions in Tables C.3 and C.4 in Appendix C, and as depicted in panel B of Figure 5, an intensive use of the steam engine in 1860-1865 had an insignificant effect on the share of employment in the service sector over the entire period.

As was the case in the income regressions in Tables 2 and 3, the IV estimate in Column (18) of Table C.2 in Appendix C reverses the OLS estimates of the association between industrialization and the share of employment in the industrial sector in 2010, from a positive to a negative one. Moreover the IV estimate in Column (18) of Table C.4 eliminates the positive effect on employment in the service sector. These (weak) reversals suggest that factors which fostered industrial development, rather than industrialization per se, contributed to the positive association between an intensive past use of steam engines and current employment in the industrial and the service sectors.

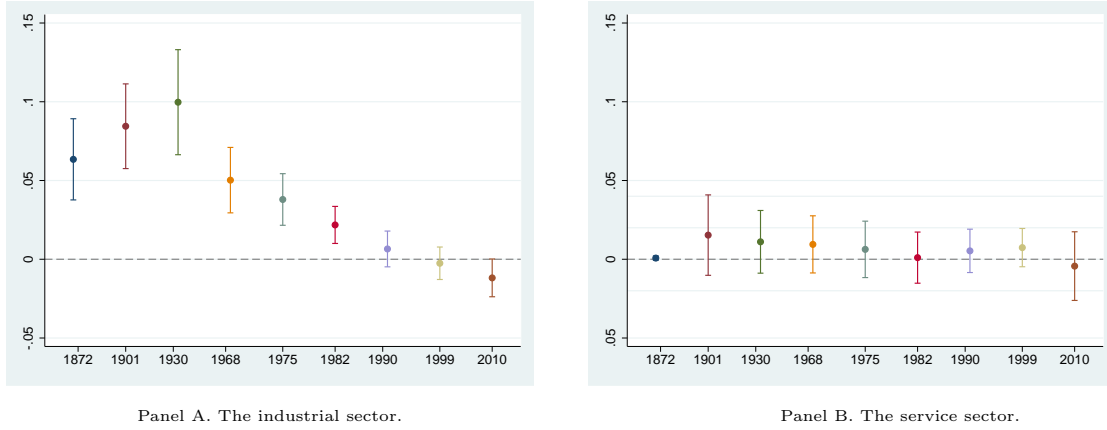
The negative effect of an intensive use of the steam engine in 1860-1865 on industrial employment in the long-run, as well as the absence of its effect on employment in the service sector, suggests that the interpretation of the negative effect of early industrialization on income per capita in the long-run requires a better understanding of the channels through which early industrialization affected the standard of living in the long-run.

#### **4.3.2 Industrialization, unemployment and inequality**

The study finds that industrialization has contributed to the level of unemployment and to the degree of inequality across departments in France in the long-run.<sup>21</sup> Accounting for the confounding effects of geographical, institutional and pre-industrial characteristics, the IV estimate in Column

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<sup>21</sup>As elaborated in section 2, data on these variables are only available for the past decade.



**Figure 5:** The effect of the horse power of steam engines in 1860-1865 on sectoral employment. Note: Panel A: the estimated coefficients of *Horse Power of Steam Engines* on the share of the workforce in the industrial sector in the IV regressions in Tables C.1 and C.2. Panel B: the estimated coefficients of *Horse Power of Steam Engines* on the share of the workforce in the service sector in the IV regressions Tables C.3 and C.4. Intervals reflect 95%-confidence levels.

**Table 4:** Unemployment, Gini inequality coefficient and the distribution of income, after 2000

|  | (1)<br>OLS                             | (2)<br>OLS           | (3)<br>IV            | (4)<br>OLS                            | (5)<br>OLS             | (6)<br>IV   | (7)<br>OLS       | (8)<br>OLS          | (9)<br>IV             |
|--|--|----------------------|----------------------|---------------------------------------|------------------------|---|------------------|---------------------|-----------------------|
|  | Unemployment rate<br>2002-2011 average |                      |                      | Gini coefficient<br>2001-2008 average |                        | 25th Percentile - Fiscal Income per Person<br>in Household, 2001-2010 Average |                  |                     |                       |
| Horse Power of Steam Engines   | 0.019<br>[0.012]                       | 0.043***<br>[0.013]  | 0.156***<br>[0.039]  | 0.004<br>[0.003]                      | 0.010***<br>[0.003]    | 0.046***<br>[0.009]   | 0.009<br>[0.010] | -0.007<br>[0.008]   | -0.098***<br>[0.025]  |
| Average Rainfall   |  | -0.253*<br>[0.129]   | -0.432**<br>[0.203]  |                                       | -0.0798**<br>[0.0325]  | -0.137***<br>[0.0493]   |                  | 0.136<br>[0.0843]   | 0.281*<br>[0.155]     |
| Average Temperature  |  | -0.005<br>[0.137]    | -0.170<br>[0.185]    |                                       | -0.0868**<br>[0.033]   | -0.140***<br>[0.050]  |                  | 0.127<br>[0.092]    | 0.260**<br>[0.127]    |
| Latitude   |  | -1.997<br>[1.222]    | -4.667**<br>[1.893]  |                                       | -0.580**<br>[0.242]    | -1.434***<br>[0.458]  |                  | -0.0367<br>[0.730]  | 2.117*<br>[1.142]     |
| Land Suitability   |  | 0.168***<br>[0.061]  | 0.178**<br>[0.089]   |                                       | 0.0578***<br>[0.015]   | 0.0610**<br>[0.026]   |                  | -0.118**<br>[0.048] | -0.127*<br>[0.070]    |
| Maritime Department  |  | 0.119**<br>[0.057]   | 0.136*<br>[0.070]    |                                       | 0.025*<br>[0.013]      | 0.031*<br>[0.018]   |                  | -0.025<br>[0.033]   | -0.039<br>[0.048]     |
| Border Department  |  | 0.160***<br>[0.059]  | 0.179**<br>[0.075]   |                                       | 0.031**<br>[0.014]     | 0.037**<br>[0.017]  |                  | 0.017<br>[0.040]    | 0.002<br>[0.048]      |
| Distance to Paris  |  | -0.0002<br>[0.0003]  | -0.0003<br>[0.0004]  |                                       | 4.75e-05<br>[6.71e-05] | 7.38e-06<br>[9.99e-05]  |                  | -0.0001<br>[0.0002] | -2.28e-05<br>[0.0003] |
| Paris and Suburbs  |  | -0.152***<br>[0.048] | -0.224***<br>[0.055] |                                       | 0.0821**<br>[0.040]    | 0.0594*<br>[0.031]  |                  | 0.558***<br>[0.192] | 0.616***<br>[0.192]   |
| Alsace-Lorraine  |  | -0.035<br>[0.081]    | -0.137<br>[0.103]    |                                       | -0.008<br>[0.020]      | -0.041<br>[0.032]   |                  | 0.146<br>[0.137]    | 0.229<br>[0.183]      |
| Urban Population in 1700   |  | 0.005<br>[0.010]     | -0.027<br>[0.018]    |                                       | 0.007**<br>[0.003]     | -0.003<br>[0.005]   |                  | 0.013<br>[0.011]    | 0.039**<br>[0.017]    |
| Adjusted R2  | 0.030                                  | 0.384                |                      | 0.014                                 | 0.507                  |   | 0.004            | 0.479               |                       |
| Observations   | 89                                     | 89                   | 89                   | 89                                    | 89                     | 89  | 89               | 89                  | 89                    |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                      |                      |                                       |                        |   |                  |                     |                       |
| Distance to Fresnes  |  |                      | -0.013***<br>[0.003] |                                       |                        | -0.013***<br>[0.003]  |                  |                     | -0.013***<br>[0.003]  |
| F-stat (1 <sup>st</sup> stage)   |  |                      | 23.261               |                                       |                        | 23.261  |                  |                     | 23.261                |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.



(3) of Table 4 suggests that the prevalence of steam power in 1860-1865 had a highly significant positive effect on the average rate of unemployment in the 2002-2011 period.

Moreover, as suggested by Column (6) of Table 4, the intensity in the use of steam engines in 1860-1865 had a positive and highly significant effect on the average Gini inequality index in the 2002-2011 period. Similarly, as reported in Column (9) of Table 4, it had a negative and highly significant effect on the income of the individuals at the bottom 25<sup>th</sup> percentile of the income distribution over the 2001-2010 period.

## 5 Mechanisms

This section explores potential mechanisms that could have led to the detrimental effect of industrialization on the standard of living in the long-run. First, the study examines the adverse effect of industrialization on the level and composition of human capital in each department and thus on the skill-intensity of its production process in the long-run. Second, it explores the contribution of early industrialization to unionization and wage rates and thus the incentive of modern industries to locate in regions where labor markets are more competitive and reflect the marginal productivity of workers. Third, the analysis examines the effect of on trade protection on the decline in competitiveness of each department in the long-run.

### 5.1 Industrialization and the long-run level composition of human capital

This section explores whether the detrimental effect of industrialization on the standard of living in the long-run could be attributed to the effect of industrialization on the evolution of human capital formation. In particular, the study explores the potential adverse effect of industrialization on the level and composition of human capital in each department and thus on the skill-intensity of its production process in the long-run.

Indeed, as established in Tables 5–7, while intensive industrialization had a significantly positive effect on human capital formation in the short-run,<sup>22</sup> it had a significantly negative effect in the level and the composition of human capital in long-run. Hence, despite the fact that industrialization had no effect on the share of employment in the service sector in the long-run, it had a detrimental effect on skilled-intensive occupations as shown in Tables C.5–C.7 in Appendix C and depicted in Panels A–C of Figure 6. Thus, the adverse effect of industrialization on the level of income per-capita in the long-run could be partly attributed to the adverse effect of industrialization on the level and the composition of human capital formation in the long-run.

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<sup>22</sup>The positive effect of industrialization on human capital formation is prevalent over this phase of industrialization (Galor and Moav, 2006).

### 5.1.1 Industrialization and the evolution of human capital

This subsection examines the effect of industrialization on the time path of human capital formation. As reported in Column (3) of Table 5, the horse power of steam engines in industrial production in 1860-1865 had a highly significant positive effect on the literacy of the French army conscripts in the years 1874-1883. However, due to the establishment of 1881-1882 education laws that made primarily schooling compulsory and free till the age of 13, the effect is insignificant in the years 1894-1903 (Column (6)).

**Table 5:** Literacy of conscripts, 1874-1883 & 1894-1903

|  | (1)  | (2)       | (3)       | (4)  | (5)        | (6)        |
|--|--|-----------|-----------|--|------------|------------|
|  | OLS  | OLS       | IV        | OLS  | OLS        | IV         |
|  | Share of Literate Individuals<br>Among Conscripts, 1874-1883 average |           |           | Share of Literate Individuals<br>Among Conscripts, 1894-1903 average |            |            |
| Horse Power of Steam Engines   | 0.008*   | 0.011     | 0.050***  | 0.005**  | 0.008**    | 0.009      |
|  | [0.005]  | [0.008]   | [0.016]   | [0.002]  | [0.004]    | [0.006]    |
| Average Rainfall   |  | 0.053     | -0.013    |  | -0.001     | -0.004     |
|  |  | [0.074]   | [0.071]   |  | [0.033]    | [0.032]    |
| Average Temperature  |  | -0.253*** | -0.323*** |  | -0.145***  | -0.147***  |
|  |  | [0.079]   | [0.070]   |  | [0.030]    | [0.030]    |
| Latitude   |  | -0.657    | -1.815**  |  | -0.634**   | -0.680**   |
|  |  | [0.792]   | [0.768]   |  | [0.268]    | [0.290]    |
| Land Suitability   |  | 0.153***  | 0.161***  |  | 0.069***   | 0.069***   |
|  |  | [0.042]   | [0.041]   |  | [0.014]    | [0.013]    |
| Maritime Department  |  | -0.037    | -0.022    |  | -0.012     | -0.011     |
|  |  | [0.027]   | [0.029]   |  | [0.012]    | [0.011]    |
| Border Department  |  | 0.044*    | 0.046     |  | -0.001     | -0.001     |
|  |  | [0.024]   | [0.030]   |  | [0.011]    | [0.010]    |
| Distance to Paris  |  | -8.63e-05 | -0.0002   |  | -8.72e-05  | -9.11e-05  |
|  |  | [0.0002]  | [0.0002]  |  | [6.96e-05] | [6.55e-05] |
| Paris and Suburbs  |  | 0.0917*** | 0.0630    |  | 0.0153     | 0.0142     |
|  |  | [0.034]   | [0.041]   |  | [0.013]    | [0.013]    |
| Urban Population in 1700   |  | 0.004     | -0.008    |  | 0.002      | 0.002      |
|  |  | [0.007]   | [0.009]   |  | [0.003]    | [0.003]    |
| Adjusted $R^2$   | 0.018  | 0.312     |           | 0.048  | 0.344      |            |
| Observations   | 87   | 87        | 87        | 87   | 87         | 87         |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |           |           |  |            |            |
| Distance to Fresnes  |  |           | -0.013*** |  |            | -0.013***  |
|  |  |           | [0.003]   |  |            | [0.003]    |
| F-stat ( $1^{st}$ stage)   |  |           | 22.612    |  |            | 22.612     |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

In contrast, as reported in Column (3) and (6) of Table 6, the horse power of steam engines in industrial production in 1860-1865 had a highly significant negative effect on the shares of men age 15-17 and 18-24, respectively, who attended school in 2010. In particular, given that school is mandatory in France until age 16, these regressions indicate that a smaller fraction of men age 15-17 remain in high-school, and a smaller fraction of men age 18-24 are present in institutions of higher learning, in departments which utilized the steam engine more intensively.<sup>23</sup>

<sup>23</sup>Similar results are found for school enrollment rates of women age 15-17 and 18-24 in 2010, as reported in Table

**Table 6:** School enrollment rates for men, 2010

|                              | (1)   | (2)                 | (3)                  | (4)   | (5)                 | (6)                  |
|------------------------------|---|---------------------|----------------------|---|---------------------|----------------------|
|                              | OLS   | OLS                 | IV                   | OLS   | OLS                 | IV                   |
|                              | School Enrollment of Men<br>Age 15-17 in 2010 |                     |                      | School Enrollment of Men<br>Age 18-24 in 2010 |                     |                      |
| Horse Power of Steam Engines | -0.029<br>[0.055]                             | -0.116<br>[0.0747]  | -1.046***<br>[0.241] | -0.0424<br>[0.052]                            | -0.0709<br>[0.062]  | -0.818***<br>[0.192] |
| Average Rainfall             |   | 2.767***<br>[0.734] | 4.248***<br>[1.299]  |   | 1.301*<br>[0.736]   | 2.490**<br>[1.166]   |
| Average Temperature          |   | 0.813<br>[0.878]    | 2.179*<br>[1.272]    |   | 0.0831<br>[0.765]   | 1.181<br>[1.138]     |
| Latitude                     |   | 24.45***<br>[6.720] | 46.54***<br>[11.81]  |   | 19.02***<br>[6.288] | 36.77***<br>[10.08]  |
| Land Suitability             |   | -0.882**<br>[0.402] | -0.967<br>[0.660]    |   | -0.796**<br>[0.364] | -0.864<br>[0.547]    |
| Maritime Department          |   | -0.642*<br>[0.361]  | -0.787<br>[0.506]    |   | -0.514<br>[0.341]   | -0.630<br>[0.460]    |
| Border Department            |   | -0.688*<br>[0.377]  | -0.842*<br>[0.490]   |   | -0.587*<br>[0.331]  | -0.711*<br>[0.426]   |
| Distance to Paris            |   | 0.005***<br>[0.002] | 0.006**<br>[0.003]   |   | 0.004**<br>[0.002]  | 0.005**<br>[0.002]   |
| Paris and Suburbs            |   | 1.404***<br>[0.288] | 1.992***<br>[0.462]  |   | 1.402***<br>[0.319] | 1.875***<br>[0.488]  |
| Alsace-Lorraine              |   | -0.744<br>[0.571]   | 0.100<br>[0.997]     |   | -0.583<br>[0.450]   | 0.09<br>[0.764]      |
| Urban Population in 1700     |   | 0.119*<br>[0.07]    | 0.382***<br>[0.131]  |   | 0.028<br>[0.058]    | 0.240**<br>[0.107]   |
| Adjusted $R^2$               | -0.008  | 0.239               |                      | -0.002  | 0.218               |                      |
| Observations                 | 89  | 89                  | 89                   | 89  | 89                  | 89                   |

| First stage: the instrumented variable is Horse Power of Steam Engines |  |                      |  |                      |
|--|--|----------------------|--|----------------------|
| Distance to Fresnes  |  | -0.013***<br>[0.003] |  | -0.013***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage)   |  | 23.261               |  | 23.261               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

Moreover, as reported in the IV regressions in Columns (3),(6),(9),(12),(15) and (18) in Table 7, the horse power of steam engines in industrial production in 1860-1865 had a progressively larger adverse effect on the share of men age 25 and above who had at least high-school degree in 1968, 1975, 1982, 1990, 1999 and 2010.<sup>24</sup> These adverse effects are statistically significant in the years 1990, 1999 and 2010.

As was the case in the income regressions in columns (6)-(10) in Table 3, the IV estimation in Table 7 reverses the OLS estimates of the relationship between industrialization and education attainment from a positive to a negative one. This reversal suggests that factors which fostered industrial development, rather than industrialization per se, contributed to the positive association between industrialization and education. In particular, once one accounts for the effect of these omitted factors, industrialization has an adverse effect on education in the long-run.

D.1 in Appendix D.

<sup>24</sup>Similar results are found for school enrollment rates of women as well, as reported in Table D.2 in Appendix D.

**Table 7:** Persistent and reversed effects of industrialization on human capital: male high-school and college graduates, 1968-2010

|  | (1)  | (2)                    | (3)                    | (4)  | (5)                    | (6)                    | (7)  | (8)                    | (9)                     |
|--|--|------------------------|------------------------|--|------------------------|------------------------|--|------------------------|-------------------------|
|  | OLS  | OLS                    | IV                     | OLS  | OLS                    | IV                     | OLS  | OLS                    | IV                      |
|  | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1968 |                        |                        | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1975 |                        |                        | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1982 |                        |                         |
| Horse Power of Steam Engines   | 0.003**<br>[0.001]   | 0.002*<br>[0.001]      | -0.002<br>[0.003]      | 0.003*<br>[0.002]  | 0.002<br>[0.001]       | -0.003<br>[0.004]      | 0.002<br>[0.002]   | 0.001<br>[0.002]       | -0.007<br>[0.005]       |
| Average Rainfall   |  | 0.019<br>[0.014]       | 0.025*<br>[0.014]      |  | 0.011<br>[0.017]       | 0.020<br>[0.017]       |  | 0.018<br>[0.018]       | 0.031<br>[0.019]        |
| Average Temperature  |  | -0.031*<br>[0.018]     | -0.026<br>[0.017]      |  | -0.043*<br>[0.022]     | -0.035<br>[0.022]      |  | -0.047**<br>[0.023]    | -0.035<br>[0.024]       |
| Latitude   |  | -0.142<br>[0.119]      | -0.053<br>[0.131]      |  | -0.150<br>[0.165]      | -0.012<br>[0.180]      |  | -0.0006<br>[0.209]     | 0.194<br>[0.229]        |
| Land Suitability   |  | 0.0122<br>[0.009]      | 0.0118<br>[0.008]      |  | 0.0141<br>[0.011]      | 0.0135<br>[0.011]      |  | 0.0132<br>[0.012]      | 0.0125<br>[0.012]       |
| Maritime Department  |  | 0.003<br>[0.006]       | 0.002<br>[0.006]       |  | 0.006<br>[0.008]       | 0.005<br>[0.008]       |  | 0.004<br>[0.008]       | 0.003<br>[0.009]        |
| Border Department  |  | 0.013**<br>[0.005]     | 0.012***<br>[0.005]    |  | 0.016**<br>[0.007]     | 0.015**<br>[0.006]     |  | 0.013<br>[0.008]       | 0.012<br>[0.008]        |
| Distance to Paris  |  | 2.12e-05<br>[3.29e-05] | 2.54e-05<br>[3.10e-05] |  | 3.71e-05<br>[4.47e-05] | 4.34e-05<br>[4.22e-05] |  | 7.96e-05<br>[5.55e-05] | 8.87e-05*<br>[5.15e-05] |
| Paris and Suburbs  |  | 0.072***<br>[0.012]    | 0.075***<br>[0.012]    |  | 0.099***<br>[0.013]    | 0.103***<br>[0.012]    |  | 0.115***<br>[0.011]    | 0.120***<br>[0.011]     |
| Alsace-Lorraine  |  | 0.025**<br>[0.012]     | 0.029**<br>[0.012]     |  | 0.025<br>[0.016]       | 0.030*<br>[0.016]      |  | 0.020<br>[0.018]       | 0.027<br>[0.018]        |
| Urban Population in 1700   |  | 0.007***<br>[0.001]    | 0.0082***<br>[0.002]   |  | 0.009***<br>[0.002]    | 0.011***<br>[0.002]    |  | 0.010***<br>[0.002]    | 0.012***<br>[0.002]     |
| Adjusted R2  | 0.037  | 0.621                  |                        | 0.025  | 0.615                  |                        | 0.004  | 0.592                  |                         |
| Observations   | 89   | 89                     | 89                     | 89   | 89                     | 89                     | 89   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                        |                        |  |                        |                        |  |                        |                         |
| Distance to Fresnes  |  |                        | -0.013***<br>[0.003]   |  |                        | -0.013***<br>[0.003]   |  |                        | -0.013***<br>[0.003]    |
| F-stat (1 <sup>st</sup> stage)   |  |                        | 23.261                 |  |                        | 23.261                 |  |                        | 23.261                  |

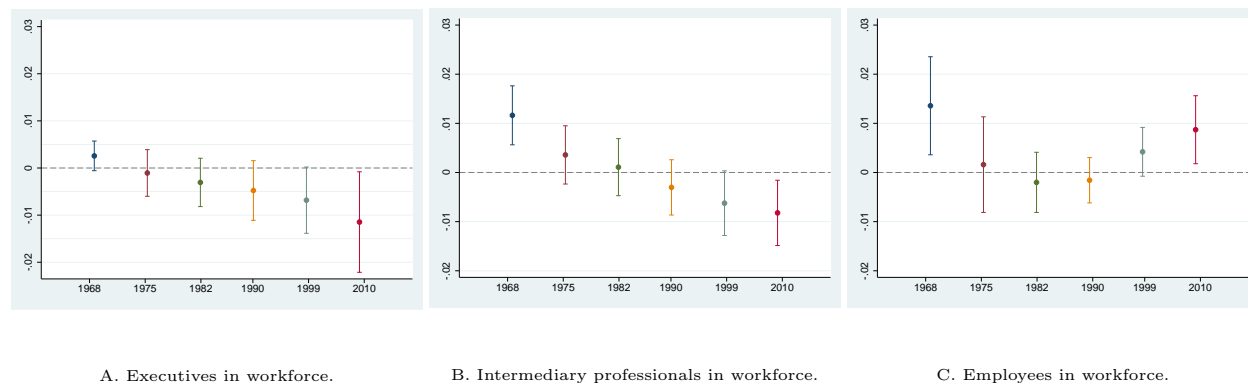
  

|  | (10)   | (11)                  | (12)                   | (13)   | (14)                   | (15)                    | (16)   | (17)                   | (18)                    |
|--|--|-----------------------|------------------------|--|------------------------|-------------------------|--|------------------------|-------------------------|
|  | OLS  | OLS                   | IV                     | OLS  | OLS                    | IV                      | OLS  | OLS                    | IV                      |
|  | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1990 |                       |                        | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1999 |                        |                         | Share of Men Age 25 and above with<br>a Secondary or Post-Secondary Degree, 2010 |                        |                         |
| Horse Power of Steam Engines   | 0.002<br>[0.002]   | 0.001<br>[0.002]      | -0.010*<br>[0.006]     | 0.002<br>[0.003]   | 0.001<br>[0.002]       | -0.0122*<br>[0.006]     | 0.0003<br>[0.003]  | 2.38e-05<br>[0.002]    | -0.018**<br>[0.008]     |
| Average Rainfall   |  | 0.013<br>[0.022]      | 0.030<br>[0.024]       |  | 0.022<br>[0.023]       | 0.043<br>[0.027]        |  | 0.037<br>[0.028]       | 0.066**<br>[0.033]      |
| Average Temperature  |  | -0.048*<br>[0.028]    | -0.032<br>[0.030]      |  | -0.039<br>[0.030]      | -0.019<br>[0.034]       |  | -0.030<br>[0.036]      | -0.003<br>[0.041]       |
| Latitude   |  | 0.0595<br>[0.266]     | 0.324<br>[0.288]       |  | 0.163<br>[0.303]       | 0.480<br>[0.325]        |  | 0.261<br>[0.340]       | 0.695*<br>[0.371]       |
| Land Suitability   |  | 0.011<br>[0.014]      | 0.010<br>[0.015]       |  | 0.005<br>[0.015]       | 0.004<br>[0.016]        |  | -0.006<br>[0.017]      | -0.007<br>[0.019]       |
| Maritime Department  |  | 0.004<br>[0.010]      | 0.002<br>[0.011]       |  | 0.002<br>[0.012]       | -0.0004<br>[0.013]      |  | 0.005<br>[0.014]       | 0.002<br>[0.015]        |
| Border Department  |  | 0.013<br>[0.011]      | 0.011<br>[0.011]       |  | 0.016<br>[0.013]       | 0.014<br>[0.012]        |  | 0.016<br>[0.016]       | 0.013<br>[0.016]        |
| Distance to Paris  |  | 0.0001*<br>[6.95e-05] | 0.0001**<br>[6.43e-05] |  | 0.0002**<br>[7.74e-05] | 0.0002***<br>[7.20e-05] |  | 0.0002**<br>[8.67e-05] | 0.0002***<br>[8.18e-05] |
| Paris and Suburbs  |  | 0.145***<br>[0.015]   | 0.152***<br>[0.016]    |  | 0.171***<br>[0.021]    | 0.179***<br>[0.023]     |  | 0.190***<br>[0.020]    | 0.201***<br>[0.022]     |
| Alsace-Lorraine  |  | 0.0097<br>[0.022]     | 0.0198<br>[0.024]      |  | -0.001<br>[0.023]      | 0.011<br>[0.025]        |  | -0.018<br>[0.022]      | -0.002<br>[0.029]       |
| Urban Population in 1700   |  | 0.012***<br>[0.002]   | 0.015***<br>[0.003]    |  | 0.016***<br>[0.003]    | 0.019***<br>[0.003]     |  | 0.019***<br>[0.003]    | 0.024***<br>[0.004]     |
| Adjusted R2  | -0.006   | 0.590                 |                        | -0.007   | 0.613                  |                         | -0.011   | 0.603                  |                         |
| Observations   | 89   | 89                    | 89                     | 89   | 89                     | 89                      | 89   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                       |                        |  |                        |                         |  |                        |                         |
| Distance to Fresnes  |  |                       | -0.013***<br>[0.003]   |  |                        | -0.013***<br>[0.003]    |  |                        | -0.013***<br>[0.003]    |
| F-stat (1 <sup>st</sup> stage)   |  |                       | 23.261                 |  |                        | 23.261                  |  |                        | 23.261                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

## 5.1.2 Industrialization in the long-run and the composition of human capital

This subsection explores the effect of industrialization on the long-run composition of human capital as reflected by the share of executives, middle management professions, and employees (i.e., individuals with high, medium, and low levels of human capital) in the labor force. It demonstrates that it had a detrimental effect on employment in skilled-intensive occupations, although industrialization had no effect on the share of employment in the service sector in the long-run (Panel B of Figure 5).



**Figure 6:** The effect of the horse power of steam engines in 1860-1865 on the share of executives, intermediary professionals and employees in the workforce (age 25-54) after WWII

Note: This figure displays the estimated coefficients of *Horse Power of Steam Engines* in the IV regressions in Tables C.5 – C.7. Intervals reflect 95%-confidence levels.

As depicted in Panels A–C of Figure 6 based on the IV regression in Tables C.5–C.7 in Appendix C, the horse power of steam engines in industrial production in 1860-1865 had a significant negative effect on the share of executives and other intellectual professions, as well as on the share of middle management professions, among individuals age 25-54 in the years 1999 and 2010. In contrast, the effect on the share of employees is significantly positive in 1999 and 2010.<sup>25</sup>

## 5.2 The contribution of industrialization to unionization and wages

The adverse effect of industrialization on income per capita in the long-run may reflect the adverse effect of industrialization on the competitiveness of the labor market in the long-run. In particular, the growth of the industrial sector may have led to the establishment of labor unions, which deterred new industries from locating in regions characterized by higher wages and possibly lower productivity (Ngai and Pissarides, 2007).<sup>26</sup>

<sup>25</sup>The control group is made of farmers, artisans and other self-employed individuals.

<sup>26</sup>Unions were given a legal existence in France in 1884 but they had already become tolerated after the passing of a law in 1864, which abrogated the 1791 *Le Chapelier* law. It is worth noting that in France, unlike in the USA for instance, labor regulations are identical throughout the country. Nevertheless, unions could have negotiated higher salaries in specific firms.

**Table 8:** Early industrialization, past union membership and GDP 2001-2010

|  | (1)<br>OLS                       | (2)<br>IV               | (3)<br>IV                 | (4)<br>IV            |
|--|----------------------------------|-------------------------|---------------------------|----------------------|
|  | Share of unionized workers, 1901 |                         | GDP per capita, 2001-2010 |                      |
| Horse Power of Steam Engines   | 0.007***<br>[0.002]              | 0.011**<br>[0.005]      | -0.061**<br>[0.026]       | -0.010**<br>[0.045]  |
| Share of unionized workers in 1901                                     |                                  |                         |                           | 3.508***<br>[1.122]  |
| Average Rainfall   | -0.0417*<br>[0.022]              | -0.0472*<br>[0.024]     | 0.164<br>[0.13]           | 0.313<br>[0.191]     |
| Average Temperature  | -0.022<br>[0.021]                | -0.028<br>[0.022]       | -0.053<br>[0.143]         | 0.039<br>[0.173]     |
| Latitude   | 0.0134<br>[0.011]                | 0.0135<br>[0.010]       | -0.0236<br>[0.066]        | -0.0725<br>[0.067]   |
| Land Suitability   | -0.147<br>[0.159]                | -0.245<br>[0.179]       | 1.702<br>[1.136]          | 2.686*<br>[1.407]    |
| Maritime Department  | -0.015<br>[0.009]                | -0.014<br>[0.009]       | -0.022<br>[0.05]          | 0.022<br>[0.064]     |
| Border Department  | 0.003<br>[0.008]                 | 0.004<br>[0.008]        | 0.027<br>[0.045]          | 0.015<br>[0.060]     |
| Distance to Paris  | 5.78e-06<br>[5.07e-05]           | -1.27e-06<br>[4.81e-05] | 0.0002<br>[0.0003]        | 0.0002<br>[0.0003]   |
| Paris and Suburbs  | -0.014<br>[0.020]                | -0.017<br>[0.019]       | 0.437***<br>[0.154]       | 0.493***<br>[0.107]  |
| Alsace-Lorraine  |                                  |                         | 0.0295<br>[0.106]         |                      |
| Urban Population in 1700   | 0.003<br>[0.002]                 | 0.002<br>[0.003]        | 0.071***<br>[0.015]       | 0.067***<br>[0.017]  |
| Adjusted <i>R</i> <sup>2</sup>   | 0.257                            |                         |                           |                      |
| Observations   | 86                               | 86                      | 89                        | 86                   |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                  |                         |                           |                      |
| Distance to Fresnes  |                                  | -0.013***<br>[0.003]    | -0.013***<br>[0.003]      | -0.011***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage)   |                                  | 21.997                  | 23.261                    | 13.151               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

Indeed, as reported in Columns (1) and (2) of Table 8, the degree of industrialization in the year 1860-1865 contributed to the share of unionized workers in the workforce in 1901 and 1930. Nevertheless, the degree of unionization is in fact positively related to the level income per capita in the long-run. Moreover, as reported in Columns (3) and (4), the effect of industrialization on the long-run level of income per capita is even larger and as significant statistically, once the potential confounding effect of unionization is accounted for.

Similarly, Columns (1) and (2) of Table 9, the relation between industrialization in 1860-1865 and the average male wage in each department in 1901 is positive but significantly statistically only in the OLS regression. Nevertheless, the average male wage in 1901 is in fact positively related to the level of income per capita in the long-run. Moreover, as reported in Columns (3) and (4), the effect of industrialization on the long-run level of income per capita is even larger and as significant statistically, once the potential confounding effect of higher wages in the past is accounted for.

Thus, the adverse effect of industrialization on income per capita in the long-run cannot be

**Table 9:** Early industrialization, past wages & GDP 2001-2010

|  | (1)                     | (2)                   | (3)                       | (4)                  |
|--|-------------------------|-----------------------|---------------------------|----------------------|
|  | OLS                     | IV                    | IV                        | IV                   |
|  | Average male wage, 1901 |                       | GDP per capita, 2001-2010 |                      |
| Horse Power of Steam Engines   | 0.023**<br>[0.010]      | 0.029<br>[0.020]      | -0.061**<br>[0.026]       | -0.010***<br>[0.028] |
| Average male wage 1901   |                         |                       |                           | 0.956***<br>[0.194]  |
| Average Rainfall   | -0.004<br>[0.073]       | -0.015<br>[0.076]     | 0.164<br>[0.128]          | 0.200<br>[0.158]     |
| Average Temperature  | -0.136<br>[0.088]       | -0.144*<br>[0.088]    | -0.053<br>[0.143]         | 0.083<br>[0.171]     |
| Land Suitability   | 0.063<br>[0.044]        | 0.061<br>[0.042]      | -0.024<br>[0.066]         | -0.057<br>[0.067]    |
| Latitude   | -1.346<br>[0.839]       | -1.515*<br>[0.865]    | 1.702<br>[1.136]          | 3.366**<br>[1.353]   |
| Maritime Department  | 0.022<br>[0.036]        | 0.022<br>[0.034]      | -0.022<br>[0.053]         | -0.039<br>[0.060]    |
| Border Department  | 0.089***<br>[0.031]     | 0.090***<br>[0.030]   | 0.027<br>[0.045]          | -0.051<br>[0.060]    |
| Distance to Paris  | -0.0004*<br>[0.0002]    | -0.0004**<br>[0.0002] | 0.0002<br>[0.0003]        | 0.0006**<br>[0.0003] |
| Paris and Suburbs  | 0.193***<br>[0.059]     | 0.188***<br>[0.056]   | 0.437***<br>[0.154]       | 0.268**<br>[0.113]   |
| Alsace-Lorraine  |                         |                       | 0.0295<br>[0.106]         |                      |
| Town Population in 1700  | 0.015<br>[0.009]        | 0.013<br>[0.010]      | 0.071***<br>[0.015]       | 0.066***<br>[0.016]  |
| Adjusted $R^2$   | 0.502                   |                       |                           |                      |
| Observations   | 84                      | 84                    | 89                        | 84                   |
| First stage: the instrumented variable is Horse Power of Steam Engines |                         |                       |                           |                      |
| Distance to Fresnes  |                         | -0.013<br>[0.003]***  | -0.013<br>[0.003]***      | -0.012<br>[0.002]*** |
| F-stat ( $1^{st}$ stage)   |                         | 23.025                | 23.261                    | 23.145               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

attributed to the effect of industrialization on unionization and wages.

### 5.3 Trade protection and competitiveness in the long-run

This section explores whether the detrimental effect of industrialization on the standard of living in the long-run could be attributed the adverse effect of trade protection on the competitiveness of each department in the long-run.

In light of the departmental variation in the composition of the 16 sectors that constituted the industrial sector in 1860-1865, the imposition of tariffs on import by the national government could have affected each department differentially. In particular, the degree of competitiveness in the most advanced industrial sectors could have diminished and may have thus led to their economic decline in the long-run.

Nevertheless, as reported in Column (5)-(10) in Table 10, while tariff rates in the years 1865,

**Table 10:** Sectorial tariff protection and income per capita, 1930 & 2001-2010

|                                       | (1)                     | (2)                  | (3)                  | (4)                  | (5)                                  | (6)                  | (7)                 | (8)                 | (9)                 | (10)                |
|---------------------------------------|-------------------------|----------------------|----------------------|----------------------|--------------------------------------|----------------------|---------------------|---------------------|---------------------|---------------------|
|                                       | IV                      | IV                   | IV                   | IV                   | IV                                   | IV                   | IV                  | IV                  | IV                  | IV                  |
|                                       | Income per capita, 1930 |                      |                      |                      | Income per capita, 2001-2010 average |                      |                     |                     |                     |                     |
| Horse Power of Steam Engines          | 0.102***<br>[0.026]     | 0.101***<br>[0.026]  | 0.103***<br>[0.027]  | 0.102***<br>[0.026]  | 0.105***<br>[0.027]                  | -0.0607**<br>[0.026] | -0.062**<br>[0.026] | -0.061**<br>[0.026] | -0.061**<br>[0.025] | -0.064**<br>[0.029] |
| Weighted tariffs across sectors, 1865 |                         | 0.019<br>[0.051]     |                      |                      |                                      |                      | -0.042<br>[0.075]   |                     |                     |                     |
| Weighted tariffs across sectors, 1872 |                         |                      | -0.036<br>[0.050]    |                      |                                      |                      |                     | -0.020<br>[0.070]   |                     |                     |
| Weighted tariffs across sectors, 1901 |                         |                      |                      | -0.013<br>[0.057]    |                                      |                      |                     |                     | -0.113**<br>[0.058] |                     |
| Weighted tariffs across sectors, 1924 |                         |                      |                      |                      | 0.073<br>[0.067]                     |                      |                     |                     |                     | -0.050<br>[0.077]   |
| Average Rainfall                      | -0.211*<br>[0.125]      | -0.215<br>[0.131]    | -0.268*<br>[0.146]   | -0.242*<br>[0.134]   | -0.228<br>[0.139]                    | 0.164<br>[0.128]     | 0.158<br>[0.134]    | 0.164<br>[0.140]    | 0.109<br>[0.129]    | 0.186<br>[0.142]    |
| Average Temperature                   | -0.444***<br>[0.113]    | -0.428***<br>[0.124] | -0.453***<br>[0.129] | -0.442***<br>[0.127] | -0.419***<br>[0.125]                 | -0.053<br>[0.143]    | -0.034<br>[0.166]   | -0.031<br>[0.171]   | -0.092<br>[0.155]   | -0.030<br>[0.165]   |
| Land Suitability                      | 0.244***<br>[0.049]     | 0.234***<br>[0.049]  | 0.242***<br>[0.048]  | 0.238***<br>[0.049]  | 0.212***<br>[0.056]                  | -0.024<br>[0.066]    | -0.007<br>[0.069]   | -0.014<br>[0.070]   | -0.005<br>[0.065]   | 0.002<br>[0.072]    |
| Latitude                              | -3.325***<br>[1.160]    | -3.309***<br>[1.143] | -3.457***<br>[1.174] | -3.366***<br>[1.143] | -3.356***<br>[1.125]                 | 1.702<br>[1.136]     | 1.603<br>[1.166]    | 1.530<br>[1.151]    | 1.710<br>[1.135]    | 1.710<br>[1.226]    |
| Maritime Department                   | 0.007<br>[0.056]        | 0.004<br>[0.056]     | 0.008<br>[0.055]     | 0.007<br>[0.055]     | -0.0006<br>[0.057]                   | -0.022<br>[0.053]    | -0.022<br>[0.053]   | -0.023<br>[0.053]   | -0.010<br>[0.050]   | -0.021<br>[0.054]   |
| Border Department                     | 0.102**<br>[0.046]      | 0.112**<br>[0.049]   | 0.122**<br>[0.051]   | 0.117**<br>[0.048]   | 0.107**<br>[0.048]                   | 0.027<br>[0.045]     | 0.037<br>[0.046]    | 0.034<br>[0.045]    | 0.039<br>[0.045]    | 0.035<br>[0.048]    |
| Distance to Paris                     | -0.0002<br>[0.0003]     | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]                  | 0.0002<br>[0.0003]   | 0.0002<br>[0.0003]  | 0.0002<br>[0.0003]  | 0.0002<br>[0.0003]  | 0.0002<br>[0.0003]  |
| Paris and Suburbs                     | 0.239***<br>[0.0877]    | 0.235***<br>[0.0903] | 0.236***<br>[0.0846] | 0.238***<br>[0.0861] | 0.226**<br>[0.0931]                  | 0.437***<br>[0.154]  | 0.442***<br>[0.152] | 0.435***<br>[0.151] | 0.433***<br>[0.141] | 0.445***<br>[0.155] |
| Alsace-Lorraine                       | 0.0920<br>[0.0831]      | 0.0841<br>[0.0835]   | 0.0855<br>[0.0848]   | 0.0861<br>[0.0838]   | 0.0611<br>[0.0955]                   | 0.0295<br>[0.106]    | 0.0321<br>[0.109]   | 0.0279<br>[0.108]   | 0.0214<br>[0.120]   | 0.0361<br>[0.116]   |
| Urban Population in 1700              | 0.0287**<br>[0.013]     | 0.028**<br>[0.013]   | 0.028**<br>[0.013]   | 0.028**<br>[0.013]   | 0.026*<br>[0.014]                    | 0.071***<br>[0.015]  | 0.071***<br>[0.015] | 0.071***<br>[0.015] | 0.072***<br>[0.015] | 0.072***<br>[0.016] |
| Observations                          | 87                      | 84                   | 84                   | 84                   | 84                                   | 89                   | 86                  | 86                  | 86                  | 86                  |

First stage: the instrumented variable is Horse Power of Steam Engines

|                     |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Distance to Fresnes | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] |
| F-stat              | 20.617               | 20.116               | 20.412               | 20.852               | 17.191               | 23.261               | 22.555               | 23.343               | 23.042               | 18.601               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.

1872, 1901 and 1924 (Dormois, 2006, 2009) had a negative but mostly insignificant association with income per capita in the years 2001-2010, those tariff rates in the past had neither an economic impact nor statistical one on the effect of industrialization on income per in the long-run.<sup>27</sup>

Thus, the adverse effect of industrialization on income per capita in the long-run cannot be attributed to the effect of industrialization on trade protection.

<sup>27</sup>As reported in the rest of Table 10 and Table E.1 in the appendix, there is no significant relationship between tariff and income per capita in the years 1872, 1901, and 1930 and the tariff rate in the past has neither an economic impact nor statistical one on the effect of industrialization on income per in 1872, 1901 and 1930.



## 6 Conclusion

This research explores the long-run effect of industrialization on the process of development. In contrast to conventional wisdom that views industrial development as a catalyst for economic growth, highlighting its persistent effect on economic prosperity, the study establishes that while the adoption of industrial technology was initially conducive for economic development, it has had a detrimental effect on standards of living in the long-run.

The study exploits exogenous source of regional variation in the adoption of steam engines during the French industrial revolution to establish that regions which industrialized earlier experienced an increase in literacy rates more swiftly and generated higher income per capita in the subsequent decades. Nevertheless, early industrialization had an adverse effect on income per capita, employment and equality by the turn of the 21<sup>st</sup> century.

The research explores potential mechanisms that could have led to the detrimental effect of industrialization on the standard of living in the long-run. First, the study examines the adverse effect of industrialization on the level and composition human capital and thus on the skill-intensity of the production process in the long-run. Second, it explores the contribution of early industrialization to unionization and wage rates and thus the incentive of modern industries to locate in regions of where labor markets are more competitive. Third, the analysis examines the effect of on trade protection on the decline in competitiveness of each department in the long-run. The findings suggest that the adverse effect of industrialization on income per capita in the long-run reflects neither greater unionization rates and higher wages nor trade protection, but rather underinvestment in human capital and lower employment in skilled-intensive occupations.

The study thus suggests that the characteristics that permitted the onset of industrialization, rather than the adoption of industrial technology *per se*, have been the source of prosperity among the currently developed economies that experienced an early industrialization.

## References

- Acemoglu, Daron, Simon Johnson and James Robinson (2002), ‘Reversal of fortune: geography and institutions in the making of the modern world income distribution’, *Quarterly Journal of Economics* **117**(4), 1231–1294.
- Angrist, Joshua D. and Jörn-Steffen Pischke (2009), *Mostly Harmless Econometrics: An Empiricist’s Companion*, Princeton University Press, Princeton, NJ.
- Annuaire Statistique De La France* (1878-1939), Imprimerie Nationale, Paris.
- Atack, Jeremy (1979), ‘Fact in fiction? Relative in costs of steam and water power: a simulation approach’, *Explorations in Economic History* **16**(10), 409–437.
- Ballot, Charles (1923), *L’Introduction du Machinisme dans l’Industrie Française*, Slatkine Reprints (1978), Geneva.
- Baten, Jörg (2000), ‘Heights and real wages in the 18th and 19th centuries: an international overview’, *Economic History Yearbook* **41**(41), 61–76.
- Bresnahan, Timothy F. and Manuel Trajtenberg (1995), ‘General purpose technologies: engines of growth?’, *Journal of Econometrics* **65**(1), 83–108.
- Caron, François (1997), *Histoire des chemins de fer en France: 1740-1883*, Fayard, Paris.
- Caruana-Galizia, Paul (2013), ‘Estimating French regional income: departmental per capita gross value added, 1872-1911’, *Research in Economic History* **29**, 71–95.
- Chanut, Jean-Marie, Jean Heffer, Jacques Mairesse and Gilles Postel-Vinay (2000), *L’Industrie Française au Milieu du 19e Siècle. Les enquêtes de la Statistique Générale de la France*, EHESS, Paris.
- Chemin, Matthieu and Etienne Wasmer (2009), ‘Using Alsace-Moselle local laws to build a difference-in-differences estimation strategy of the employment effects of the 35-hour workweek regulation in France’, *Journal of Labor Economics* **27**(4), 487–524.
- Combes, Pierre-Philippe, Miren Lafourcade, Jacques-François Thisse and Jean-Claude Toutain (2011), ‘The rise and fall of spatial inequalities in France: a long-run perspective’, *Explorations in Economic History* **48**, 243–271.
- Conley, Timothy G. (1999), ‘GMM estimation with cross sectional dependence’, *Journal of Econometrics* **92**(1), 1–45.
- Daudin, Guillaume (2010), ‘Domestic trade and market size in late eighteenth-century France’, *Journal of Economic History* **70**(3), 716–743.
- Diebolt, Claude, Magali Jaoul and Gilles San Martino (2005), ‘Le mythe de Ferry: une analyse cliométrique’, *Revue d’économie politique* **115**(4), 471–497.
- Dormois, Jean-Pierre (2006), The impact of late-nineteenth century tariffs on the productivity of European industries (1870-1930), in J.-P. Dormois and P. Lains, eds, ‘Classical trade protectionism, 1815-1914’, Routledge, London, UK, pp. 160–192.
- Dormois, Jean-Pierre (2009), *La Défense du travail national: les effets du protectionnisme sur l’industrie en Europe*, Presses universitaires Paris Sorbonne, Paris.
- France. Ministère du travail et de la prévoyance sociale (1911), *Statistique générale. Salaires et coût de l’existence : à diverses époques, jusqu’en 1910*, Imprimerie Nationale, Paris.
- Furet, François and Jacques Ozouf (1977), *Lire et écrire. L’alphabétisation des Français de Calvin à Jules Ferry*, Editions de Minuit, Paris, France.
- Galor, Oded (2011), *Unified Growth Theory*, Princeton University Press, Princeton, NJ.

- Galor, Oded and Omer Moav (2006), ‘Das Human-Kapital: a theory of the demise of class structure’, *Review of Economic Studies* **73**, 85–117.
- Grew, Raymond and Patrick J. Harrigan (1991), *School, State, and Society: The Growth of Elementary Schooling in Nineteenth-Century France—A Quantitative Analysis*, University of Michigan Press, Ann Arbor, MI.
- Jovanovic, Boyan and Peter L. Rousseau (2005), General purpose technologies, in P.Aghion and S.Durlauf, eds, ‘Handbook of Economic Growth’, Elsevier North-Holland, Amsterdam, pp. 1181–1224.
- Kanefsky, John and John Robey (1980), ‘Steam engines in 18th-century Britain: a quantitative assessment’, *Technology and Culture* **21**(2), 161–186.
- Komlos, John (2005), ‘Height of French soldiers, 1716-1784’, *ICPSR - Computer File* **04363-v1**.
- Léon, Pierre (1976), L’affermisssement du phénomène d’industrialisation, in F.Braudel and E.Labrousse, eds, ‘Histoire économique et sociale de la France, vol. 3’, PUF, Paris, pp. 475–616.
- Lepetit, Bernard (1994), *The Pre-Industrial Urban System: France, 1740-1840*, Cambridge University Press, Cambridge, UK.
- Mokyr, Joel (1990), *The Lever of Riches*, Oxford University Press, Oxford, U.K.
- Nelson, Richard R. and Edmund S. Phelps (1966), ‘Heights and human welfare: Recent developments and new directions’, *American Economic Review* **56**(1-2), 69–75.
- Ngai, L. Rachel and Christopher Pissarides (2007), ‘Structural change in a multisector model of growth’, *American Economic Review* **97**(1), 429–443.
- Nuvolari, Alessandro, Bart Verspagen and Nick von Tunzelmann (2011), ‘Steam engines in 18th-century Britain: a quantitative assessment’, *Cliometrica* **21**(5), 291–321.
- Ramankutty, Navin, Jonathan A. Foley, John Norman and Kevin McSweeney (2002), ‘The global distribution of cultivable lands: current patterns and sensitivity to possible climate change’, *Global Ecology and Biogeography* **11**(5), 377–392.
- Rosenberg, Nathan and Manuel Trajtenberg (2004), ‘A general purpose technology at work: the Corliss steam engine in the late nineteenth-century United States’, *Journal of Economic History* **64**(1), 1–39.
- Sée, Henri (1925), *La vie Economique de la France sous la Monarchie Censitaire (1815-1848)*, Librairie Félix Alcan, Paris.
- Stock, James H. and Motohiro Yogo (2005), Testing for weak instruments in linear IV regression, in J. H. Stock and D. W. Andrews, eds, ‘Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg’, Cambridge University Press, Cambridge UK, pp. 80–108.
- Weir, David R. (1997), Health and welfare during industrialization, in R. H. Steckel and R. Floud, eds, ‘Health and welfare during industrialization’, University of Chicago Press, Chicago, Ill., pp. 161–200.
- Woronoff, Denis (1997), Les forges, 1811, in G. Béaur and P. Minard, eds, ‘Atlas de la révolution française: Economie, Vol. 10’, Editions de l’école des hautes études en sciences sociales, Paris, pp. 99–100.

# Appendix A. Descriptive statistics

Table A.1: Descriptive statistics

|   | Obs | Mean    | Std. Dev. | Min     | Max      |
|---|-----|---------|-----------|---------|----------|
| <b>Dependent Variables</b>  |     |         |           |         |          |
| <b>Income</b>   |     |         |           |         |          |
| GDP per capita, 1872  | 85  | 655.24  | 198.13    | 235.60  | 1197.00  |
| GDP per capita, 1901  | 85  | 862.91  | 270.96    | 255.30  | 1816.40  |
| GDP per capita, 1930  | 87  | 6464.61 | 1500.21   | 4033.47 | 14109.92 |
| GDP per capita, 2001-2011 average   | 89  | 23.39   | 4.71      | 17.87   | 56.00    |
| <b>Unemployment, Gini Coefficient and 25th Percentile of the Income Distribution, Post 2000</b> |     |         |           |         |          |
| Unemployment rate, 2002-2011 average  | 89  | 8.38    | 1.58      | 5.05    | 12.59    |
| Gini coefficient, 2001-2008 average   | 89  | 0.36    | 0.02      | 0.33    | 0.44     |
| 1st Quartile Fiscal Income per Person in Household, 2001-2010 Average                           | 89  | 7125.19 | 1411.45   | 5292.10 | 15686.58 |
| <b>Workforce, Pre-WWII</b>  |     |         |           |         |          |
| Share of Workforce in Industry, 1872  | 87  | 0.21    | 0.10      | 0.05    | 0.49     |
| Share of Workforce in Industry, 1901  | 87  | 0.27    | 0.10      | 0.10    | 0.57     |
| Share of Workforce in Industry, 1930  | 89  | 0.33    | 0.13      | 0.12    | 0.66     |
| Share of Workforce in Services, 1872  | 87  | 0.01    | 0.01      | 0.00    | 0.03     |
| Share of Workforce in Services, 1901  | 87  | 0.24    | 0.08      | 0.12    | 0.53     |
| Share of Workforce in Services, 1930  | 89  | 0.21    | 0.06      | 0.12    | 0.47     |
| <b>Workforce, Post-WWII</b>   |     |         |           |         |          |
| Share of Workforce in Industry, 1968  | 89  | 0.37    | 0.09      | 0.18    | 0.55     |
| Share of Workforce in Industry, 1975  | 89  | 0.36    | 0.08      | 0.18    | 0.55     |
| Share of Workforce in Industry, 1982  | 89  | 0.34    | 0.07      | 0.20    | 0.49     |
| Share of Workforce in Industry, 1990  | 89  | 0.31    | 0.06      | 0.15    | 0.44     |
| Share of Workforce in Industry, 1999  | 89  | 0.26    | 0.06      | 0.14    | 0.36     |
| Share of Workforce in Industry, 2010  | 89  | 0.23    | 0.03      | 0.14    | 0.33     |
| Share of Workforce in Services, 1968  | 89  | 0.40    | 0.07      | 0.28    | 0.60     |
| Share of Workforce in Services, 1975  | 89  | 0.46    | 0.07      | 0.33    | 0.65     |
| Share of Workforce in Services, 1982  | 89  | 0.53    | 0.07      | 0.40    | 0.71     |
| Share of Workforce in Services, 1990  | 89  | 0.60    | 0.07      | 0.47    | 0.76     |
| Share of Workforce in Services, 1999  | 89  | 0.68    | 0.06      | 0.57    | 0.85     |
| Share of Workforce in Services, 2010  | 89  | 0.53    | 0.09      | 0.37    | 0.86     |
| Share of Executives in Workforce (age 25-54), 1968  | 89  | 0.041   | 0.013     | 0.02    | 0.114    |
| Share of Executives in Workforce (age 25-54), 1975  | 89  | 0.066   | 0.02      | 0.034   | 0.143    |
| Share of Executives in Workforce (age 25-54), 1982  | 89  | 0.073   | 0.022     | 0.043   | 0.17     |
| Share of Executives in Workforce (age 25-54), 1990  | 89  | 0.093   | 0.028     | 0.059   | 0.229    |
| Share of Executives in Workforce (age 25-54), 1999  | 89  | 0.095   | 0.029     | 0.062   | 0.249    |
| Share of Executives in Workforce (age 25-54), 2010  | 89  | 0.114   | 0.04      | 0.07    | 0.319    |
| Share of Intermediary Professionals in Workforce (age 25-54), 1968                              | 89  | 0.153   | 0.032     | 0.083   | 0.299    |
| Share of Intermediary Professionals in Workforce (age 25-54), 1975                              | 89  | 0.218   | 0.034     | 0.147   | 0.315    |
| Share of Intermediary Professionals in Workforce (age 25-54), 1982                              | 89  | 0.237   | 0.026     | 0.18    | 0.312    |
| Share of Intermediary Professionals in Workforce (age 25-54), 1990                              | 89  | 0.263   | 0.022     | 0.224   | 0.321    |
| Share of Intermediary Professionals in Workforce (age 25-54), 1999                              | 89  | 0.297   | 0.021     | 0.257   | 0.36     |
| Share of Intermediary Professionals in Workforce (age 25-54), 2010                              | 89  | 0.283   | 0.022     | 0.244   | 0.369    |
| Share of Employees in Workforce (age 25-54), 1968   | 89  | 0.041   | 0.013     | 0.02    | 0.114    |
| Share of Employees in Workforce (age 25-54), 1975   | 89  | 0.066   | 0.02      | 0.034   | 0.143    |
| Share of Employees in Workforce (age 25-54), 1982   | 89  | 0.073   | 0.022     | 0.043   | 0.17     |
| Share of Employees in Workforce (age 25-54), 1990   | 89  | 0.093   | 0.028     | 0.059   | 0.229    |
| Share of Employees in Workforce (age 25-54), 1999   | 89  | 0.095   | 0.029     | 0.062   | 0.249    |
| Share of Employees in Workforce (age 25-54), 2010   | 89  | 0.114   | 0.04      | 0.07    | 0.319    |
| <b>Education Measures, Pre-WWI</b>  |     |         |           |         |          |
| Average Share of Literate Individuals Among Conscripts, 1874-1883 Average                       | 87  | 0.82    | 0.10      | 0.53    | 0.97     |
| Average Share of Literate Individuals Among Conscripts, 1894-1903 Average                       | 87  | 0.94    | 0.04      | 0.82    | 0.99     |
| <b>Education Measures, Post-WWII</b>  |     |         |           |         |          |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 1968                   | 89  | 0.09    | 0.02      | 0.06    | 0.19     |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 1975                   | 89  | 0.12    | 0.03      | 0.07    | 0.24     |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 1982                   | 89  | 0.16    | 0.03      | 0.10    | 0.28     |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 1990                   | 89  | 0.20    | 0.04      | 0.14    | 0.36     |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 1999                   | 89  | 0.25    | 0.05      | 0.18    | 0.46     |
| Share of Men Age 25 and Above with a Secondary or Post-Secondary Degree, 2010                   | 89  | 0.36    | 0.06      | 0.27    | 0.58     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 1968                 | 89  | 0.05    | 0.02      | 0.03    | 0.13     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 1975                 | 89  | 0.10    | 0.03      | 0.06    | 0.21     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 1982                 | 89  | 0.14    | 0.03      | 0.09    | 0.25     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 1990                 | 89  | 0.19    | 0.04      | 0.13    | 0.36     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 1999                 | 89  | 0.28    | 0.05      | 0.20    | 0.49     |
| Share of Women Age 25 and Above with a Secondary or Post-Secondary Degree, 2010                 | 89  | 0.41    | 0.06      | 0.31    | 0.62     |
| School Enrollment of Men Age 15-17 in 2010  | 89  | 95.55   | 1.03      | 93.10   | 97.70    |
| School Enrollment of Women Age 15-17 in 2010  | 89  | 96.68   | 0.88      | 94.40   | 98.10    |
| School Enrollment of Men Age 18-24 in 2010  | 89  | 44.25   | 7.11      | 30.80   | 61.50    |
| School Enrollment of Women Age 18-24 in 2010  | 89  | 48.02   | 8.35      | 35.90   | 66.90    |
| <b>Explanatory Variables</b>  |     |         |           |         |          |
| Horse Power of Steam Engines  | 89  | 1839.35 | 3855.33   | 0       | 27638    |
| Average Rainfall  | 89  | 878.03  | 156.42    | 642.90  | 1289.24  |
| Average Temperature   | 89  | 10.45   | 1.69      | 4.42    | 13.73    |
| Latitude  | 89  | 0.74    | 0.19      | 0.21    | 0.98     |
| Land Suitability  | 89  | 46.49   | 2.15      | 41.86   | 50.49    |
| Maritime Department   | 89  | 0.27    | 0.45      | 0       | 1        |
| Border Department   | 89  | 0.24    | 0.43      | 0       | 1        |
| Distance to Paris   | 89  | 365.88  | 188.95    | 1       | 918.86   |
| Paris and Suburbs   | 89  | 0.03    | 0.18      | 0       | 1        |
| Alsace-Lorraine   | 89  | 0.03    | 0.18      | 0       | 1        |
| Urban Population in 1700 (thousand of inhabitants)  | 89  | 20.79   | 57.78     | 0       | 510      |
| <b>Instrumental Variable</b>  |     |         |           |         |          |
| Distance to Fresnes sur Escaut  | 89  | 496.60  | 221.88    | 42.88   | 1027.22  |

Note on the departments' geographic characteristics: latitude in decimal degrees, area in square kms, average annual rainfall (cm), average temperature (celsius), median altitude (in meters), department-level average land suitability from Ramankutty et al. (2002).

**Table A.2:** Descriptive statistics: variables for robustness analysis.

|  | Obs | Mean     | Std. Dev. | Min    | Max     |
|--|-----|----------|-----------|--------|---------|
| <b>Education before 1840</b>                               |     |          |           |        |         |
| Percentage of conscripts who could read, 1827-1829         | 89  | 15.11    | 14.90     | 0.90   | 61.70   |
| Percentage of conscripts who could read, 1831-1835         | 89  | 18.68    | 16.01     | 1.60   | 71.30   |
| Percentage of conscripts who could read, 1836-1840         | 87  | 23.90    | 17.50     | 1.50   | 77.70   |
| <b>Economic development before 1815</b>                    |     |          |           |        |         |
| Market integration during the French Revolution            | 86  | 132.71   | 106.95    | 21.00  | 732.00  |
| Iron forges in 1789  | 89  | 2.15     | 8.76      | 0      | 52.00   |
| Iron forges in 1811  | 89  | 2.53     | 11.09     | 0      | 79.00   |
| Presence of iron forges in 1789                            | 89  | 0.10     | 0.30      | 0      | 1       |
| Presence of iron forges in 1811                            | 89  | 0.10     | 0.30      | 0      | 1       |
| <b>Railroad connection</b>                                 |     |          |           |        |         |
| Railroad connection to Paris in 1860                       | 89  | 0.73     | 0.45      | 0      | 1       |
| <b>Population density</b>                                  |     |          |           |        |         |
| Population density 1801                                    | 85  | 0.74     | 1.55      | 0.19   | 13.17   |
| Population density 1831                                    | 86  | 0.91     | 2.18      | 0.22   | 19.50   |
| Population density 1861                                    | 89  | 1.20     | 4.32      | 0.21   | 40.74   |
| <b>Horse Power of Steam Engines per inhabitant in 1861</b> |     |          |           |        |         |
| Horse Power of Steam Engines per inhabitant in 1861        | 89  | 0.003    | 0.005     | 0      | 0.03    |
| <b>Share of the native population</b>                      |     |          |           |        |         |
| Share of the native population in each department, 1901    | 87  | 0.85     | 0.09      | 0.47   | 0.98    |
| Share of the native population in each department, 2010    | 89  | 0.57     | 0.11      | 0.25   | 0.78    |
| <b>Distance to London</b>                                  |     |          |           |        |         |
| Distance to London (km)                                    | 89  | 636.23   | 229.93    | 242.93 | 1261.78 |
| <b>Soldier deaths in World Wars</b>                        |     |          |           |        |         |
| Soldier deaths in World War I                              | 89  | 14245.46 | 10339.62  | 893    | 80591   |
| Soldier deaths in World War II                             | 89  | 1568.24  | 1659.00   | 18     | 13218   |
| <b>Share of unionized workers in workforce</b>             |     |          |           |        |         |
| Share of unionized workers in workforce, 1901              | 87  | 0.06     | 0.03      | 0.00   | 0.14    |
| Share of unionized workers in workforce, 1930              | 89  | 0.17     | 0.07      | 0.02   | 0.37    |
| <b>Average wage, 1901 (in French Francs)</b>               |     |          |           |        |         |
| Average male wage, 1901                                    | 84  | 4.23     | 0.73      | 2.66   | 7.61    |
| <b>Concentration index, 1861</b>                           |     |          |           |        |         |
| Concentration index  | 85  | 0.40     | 0.20      | 0.12   | 1       |
| <b>Weighted tariffs across sectors</b>                     |     |          |           |        |         |
| Weighted tariffs across sectors, 1865                      | 86  | 4.18     | 1.40      | 0.29   | 8.79    |
| Weighted tariffs across sectors, 1872                      | 86  | 4.42     | 1.59      | 0.17   | 9.84    |
| Weighted tariffs across sectors, 1901                      | 86  | 8.40     | 2.57      | 3.30   | 15.29   |
| Weighted tariffs across sectors, 1924                      | 86  | 6.03     | 1.83      | 2.24   | 10.03   |

## Appendix B. Additional robustness analysis

Table B.1: Population density in the 19<sup>th</sup> century and GDP per capita

|  | (1)<br>IV            | (2)<br>IV            | (3)<br>IV            | (4)<br>IV            | (5)<br>IV            | (6)<br>IV            | (7)<br>IV            | (8)<br>IV            | (9)<br>IV            | (10)<br>IV           | (11)<br>IV           | (12)<br>IV           | (13)<br>IV                        | (14)<br>IV           | (15)<br>IV           | (16)<br>IV           |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------------------|----------------------|----------------------|----------------------|
|  | GDP per capita, 1872 |                      |                      |                      | GDP per capita, 1901 |                      |                      |                      | GDP per capita, 1930 |                      |                      |                      | GDP per capita, 2001-2010 average |                      |                      |                      |
| Horse Power of Steam Engines   | 0.121**<br>[0.0515]  | 0.101**<br>[0.047]   | 0.101**<br>[0.047]   | 0.123**<br>[0.052]   | 0.244***<br>[0.072]  | 0.213***<br>[0.065]  | 0.214***<br>[0.066]  | 0.247***<br>[0.073]  | 0.102***<br>[0.026]  | 0.099***<br>[0.025]  | 0.099***<br>[0.025]  | 0.099***<br>[0.026]  | -0.061**<br>[0.026]               | -0.050**<br>[0.023]  | -0.051**<br>[0.024]  | -0.066**<br>[0.026]  |
| Population density, 1801   |                      | -0.046<br>[0.041]    |                      |                      |                      | -0.052<br>[0.063]    |                      |                      |                      | 0.080*<br>[0.042]    |                      |                      |                                   | 0.156**<br>[0.062]   |                      |                      |
| Population density, 1831   |                      |                      | -0.039<br>[0.038]    |                      |                      |                      | -0.061<br>[0.061]    |                      |                      |                      | 0.078**<br>[0.039]   |                      |                                   |                      | 0.152***<br>[0.054]  |                      |
| Population density, 1861   |                      |                      |                      | -0.062<br>[0.039]    |                      |                      |                      | -0.106<br>[0.070]    |                      |                      |                      | 0.0783**<br>[0.034]  |                                   |                      |                      | 0.171***<br>[0.047]  |
| Average Rainfall   | -0.505**<br>[0.239]  | -0.436**<br>[0.218]  | -0.437**<br>[0.217]  | -0.495**<br>[0.237]  | -0.795**<br>[0.338]  | -0.675**<br>[0.303]  | -0.678**<br>[0.304]  | -0.778**<br>[0.338]  | -0.211*<br>[0.125]   | -0.187<br>[0.129]    | -0.175<br>[0.128]    | -0.224*<br>[0.122]   | 0.164<br>[0.128]                  | 0.135<br>[0.115]     | 0.152<br>[0.116]     | 0.125<br>[0.126]     |
| Average Temperature  | 0.109<br>[0.315]     | -0.064<br>[0.330]    | -0.068<br>[0.330]    | 0.126<br>[0.315]     | -0.537<br>[0.361]    | -0.809**<br>[0.383]  | -0.805**<br>[0.382]  | -0.508<br>[0.360]    | -0.444***<br>[0.113] | -0.436***<br>[0.154] | -0.439***<br>[0.153] | -0.465***<br>[0.112] | -0.0530<br>[0.143]                | 0.0992<br>[0.157]    | 0.0951<br>[0.154]    | 0.0982<br>[0.141]    |
| Latitude   | 0.118<br>[0.127]     | 0.155<br>[0.116]     | 0.154<br>[0.117]     | 0.114<br>[0.127]     | 0.279*<br>[0.156]    | 0.318**<br>[0.147]   | 0.318**<br>[0.147]   | 0.271*<br>[0.155]    | 0.244***<br>[0.0491] | 0.237***<br>[0.0527] | 0.235***<br>[0.0522] | 0.250***<br>[0.0490] | -0.0236<br>[0.0662]               | -0.0443<br>[0.0581]  | -0.0521<br>[0.0589]  | -0.0146<br>[0.0664]  |
| Land Suitability   | -4.899<br>[3.123]    | -4.684<br>[2.991]    | -4.693<br>[2.960]    | -4.764<br>[3.066]    | -8.713**<br>[3.849]  | -8.508**<br>[3.672]  | -8.444**<br>[3.640]  | -8.482**<br>[3.842]  | -3.325***<br>[1.160] | -3.338***<br>[1.193] | -3.425***<br>[1.173] | -3.476***<br>[1.114] | 1.702<br>[1.136]                  | 1.661<br>[1.019]     | 1.481<br>[1.008]     | 1.350<br>[1.178]     |
| Maritime Department  | 0.108<br>[0.111]     | 0.120<br>[0.113]     | 0.121<br>[0.107]     | 0.106<br>[0.111]     | 0.044<br>[0.138]     | 0.062<br>[0.136]     | 0.058<br>[0.131]     | 0.040<br>[0.139]     | 0.007<br>[0.056]     | -0.011<br>[0.060]    | -0.003<br>[0.060]    | 0.009<br>[0.054]     | -0.022<br>[0.053]                 | -0.060<br>[0.049]    | -0.043<br>[0.049]    | -0.016<br>[0.051]    |
| Border Department  | 0.006<br>[0.138]     | 0.008<br>[0.132]     | 0.009<br>[0.133]     | 0.010<br>[0.139]     | 0.155<br>[0.163]     | 0.155<br>[0.152]     | 0.155<br>[0.153]     | 0.162<br>[0.164]     | 0.102**<br>[0.047]   | 0.093**<br>[0.047]   | 0.094**<br>[0.046]   | 0.097**<br>[0.046]   | 0.027<br>[0.045]                  | 0.014<br>[0.039]     | 0.019<br>[0.041]     | 0.018<br>[0.045]     |
| Distance to Paris  | -0.001<br>[0.0007]   | -0.001<br>[0.0007]   | -0.001<br>[0.0007]   | -0.001<br>[0.0007]   | -0.001<br>[0.0008]   | -0.001<br>[0.0008]   | -0.001<br>[0.0008]   | -0.001<br>[0.0009]   | -0.0002<br>[0.0003]  | -0.0002<br>[0.0002]  | -0.0003<br>[0.0003]  | -0.0003<br>[0.0003]  | 0.0002<br>[0.0003]                | 0.0003<br>[0.0003]   | 0.0002<br>[0.0003]   | 0.0002<br>[0.0003]   |
| Paris and Suburbs  | -0.016<br>[0.116]    | 0.041<br>[0.010]     | 0.039<br>[0.099]     | 0.045<br>[0.101]     | -0.189<br>[0.171]    | -0.123<br>[0.168]    | -0.110<br>[0.170]    | -0.084<br>[0.182]    | 0.239***<br>[0.088]  | 0.178***<br>[0.051]  | 0.171***<br>[0.049]  | 0.161***<br>[0.048]  | 0.437***<br>[0.154]               | 0.311***<br>[0.073]  | 0.297***<br>[0.068]  | 0.267***<br>[0.068]  |
| Alsace-Lorraine  |                      |                      |                      |                      |                      |                      |                      |                      | 0.092<br>[0.083]     | 0.077<br>[0.080]     | 0.079<br>[0.082]     | 0.084<br>[0.083]     | 0.030<br>[0.106]                  | 0.012<br>[0.091]     | 0.016<br>[0.086]     | 0.030<br>[0.088]     |
| Urban Population in 1700   | -0.006<br>[0.0301]   | 0.323<br>[0.239]     | 0.321<br>[0.236]     | 0.479*<br>[0.252]    | -0.049<br>[0.0392]   | 0.742*<br>[0.412]    | 0.742*<br>[0.409]    | 0.979**<br>[0.406]   | 0.0277**<br>[0.013]  | 0.153<br>[0.144]     | 0.157<br>[0.145]     | 0.149<br>[0.135]     | 0.0707***<br>[0.015]              | -0.258**<br>[0.122]  | -0.247**<br>[0.122]  | -0.373***<br>[0.129] |
| Observations   | 85                   | 81                   | 82                   | 85                   | 85                   | 81                   | 82                   | 85                   | 87                   | 83                   | 84                   | 87                   | 89                                | 85                   | 86                   | 89                   |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                                   |                      |                      |                      |
| Distance to Fresnes  | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003]              | -0.014***<br>[0.003] | -0.014***<br>[0.003] | -0.013***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 19.779               | 19.822               | 19.872               | 19.526               | 19.779               | 19.822               | 19.872               | 20.617               | 20.804               | 20.775               | 21.025               | 23.261                            | 22.556               | 22.470               | 23.408               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Steam engines per inhabitant in 1861

|  | (1)                  | (2)        | (3)                  | (4)        | (5)                  | (6)        | (7)                               | (8)        |
|--|----------------------|------------|----------------------|------------|----------------------|------------|-----------------------------------|------------|
|  | IV                   | IV         | IV                   | IV         | IV                   | IV         | IV                                | IV         |
|  | GDP per capita, 1872 |            | GDP per capita, 1901 |            | GDP per capita, 1930 |            | GDP per capita, 2001-2010 average |            |
| Horse Power of Steam Engines   | 0.121**              |            | 0.244***             |            | 0.102***             |            | -0.061**                          |            |
|  | [0.052]              |            | [0.072]              |            | [0.026]              |            | [0.026]                           |            |
| Horse Power of Steam Engines per inhabitant in 1861                    |                      | 31.67**    |                      | 63.61***   |                      | 26.21***   |                                   | -16.80**   |
|  |                      | [14.78]    |                      | [22.27]    |                      | [8.140]    |                                   | [6.968]    |
| Average Rainfall   | -0.505**             | -0.257     | -0.795**             | -0.296     | -0.211*              | -0.00742   | 0.164                             | 0.0756     |
|  | [0.239]              | [0.208]    | [0.338]              | [0.246]    | [0.125]              | [0.0900]   | [0.128]                           | [0.0941]   |
| Average Temperature  | 0.109                | 0.167      | -0.537               | -0.421     | -0.444***            | -0.397***  | -0.0530                           | -0.0977    |
|  | [0.315]              | [0.270]    | [0.361]              | [0.319]    | [0.113]              | [0.116]    | [0.143]                           | [0.109]    |
| Land Suitability   | 0.118                | 0.189      | 0.279*               | 0.420**    | 0.244***             | 0.305***   | -0.0236                           | -0.0498    |
|  | [0.127]              | [0.128]    | [0.156]              | [0.182]    | [0.0491]             | [0.0613]   | [0.0662]                          | [0.0649]   |
| Latitude   | -4.899               | -3.447     | -8.713**             | -5.797*    | -3.325***            | -2.004*    | 1.702                             | 0.792      |
|  | [3.123]              | [2.598]    | [3.849]              | [3.218]    | [1.160]              | [1.123]    | [1.136]                           | [0.796]    |
| Maritime Department  | 0.108                | 0.092      | 0.044                | 0.012      | 0.007                | -0.0104    | -0.022                            | -0.008     |
|  | [0.111]              | [0.105]    | [0.138]              | [0.131]    | [0.056]              | [0.052]    | [0.053]                           | [0.046]    |
| Border Department  | 0.00609              | -0.0614    | 0.155                | 0.0199     | 0.102**              | 0.045      | 0.027                             | 0.053      |
|  | [0.138]              | [0.134]    | [0.163]              | [0.144]    | [0.046]              | [0.042]    | [0.045]                           | [0.043]    |
| Distance to Paris  | -0.001               | -0.001     | -0.001               | -0.001     | -0.0002              | -0.0002    | 0.0002                            | 0.0001     |
|  | [0.0007]             | [0.0007]   | [0.0008]             | [0.0008]   | [0.0003]             | [0.0003]   | [0.0003]                          | [0.0002]   |
| Paris and Suburbs  | -0.016               | 0.072      | -0.189               | -0.011     | 0.239***             | 0.314***   | 0.437***                          | 0.383***   |
|  | [0.116]              | [0.107]    | [0.171]              | [0.164]    | [0.088]              | [0.092]    | [0.154]                           | [0.148]    |
| Alsace-Lorraine  |                      |            |                      |            | 0.092                | 0.064      | 0.030                             | 0.067      |
|  |                      |            |                      |            | [0.083]              | [0.116]    | [0.106]                           | [0.121]    |
| Urban Population in 1700   | -0.006               | 0.029      | -0.049               | 0.021      | 0.028**              | 0.058***   | 0.071***                          | 0.0541***  |
|  | [0.030]              | [0.023]    | [0.039]              | [0.028]    | [0.013]              | [0.012]    | [0.015]                           | [0.012]    |
| Observations   | 85                   | 85         | 85                   | 85         | 87                   | 87         | 89                                | 89         |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |            |                      |            |                      |            |                                   |            |
| Distance to Fresnes  | -0.0123***           | 0.00005*** | -0.0123***           | 0.00005*** | -0.0127***           | 0.00005*** | -0.0132***                        | 0.00005*** |
|  | [0.003]              | [0.00001]  | [0.003]              | [0.00001]  | [0.003]              | [0.00001]  | [0.003]                           | [0.00001]  |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 13.216     | 19.526               | 13.216     | 20.617               | 13.990     | 23.261                            | 15.092     |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** The distance to London and GDP per capita

|  | (1)                     | (2)                     | (3)                     | (4)                     | (5)                     | (6)                     | (7)                       | (8)                     |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------------------|-------------------------|
|  | IV                      | IV                      | IV                      | IV                      | IV                      | IV                      | IV                        | IV                      |
|  | GDP per capita, 1872    |                         | GDP per capita, 1901    |                         | GDP per capita, 1930    |                         | GDP per capita, 2001-2010 |                         |
| Horse Power of Steam Engines   | 0.121**<br>[0.0515]     | 0.104<br>[0.0714]       | 0.244***<br>[0.0724]    | 0.272**<br>[0.123]      | 0.102***<br>[0.0261]    | 0.120***<br>[0.0390]    | -0.0607**<br>[0.0261]     | -0.111**<br>[0.0497]    |
| Distance to London   |                         | 0.000277<br>[0.000730]  |                         | -0.000448<br>[0.00123]  |                         | -0.000295<br>[0.000433] |                           | 0.000844<br>[0.000561]  |
| Average Rainfall   | -0.505**<br>[0.239]     | -0.489**<br>[0.244]     | -0.795**<br>[0.338]     | -0.821**<br>[0.376]     | -0.211*<br>[0.125]      | -0.229<br>[0.140]       | 0.164<br>[0.128]          | 0.208<br>[0.170]        |
| Average Temperature  | 0.109<br>[0.315]        | 0.158<br>[0.321]        | -0.537<br>[0.361]       | -0.616<br>[0.425]       | -0.444***<br>[0.113]    | -0.497***<br>[0.149]    | -0.0530<br>[0.143]        | 0.102<br>[0.218]        |
| Latitude   | 0.118<br>[0.127]        | 0.108<br>[0.126]        | 0.279*<br>[0.156]       | 0.296*<br>[0.170]       | 0.244***<br>[0.0491]    | 0.257***<br>[0.0572]    | -0.0236<br>[0.0662]       | -0.0623<br>[0.0888]     |
| Land Suitability   | -4.899<br>[3.123]       | -3.757<br>[4.732]       | -8.713**<br>[3.849]     | -10.56<br>[7.283]       | -3.325***<br>[1.160]    | -4.476**<br>[2.037]     | 1.702<br>[1.136]          | 5.004*<br>[2.947]       |
| Maritime Department  | 0.108<br>[0.111]        | 0.123<br>[0.121]        | 0.0438<br>[0.138]       | 0.0200<br>[0.159]       | 0.00656<br>[0.0559]     | -0.0112<br>[0.0692]     | -0.0215<br>[0.0527]       | 0.0288<br>[0.0723]      |
| Border Department  | 0.00609<br>[0.138]      | -0.00780<br>[0.144]     | 0.155<br>[0.163]        | 0.178<br>[0.204]        | 0.102**<br>[0.0464]     | 0.116**<br>[0.0491]     | 0.0269<br>[0.0448]        | -0.0112<br>[0.0702]     |
| Distance to Paris  | -0.00112<br>[0.000723]  | -0.00127<br>[0.000804]  | -0.00108<br>[0.000847]  | -0.000847<br>[0.000964] | -0.000211<br>[0.000289] | -3.96e-05<br>[0.000432] | 0.000215<br>[0.000280]    | -0.000264<br>[0.000446] |
| Paris and Suburbs  | -0.0164<br>[0.116]      | -0.0224<br>[0.113]      | -0.189<br>[0.171]       | -0.179<br>[0.178]       | 0.239***<br>[0.0877]    | 0.246***<br>[0.0879]    | 0.437***<br>[0.154]       | 0.416**<br>[0.167]      |
| Alsace-Lorraine  |                         |                         |                         |                         | 0.0920<br>[0.0831]      | 0.0875<br>[0.0932]      | 0.0295<br>[0.106]         | 0.0413<br>[0.150]       |
| Urban Population in 1700   | -0.00613<br>[0.0301]    | -0.000705<br>[0.0307]   | -0.0485<br>[0.0392]     | -0.0572<br>[0.0534]     | 0.0277**<br>[0.0132]    | 0.0227<br>[0.0148]      | 0.0707***<br>[0.0149]     | 0.0846***<br>[0.0217]   |
| Observations   | 85                      | 85                      | 85                      | 85                      | 87                      | 87                      | 89                        | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |                         |                         |                         |                         |                         |                         |                           |                         |
| Distance to Fresnes  | -0.0123***<br>[0.00278] | -0.0093***<br>[0.00329] | -0.0123***<br>[0.00278] | -0.0093***<br>[0.00329] | -0.0127***<br>[0.00279] | 0.01***<br>[0.00327]    | -0.0132***<br>[0.00274]   | 0.0102***<br>[0.00317]  |
| F-stat   | 19.526                  | 7.908                   | 19.526                  | 7.908                   | 20.617                  | 9.332                   | 23.261                    | 10.373                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Human capital before 1840 and GDP per capita

|  | (1)<br>IV             | (2)<br>IV             | (3)<br>IV             | (4)<br>IV             | (5)<br>IV             | (6)<br>IV             | (7)<br>IV             | (8)<br>IV             | (9)<br>IV             | (10)<br>IV            | (11)<br>IV            | (12)<br>IV                        | (13)<br>IV            | (14)<br>IV            | (15)<br>IV            | (16)<br>IV            |                     |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------|
|  | GDP per capita, 1872  |                       |                       | GDP per capita, 1901  |                       |                       |                       |                       | GDP per capita, 1930  |                       |                       | GDP per capita, 2001-2010 average |                       |                       |                       |                       |                     |
| Horse Power of Steam Engines   | 0.121**<br>[0.05]     | 0.119**<br>[0.050]    | 0.120**<br>[0.050]    | 0.121**<br>[0.051]    | 0.244***<br>[0.072]   | 0.240***<br>[0.069]   | 0.241***<br>[0.069]   | 0.243***<br>[0.070]   | 0.102***<br>[0.026]   | 0.101***<br>[0.026]   | 0.102***<br>[0.026]   | 0.103***<br>[0.027]               | -0.0607**<br>[0.026]  | -0.0593**<br>[0.025]  | -0.0557**<br>[0.023]  | -0.0575**<br>[0.024]  |                     |
| Share of conscripts who could read, 1827-1829                          |                       | 0.003<br>[0.003]      |                       |                       |                       | 0.006<br>[0.004]      |                       |                       |                       | 0.001<br>[0.002]      |                       |                                   |                       | -0.001<br>[0.002]     |                       |                       |                     |
| Share of conscripts who could read, 1831-1835                          |                       |                       | 0.003<br>[0.003]      |                       |                       |                       | 0.005<br>[0.004]      |                       |                       |                       | 0.0007<br>[0.002]     |                                   |                       |                       |                       | -0.004**<br>[0.002]   |                     |
| Share of conscripts who could read, 1836-1840                          |                       |                       |                       | 0.001<br>[0.003]      |                       |                       |                       | 0.004<br>[0.004]      |                       |                       |                       |                                   | -6.89e-05<br>[0.002]  |                       |                       |                       | -0.003**<br>[0.001] |
| Average Rainfall   | -0.505**<br>[0.239]   | -0.515**<br>[0.249]   | -0.530**<br>[0.257]   | -0.516**<br>[0.252]   | -0.795**<br>[0.338]   | -0.815**<br>[0.327]   | -0.846***<br>[0.331]  | -0.828**<br>[0.327]   | -0.211*<br>[0.125]    | -0.214*<br>[0.126]    | -0.217*<br>[0.129]    | -0.209<br>[0.128]                 | 0.164<br>[0.132]      | 0.159<br>[0.132]      | 0.163<br>[0.132]      | 0.144<br>[0.133]      |                     |
| Average Temperature  | 0.109<br>[0.315]      | 0.182<br>[0.281]      | 0.155<br>[0.280]      | 0.114<br>[0.308]      | -0.537<br>[0.361]     | -0.393<br>[0.339]     | -0.443<br>[0.335]     | -0.523<br>[0.350]     | -0.444***<br>[0.113]  | -0.417***<br>[0.115]  | -0.432***<br>[0.111]  | -0.443***<br>[0.113]              | -0.0530<br>[0.143]    | -0.0761<br>[0.144]    | -0.109<br>[0.120]     | -0.0578<br>[0.128]    |                     |
| Latitude   | 0.118<br>[0.127]      | 0.140<br>[0.129]      | 0.138<br>[0.132]      | 0.131<br>[0.133]      | 0.279*<br>[0.156]     | 0.322**<br>[0.156]    | 0.319*<br>[0.163]     | 0.318*<br>[0.163]     | 0.244***<br>[0.0491]  | 0.252***<br>[0.050]   | 0.249***<br>[0.051]   | 0.242***<br>[0.050]               | -0.0236<br>[0.066]    | -0.0335<br>[0.067]    | -0.0614<br>[0.063]    | -0.0628<br>[0.064]    |                     |
| Land Suitability   | -4.899<br>[3.123]     | -4.263<br>[2.896]     | -4.181<br>[2.934]     | -4.662<br>[2.953]     | -8.713**<br>[3.849]   | -7.461**<br>[3.658]   | -7.226**<br>[3.582]   | -7.985**<br>[3.543]   | -3.325***<br>[1.160]  | -3.116***<br>[1.204]  | -3.156***<br>[1.087]  | -3.426***<br>[1.162]              | 1.702<br>[1.136]      | 1.506<br>[1.133]      | 0.778<br>[1.029]      | 1.313<br>[1.088]      |                     |
| Maritime Department  | 0.108<br>[0.111]      | 0.0980<br>[0.109]     | 0.104<br>[0.108]      | 0.111<br>[0.113]      | 0.044<br>[0.138]      | 0.023<br>[0.139]      | 0.035<br>[0.135]      | 0.051<br>[0.139]      | 0.007<br>[0.0559]     | 0.003<br>[0.057]      | 0.006<br>[0.056]      | 0.009<br>[0.057]                  | -0.009<br>[0.053]     | -0.022<br>[0.053]     | -0.019<br>[0.049]     | -0.020<br>[0.049]     | -0.034<br>[0.052]   |
| Border Department  | 0.006<br>[0.138]      | -0.008<br>[0.142]     | 0.003<br>[0.137]      | 0.006<br>[0.138]      | 0.155<br>[0.163]      | 0.129<br>[0.162]      | 0.150<br>[0.160]      | 0.155<br>[0.164]      | 0.102**<br>[0.0464]   | 0.0972**<br>[0.048]   | 0.101**<br>[0.047]    | 0.103**<br>[0.047]                | 0.027<br>[0.045]      | 0.034<br>[0.046]      | 0.039<br>[0.044]      | 0.035<br>[0.046]      |                     |
| Distance to Paris  | -0.001<br>[0.0007]    | -0.001<br>[0.0007]    | -0.001<br>[0.0007]    | -0.001<br>[0.0007]    | -0.001<br>[0.0008]    | -0.001<br>[0.0008]    | -0.001<br>[0.0008]    | -0.001<br>[0.0008]    | -0.0009<br>[0.0003]   | -0.001<br>[0.0003]    | -0.0002<br>[0.0003]   | -0.0002<br>[0.0003]               | -0.0002<br>[0.0003]   | 0.0002<br>[0.0003]    | 0.0002<br>[0.0003]    | 0.0002<br>[0.0003]    | 0.0002<br>[0.0003]  |
| Paris and Suburbs  | -0.016<br>[0.116]     | -0.056<br>[0.136]     | -0.015<br>[0.120]     | -0.010<br>[0.117]     | -0.189<br>[0.171]     | -0.267<br>[0.204]     | -0.185<br>[0.185]     | -0.170<br>[0.182]     | 0.239***<br>[0.0877]  | 0.224***<br>[0.079]   | 0.239***<br>[0.086]   | 0.236***<br>[0.089]               | 0.437***<br>[0.154]   | 0.452***<br>[0.158]   | 0.439***<br>[0.165]   | 0.423**<br>[0.164]    |                     |
| Alsace-Lorraine  |                       |                       |                       |                       |                       |                       |                       |                       | 0.092<br>[0.083]      | 0.101<br>[0.079]      | 0.096<br>[0.080]      | 0.047<br>[0.098]                  | 0.030<br>[0.106]      | 0.020<br>[0.101]      | 0.010<br>[0.085]      | 0.212***<br>[0.072]   |                     |
| Urban Population in 1700   | -0.006<br>[0.030]     | -0.003<br>[0.028]     | -0.002<br>[0.026]     | -0.003<br>[0.026]     | -0.049<br>[0.039]     | -0.04<br>[0.038]      | -0.040<br>[0.036]     | -0.037<br>[0.036]     | 0.028**<br>[0.013]    | 0.029**<br>[0.013]    | 0.029**<br>[0.012]    | 0.027**<br>[0.013]                | 0.071***<br>[0.015]   | 0.069***<br>[0.016]   | 0.063***<br>[0.014]   | 0.063***<br>[0.015]   |                     |
| Observations   | 85                    | 85                    | 85                    | 85                    | 85                    | 85                    | 85                    | 85                    | 87                    | 87                    | 87                    | 86                                | 89                    | 89                    | 89                    | 87                    |                     |
| First stage: the instrumented variable is Horse Power of Steam Engines |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                                   |                       |                       |                       |                       |                     |
| Distance to Fresnes  | -0.0123***<br>[0.003] | -0.0125***<br>[0.003] | -0.0125***<br>[0.003] | -0.0123***<br>[0.002] | -0.0123***<br>[0.003] | -0.0124***<br>[0.003] | -0.0125***<br>[0.003] | -0.0123***<br>[0.002] | -0.0127***<br>[0.003] | -0.0128***<br>[0.003] | -0.0128***<br>[0.003] | -0.0123***<br>[0.002]             | -0.0132***<br>[0.003] | -0.0136***<br>[0.003] | -0.0138***<br>[0.003] | -0.0133***<br>[0.003] |                     |
| F-stat (1 <sup>st</sup> stage)   | 19.526                | 22.815                | 25.273                | 26.354                | 19.526                | 22.815                | 25.273                | 26.354                | 20.617                | 24.468                | 26.714                | 26.047                            | 23.261                | 25.817                | 28.524                | 27.759                |                     |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.5:** Migrations and GDP per capita

|  | (1)                  | (2)       | (3)                       | (4)       |
|--|----------------------|-----------|---------------------------|-----------|
|  | IV                   | IV        | IV                        | IV        |
|  | GDP per capita, 1901 |           | GDP per capita, 2001-2010 |           |
| Horse Power of Steam Engines   | 0.121**              | 0.227***  | -0.0607**                 | -0.0598** |
|  | [0.052]              | [0.070]   | [0.026]                   | [0.026]   |
| Share of the native population in each department, 1901                |                      | -1.530**  |                           |           |
|  |                      | [0.769]   |                           |           |
| Share of the native population in each department, 2010                |                      |           |                           | -0.162    |
|  |                      |           |                           | [0.211]   |
| Average Rainfall   | -0.505**             | -0.714**  | 0.164                     | 0.185     |
|  | [0.239]              | [0.334]   | [0.128]                   | [0.128]   |
| Average Temperature  | 0.109                | -0.484    | -0.0530                   | -0.0262   |
|  | [0.315]              | [0.345]   | [0.143]                   | [0.141]   |
| Latitude   | 0.118                | 0.200     | -0.0236                   | -0.0401   |
|  | [0.127]              | [0.162]   | [0.066]                   | [0.063]   |
| Land Suitability   | -4.899               | -8.102**  | 1.702                     | 2.131     |
|  | [3.123]              | [3.718]   | [1.136]                   | [1.321]   |
| Maritime Department  | 0.108                | 0.0981    | -0.0215                   | -0.0227   |
|  | [0.111]              | [0.120]   | [0.0527]                  | [0.0520]  |
| Border Department  | 0.00609              | 0.144     | 0.0269                    | 0.0246    |
|  | [0.138]              | [0.147]   | [0.0448]                  | [0.0444]  |
| Distance to Paris  | -0.001               | -0.001    | 0.0002                    | 0.0003    |
|  | [0.0007]             | [0.0008]  | [0.0003]                  | [0.0003]  |
| Paris and Suburbs  | -0.016               | -0.539*   | 0.437***                  | 0.386**   |
|  | [0.116]              | [0.284]   | [0.154]                   | [0.165]   |
| Alsace-Lorraine  |                      |           | 0.0295                    | 0.0237    |
|  |                      |           | [0.106]                   | [0.105]   |
| Urban Population in 1700   | -0.006               | -0.072*   | 0.071***                  | 0.070***  |
|  | [0.030]              | [0.038]   | [0.015]                   | [0.015]   |
| No Engine in 1860-1865   | 0.466*               | 0.925**   | -0.342***                 | -0.337*** |
|  | [0.249]              | [0.384]   | [0.125]                   | [0.122]   |
| Observations   | 85                   | 85        | 89                        | 89        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |           |                           |           |
| Distance to Fresnes  | -0.012***            | -0.012*** | -0.013***                 | -0.013*** |
|  | [0.003]              | [0.003]   | [0.003]                   | [0.003]   |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 19.605    | 23.261                    | 22.769    |

Note: Data on the native population in 1872 and 1930 are not available. All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Iron forges before 1815 and GDP per capita

|  | (1)<br>IV            | (2)<br>IV            | (3)<br>IV            | (4)<br>IV            | (5)<br>IV            | (6)<br>IV            | (7)<br>IV            | (8)<br>IV            | (9)<br>IV            | (10)<br>IV                        | (11)<br>IV           | (12)<br>IV           |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------------------|----------------------|----------------------|
|  | GDP per capita, 1872 |                      |                      | GDP per capita, 1901 |                      |                      | GDP per capita, 1930 |                      |                      | GDP per capita, 2001-2010 average |                      |                      |
| Horse Power of Steam Engines   | 0.121**<br>[0.052]   | 0.134***<br>[0.050]  | 0.134***<br>[0.050]  | 0.244***<br>[0.072]  | 0.256***<br>[0.070]  | 0.256***<br>[0.070]  | 0.102***<br>[0.026]  | 0.100***<br>[0.027]  | 0.101***<br>[0.027]  | -0.0607**<br>[0.026]              | -0.0604**<br>[0.027] | -0.0605**<br>[0.027] |
| Iron forges in 1789  |                      | -0.030<br>[0.0566]   |                      |                      | 0.00386<br>[0.105]   |                      |                      | -0.036<br>[0.0340]   |                      |                                   | -0.0120<br>[0.0318]  |                      |
| Presence of iron forges in 1789  |                      | -0.122<br>[0.191]    |                      |                      | -0.182<br>[0.339]    |                      |                      | 0.0946<br>[0.117]    |                      |                                   | 0.0200<br>[0.0841]   |                      |
| Iron forges in 1811  |                      |                      | -0.024<br>[0.061]    |                      |                      | 0.017<br>[0.117]     |                      |                      | -0.036<br>[0.038]    |                                   |                      | -0.018<br>[0.034]    |
| Presence of iron forges in 1811  |                      |                      | -0.139<br>[0.198]    |                      |                      | -0.218<br>[0.358]    |                      |                      | 0.093<br>[0.126]     |                                   |                      | 0.035<br>[0.0879]    |
| Average Rainfall   | -0.505**<br>[0.239]  | -0.452*<br>[0.236]   | -0.454*<br>[0.237]   | -0.795**<br>[0.338]  | -0.757**<br>[0.349]  | -0.760**<br>[0.350]  | -0.211*<br>[0.125]   | -0.202<br>[0.123]    | -0.202<br>[0.124]    | 0.164<br>[0.128]                  | 0.170<br>[0.126]     | 0.171<br>[0.126]     |
| Average Temperature  | 0.109<br>[0.315]     | 0.161<br>[0.331]     | 0.163<br>[0.331]     | -0.537<br>[0.361]    | -0.486<br>[0.371]    | -0.484<br>[0.371]    | -0.444***<br>[0.113] | -0.450***<br>[0.113] | -0.449***<br>[0.113] | -0.0530<br>[0.143]                | -0.0518<br>[0.143]   | -0.0526<br>[0.143]   |
| Latitude   | 0.118<br>[0.127]     | 0.105<br>[0.132]     | 0.104<br>[0.132]     | 0.279*<br>[0.156]    | 0.265*<br>[0.159]    | 0.263*<br>[0.159]    | 0.244***<br>[0.0491] | 0.248***<br>[0.0486] | 0.247***<br>[0.0487] | -0.0236<br>[0.0662]               | -0.0235<br>[0.0664]  | -0.0233<br>[0.0664]  |
| Land Suitability   | -4.899<br>[3.123]    | -5.405*<br>[3.068]   | -5.405*<br>[3.074]   | -8.713**<br>[3.849]  | -9.172**<br>[3.783]  | -9.189**<br>[3.785]  | -3.325***<br>[1.160] | -3.305***<br>[1.151] | -3.296***<br>[1.154] | 1.702<br>[1.136]                  | 1.683<br>[1.146]     | 1.692<br>[1.149]     |
| Maritime Department  | 0.108<br>[0.111]     | 0.0975<br>[0.114]    | 0.0973<br>[0.114]    | 0.0438<br>[0.138]    | 0.0346<br>[0.141]    | 0.0349<br>[0.141]    | 0.00656<br>[0.0559]  | 0.00630<br>[0.0563]  | 0.00597<br>[0.0564]  | -0.0215<br>[0.0527]               | -0.0223<br>[0.0527]  | -0.0225<br>[0.0528]  |
| Border Department  | 0.00609<br>[0.138]   | 0.0244<br>[0.144]    | 0.0260<br>[0.144]    | 0.155<br>[0.163]     | 0.177<br>[0.161]     | 0.179<br>[0.161]     | 0.102**<br>[0.0464]  | 0.0950*<br>[0.0487]  | 0.0955*<br>[0.0489]  | 0.0269<br>[0.0448]                | 0.0260<br>[0.0462]   | 0.0252<br>[0.0462]   |
| Distance to Paris  | -0.0011<br>[0.0007]  | -0.0013*<br>[0.0007] | -0.0013*<br>[0.0007] | -0.0011<br>[0.0008]  | -0.0012<br>[0.0008]  | -0.0012<br>[0.0008]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | 0.0002<br>[0.0003]                | 0.0002<br>[0.0003]   | 0.0002<br>[0.0003]   |
| Paris and Suburbs  | -0.0164<br>[0.116]   | -0.0651<br>[0.116]   | -0.0656<br>[0.116]   | -0.189<br>[0.171]    | -0.233<br>[0.168]    | -0.235<br>[0.168]    | 0.239***<br>[0.088]  | 0.241***<br>[0.088]  | 0.242***<br>[0.088]  | 0.437***<br>[0.154]               | 0.435***<br>[0.154]  | 0.436***<br>[0.154]  |
| Alsace-Lorraine  |                      |                      |                      |                      |                      |                      | 0.092<br>[0.083]     | 0.097<br>[0.085]     | 0.096<br>[0.085]     | 0.030<br>[0.106]                  | 0.028<br>[0.107]     | 0.028<br>[0.107]     |
| Urban Population in 1700   | -0.006<br>[0.030]    | -0.008<br>[0.030]    | -0.008<br>[0.031]    | -0.049<br>[0.039]    | -0.051<br>[0.039]    | -0.051<br>[0.039]    | 0.028**<br>[0.013]   | 0.029**<br>[0.013]   | 0.029**<br>[0.013]   | 0.071***<br>[0.015]               | 0.0718***<br>[0.015] | 0.071***<br>[0.015]  |
| Observations   | 85                   | 85                   | 85                   | 85                   | 85                   | 85                   | 87                   | 87                   | 87                   | 89                                | 89                   | 89                   |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |                      |                      |                      |                      |                      |                      |                      |                      |                                   |                      |                      |
| Distance to Fresnes  | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003]              | -0.013***<br>[0.003] | -0.013***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 18.147               | 18.146               | 19.526               | 18.147               | 18.146               | 20.617               | 19.129               | 19.127               | 23.261                            | 21.562               | 21.580               |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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.7:** Market integration during the French Revolution and GDP per capita

|  | (1)                  | (2)       | (3)                  | (4)       | (5)                  | (6)       | (7)                               | (8)       |
|--|----------------------|-----------|----------------------|-----------|----------------------|-----------|-----------------------------------|-----------|
|  | IV                   | IV        | IV                   | IV        | IV                   | IV        | IV                                | IV        |
|  | GDP per capita, 1872 |           | GDP per capita, 1901 |           | GDP per capita, 1930 |           | GDP per capita, 2001-2010 average |           |
| Horse Power of Steam Engines   | 0.121**              | 0.113**   | 0.244***             | 0.246***  | 0.102***             | 0.104***  | -0.061**                          | -0.078**  |
|  | [0.052]              | [0.057]   | [0.072]              | [0.073]   | [0.026]              | [0.027]   | [0.026]                           | [0.031]   |
| Market Integration during the French Revolution                        |                      | -0.050    |                      | -0.187*   |                      | -0.046    |                                   | 0.127***  |
|  |                      | [0.0921]  |                      | [0.101]   |                      | [0.0349]  |                                   | [0.0387]  |
| Average Rainfall   | -0.505**             | -0.393*   | -0.795**             | -0.542*   | -0.211*              | -0.169    | 0.164                             | 0.0703    |
|  | [0.239]              | [0.213]   | [0.338]              | [0.295]   | [0.125]              | [0.107]   | [0.128]                           | [0.127]   |
| Average Temperature  | 0.109                | 0.00261   | -0.537               | -0.763**  | -0.444***            | -0.489*** | -0.053                            | 0.033     |
|  | [0.315]              | [0.332]   | [0.361]              | [0.344]   | [0.113]              | [0.119]   | [0.143]                           | [0.154]   |
| Latitude   | 0.118                | 0.180     | 0.279*               | 0.436***  | 0.244***             | 0.285***  | -0.0236                           | -0.0884   |
|  | [0.127]              | [0.136]   | [0.156]              | [0.162]   | [0.049]              | [0.056]   | [0.066]                           | [0.073]   |
| Land Suitability   | -4.899               | -4.845    | -8.713**             | -9.068**  | -3.325***            | -3.356*** | 1.702                             | 2.129*    |
|  | [3.123]              | [3.107]   | [3.849]              | [3.531]   | [1.160]              | [1.155]   | [1.136]                           | [1.223]   |
| Maritime Department  | 0.108                | 0.121     | 0.044                | 0.091     | 0.007                | 0.009     | -0.0215                           | -0.0620   |
|  | [0.111]              | [0.117]   | [0.138]              | [0.130]   | [0.056]              | [0.055]   | [0.053]                           | [0.052]   |
| Border Department  | 0.006                | -0.005    | 0.155                | 0.112     | 0.102**              | 0.088**   | 0.027                             | 0.044     |
|  | [0.138]              | [0.142]   | [0.163]              | [0.149]   | [0.046]              | [0.042]   | [0.045]                           | [0.047]   |
| Distance to Paris  | -0.0011              | -0.0012   | -0.0011              | -0.0013   | -0.0002              | -0.0002   | 0.0002                            | 0.0004    |
|  | [0.0007]             | [0.0007]  | [0.0008]             | [0.0008]  | [0.0003]             | [0.0003]  | [0.0003]                          | [0.0003]  |
| Paris and Suburbs  | -0.016               | -0.028    | -0.189               | -0.276    | 0.239***             | 0.216**   | 0.437***                          | 0.506***  |
|  | [0.116]              | [0.135]   | [0.171]              | [0.196]   | [0.0877]             | [0.0982]  | [0.154]                           | [0.149]   |
| Alsace-Lorraine  |                      |           |                      |           | 0.0920               | 0.0904    | 0.0295                            | 0.0470    |
|  |                      |           |                      |           | [0.0831]             | [0.0738]  | [0.106]                           | [0.111]   |
| Urban Population in 1700   | -0.006               | 0.011     | -0.049               | 0.001     | 0.028**              | 0.040***  | 0.071***                          | 0.044***  |
|  | [0.030]              | [0.028]   | [0.039]              | [0.039]   | [0.013]              | [0.013]   | [0.015]                           | [0.014]   |
| Observations   | 85                   | 83        | 85                   | 83        | 87                   | 85        | 89                                | 86        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |           |                      |           |                      |           |                                   |           |
| Distance to Fresnes  | -0.123***            | -0.011*** | -0.123***            | -0.011*** | -0.127***            | -0.118*** | -0.132***                         | -0.118*** |
|  | [ 0.003]             | [0.003]   | [ 0.003]             | [0.003]   | [ 0.003]             | [ 0.003]  | [ 0.003]                          | [ 0.003]  |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 18.620    | 19.526               | 18.620    | 20.617               | 19.807    | 23.261                            | 19.868    |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Railroad network and GDP per capita

|  | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                               | (8)                   |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------------------|-----------------------|
|  | IV                   | IV                   | IV                   | IV                   | IV                   | IV                   | IV                                | IV                    |
|  | GDP per capita, 1872 |                      | GDP per capita, 1901 |                      | GDP per capita, 1930 |                      | GDP per capita, 2001-2010 average |                       |
| Horse Power of Steam Engines   | 0.121**<br>[0.0515]  | 0.121**<br>[0.0499]  | 0.244***<br>[0.0724] | 0.246***<br>[0.0708] | 0.102***<br>[0.0261] | 0.103***<br>[0.0254] | -0.0607**<br>[0.0261]             | -0.0543**<br>[0.0214] |
| Railroad connection to Paris in 1860                                   |                      | -0.00501<br>[0.0708] |                      | 0.0265<br>[0.114]    |                      | 0.0119<br>[0.0405]   |                                   | 0.113***<br>[0.0346]  |
| Average Rainfall   | -0.505**<br>[0.239]  | -0.503**<br>[0.232]  | -0.795**<br>[0.338]  | -0.805**<br>[0.346]  | -0.211*<br>[0.125]   | -0.215*<br>[0.127]   | 0.164<br>[0.128]                  | 0.149<br>[0.114]      |
| Average Temperature  | 0.109<br>[0.315]     | 0.111<br>[0.313]     | -0.537<br>[0.361]    | -0.547<br>[0.366]    | -0.444***<br>[0.113] | -0.448***<br>[0.114] | -0.0530<br>[0.143]                | -0.106<br>[0.122]     |
| Latitude   | 0.118<br>[0.127]     | 0.120<br>[0.128]     | 0.279*<br>[0.156]    | 0.268*<br>[0.161]    | 0.244***<br>[0.0491] | 0.240***<br>[0.0505] | -0.0236<br>[0.0662]               | -0.0586<br>[0.0606]   |
| Land Suitability   | -4.899<br>[3.123]    | -4.913<br>[3.170]    | -8.713**<br>[3.849]  | -8.638**<br>[3.914]  | -3.325***<br>[1.160] | -3.286***<br>[1.179] | 1.702<br>[1.136]                  | 2.026*<br>[1.057]     |
| Maritime Department  | 0.108<br>[0.111]     | 0.108<br>[0.111]     | 0.0438<br>[0.138]    | 0.0477<br>[0.139]    | 0.00656<br>[0.0559]  | 0.00818<br>[0.0570]  | -0.0215<br>[0.0527]               | -0.00461<br>[0.0524]  |
| Border Department  | 0.00609<br>[0.138]   | 0.00678<br>[0.138]   | 0.155<br>[0.163]     | 0.152<br>[0.164]     | 0.102**<br>[0.0464]  | 0.100**<br>[0.0464]  | 0.0269<br>[0.0448]                | 0.00441<br>[0.0412]   |
| Distance to Paris  | -0.0011<br>[0.0007]  | -0.0011<br>[0.0007]  | -0.0011<br>[0.0008]  | -0.0011<br>[0.0009]  | -0.0002<br>[0.0003]  | -0.0002<br>[0.0003]  | 0.0002<br>[0.0003]                | 0.0003<br>[0.0003]    |
| Paris and Suburbs  | -0.016<br>[0.116]    | -0.0166<br>[0.116]   | -0.189<br>[0.171]    | -0.188<br>[0.170]    | 0.239***<br>[0.0877] | 0.239***<br>[0.0878] | 0.437***<br>[0.154]               | 0.438***<br>[0.155]   |
| Alsace-Lorraine  |                      |                      |                      |                      | 0.092<br>[0.083]     | 0.086<br>[0.083]     | 0.030<br>[0.106]                  | -0.012<br>[0.102]     |
| Urban Population in 1700   | -0.006<br>[0.030]    | -0.006<br>[0.029]    | -0.049<br>[0.039]    | -0.050<br>[0.038]    | 0.028**<br>[0.013]   | 0.027**<br>[0.013]   | 0.071***<br>[0.015]               | 0.066***<br>[0.014]   |
| Observations   | 85                   | 85                   | 85                   | 85                   | 87                   | 87                   | 89                                | 89                    |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |                      |                      |                      |                      |                      |                                   |                       |
| Distance to Fresnes  | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.012***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.013***<br>[0.003] | -0.0132***<br>[0.003]             | -0.0137***<br>[0.003] |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 20.802               | 19.526               | 20.802               | 20.617               | 21.835               | 23.261                            | 26.360                |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Concentration of the early industrial sector and GDP

|  | (1)                  | (2)       | (3)                  | (4)       | (5)                  | (6)       | (7)                       | (8)       |
|--|----------------------|-----------|----------------------|-----------|----------------------|-----------|---------------------------|-----------|
|  | IV                   | IV        | IV                   | IV        | IV                   | IV        | IV                        | IV        |
|  | GDP per capita, 1872 |           | GDP per capita, 1901 |           | GDP per capita, 1930 |           | GDP per capita, 2001-2011 |           |
| Horse Power of Steam Engines   | 0.121**              | 0.116**   | 0.244***             | 0.229***  | 0.102***             | 0.098***  | -0.061**                  | -0.054**  |
|  | [0.052]              | [0.050]   | [0.072]              | [0.072]   | [0.026]              | [0.026]   | [0.026]                   | [0.025]   |
| Concentration Index  |                      | 0.066     |                      | 0.258     |                      | 0.068     |                           | -0.096    |
|  |                      | [0.150]   |                      | [0.225]   |                      | [0.0945]  |                           | [0.086]   |
| Average Rainfall   | -0.505**             | -0.504**  | -0.795**             | -0.795**  | -0.211*              | -0.218*   | 0.164                     | 0.167     |
|  | [0.239]              | [0.248]   | [0.338]              | [0.338]   | [0.125]              | [0.126]   | [0.128]                   | [0.130]   |
| Average Temperature  | 0.109                | 0.139     | -0.537               | -0.351    | -0.444***            | -0.403*** | -0.0530                   | -0.0476   |
|  | [0.315]              | [0.329]   | [0.361]              | [0.360]   | [0.113]              | [0.117]   | [0.143]                   | [0.152]   |
| Latitude   | 0.118                | 0.137     | 0.279*               | 0.260*    | 0.244***             | 0.238***  | -0.0236                   | -0.0401   |
|  | [0.127]              | [0.130]   | [0.156]              | [0.153]   | [0.0491]             | [0.0497]  | [0.0662]                  | [0.0644]  |
| Land Suitability   | -4.899               | -4.385    | -8.713**             | -7.833**  | -3.325***            | -3.071*** | 1.702                     | 1.073     |
|  | [3.123]              | [2.983]   | [3.849]              | [3.690]   | [1.160]              | [1.059]   | [1.136]                   | [1.050]   |
| Maritime Department  | 0.108                | 0.099     | 0.044                | 0.024     | 0.007                | 0.001     | -0.022                    | -0.016    |
|  | [0.111]              | [0.110]   | [0.138]              | [0.134]   | [0.056]              | [0.053]   | [0.053]                   | [0.050]   |
| Border Department  | 0.006                | 0.013     | 0.155                | 0.213     | 0.102**              | 0.118**   | 0.027                     | 0.031     |
|  | [0.138]              | [0.144]   | [0.163]              | [0.168]   | [0.046]              | [0.047]   | [0.045]                   | [0.044]   |
| Distance to Paris  | -0.0011              | -0.0010   | -0.0011              | -0.0010   | -0.0002              | -0.0002   | 0.0002                    | 8.66e-05  |
|  | [0.0007]             | [0.0007]  | [0.0008]             | [0.0008]  | [0.0003]             | [0.0003]  | [0.0003]                  | [0.0003]  |
| Paris and Suburbs  | -0.016               | 0.009     | -0.189               | -0.142    | 0.239***             | 0.252***  | 0.437***                  | 0.405***  |
|  | [0.116]              | [0.115]   | [0.171]              | [0.177]   | [0.0877]             | [0.090]   | [0.154]                   | [0.154]   |
| Alsace-Lorraine  |                      |           |                      |           | 0.092                | 0.066     | 0.030                     | 0.052     |
|  |                      |           |                      |           | [0.0831]             | [0.0839]  | [0.106]                   | [0.107]   |
| Urban Population in 1700   | -0.006               | -0.001    | -0.049               | -0.036    | 0.028**              | 0.031**   | 0.071***                  | 0.064***  |
|  | [0.030]              | [0.030]   | [0.039]              | [0.039]   | [0.013]              | [0.013]   | [0.015]                   | [0.015]   |
| Observations   | 85                   | 81        | 85                   | 81        | 87                   | 83        | 89                        | 85        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |           |                      |           |                      |           |                           |           |
| Distance to Fresnes  | -0.012***            | -0.013*** | -0.012***            | -0.013*** | -0.013***            | -0.013*** | -0.013***                 | -0.014*** |
|  | [0.003]              | [0.003]   | [0.003]              | [0.003]   | [0.003]              | [0.003]   | [0.003]                   | [0.003]   |
| F-stat (1 <sup>st</sup> stage)   | 19.526               | 18.828    | 19.526               | 18.828    | 20.617               | 19.527    | 23.261                    | 21.502    |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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: World Wars and GDP**

|  | (1)                  | (2)       | (3)                       | (4)       |
|--|----------------------|-----------|---------------------------|-----------|
|  | IV                   | IV        | IV                        | IV        |
|  | GDP per capita, 1930 |           | GDP per capita, 2001-2010 |           |
| Horse Power of Steam Engines   | 0.102***             | 0.102***  | -0.0607**                 | -0.0571** |
|  | [0.026]              | [0.026]   | [0.026]                   | [0.026]   |
| WWI deaths   |                      | -0.009    |                           |           |
|  |                      | [0.065]   |                           |           |
| WWII deaths  |                      |           |                           | 0.088     |
|  |                      |           |                           | [0.061]   |
| Average Rainfall   | -0.211*              | -0.204*   | 0.164                     | 0.135     |
|  | [0.125]              | [0.121]   | [0.128]                   | [0.130]   |
| Average Temperature  | -0.444***            | -0.434*** | -0.0530                   | -0.201    |
|  | [0.113]              | [0.124]   | [0.143]                   | [0.152]   |
| Land Suitability   | 0.244***             | 0.240***  | -0.0236                   | 0.0367    |
|  | [0.0491]             | [0.0617]  | [0.0662]                  | [0.0697]  |
| Latitude   | -3.325***            | -3.244*** | 1.702                     | 0.0126    |
|  | [1.160]              | [1.152]   | [1.136]                   | [1.375]   |
| Maritime Department  | 0.0066               | 0.009     | -0.0215                   | -0.039    |
|  | [0.056]              | [0.057]   | [0.053]                   | [0.050]   |
| Border Department  | 0.102**              | 0.102**   | 0.027                     | 0.004     |
|  | [0.046]              | [0.046]   | [0.045]                   | [0.040]   |
| Distance to Paris  | -0.0002              | -0.0002   | 0.0002                    | -5.71e-06 |
|  | [0.0003]             | [0.0003]  | [0.0003]                  | [0.0003]  |
| Paris and Suburbs  | 0.239***             | 0.245***  | 0.437***                  | 0.345***  |
|  | [0.088]              | [0.086]   | [0.154]                   | [0.128]   |
| Alsace-Lorraine  | 0.092                | 0.072     | 0.030                     | 0.071     |
|  | [0.083]              | [0.193]   | [0.106]                   | [0.097]   |
| Urban Population in 1700   | 0.028**              | 0.028**   | 0.071***                  | 0.059***  |
|  | [0.013]              | [0.012]   | [0.015]                   | [0.013]   |
| Observations   | 87                   | 87        | 89                        | 89        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                      |           |                           |           |
| Distance to Fresnes  | -0.013***            | -0.013*** | -0.013***                 | -0.014*** |
|  | [0.003]              | [0.003]   | [0.003]                   | [0.003]   |
| F-stat (1 <sup>st</sup> stage)   | 20.617               | 19.444    | 23.261                    | 23.457    |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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: World Wars and share of the workforce in the industrial sector**

|  | (1)<br>IV<br>Share of Workforce in Industry<br>1930 | (2)<br>IV<br>Share of Workforce in Industry<br>1930 | (3)<br>IV<br>Share of Workforce in Industry<br>1968 | (4)<br>IV<br>Share of Workforce in Industry<br>1968 | (5)<br>IV<br>Share of Workforce in Industry<br>1975 | (6)<br>IV<br>Share of Workforce in Industry<br>1975 | (7)<br>IV<br>Share of Workforce in Industry<br>1982 | (8)<br>IV<br>Share of Workforce in Industry<br>1982 | (9)<br>IV<br>Share of Workforce in Industry<br>1990 | (10)<br>IV<br>Share of Workforce in Industry<br>1990 | (11)<br>IV<br>Share of Workforce in Industry<br>1999 | (12)<br>IV<br>Share of Workforce in Industry<br>1999 | (13)<br>IV<br>Share of Workforce in Industry<br>2010 | (14)<br>IV<br>Share of Workforce in Industry<br>2010 |
|--|---|---|---|---|---|---|---|---|---|--|--|--|--|--|
| Horse Power of Steam Engines   | 0.100***<br>[0.017]                                 | 0.099***<br>[0.017]                                 | 0.050***<br>[0.011]                                 | 0.050***<br>[0.011]                                 | 0.038***<br>[0.008]                                 | 0.038***<br>[0.008]                                 | 0.022***<br>[0.006]                                 | 0.022***<br>[0.006]                                 | 0.007<br>[0.006]                                    | 0.006<br>[0.006]                                     | -0.002<br>[0.006]                                    | -0.003<br>[0.005]                                    | -0.012*<br>[0.006]                                   | -0.012**<br>[0.006]                                  |
| WWI deaths   |   | -0.100***<br>[0.0368]                               |   |   |   |   |   |   |   |  |  |  |  |  |
| WWII deaths  |   |   | -0.009<br>[0.011]                                   | -0.009<br>[0.011]                                   |   | -0.005<br>[0.010]                                   |   | -0.003<br>[0.009]                                   |   | -0.005<br>[0.010]                                    |  | -0.004<br>[0.009]                                    |  | 0.003<br>[0.010]                                     |
| Average Rainfall   | -0.0352<br>[0.0961]                                 | 0.0504<br>[0.0951]                                  | 0.0512<br>[0.0491]                                  | 0.0512<br>[0.0491]                                  | 0.0789*<br>[0.0437]                                 | 0.0806*<br>[0.0422]                                 | 0.0928***<br>[0.0317]                               | 0.0939***<br>[0.0309]                               | 0.0993***<br>[0.0342]                               | 0.101***<br>[0.0338]                                 | 0.105***<br>[0.0319]                                 | 0.106***<br>[0.0317]                                 | 0.0699**<br>[0.0327]                                 | 0.0688**<br>[0.0333]                                 |
| Average Temperature  | -0.192**<br>[0.098]                                 | -0.081<br>[0.100]                                   | -0.094<br>[0.060]                                   | -0.094<br>[0.060]                                   | -0.054<br>[0.051]                                   | -0.046<br>[0.052]                                   | -0.004<br>[0.039]                                   | 0.001<br>[0.041]                                    | 0.026<br>[0.041]                                    | 0.034<br>[0.042]                                     | 0.048<br>[0.032]                                     | 0.054*<br>[0.032]                                    | 0.049<br>[0.035]                                     | 0.044<br>[0.037]                                     |
| Land Suitability   | -0.785<br>[0.909]                                   | 0.172<br>[0.945]                                    | -0.541<br>[0.501]                                   | -0.541<br>[0.501]                                   | -0.548<br>[0.386]                                   | -0.452<br>[0.385]                                   | -0.215<br>[0.289]                                   | -0.153<br>[0.287]                                   | 0.114<br>[0.308]                                    | 0.204<br>[0.303]                                     | 0.475<br>[0.289]                                     | 0.546*<br>[0.284]                                    | 0.685**<br>[0.318]                                   | 0.624*<br>[0.320]                                    |
| Latitude   | 0.073*<br>[0.044]                                   | 0.023<br>[0.046]                                    | 0.048<br>[0.030]                                    | 0.048<br>[0.030]                                    | 0.041*<br>[0.025]                                   | 0.038<br>[0.026]                                    | 0.023<br>[0.021]                                    | 0.021<br>[0.022]                                    | 0.024<br>[0.022]                                    | 0.021<br>[0.024]                                     | 0.009<br>[0.019]                                     | 0.007<br>[0.020]                                     | -6.57e-05<br>[0.019]                                 | 0.002<br>[0.019]                                     |
| Maritime Department  | -0.001<br>[0.0374]                                  | 0.021<br>[0.0396]                                   | -0.029<br>[0.0195]                                  | -0.029<br>[0.0195]                                  | -0.027*<br>[0.0152]                                 | -0.026*<br>[0.0159]                                 | -0.024**<br>[0.0115]                                | -0.023*<br>[0.0120]                                 | -0.029**<br>[0.0121]                                | -0.029**<br>[0.0126]                                 | -0.031***<br>[0.0112]                                | -0.030***<br>[0.0115]                                | -0.005<br>[0.0125]                                   | -0.005<br>[0.0127]                                   |
| Border Department  | 0.095**<br>[0.040]                                  | 0.090**<br>[0.036]                                  | 0.074***<br>[0.023]                                 | 0.074***<br>[0.023]                                 | 0.055***<br>[0.020]                                 | 0.056***<br>[0.020]                                 | 0.024*<br>[0.014]                                   | 0.025*<br>[0.015]                                   | 0.010<br>[0.014]                                    | 0.011<br>[0.014]                                     | -0.005<br>[0.012]                                    | -0.005<br>[0.012]                                    | -0.005<br>[0.010]                                    | -0.006<br>[0.010]                                    |
| Distance to Paris  | 6.19e-05<br>[0.0002]                                | 0.0001<br>[0.0002]                                  | -0.0001<br>[0.0001]                                 | -0.0001<br>[0.0001]                                 | -0.0002**<br>[9.78e-05]                             | -0.00022*<br>[9.83e-05]                             | -0.0002**<br>[7.78e-05]                             | -0.0002**<br>[7.74e-05]                             | -0.0002**<br>[8.03e-05]                             | -0.0002**<br>[8.06e-05]                              | -0.0001<br>[7.05e-05]                                | -0.0001<br>[7.11e-05]                                | 4.17e-05<br>[7.20e-05]                               | 3.37e-05<br>[7.20e-05]                               |
| Paris and Suburbs  | 0.082<br>[0.059]                                    | 0.155***<br>[0.036]                                 | 0.010<br>[0.047]                                    | 0.010<br>[0.047]                                    | -0.0394<br>[0.051]                                  | -0.034<br>[0.048]                                   | -0.069**<br>[0.033]                                 | -0.066**<br>[0.031]                                 | -0.071**<br>[0.028]                                 | -0.066**<br>[0.027]                                  | -0.092***<br>[0.021]                                 | -0.088***<br>[0.020]                                 | -0.028<br>[0.023]                                    | -0.031<br>[0.025]                                    |
| Alsace-Lorraine  | -0.048<br>[0.058]                                   | -0.304**<br>[0.125]                                 | -0.036<br>[0.033]                                   | -0.036<br>[0.033]                                   | -0.015<br>[0.024]                                   | -0.018<br>[0.024]                                   | 0.014<br>[0.018]                                    | 0.012<br>[0.019]                                    | 0.022<br>[0.020]                                    | 0.020<br>[0.022]                                     | 0.018<br>[0.019]                                     | 0.016<br>[0.020]                                     | 0.024<br>[0.020]                                     | 0.026<br>[0.020]                                     |
| Urban Population in 1700   | 0.0013<br>[0.010]                                   | 0.009<br>[0.009]                                    | 0.002<br>[0.006]                                    | 0.002<br>[0.006]                                    | -0.001<br>[0.005]                                   | -0.0008<br>[0.005]                                  | -0.004<br>[0.004]                                   | -0.003<br>[0.003]                                   | -0.003<br>[0.004]                                   | -0.002<br>[0.004]                                    | -0.003<br>[0.003]                                    | -0.003<br>[0.003]                                    | 0.003<br>[0.003]                                     | 0.003<br>[0.003]                                     |
| Observations   | 89  | 89  | 89  | 89  | 89  | 89  | 89  | 89  | 89  | 89   | 89   | 89   | 89   | 89   |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |   |   |   |   |   |   |   |   |  |  |  |  |  |
| Distance to Fresnes  | -0.013***<br>[0.003]                                | -0.014***<br>[0.003]                                | -0.014***<br>[0.003]                                | -0.014***<br>[0.003]                                | -0.013***<br>[0.003]                                | -0.014***<br>[0.003]                                | -0.013***<br>[0.003]                                | -0.014***<br>[0.003]                                | -0.013***<br>[0.003]                                | -0.014***<br>[0.003]                                 | -0.013***<br>[0.003]                                 | -0.014***<br>[0.003]                                 | -0.013***<br>[0.003]                                 | -0.014***<br>[0.003]                                 |
| F-stat (1 <sup>st</sup> stage)   | 23.261  | 21.660  | 23.457  | 23.457  | 23.261  | 23.457  | 23.261  | 23.457  | 23.261  | 23.457   | 23.261   | 23.457   | 23.261   | 23.457   |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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. The evolution of sectoral employment, 1872-2010

Table C.1: Share of workforce in industry, 1872, 1901 & 1930

|  | (1)                                  | (2)                    | (3)                     | (4)                                  | (5)                    | (6)                     | (7)                                  | (8)                    | (9)                     |
|--|--------------------------------------|------------------------|-------------------------|--------------------------------------|------------------------|-------------------------|--------------------------------------|------------------------|-------------------------|
|  | OLS                                  | OLS                    | IV                      | OLS                                  | OLS                    | IV                      | OLS                                  | OLS                    | IV                      |
|  | Share of Workforce in Industry, 1872 |                        |                         | Share of Workforce in Industry, 1901 |                        |                         | Share of Workforce in Industry, 1930 |                        |                         |
| Horse Power of Steam Engines   | 0.0326***<br>[0.00472]               | 0.0273***<br>[0.00648] | 0.0634***<br>[0.0131]   | 0.0354***<br>[0.00489]               | 0.0366***<br>[0.00776] | 0.0845***<br>[0.0137]   | 0.0429***<br>[0.00614]               | 0.0420***<br>[0.00877] | 0.100***<br>[0.0174]    |
| Average Rainfall   |                                      | 0.0284<br>[0.0548]     | -0.0341<br>[0.0725]     |                                      | 0.0107<br>[0.0546]     | -0.0721<br>[0.0827]     |                                      | 0.0574<br>[0.0600]     | -0.0352<br>[0.0961]     |
| Average Temperature  |                                      | 0.0998<br>[0.0646]     | 0.0332<br>[0.0751]      |                                      | -0.0435<br>[0.0629]    | -0.132*<br>[0.0797]     |                                      | -0.107<br>[0.0750]     | -0.192**<br>[0.0976]    |
| Latitude   |                                      | 0.476<br>[0.494]       | -0.617<br>[0.607]       |                                      | 0.468<br>[0.566]       | -0.980<br>[0.774]       |                                      | 0.596<br>[0.654]       | -0.785<br>[0.909]       |
| Land Suitability   |                                      | 0.00619<br>[0.0327]    | 0.0134<br>[0.0359]      |                                      | 0.0509*<br>[0.0303]    | 0.0604*<br>[0.0364]     |                                      | 0.0681*<br>[0.0343]    | 0.0734*<br>[0.0437]     |
| Maritime Department  |                                      | -0.0113<br>[0.0233]    | 0.00303<br>[0.0260]     |                                      | -0.0273<br>[0.0233]    | -0.00838<br>[0.0304]    |                                      | -0.0104<br>[0.0287]    | -0.00129<br>[0.0374]    |
| Border Department  |                                      | 0.0611***<br>[0.0222]  | 0.0626**<br>[0.0266]    |                                      | 0.0449*<br>[0.0231]    | 0.0469<br>[0.0312]      |                                      | 0.0851***<br>[0.0258]  | 0.0947**<br>[0.0397]    |
| Distance to Paris  |                                      | -7.18e-05<br>[0.0001]  | -0.0002<br>[0.0001]     |                                      | 0.0001<br>[0.0001]     | -2.32e-05<br>[0.0002]   |                                      | 0.0001<br>[0.0002]     | 6.19e-05<br>[0.0002]    |
| Paris and Suburbs  |                                      | -0.0220<br>[0.0443]    | -0.0491<br>[0.0370]     |                                      | 0.0348<br>[0.0254]     | -0.00119<br>[0.0312]    |                                      | 0.119***<br>[0.0414]   | 0.0820<br>[0.0588]      |
| Alsace-Lorraine  |                                      |                        |                         |                                      |                        |                         |                                      | 0.00460<br>[0.0522]    | -0.0481<br>[0.0583]     |
| Urban Population in 1700   |                                      | 0.00987*<br>[0.00531]  | -0.00144<br>[0.00756]   |                                      | 0.00992<br>[0.00674]   | -0.00507<br>[0.00863]   |                                      | 0.0178***<br>[0.00655] | 0.00132<br>[0.00989]    |
| Adjusted R2  | 0.465                                | 0.582                  |                         | 0.493                                | 0.575                  |                         | 0.459                                | 0.669                  |                         |
| Observations   | 87                                   | 87                     | 87                      | 87                                   | 87                     | 87                      | 89                                   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |                        |                         |                                      |                        |                         |                                      |                        |                         |
| Distance to Fresnes  |                                      |                        | -0.0131***<br>[0.00276] |                                      |                        | -0.0131***<br>[0.00276] |                                      |                        | -0.0132***<br>[0.00274] |
| F-stat (1 <sup>st</sup> stage)   |                                      |                        | 22.612                  |                                      |                        | 22.612                  |                                      |                        | 23.261                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.2:** Share of workforce in industry, 1968-2010

|  | (1)<br>OLS                           | (2)<br>OLS                | (3)<br>IV                 | (4)<br>OLS                           | (5)<br>OLS               | (6)<br>IV                 | (7)<br>OLS                           | (8)<br>OLS                | (9)<br>IV                 |
|--|--------------------------------------|---------------------------|---------------------------|--------------------------------------|--------------------------|---------------------------|--------------------------------------|---------------------------|---------------------------|
|  | Share of Workforce in Industry, 1968 |                           |                           | Share of Workforce in Industry, 1975 |                          |                           | Share of Workforce in Industry, 1982 |                           |                           |
| Horse Power of Steam Engines   | 0.0256***<br>[0.00409]               | 0.0282***<br>[0.00593]    | 0.0502***<br>[0.0106]     | 0.0244***<br>[0.00394]               | 0.0258***<br>[0.00513]   | 0.0380***<br>[0.00836]    | 0.0194***<br>[0.00321]               | 0.0192***<br>[0.00396]    | 0.0218***<br>[0.00600]    |
| Average Rainfall   |                                      | 0.0831**<br>[0.0391]      | 0.0481<br>[0.0511]        |                                      | 0.0983**<br>[0.0406]     | 0.0789*<br>[0.0437]       |                                      | 0.0969***<br>[0.0333]     | 0.0928***<br>[0.0317]     |
| Average Temperature  |                                      | -0.0767<br>[0.0529]       | -0.109*<br>[0.0574]       |                                      | -0.0362<br>[0.0509]      | -0.0541<br>[0.0507]       |                                      | -0.000221<br>[0.0414]     | -0.00405<br>[0.0386]      |
| Latitude   |                                      | -0.195<br>[0.387]         | -0.717<br>[0.498]         |                                      | -0.259<br>[0.349]        | -0.548<br>[0.386]         |                                      | -0.153<br>[0.292]         | -0.215<br>[0.289]         |
| Land Suitability   |                                      | 0.0521*<br>[0.0292]       | 0.0542*<br>[0.0280]       |                                      | 0.0403<br>[0.0267]       | 0.0414*<br>[0.0245]       |                                      | 0.0227<br>[0.0226]        | 0.0229<br>[0.0205]        |
| Maritime Department  |                                      | -0.0345**<br>[0.0172]     | -0.0310*<br>[0.0187]      |                                      | -0.0292*<br>[0.0156]     | -0.0273*<br>[0.0152]      |                                      | -0.0239*<br>[0.0115]      | -0.0235**<br>[0.0115]     |
| Border Department  |                                      | 0.0679***<br>[0.0193]     | 0.0716***<br>[0.0226]     |                                      | 0.0528***<br>[0.0196]    | 0.0548***<br>[0.0199]     |                                      | 0.0239<br>[0.0153]        | 0.0244*<br>[0.0143]       |
| Distance to Paris  |                                      | -0.000103<br>[0.000109]   | -0.000127<br>[0.000118]   |                                      | -0.000189*<br>[0.000101] | -0.000203**<br>[9.78e-05] |                                      | -0.000192**<br>[8.39e-05] | -0.000195**<br>[7.78e-05] |
| Paris and Suburbs  |                                      | 0.0139<br>[0.0483]        | -5.41e-05<br>[0.0520]     |                                      | -0.0317<br>[0.0512]      | -0.0394<br>[0.0513]       |                                      | -0.0692**<br>[0.0345]     | -0.0692**<br>[0.0331]     |
| Alsace-Lorraine  |                                      | -0.0118<br>[0.0297]       | -0.0318<br>[0.0327]       |                                      | -0.00418<br>[0.0242]     | -0.0152<br>[0.0237]       |                                      | 0.0161<br>[0.0182]        | 0.0137<br>[0.0179]        |
| Urban Population in 1700   |                                      | 0.00647<br>[0.00484]      | 0.000248<br>[0.00595]     |                                      | 0.00196<br>[0.00465]     | -0.00148<br>[0.00530]     |                                      | -0.00306<br>[0.00355]     | -0.00379<br>[0.00367]     |
| Adjusted R2  | 0.341                                | 0.581                     |                           | 0.349                                | 0.573                    |                           | 0.326                                | 0.579                     |                           |
| Observations   | 89                                   | 89                        | 89                        | 89                                   | 89                       | 89                        | 89                                   | 89                        | 89                        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |                           |                           |                                      |                          |                           |                                      |                           |                           |
| Distance to Fresnes  |                                      |                           | -0.0132***<br>[0.00274]   |                                      |                          | -0.0132***<br>[0.00274]   |                                      |                           | -0.0132***<br>[0.00274]   |
| F-stat (1 <sup>st</sup> stage)   |                                      |                           | 23.261                    |                                      |                          | 23.261                    |                                      |                           | 23.261                    |
|  | (10)<br>OLS                          | (11)<br>OLS               | (12)<br>IV                | (13)<br>OLS                          | (14)<br>OLS              | (15)<br>IV                | (16)<br>OLS                          | (17)<br>OLS               | (18)<br>IV                |
|  | Share of Workforce in Industry, 1990 |                           |                           | Share of Workforce in Industry, 1999 |                          |                           | Share of Workforce in Industry, 2010 |                           |                           |
| Horse Power of Steam Engines   | 0.0163***<br>[0.00303]               | 0.0142***<br>[0.00359]    | 0.00655<br>[0.00579]      | 0.0112***<br>[0.00268]               | 0.00831***<br>[0.00266]  | -0.00254<br>[0.00526]     | 0.00570***<br>[0.00185]              | 0.00428<br>[0.00279]      | -0.0118*<br>[0.00612]     |
| Average Rainfall   |                                      | 0.0872**<br>[0.0363]      | 0.0993***<br>[0.0342]     |                                      | 0.0878***<br>[0.0321]    | 0.105***<br>[0.0319]      |                                      | 0.0442<br>[0.0267]        | 0.0699**<br>[0.0327]      |
| Average Temperature  |                                      | 0.0149<br>[0.0421]        | 0.0261<br>[0.0406]        |                                      | 0.0320<br>[0.0309]       | 0.0479<br>[0.0321]        |                                      | 0.0254<br>[0.0321]        | 0.0491<br>[0.0346]        |
| Latitude   |                                      | -0.0671<br>[0.298]        | 0.114<br>[0.308]          |                                      | 0.217<br>[0.260]         | 0.475<br>[0.289]          |                                      | 0.302<br>[0.226]          | 0.685**<br>[0.318]        |
| Land Suitability   |                                      | 0.0247<br>[0.0227]        | 0.0240<br>[0.0219]        |                                      | 0.0103<br>[0.0181]       | 0.00934<br>[0.0186]       |                                      | 0.00141<br>[0.0149]       | -6.57e-05<br>[0.0187]     |
| Maritime Department  |                                      | -0.0282**<br>[0.0123]     | -0.0294**<br>[0.0121]     |                                      | -0.0295***<br>[0.0109]   | -0.0312***<br>[0.0112]    |                                      | -0.00200<br>[0.0106]      | -0.00452<br>[0.0125]      |
| Border Department  |                                      | 0.0114<br>[0.0159]        | 0.0101<br>[0.0143]        |                                      | -0.00366<br>[0.0125]     | -0.00546<br>[0.0117]      |                                      | -0.00248<br>[0.00945]     | -0.00515<br>[0.0103]      |
| Distance to Paris  |                                      | -0.000184**<br>[8.36e-05] | -0.000176**<br>[8.03e-05] |                                      | -0.000122*<br>[7.02e-05] | -0.000110<br>[7.05e-05]   |                                      | 2.38e-05<br>[6.19e-05]    | 4.17e-05<br>[7.20e-05]    |
| Paris and Suburbs  |                                      | -0.0759**<br>[0.0325]     | -0.0711**<br>[0.0284]     |                                      | -0.0986***<br>[0.0253]   | -0.0918***<br>[0.0212]    |                                      | -0.0383<br>[0.0287]       | -0.0281<br>[0.0231]       |
| Alsace-Lorraine  |                                      | 0.0149<br>[0.0200]        | 0.0218<br>[0.0203]        |                                      | 0.00821<br>[0.0173]      | 0.0180<br>[0.0188]        |                                      | 0.00981<br>[0.0205]       | 0.0244<br>[0.0204]        |
| Urban Population in 1700   |                                      | -0.00503<br>[0.00352]     | -0.00287<br>[0.00356]     |                                      | -0.00613**<br>[0.00290]  | -0.00306<br>[0.00301]     |                                      | -0.00125<br>[0.00282]     | 0.00330<br>[0.00325]      |
| Adjusted R2  | 0.251                                | 0.530                     |                           | 0.158                                | 0.571                    |                           | 0.102                                | 0.133                     |                           |
| Observations   | 89                                   | 89                        | 89                        | 89                                   | 89                       | 89                        | 89                                   | 89                        | 89                        |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |                           |                           |                                      |                          |                           |                                      |                           |                           |
| Distance to Fresnes  |                                      |                           | -0.0132***<br>[0.00274]   |                                      |                          | -0.0132***<br>[0.00274]   |                                      |                           | -0.0132***<br>[0.00274]   |
| F-stat (1 <sup>st</sup> stage)   |                                      |                           | 23.261                    |                                      |                          | 23.261                    |                                      |                           | 23.261                    |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.3:** Share of workforce in services, 1872, 1901 & 1930

|  | (1)                                  | (2)         | (3)          | (4)                                  | (5)        | (6)        | (7)                                  | (8)        | (9)        |
|--|--------------------------------------|-------------|--------------|--------------------------------------|------------|------------|--------------------------------------|------------|------------|
|  | OLS                                  | OLS         | IV           | OLS                                  | OLS        | IV         | OLS                                  | OLS        | IV         |
|  | Share of Workforce in Services, 1872 |             |              | Share of Workforce in Services, 1901 |            |            | Share of Workforce in Services, 1930 |            |            |
| Horse Power of Steam Engines   | 0.000157                             | 0.000156    | 0.000753     | 0.0119**                             | 0.0113**   | 0.0153     | 0.0102***                            | 0.00524*   | 0.0108     |
|  | [0.000312]                           | [0.000326]  | [0.000699]   | [0.00544]                            | [0.00516]  | [0.0130]   | [0.00365]                            | [0.00292]  | [0.00993]  |
| Average Rainfall   |                                      | -0.00649    | -0.00752*    |                                      | -0.129**   | -0.136**   |                                      | -0.0722*   | -0.0810**  |
|  |                                      | [0.00413]   | [0.00429]    |                                      | [0.0548]   | [0.0538]   |                                      | [0.0371]   | [0.0372]   |
| Average Temperature  |                                      | -0.00678    | -0.00788*    |                                      | -0.139*    | -0.147**   |                                      | -0.111*    | -0.119**   |
|  |                                      | [0.00464]   | [0.00450]    |                                      | [0.0723]   | [0.0680]   |                                      | [0.0604]   | [0.0570]   |
| Latitude   |                                      | -0.111***   | -0.129***    |                                      | -0.0152    | -0.137     |                                      | -0.261     | -0.392     |
|  |                                      | [0.0360]    | [0.0414]     |                                      | [0.413]    | [0.456]    |                                      | [0.301]    | [0.306]    |
| Land Suitability   |                                      | 0.00359     | 0.00371*     |                                      | 0.0607**   | 0.0615**   |                                      | 0.0613**   | 0.0618***  |
|  |                                      | [0.00233]   | [0.00224]    |                                      | [0.0267]   | [0.0250]   |                                      | [0.0247]   | [0.0233]   |
| Maritime Department  |                                      | 0.00338*    | 0.00362**    |                                      | 0.0339     | 0.0355*    |                                      | 0.0314*    | 0.0322*    |
|  |                                      | [0.00178]   | [0.00173]    |                                      | [0.0204]   | [0.0195]   |                                      | [0.0187]   | [0.0171]   |
| Border Department  |                                      | 0.00157     | 0.00160      |                                      | 0.0396*    | 0.0397**   |                                      | 0.0359**   | 0.0368***  |
|  |                                      | [0.00156]   | [0.00149]    |                                      | [0.0206]   | [0.0196]   |                                      | [0.0136]   | [0.0134]   |
| Distance to Paris  |                                      | -2.53e-05** | -2.69e-05*** |                                      | 9.87e-05   | 8.82e-05   |                                      | 1.77e-05   | 1.16e-05   |
|  |                                      | [1.02e-05]  | [9.81e-06]   |                                      | [0.000113] | [0.000101] |                                      | [8.15e-05] | [7.28e-05] |
| Paris and Suburbs  |                                      | 0.0076**    | 0.0071**     |                                      | 0.147***   | 0.144***   |                                      | 0.150***   | 0.146***   |
|  |                                      | [0.0032]    | [0.0023]     |                                      | [0.0460]   | [0.0430]   |                                      | [0.0355]   | [0.0328]   |
| Alsace-Lorraine  |                                      |             |              |                                      |            |            |                                      | 0.0379*    | 0.0328     |
|  |                                      |             |              |                                      |            |            |                                      | [0.0216]   | [0.0247]   |
| Urban Population in 1700   |                                      | -0.0007*    | -0.0009**    |                                      | 0.0105*    | 0.0093*    |                                      | 0.0106***  | 0.0090***  |
|  |                                      | [0.0004]    | [0.0004]     |                                      | [0.0055]   | [0.0053]   |                                      | [0.0037]   | [0.0035]   |
| Adjusted R2  | -0.008                               | 0.214       |              | 0.077                                | 0.409      |            | 0.091                                | 0.516      |            |
| Observations   | 87                                   | 87          | 87           | 87                                   | 87         | 87         | 89                                   | 89         | 89         |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |             |              |                                      |            |            |                                      |            |            |
| Distance to Fresnes  |                                      |             | -0.0131***   |                                      |            | -0.0131*** |                                      |            | -0.0132*** |
|  |                                      |             | [0.00276]    |                                      |            | [0.00276]  |                                      |            | [0.00274]  |
| F-stat (1 <sup>st</sup> stage)   |                                      |             | 22.612       |                                      |            | 22.612     |                                      |            | 23.261     |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.4: Share of workforce in services, 1968-2010

|  | (1)<br>OLS                           | (2)<br>OLS              | (3)<br>IV               | (4)<br>OLS                           | (5)<br>OLS             | (6)<br>IV               | (7)<br>OLS                           | (8)<br>OLS             | (9)<br>IV               |
|--|--------------------------------------|-------------------------|-------------------------|--------------------------------------|------------------------|-------------------------|--------------------------------------|------------------------|-------------------------|
|  | Share of Workforce in Services, 1968 |                         |                         | Share of Workforce in Services, 1975 |                        |                         | Share of Workforce in Services, 1982 |                        |                         |
| Horse Power of Steam Engines   | 0.00335<br>[0.00397]                 | 0.00448<br>[0.00331]    | 0.00944<br>[0.00926]    | -0.00159<br>[0.00443]                | 0.00103<br>[0.00291]   | 0.00628<br>[0.00914]    | -0.00306<br>[0.00417]                | -0.00132<br>[0.00272]  | 0.00103<br>[0.00828]    |
| Average Rainfall   |                                      | -0.108***<br>[0.0388]   | -0.116***<br>[0.0390]   |                                      | -0.120***<br>[0.0409]  | -0.128***<br>[0.0419]   |                                      | -0.115***<br>[0.0351]  | -0.119***<br>[0.0354]   |
| Average Temperature  |                                      | -0.139***<br>[0.0461]   | -0.146***<br>[0.0460]   |                                      | -0.161***<br>[0.0466]  | -0.169***<br>[0.0473]   |                                      | -0.132***<br>[0.0390]  | -0.136***<br>[0.0399]   |
| Latitude   |                                      | -0.836**<br>[0.387]     | -0.954**<br>[0.435]     |                                      | -0.854**<br>[0.421]    | -0.978**<br>[0.485]     |                                      | -0.512<br>[0.396]      | -0.568<br>[0.451]       |
| Land Suitability   |                                      | 0.0396*<br>[0.0236]     | 0.0400*<br>[0.0222]     |                                      | 0.0373<br>[0.0241]     | 0.0378*<br>[0.0228]     |                                      | 0.0196<br>[0.0216]     | 0.0198<br>[0.0201]      |
| Maritime Department  |                                      | 0.0552***<br>[0.0175]   | 0.0559***<br>[0.0161]   |                                      | 0.0550***<br>[0.0172]  | 0.0558***<br>[0.0161]   |                                      | 0.0487***<br>[0.0160]  | 0.0491***<br>[0.0150]   |
| Border Department  |                                      | 0.0399***<br>[0.0144]   | 0.0408***<br>[0.0140]   |                                      | 0.0367**<br>[0.0158]   | 0.0376**<br>[0.0152]    |                                      | 0.0424***<br>[0.0139]  | 0.0428***<br>[0.0133]   |
| Distance to Paris  |                                      | -2.31e-05<br>[9.87e-05] | -2.87e-05<br>[9.23e-05] |                                      | 1.51e-05<br>[0.000105] | 9.20e-06<br>[0.000101]  |                                      | 8.49e-05<br>[9.69e-05] | 8.23e-05<br>[9.22e-05]  |
| Paris and Suburbs  |                                      | 0.128***<br>[0.0222]    | 0.125***<br>[0.0213]    |                                      | 0.137***<br>[0.0266]   | 0.133***<br>[0.0251]    |                                      | 0.149***<br>[0.0190]   | 0.148***<br>[0.0187]    |
| Alsace-Lorraine  |                                      | 0.0415<br>[0.0279]      | 0.0370<br>[0.0280]      |                                      | 0.0381<br>[0.0271]     | 0.0333<br>[0.0272]      |                                      | 0.0134<br>[0.0251]     | 0.0113<br>[0.0240]      |
| Urban Population in 1700   |                                      | 0.0129***<br>[0.00389]  | 0.0115***<br>[0.00404]  |                                      | 0.0135***<br>[0.00408] | 0.0120***<br>[0.00431]  |                                      | 0.0145***<br>[0.00361] | 0.0138***<br>[0.00366]  |
| Adjusted R2  | -0.002                               | 0.530                   |                         | -0.009                               | 0.552                  |                         | -0.003                               | 0.613                  |                         |
| Observations   | 89                                   | 89                      | 89                      | 89                                   | 89                     | 89                      | 89                                   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |                         |                         |                                      |                        |                         |                                      |                        |                         |
| Distance to Fresnes  |                                      |                         | -0.0132***<br>[0.00274] |                                      |                        | -0.0132***<br>[0.00274] |                                      |                        | -0.0132***<br>[0.00274] |
| F-stat (1 <sup>st</sup> stage)   |                                      |                         | 23.261                  |                                      |                        | 23.261                  |                                      |                        | 23.261                  |
|  | (10)<br>OLS                          | (11)<br>OLS             | (12)<br>IV              | (13)<br>OLS                          | (14)<br>OLS            | (15)<br>IV              | (16)<br>OLS                          | (17)<br>OLS            | (18)<br>IV              |
|  | Share of Workforce in Services, 1990 |                         |                         | Share of Workforce in Services, 1999 |                        |                         | Share of Workforce in Services, 2010 |                        |                         |
| Horse Power of Steam Engines   | -0.00511<br>[0.00387]                | -0.00189<br>[0.00259]   | 0.00533<br>[0.00702]    | -0.00382<br>[0.00357]                | -0.000654<br>[0.00233] | 0.00740<br>[0.00620]    | 0.00643<br>[0.00518]                 | 0.0100**<br>[0.00435]  | -0.00435<br>[0.0111]    |
| Average Rainfall   |                                      | -0.106***<br>[0.0345]   | -0.117***<br>[0.0351]   |                                      | -0.101***<br>[0.0313]  | -0.114***<br>[0.0317]   |                                      | -0.156***<br>[0.0511]  | -0.133***<br>[0.0485]   |
| Average Temperature  |                                      | -0.122***<br>[0.0332]   | -0.133***<br>[0.0364]   |                                      | -0.0998***<br>[0.0295] | -0.112***<br>[0.0325]   |                                      | -0.206***<br>[0.0606]  | -0.185***<br>[0.0577]   |
| Latitude   |                                      | -0.409<br>[0.370]       | -0.580<br>[0.428]       |                                      | -0.434<br>[0.322]      | -0.625*<br>[0.366]      |                                      | -0.322<br>[0.460]      | -0.0191<br>[0.512]      |
| Land Suitability   |                                      | 0.00747<br>[0.0191]     | 0.00813<br>[0.0186]     |                                      | 0.00947<br>[0.0168]    | 0.0102<br>[0.0166]      |                                      | 0.0371<br>[0.0314]     | 0.0358<br>[0.0288]      |
| Maritime Department  |                                      | 0.0500***<br>[0.0150]   | 0.0512***<br>[0.0143]   |                                      | 0.0442***<br>[0.0134]  | 0.0454***<br>[0.0128]   |                                      | 0.0562***<br>[0.0199]  | 0.0540***<br>[0.0195]   |
| Border Department  |                                      | 0.0373***<br>[0.0130]   | 0.0385***<br>[0.0127]   |                                      | 0.0357***<br>[0.0111]  | 0.0370***<br>[0.0112]   |                                      | 0.0122<br>[0.0170]     | 0.00983<br>[0.0165]     |
| Distance to Paris  |                                      | 0.000110<br>[8.97e-05]  | 0.000102<br>[8.69e-05]  |                                      | 9.04e-05<br>[7.84e-05] | 8.14e-05<br>[7.56e-05]  |                                      | 0.000165<br>[0.000119] | 0.000181<br>[0.000111]  |
| Paris and Suburbs  |                                      | 0.138***<br>[0.0203]    | 0.134***<br>[0.0184]    |                                      | 0.144***<br>[0.0184]   | 0.139***<br>[0.0163]    |                                      | 0.260***<br>[0.0387]   | 0.269***<br>[0.0400]    |
| Alsace-Lorraine  |                                      | 0.00845<br>[0.0224]     | 0.00191<br>[0.0224]     |                                      | 0.00654<br>[0.0195]    | -0.000764<br>[0.0198]   |                                      | 0.0871***<br>[0.0318]  | 0.100***<br>[0.0372]    |
| Urban Population in 1700   |                                      | 0.0130***<br>[0.00350]  | 0.0109***<br>[0.00359]  |                                      | 0.0117***<br>[0.00311] | 0.00941***<br>[0.00311] |                                      | 0.00895*<br>[0.00460]  | 0.0130***<br>[0.00474]  |
| Adjusted R2  | 0.013                                | 0.624                   |                         | 0.005                                | 0.655                  |                         | 0.011                                | 0.537                  |                         |
| Observations   | 89                                   | 89                      | 89                      | 89                                   | 89                     | 89                      | 89                                   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |                                      |                         |                         |                                      |                        |                         |                                      |                        |                         |
| Distance to Fresnes  |                                      |                         | -0.0132***<br>[0.00274] |                                      |                        | -0.0132***<br>[0.00274] |                                      |                        | -0.0132***<br>[0.00274] |
| F-stat (1 <sup>st</sup> stage)   |                                      |                         | 23.261                  |                                      |                        | 23.261                  |                                      |                        | 23.261                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.5: Industrialization and Share of Executives in Workforce (age 25-54), 1968-2010**

|  | (1)   | (2)                      | (3)                     | (4)                    | (5)                     | (6)                    | (7)                    | (8)                    | (9)                    |
|--|---|--------------------------|-------------------------|------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|
|  | OLS   | OLS                      | IV                      | OLS                    | OLS                     | IV                     | OLS                    | OLS                    | IV                     |
|  | Share of executives and intellectual professions in workforce (age 25-54) |                          |                         |                        |                         |                        |                        |                        |                        |
|  | 1968  |                          |                         | 1975                   |                         |                        | 1982                   |                        |                        |
| Horse Power of Steam Engines   | 0.00236***<br>[0.000788]  | 0.00196***<br>[0.000653] | 0.00257<br>[0.00160]    | 0.00211**<br>[0.00101] | 0.00133<br>[0.000887]   | -0.00105<br>[0.00253]  | 0.00219*<br>[0.00111]  | 0.000817<br>[0.000869] | -0.00306<br>[0.00262]  |
| Average Rainfall   |   | 0.00849<br>[0.00668]     | 0.00751<br>[0.00677]    |                        | -0.00316<br>[0.00908]   | 0.000634<br>[0.00938]  |                        | -0.00358<br>[0.0108]   | 0.00259<br>[0.0112]    |
| Average Temperature  |   | -0.00978<br>[0.00710]    | -0.0107<br>[0.00713]    |                        | -0.0257**<br>[0.0124]   | -0.0222*<br>[0.0127]   |                        | -0.0221*<br>[0.0123]   | -0.0164<br>[0.0134]    |
| Latitude   |   | -0.0129<br>[0.0658]      | -0.0275<br>[0.0736]     |                        | -0.0249<br>[0.116]      | 0.0317<br>[0.127]      |                        | -0.0260<br>[0.121]     | 0.0660<br>[0.130]      |
| Land Suitability   |   | 0.00266<br>[0.00384]     | 0.00272<br>[0.00357]    |                        | 0.00936<br>[0.00673]    | 0.00914<br>[0.00634]   |                        | 0.00835<br>[0.00656]   | 0.00799<br>[0.00635]   |
| Maritime Department  |   | -0.00290<br>[0.00299]    | -0.00281<br>[0.00281]   |                        | 0.00122<br>[0.00454]    | 0.000850<br>[0.00452]  |                        | 0.000893<br>[0.00476]  | 0.00288<br>[0.00493]   |
| Border Department  |   | 0.00891***<br>[0.00244]  | 0.00901***<br>[0.00237] |                        | 0.0106**<br>[0.00440]   | 0.0102**<br>[0.00396]  |                        | 0.00755<br>[0.00500]   | 0.00691<br>[0.00467]   |
| Distance to Paris  |   | 1.35e-05<br>[1.76e-05]   | 1.28e-05<br>[1.67e-05]  |                        | 3.28e-05<br>[2.98e-05]  | 3.55e-05<br>[2.77e-05] |                        | 2.94e-05<br>[3.19e-05] | 3.37e-05<br>[2.91e-05] |
| Paris and Suburbs  |   | 0.0352***<br>[0.0117]    | 0.0349***<br>[0.0107]   |                        | 0.0628***<br>[0.00691]  | 0.0643***<br>[0.00663] |                        | 0.0764***<br>[0.00759] | 0.0789***<br>[0.00744] |
| Alsace-Lorraine  |   | 0.000406<br>[0.00552]    | -0.000150<br>[0.00525]  |                        | 0.00442<br>[0.00971]    | 0.00658<br>[0.00891]   |                        | 0.00338<br>[0.00978]   | 0.00689<br>[0.00878]   |
| Urban Population in 1700   |   | 0.0042***<br>[0.0008]    | 0.0041***<br>[0.0009]   |                        | 0.0056***<br>[0.0010]   | 0.0062***<br>[0.0011]  |                        | 0.0060***<br>[0.0011]  | 0.0071***<br>[0.0013]  |
| Adjusted R2  | 0.116   | 0.603                    |                         | 0.035                  | 0.598                   |                        | 0.031                  | 0.630                  |                        |
| Observations   | 89  | 89                       | 89                      | 89                     | 89                      | 89                     | 89                     | 89                     | 89                     |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |                          |                         |                        |                         |                        |                        |                        |                        |
| Distance to Fresnes  |   |                          | -0.0132***<br>[.00274]  |                        |                         | -0.0132***<br>[.00274] |                        |                        | -0.0132***<br>[.00274] |
| F-stat (1 <sup>st</sup> stage)   |   |                          | 23.261                  |                        |                         | 23.261                 |                        |                        | 23.261                 |
|  | (1)   | (2)                      | (3)                     | (4)                    | (5)                     | (6)                    | (7)                    | (8)                    | (9)                    |
|  | OLS   | OLS                      | IV                      | OLS                    | OLS                     | IV                     | OLS                    | OLS                    | IV                     |
|  | Share of intermediary professions in workforce (age 25-54)                |                          |                         |                        |                         |                        |                        |                        |                        |
|  | 1990  |                          |                         | 1999                   |                         |                        | 2010                   |                        |                        |
| Horse Power of Steam Engines   | 0.00245*<br>[0.00147]   | 0.000888<br>[0.00110]    | -0.00478<br>[0.00323]   | 0.00329**<br>[0.00159] | 0.000837<br>[0.00115]   | -0.00682*<br>[0.00359] | 0.00453**<br>[0.00213] | 0.00176<br>[0.00165]   | -0.0115**<br>[0.00544] |
| Average Rainfall   |   | -0.00407<br>[0.0131]     | 0.00494<br>[0.0138]     |                        | 0.00991<br>[0.0133]     | 0.0221<br>[0.0158]     |                        | 0.0166<br>[0.0191]     | 0.0377<br>[0.0240]     |
| Average Temperature  |   | -0.0194<br>[0.0161]      | -0.0111<br>[0.0173]     |                        | -0.00825<br>[0.0174]    | 0.00301<br>[0.0195]    |                        | -0.0148<br>[0.0262]    | 0.00469<br>[0.0300]    |
| Latitude   |   | -0.0582<br>[0.148]       | 0.0763<br>[0.158]       |                        | 0.0273<br>[0.156]       | 0.209<br>[0.171]       |                        | 0.0463<br>[0.205]      | 0.361<br>[0.237]       |
| Land Suitability   |   | 0.00940<br>[0.00778]     | 0.00888<br>[0.00766]    |                        | 0.00472<br>[0.00803]    | 0.00402<br>[0.00842]   |                        | 0.00540<br>[0.0113]    | 0.00419<br>[0.0124]    |
| Maritime Department  |   | -0.00149<br>[0.00623]    | -0.00238<br>[0.00648]   |                        | -0.00305<br>[0.00694]   | -0.00425<br>[0.00743]  |                        | -0.00373<br>[0.01000]  | -0.00579<br>[0.0110]   |
| Border Department  |   | 0.00868<br>[0.00666]     | 0.00774<br>[0.00641]    |                        | 0.00977<br>[0.00738]    | 0.00850<br>[0.00733]   |                        | 0.0131<br>[0.0113]     | 0.0109<br>[0.0117]     |
| Distance to Paris  |   | 4.55e-05<br>[3.91e-05]   | 5.18e-05<br>[3.59e-05]  |                        | 4.91e-05<br>[4.10e-05]  | 5.76e-05<br>[3.92e-05] |                        | 7.39e-05<br>[5.49e-05] | 8.86e-05<br>[5.48e-05] |
| Paris and Suburbs  |   | 0.0997***<br>[0.0118]    | 0.103***<br>[0.0121]    |                        | 0.0978***<br>[0.0166]   | 0.103***<br>[0.0172]   |                        | 0.128***<br>[0.0222]   | 0.137***<br>[0.0239]   |
| Alsace-Lorraine  |   | 0.00311<br>[0.0133]      | 0.00824<br>[0.0127]     |                        | -0.000848<br>[0.0124]   | 0.00610<br>[0.0134]    |                        | -0.00813<br>[0.0166]   | 0.00386<br>[0.0206]    |
| Urban Population in 1700   |   | 0.00799***<br>[0.00145]  | 0.00960***<br>[0.00180] |                        | 0.00942***<br>[0.00164] | 0.0116***<br>[0.00212] |                        | 0.0131***<br>[0.00239] | 0.0168***<br>[0.00324] |
| Adjusted R2  | 0.020   | 0.639                    |                         | 0.041                  | 0.601                   |                        | 0.041                  | 0.572                  |                        |
| Observations   | 89  | 89                       | 89                      | 89                     | 89                      | 89                     | 89                     | 89                     | 89                     |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |                          |                         |                        |                         |                        |                        |                        |                        |
| Distance to Fresnes  |   |                          | -0.0132***<br>[.00274]  |                        |                         | -0.0132***<br>[.00274] |                        |                        | -0.0132***<br>[.00274] |
| F-stat (1 <sup>st</sup> stage)   |   |                          | 23.261                  |                        |                         | 23.261                 |                        |                        | 23.261                 |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.6:** Industrialization and Share of Intermediary Professionals in Workforce (age 25-54), 1968-2010

|  | (1)  | (2)                     | (3)                     | (4)                     | (5)                     | (6)                     | (7)                     | (8)                    | (9)                    |
|--|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------------------------|------------------------|
|  | OLS  | OLS                     | IV                      | OLS                     | OLS                     | IV                      | OLS                     | OLS                    | IV                     |
|  | Share of intermediary professions in workforce (age 25-54) |                         |                         |                         |                         |                         |                         |                        |                        |
|  | 1968   |                         |                         | 1975                    |                         |                         | 1982                    |                        |                        |
| Horse Power of Steam Engines   | 0.00637***<br>[0.00117]                                    | 0.00616***<br>[0.00152] | 0.0116***<br>[0.00306]  | 0.00455***<br>[0.00117] | 0.00471***<br>[0.00127] | 0.00358<br>[0.00302]    | 0.00239**<br>[0.000986] | 0.00169<br>[0.00121]   | 0.00109<br>[0.00296]   |
| Average Rainfall   |  | 0.0304**<br>[0.0115]    | 0.0217<br>[0.0133]      |                         | 0.000676<br>[0.0127]    | 0.00247<br>[0.0128]     |                         | 0.0124<br>[0.0150]     | 0.0134<br>[0.0147]     |
| Average Temperature  |  | -0.0275*<br>[0.0138]    | -0.0355**<br>[0.0153]   |                         | -0.0569***<br>[0.0130]  | -0.0553***<br>[0.0135]  |                         | -0.0516***<br>[0.0158] | -0.0507***<br>[0.0156] |
| Latitude   |  | -0.0376<br>[0.117]      | -0.168<br>[0.152]       |                         | -0.221*<br>[0.128]      | -0.194<br>[0.144]       |                         | -0.0793<br>[0.144]     | -0.0649<br>[0.164]     |
| Land Suitability   |  | 0.00895<br>[0.00636]    | 0.00945<br>[0.00652]    |                         | 0.0135*<br>[0.00752]    | 0.0134*<br>[0.00700]    |                         | 0.0120<br>[0.00873]    | 0.0120<br>[0.00807]    |
| Maritime Department  |  | -0.0113**<br>[0.00555]  | -0.0105*<br>[0.00572]   |                         | 0.00340<br>[0.00567]    | 0.00322<br>[0.00546]    |                         | 0.00513<br>[0.00525]   | 0.00503<br>[0.00505]   |
| Border Department  |  | 0.0172***<br>[0.00497]  | 0.0181***<br>[0.00572]  |                         | 0.0152***<br>[0.00492]  | 0.0150***<br>[0.00448]  |                         | 0.00760<br>[0.00610]   | 0.00750<br>[0.00560]   |
| Distance to Paris  |  | -1.37e-05<br>[3.20e-05] | -1.98e-05<br>[3.34e-05] |                         | -2.66e-05<br>[3.70e-05] | -2.54e-05<br>[3.47e-05] |                         | 7.94e-06<br>[3.72e-05] | 8.61e-06<br>[3.72e-05] |
| Paris and Suburbs  |  | 0.0240**<br>[0.0094]    | 0.0206**<br>[0.0084]    |                         | 0.0554***<br>[0.0181]   | 0.0561***<br>[0.0167]   |                         | 0.0446***<br>[0.0168]  | 0.0450***<br>[0.0156]  |
| Alsace-Lorraine  |  | -0.00869<br>[0.00905]   | -0.0137*<br>[0.00805]   |                         | 0.00827<br>[0.00850]    | 0.00929<br>[0.00816]    |                         | 0.00921<br>[0.00877]   | 0.00975<br>[0.00777]   |
| Urban Population in 1700   |  | 0.0060***<br>[0.0013]   | 0.0045***<br>[0.0014]   |                         | 0.0054***<br>[0.0014]   | 0.0057***<br>[0.0015]   |                         | 0.0058***<br>[0.0014]  | 0.0060***<br>[0.0017]  |
| Adjusted $R^2$   | 0.274  | 0.623                   |                         | 0.123                   | 0.546                   |                         | 0.040                   | 0.421                  |                        |
| Observations   | 89   | 89                      | 89                      | 89                      | 89                      | 89                      | 89                      | 89                     | 89                     |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                         |                         |                         |                         |                         |                         |                        |                        |
| Distance to Fresnes  |  |                         | -0.0132***<br>[.00274]  |                         |                         |                         | -0.0132***<br>[.00274]  |                        | -0.0132***<br>[.00274] |
| F-stat (1 <sup>st</sup> stage)   |  |                         | 23.261                  |                         |                         |                         | 23.261                  |                        | 23.261                 |

|  | (1)  | (2)                     | (3)                     | (4)                  | (5)                     | (6)                     | (7)                     | (8)                     | (9)                     |
|--|--|-------------------------|-------------------------|----------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|  | OLS  | OLS                     | IV                      | OLS                  | OLS                     | IV                      | OLS                     | OLS                     | IV                      |
|  | Share of intermediary professions in workforce (age 25-54) |                         |                         |                      |                         |                         |                         |                         |                         |
|  | 1990   |                         |                         | 1999                 |                         |                         | 2010                    |                         |                         |
| Horse Power of Steam Engines   | 0.00143<br>[0.000933]                                      | 0.000957<br>[0.00119]   | -0.00303<br>[0.00287]   | 0.00125<br>[0.00102] | 0.00116<br>[0.00122]    | -0.00624*<br>[0.00336]  | -0.000644<br>[0.000965] | -0.000115<br>[0.00128]  | -0.00822**<br>[0.00339] |
| Average Rainfall   |  | 0.00828<br>[0.0138]     | 0.0146<br>[0.0138]      |                      | -0.000450<br>[0.0142]   | 0.0113<br>[0.0153]      |                         | -0.00358<br>[0.0154]    | 0.00932<br>[0.0154]     |
| Average Temperature  |  | -0.0541***<br>[0.0155]  | -0.0482***<br>[0.0167]  |                      | -0.0463***<br>[0.0158]  | -0.0354*<br>[0.0181]    |                         | -0.0397**<br>[0.0162]   | -0.0278<br>[0.0181]     |
| Latitude   |  | -0.0368<br>[0.148]      | 0.0579<br>[0.162]       |                      | 0.0229<br>[0.155]       | 0.199<br>[0.171]        |                         | -0.0391<br>[0.135]      | 0.153<br>[0.162]        |
| Land Suitability   |  | 0.0133<br>[0.00826]     | 0.0129<br>[0.00799]     |                      | 0.00989<br>[0.00854]    | 0.00921<br>[0.00898]    |                         | 0.00604<br>[0.00919]    | 0.00530<br>[0.00986]    |
| Maritime Department  |  | 0.00377<br>[0.00555]    | 0.00315<br>[0.00586]    |                      | 0.00317<br>[0.00574]    | 0.00201<br>[0.00657]    |                         | 0.00672<br>[0.00506]    | 0.00546<br>[0.00613]    |
| Border Department  |  | 0.00600<br>[0.00645]    | 0.00534<br>[0.00587]    |                      | 0.00523<br>[0.00675]    | 0.00400<br>[0.00652]    |                         | 0.00153<br>[0.00619]    | 0.000182<br>[0.00627]   |
| Distance to Paris  |  | 3.25e-05<br>[3.86e-05]  | 3.70e-05<br>[3.58e-05]  |                      | 5.18e-05<br>[4.13e-05]  | 6.00e-05<br>[3.85e-05]  |                         | 4.82e-05<br>[3.73e-05]  | 5.73e-05<br>[3.57e-05]  |
| Paris and Suburbs  |  | 0.0563***<br>[0.0172]   | 0.0588***<br>[0.0150]   |                      | 0.0542***<br>[0.0191]   | 0.0589***<br>[0.0159]   |                         | 0.0468**<br>[0.0205]    | 0.0519***<br>[0.0171]   |
| Alsace-Lorraine  |  | 0.00746<br>[0.00908]    | 0.0111<br>[0.00938]     |                      | 0.00692<br>[0.0103]     | 0.0136<br>[0.0126]      |                         | 0.00214<br>[0.00992]    | 0.00949<br>[0.0132]     |
| Urban Population in 1700   |  | 0.00559***<br>[0.00145] | 0.00671***<br>[0.00171] |                      | 0.00584***<br>[0.00155] | 0.00793***<br>[0.00193] |                         | 0.00530***<br>[0.00157] | 0.00759***<br>[0.00194] |
| Adjusted $R^2$   | 0.006  | 0.428                   |                         | 0.001                | 0.385                   |                         | -0.008                  | 0.309                   |                         |
| Observations   | 89   | 89                      | 89                      | 89                   | 89                      | 89                      | 89                      | 89                      | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                         |                         |                      |                         |                         |                         |                         |                         |
| Distance to Fresnes  |  |                         | -0.0132***<br>[.00274]  |                      |                         |                         | -0.0132***<br>[.00274]  |                         | -0.0132***<br>[.00274]  |
| F-stat (1 <sup>st</sup> stage)   |  |                         | 23.261                  |                      |                         |                         | 23.261                  |                         | 23.261                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 C.7: Industrialization and Share of Employees in Workforce (age 25-54), 1968-2010

|  | (1)   | (2)                     | (3)                     | (4)                  | (5)                     | (6)                     | (7)                   | (8)                     | (9)                     |
|--|---|-------------------------|-------------------------|----------------------|-------------------------|-------------------------|-----------------------|-------------------------|-------------------------|
|  | OLS   | OLS                     | IV                      | OLS                  | OLS                     | IV                      | OLS                   | OLS                     | IV                      |
|  | Share of employees in workforce (age 25-54) |                         |                         |                      |                         |                         |                       |                         |                         |
|  | 1968  |                         |                         | 1975                 |                         |                         | 1982                  |                         |                         |
| Horse Power of Steam Engines   | 0.00640***<br>[0.00178]                     | 0.00661***<br>[0.00204] | 0.0136***<br>[0.00509]  | 0.00182<br>[0.00175] | 0.00191<br>[0.00173]    | 0.00160<br>[0.00496]    | -0.00122<br>[0.00135] | -0.000742<br>[0.00118]  | -0.00201<br>[0.00312]   |
| Average Rainfall   |   | 0.00701<br>[0.0188]     | -0.00409<br>[0.0202]    |                      | -0.0421**<br>[0.0204]   | -0.0416**<br>[0.0203]   |                       | -0.0482***<br>[0.0153]  | -0.0462***<br>[0.0150]  |
| Average Temperature  |   | 0.00314<br>[0.0247]     | -0.00710<br>[0.0260]    |                      | -0.0298<br>[0.0266]     | -0.0293<br>[0.0256]     |                       | -0.0240<br>[0.0182]     | -0.0222<br>[0.0178]     |
| Latitude   |   | -0.316<br>[0.192]       | -0.481**<br>[0.227]     |                      | -0.508**<br>[0.209]     | -0.500**<br>[0.237]     |                       | -0.474***<br>[0.148]    | -0.444**<br>[0.173]     |
| Land Suitability   |   | 0.00720<br>[0.0122]     | 0.00783<br>[0.0120]     |                      | 0.0198<br>[0.0145]      | 0.0197<br>[0.0134]      |                       | 0.00995<br>[0.00986]    | 0.00984<br>[0.00912]    |
| Maritime Department  |   | -0.00446<br>[0.00880]   | -0.00337<br>[0.00884]   |                      | 0.0139<br>[0.00877]     | 0.0139*<br>[0.00823]    |                       | 0.0215**<br>[0.00629]   | 0.0213***<br>[0.00595]  |
| Border Department  |   | 0.0330***<br>[0.00747]  | 0.0341***<br>[0.00851]  |                      | 0.0291***<br>[0.00789]  | 0.0290***<br>[0.00730]  |                       | 0.0181***<br>[0.00532]  | 0.0179***<br>[0.00490]  |
| Distance to Paris  |   | -6.51e-05<br>[4.91e-05] | -7.29e-05<br>[4.80e-05] |                      | -5.63e-05<br>[5.44e-05] | -5.59e-05<br>[5.13e-05] |                       | -5.61e-05<br>[3.68e-05] | -5.46e-05<br>[3.55e-05] |
| Paris and Suburbs  |   | 0.0382<br>[0.0257]      | 0.0338<br>[0.0227]      |                      | 0.0707***<br>[0.00830]  | 0.0709***<br>[0.00855]  |                       | 0.0563***<br>[0.00721]  | 0.0571***<br>[0.00704]  |
| Alsace-Lorraine  |   | -0.00429<br>[0.0131]    | -0.0106<br>[0.0146]     |                      | 0.00708<br>[0.0174]     | 0.00736<br>[0.0163]     |                       | 0.0146<br>[0.0120]      | 0.0158<br>[0.0107]      |
| Urban Population in 1700   |   | 0.0070***<br>[0.0024]   | 0.0050*<br>[0.0025]     |                      | 0.0057***<br>[0.0020]   | 0.0058***<br>[0.0021]   |                       | 0.0033**<br>[0.0014]    | 0.0036**<br>[0.0015]    |
| Adjusted R2  | 0.149                                       | 0.407                   |                         | 0.000                | 0.466                   |                         | -0.003                | 0.549                   |                         |
| Observations   | 89  | 89                      | 89                      | 89                   | 89                      | 89                      | 89                    | 89                      | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |                         |                         |                      |                         |                         |                       |                         |                         |
| Distance to Fresnes  |   |                         | -0.0132***<br>[.00274]  |                      |                         | -0.0132***<br>[.00274]  |                       |                         | -0.0132***<br>[.00274]  |
| F-stat (1 <sup>st</sup> stage)   |   |                         | 23.261                  |                      |                         | 23.261                  |                       |                         | 23.261                  |

|  | (1)   | (2)                       | (3)                     | (4)                      | (5)                     | (6)                     | (7)                       | (8)                      | (9)                      |
|--|---|---------------------------|-------------------------|--------------------------|-------------------------|-------------------------|---------------------------|--------------------------|--------------------------|
|  | OLS   | OLS                       | IV                      | OLS                      | OLS                     | IV                      | OLS                       | OLS                      | IV                       |
|  | Share of employees in workforce (age 25-54) |                           |                         |                          |                         |                         |                           |                          |                          |
|  | 1990  |                           |                         | 1999                     |                         |                         | 2010                      |                          |                          |
| Horse Power of Steam Engines   | -0.00390***<br>[0.00119]                    | -0.00273***<br>[0.000985] | -0.00157<br>[0.00235]   | -0.00493***<br>[0.00104] | -0.00234**<br>[0.00101] | 0.00421*<br>[0.00254]   | -0.00494***<br>[0.000889] | -0.00212*<br>[0.00125]   | 0.00871**<br>[0.00353]   |
| Average Rainfall   |   | -0.0430***<br>[0.0112]    | -0.0448***<br>[0.0112]  |                          | -0.0469***<br>[0.0107]  | -0.0573***<br>[0.0127]  |                           | -0.0435***<br>[0.0142]   | -0.0607***<br>[0.0172]   |
| Average Temperature  |   | -0.00791<br>[0.0137]      | -0.00961<br>[0.0137]    |                          | -0.0103<br>[0.0122]     | -0.0199<br>[0.0141]     |                           | 0.00844<br>[0.0146]      | -0.00747<br>[0.0186]     |
| Latitude   |   | -0.304**<br>[0.116]       | -0.331**<br>[0.130]     |                          | -0.351***<br>[0.113]    | -0.507***<br>[0.118]    |                           | -0.274**<br>[0.126]      | -0.531***<br>[0.132]     |
| Land Suitability   |   | -0.00296<br>[0.00653]     | -0.00285<br>[0.00613]   |                          | -0.00528<br>[0.00513]   | -0.00469<br>[0.00622]   |                           | -0.00539<br>[0.00583]    | -0.00440<br>[0.00793]    |
| Maritime Department  |   | 0.0245***<br>[0.00458]    | 0.0247***<br>[0.00427]  |                          | 0.0246***<br>[0.00463]  | 0.0256***<br>[0.00508]  |                           | 0.0194***<br>[0.00573]   | 0.0211***<br>[0.00689]   |
| Border Department  |   | 0.0149***<br>[0.00453]    | 0.0151***<br>[0.00430]  |                          | 0.0107**<br>[0.00479]   | 0.0118**<br>[0.00552]   |                           | 0.0102<br>[0.00708]      | 0.0120<br>[0.00816]      |
| Distance to Paris  |   | -2.81e-05<br>[2.73e-05]   | -2.94e-05<br>[2.57e-05] |                          | -3.08e-05<br>[2.69e-05] | -3.81e-05<br>[2.58e-05] |                           | -2.55e-05<br>[3.30e-05]  | -3.75e-05<br>[3.20e-05]  |
| Paris and Suburbs  |   | 0.0347***<br>[0.00898]    | 0.0339***<br>[0.00877]  |                          | 0.0124*<br>[0.00705]    | 0.00824<br>[0.00800]    |                           | -0.00420<br>[0.00647]    | -0.0111<br>[0.00815]     |
| Alsace-Lorraine  |   | 0.0112<br>[0.00712]       | 0.0101<br>[0.00709]     |                          | 0.00932<br>[0.0100]     | 0.00338<br>[0.0120]     |                           | 0.00764<br>[0.0143]      | -0.00218<br>[0.0180]     |
| Urban Population in 1700   |   | 0.00107<br>[0.00111]      | 0.000747<br>[0.00114]   |                          | -0.00157<br>[0.00106]   | -0.00342**<br>[0.00135] |                           | -0.00401***<br>[0.00127] | -0.00707***<br>[0.00192] |
| Adjusted R2  | 0.114                                       | 0.609                     |                         | 0.205                    | 0.630                   |                         | 0.202                     | 0.510                    |                          |
| Observations   | 89  | 89                        | 89                      | 89                       | 89                      | 89                      | 89                        | 89                       | 89                       |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |                           |                         |                          |                         |                         |                           |                          |                          |
| Distance to Fresnes  |   |                           | -0.0132***<br>[.00274]  |                          |                         | -0.0132***<br>[.00274]  |                           |                          | -0.0132***<br>[.00274]   |
| F-stat (1 <sup>st</sup> stage)   |   |                           | 23.261                  |                          |                         | 23.261                  |                           |                          | 23.261                   |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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. Educational achievements of women

**Table D.1:** School enrollment rates for women, 2010

|  | (1)   | (2)                 | (3)                     | (4)   | (5)                 | (6)                     |
|--|---|---------------------|-------------------------|---|---------------------|-------------------------|
|  | OLS   | OLS                 | IV                      | OLS   | OLS                 | IV                      |
|  | School Enrollment of Women<br>Age 15-17 in 2010 |                     |                         | School Enrollment of Women<br>Age 18-24 in 2010 |                     |                         |
| Horse Power of Steam Engines   | 0.593**<br>[0.295]                              | -0.462<br>[0.472]   | -2.696***<br>[1.025]    | 0.815**<br>[0.326]                              | -0.329<br>[0.564]   | -3.062**<br>[1.248]     |
| Average Rainfall   |   | 10.14**<br>[4.431]  | 13.70***<br>[4.811]     |   | 8.344*<br>[4.550]   | 12.70**<br>[5.425]      |
| Average Temperature  |   | 3.980<br>[5.792]    | 7.263<br>[5.620]        |   | 1.977<br>[6.158]    | 5.994<br>[6.231]        |
| Latitude   |   | 47.47<br>[40.67]    | 100.5**<br>[46.32]      |   | 58.80<br>[47.68]    | 123.7**<br>[56.00]      |
| Land Suitability   |   | -3.391<br>[3.083]   | -3.596<br>[3.097]       |   | -2.725<br>[3.374]   | -2.975<br>[3.507]       |
| Maritime Department  |   | -0.264<br>[2.027]   | -0.613<br>[2.072]       |   | -0.421<br>[2.265]   | -0.848<br>[2.395]       |
| Border Department  |   | 1.395<br>[2.023]    | 1.024<br>[2.002]        |   | 1.872<br>[1.982]    | 1.419<br>[2.033]        |
| Distance to Paris  |   | 0.0129<br>[0.0109]  | 0.0154<br>[0.0112]      |   | 0.0204<br>[0.0123]  | 0.0235*<br>[0.0129]     |
| Paris and Suburbs  |   | 10.58***<br>[1.919] | 11.99***<br>[1.801]     |   | 12.53***<br>[2.816] | 14.26***<br>[2.434]     |
| Alsace-Lorraine  |   | -3.612<br>[3.773]   | -1.586<br>[4.382]       |   | -5.091<br>[3.812]   | -2.612<br>[3.932]       |
| Urban Population in 1700   |   | 3.034***<br>[0.409] | 3.666***<br>[0.509]     |   | 3.561***<br>[0.477] | 4.335***<br>[0.586]     |
| Adjusted $R^2$   | 0.017   | 0.392               |                         | 0.027   | 0.433               |                         |
| Observations   | 89  | 89                  | 89                      | 89  | 89                  | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |   |                     |                         |   |                     |                         |
| Distance to Fresnes  |   |                     | -0.0132***<br>[0.00274] |   |                     | -0.0132***<br>[0.00274] |
| F-stat ( $1^{st}$ stage)   |   |                     | 23.261                  |   |                     | 23.261                  |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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:** Persistent and reversed effects of industrialization on human capital: female high-school and college graduates, 1968-2010

|  | (1)<br>OLS   | (2)<br>OLS             | (3)<br>IV               | (4)<br>OLS   | (5)<br>OLS             | (6)<br>IV               | (7)<br>OLS   | (8)<br>OLS             | (9)<br>IV               |
|--|--|------------------------|-------------------------|--|------------------------|-------------------------|--|------------------------|-------------------------|
|  | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1968 |                        |                         | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1975 |                        |                         | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1982 |                        |                         |
| Horse Power of Steam Engines   | 5.50e-05<br>[0.000942]   | 0.000734<br>[0.000712] | -0.00175<br>[0.00192]   | -0.000226<br>[0.00158]   | 0.00119<br>[0.00115]   | -0.00380<br>[0.00315]   | -0.00176<br>[0.00179]  | 0.000352<br>[0.00120]  | -0.00656*<br>[0.00369]  |
| Average Rainfall   |  | 0.00499<br>[0.00747]   | 0.00895<br>[0.00869]    |  | 0.00729<br>[0.0117]    | 0.0152<br>[0.0139]      |  | 0.0110<br>[0.0128]     | 0.0220<br>[0.0155]      |
| Average Temperature  |  | -0.0341***<br>[0.0106] | -0.0305***<br>[0.0106]  |  | -0.0625***<br>[0.0171] | -0.0551***<br>[0.0176]  |  | -0.0767***<br>[0.0177] | -0.0666***<br>[0.0197]  |
| Latitude   |  | -0.166**<br>[0.0737]   | -0.107<br>[0.0875]      |  | -0.229*<br>[0.130]     | -0.110<br>[0.147]       |  | -0.204<br>[0.175]      | -0.0400<br>[0.194]      |
| Land Suitability   |  | 0.00537<br>[0.00492]   | 0.00515<br>[0.00480]    |  | 0.00993<br>[0.00834]   | 0.00947<br>[0.00818]    |  | 0.00948<br>[0.00880]   | 0.00885<br>[0.00898]    |
| Maritime Department  |  | 0.000909<br>[0.00375]  | 0.000521<br>[0.00381]   |  | 0.00161<br>[0.00602]   | 0.00083<br>[0.00630]    |  | 0.000324<br>[0.00654]  | -0.000755<br>[0.00721]  |
| Border Department  |  | 0.00768**<br>[0.00304] | 0.00726***<br>[0.00279] |  | 0.0104*<br>[0.00560]   | 0.00956*<br>[0.00516]   |  | 0.00545<br>[0.00658]   | 0.00430<br>[0.00630]    |
| Distance to Paris  |  | 7.75e-06<br>[1.87e-05] | 1.05e-05<br>[1.87e-05]  |  | 2.78e-05<br>[3.33e-05] | 3.34e-05<br>[3.28e-05]  |  | 6.06e-05<br>[4.42e-05] | 6.83e-05<br>[4.21e-05]  |
| Paris and Suburbs  |  | 0.0534***<br>[0.0096]  | 0.0549***<br>[0.0095]   |  | 0.0880***<br>[0.0126]  | 0.0912***<br>[0.0127]   |  | 0.103***<br>[0.0110]   | 0.107***<br>[0.0117]    |
| Alsace-Lorraine  |  | -0.00349<br>[0.00682]  | -0.00123<br>[0.00683]   |  | -0.0103<br>[0.0120]    | -0.00580<br>[0.0126]    |  | -0.0142<br>[0.0134]    | -0.00795<br>[0.0142]    |
| Urban Population in 1700   |  | 0.0042***<br>[0.0008]  | 0.0049***<br>[0.0009]   |  | 0.0075***<br>[0.0013]  | 0.0089***<br>[0.0016]   |  | 0.0089***<br>[0.0014]  | 0.0109***<br>[0.0019]   |
| Adjusted R2  | -0.011   | 0.629                  |                         | -0.011   | 0.638                  |                         | 0.001  | 0.662                  |                         |
| Observations   | 89   | 89                     | 89                      | 89   | 89                     | 89                      | 89   | 89                     | 89                      |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                        |                         |  |                        |                         |  |                        |                         |
| Distance to Fresnes  |  |                        | -0.0132***<br>[0.00274] |  |                        | -0.0132***<br>[0.00274] |  |                        | -0.0132***<br>[0.00274] |
| F-stat (1 <sup>st</sup> stage)   |  |                        | 23.261                  |  |                        | 23.261                  |  |                        | 23.261                  |

|  | (10)<br>OLS  | (11)<br>OLS             | (12)<br>IV               | (13)<br>OLS  | (14)<br>OLS              | (15)<br>IV                | (16)<br>OLS  | (17)<br>OLS              | (18)<br>IV                |
|--|--|-------------------------|--------------------------|--|--------------------------|---------------------------|--|--------------------------|---------------------------|
|  | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1990 |                         |                          | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 1999 |                          |                           | Share of Women Age 25 and above with<br>a Secondary or Post-Secondary Degree, 2010 |                          |                           |
| Horse Power of Steam Engines   | -0.00255<br>[0.00238]  | 0.00112<br>[0.00159]    | -0.00931*<br>[0.00514]   | -0.00331<br>[0.00288]  | 0.000944<br>[0.00200]    | -0.0116*<br>[0.00621]     | -0.00590**<br>[0.00293]  | -0.000848<br>[0.00231]   | -0.0179**<br>[0.00726]    |
| Average Rainfall   |  | 0.00614<br>[0.0183]     | 0.0227<br>[0.0226]       |  | 0.00448<br>[0.0224]      | 0.0244<br>[0.0279]        |  | 0.0229<br>[0.0267]       | 0.0500<br>[0.0342]        |
| Average Temperature  |  | -0.0853***<br>[0.0244]  | -0.0700**<br>[0.0277]    |  | -0.0888***<br>[0.0295]   | -0.0704**<br>[0.0338]     |  | -0.0693**<br>[0.0340]    | -0.0442<br>[0.0394]       |
| Latitude   |  | -0.202<br>[0.241]       | 0.0451<br>[0.267]        |  | -0.148<br>[0.291]        | 0.149<br>[0.319]          |  | -0.0926<br>[0.320]       | 0.312<br>[0.354]          |
| Land Suitability   |  | 0.00943<br>[0.0122]     | 0.00848<br>[0.0126]      |  | 0.00404<br>[0.0140]      | 0.00290<br>[0.0146]       |  | -0.00571<br>[0.0160]     | -0.00726<br>[0.0174]      |
| Maritime Department  |  | -0.00185<br>[0.00964]   | -0.00347<br>[0.0107]     |  | -0.00140<br>[0.0117]     | -0.00335<br>[0.0129]      |  | 0.00442<br>[0.0129]      | 0.00176<br>[0.0148]       |
| Border Department  |  | 0.00926<br>[0.00983]    | 0.00753<br>[0.00973]     |  | 0.0114<br>[0.0125]       | 0.00930<br>[0.0125]       |  | 0.00799<br>[0.0146]      | 0.00517<br>[0.0155]       |
| Distance to Paris  |  | 0.000115*<br>[6.16e-05] | 0.000127**<br>[5.90e-05] |  | 0.000172**<br>[7.33e-05] | 0.000186***<br>[7.01e-05] |  | 0.000193**<br>[8.17e-05] | 0.000212***<br>[7.87e-05] |
| Paris and Suburbs  |  | 0.151***<br>[0.0162]    | 0.157***<br>[0.0172]     |  | 0.184***<br>[0.0213]     | 0.192***<br>[0.0226]      |  | 0.196***<br>[0.0196]     | 0.207***<br>[0.0216]      |
| Alsace-Lorraine  |  | -0.0252<br>[0.0184]     | -0.0157<br>[0.0201]      |  | -0.0301<br>[0.0221]      | -0.0188<br>[0.0239]       |  | -0.0379*<br>[0.0211]     | -0.0224<br>[0.0258]       |
| Urban Population in 1700   |  | 0.0118***<br>[0.00211]  | 0.0147***<br>[0.00277]   |  | 0.0152***<br>[0.00253]   | 0.0187***<br>[0.00342]    |  | 0.0166***<br>[0.00281]   | 0.0215***<br>[0.00406]    |
| Adjusted R2  | 0.002  | 0.659                   |                          | 0.003  | 0.667                    |                           | 0.027  | 0.653                    |                           |
| Observations   | 89   | 89                      | 89                       | 89   | 89                       | 89                        | 89   | 89                       | 89                        |
| First stage: the instrumented variable is Horse Power of Steam Engines |  |                         |                          |  |                          |                           |  |                          |                           |
| Distance to Fresnes  |  |                         | -0.0132***<br>[0.00274]  |  |                          | -0.0132***<br>[0.00274]   |  |                          | -0.0132***<br>[0.00274]   |
| F-stat (1 <sup>st</sup> stage)   |  |                         | 23.261                   |  |                          | 23.261                    |  |                          | 23.261                    |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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. Sectorial tariff protection and income per capita, 1872 & 1901

**Table E.1:** Sectorial tariff protection and income per capita, 1872 & 1901

|  | (1)                     | (2)        | (3)        | (4)                     | (5)        | (6)        | (7)        |
|--|-------------------------|------------|------------|-------------------------|------------|------------|------------|
|  | IV                      | IV         | IV         | IV                      | IV         | IV         | IV         |
|  | Income per capita, 1872 |            |            | Income per capita, 1901 |            |            |            |
| Horse Power of Steam Engines   | 0.121**                 | 0.120**    | 0.117**    | 0.244***                | 0.241***   | 0.246***   | 0.238***   |
|  | [0.0515]                | [0.0534]   | [0.0530]   | [0.0724]                | [0.0727]   | [0.0753]   | [0.0718]   |
| Weighted tariffs across sectors, 1865                                  |                         | 0.202      |            |                         | 0.132      |            |            |
|  |                         | [0.128]    |            |                         | [0.187]    |            |            |
| Weighted tariffs across sectors, 1872                                  |                         |            | 0.0802     |                         |            | -0.0945    |            |
|  |                         |            | [0.118]    |                         |            | [0.161]    |            |
| Weighted tariffs across sectors, 1901                                  |                         |            |            |                         |            |            | 0.101      |
|  |                         |            |            |                         |            |            | [0.153]    |
| Average Rainfall   | -0.505**                | -0.356     | -0.421     | -0.795**                | -0.739**   | -0.941**   | -0.744**   |
|  | [0.239]                 | [0.253]    | [0.275]    | [0.338]                 | [0.362]    | [0.401]    | [0.363]    |
| Average Temperature  | 0.109                   | 0.188      | 0.164      | -0.537                  | -0.430     | -0.523     | -0.413     |
|  | [0.315]                 | [0.339]    | [0.350]    | [0.361]                 | [0.388]    | [0.405]    | [0.386]    |
| Land Suitability   | 0.118                   | 0.0766     | 0.106      | 0.279*                  | 0.235      | 0.274*     | 0.259      |
|  | [0.127]                 | [0.130]    | [0.132]    | [0.156]                 | [0.163]    | [0.158]    | [0.159]    |
| Latitude   | -4.899                  | -4.534     | -4.674     | -8.713**                | -8.537**   | -9.060**   | -8.662**   |
|  | [3.123]                 | [3.366]    | [3.279]    | [3.849]                 | [3.879]    | [3.855]    | [3.748]    |
| Maritime Department  | 0.108                   | 0.0985     | 0.101      | 0.0438                  | 0.0299     | 0.0425     | 0.0234     |
|  | [0.111]                 | [0.110]    | [0.112]    | [0.138]                 | [0.137]    | [0.139]    | [0.136]    |
| Border Department  | 0.00609                 | -0.0252    | -0.00360   | 0.155                   | 0.178      | 0.222      | 0.188      |
|  | [0.138]                 | [0.149]    | [0.149]    | [0.163]                 | [0.169]    | [0.173]    | [0.166]    |
| Distance to Paris  | -0.0011                 | -0.0011    | -0.0011    | -0.0011                 | -0.0011    | -0.0011    | -0.0011    |
|  | [0.0007]                | [0.0007]   | [0.0007]   | [0.0008]                | [0.0008]   | [0.0008]   | [0.0008]   |
| Paris and Suburbs  | -0.0164                 | -0.0496    | -0.0137    | -0.189                  | -0.213     | -0.195     | -0.190     |
|  | [0.116]                 | [0.108]    | [0.114]    | [0.171]                 | [0.160]    | [0.177]    | [0.166]    |
| Alsace-Lorraine  |                         |            |            |                         |            |            |            |
| Urban Population in 1700   | -0.00613                | -0.00710   | -0.00547   | -0.0485                 | -0.0485    | -0.0485    | -0.0476    |
|  | [0.0301]                | [0.0296]   | [0.0297]   | [0.0392]                | [0.0389]   | [0.0398]   | [0.0394]   |
| Observations   | 85                      | 82         | 82         | 85                      | 82         | 82         | 82         |
| First stage: the instrumented variable is Horse Power of Steam Engines |                         |            |            |                         |            |            |            |
| Distance to Fresnes  | -0.0123***              | -0.0123*** | -0.0120*** | -0.0123***              | -0.0123*** | -0.0120*** | -0.0124*** |
|  | [0.00278]               | [0.00283]  | [0.00272]  | [0.00278]               | [0.00283]  | [0.00272]  | [0.00279]  |
| F-stat   | 19.526                  | 19.007     | 19.492     | 19.526                  | 19.007     | 19.492     | 19.807     |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. 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 F. Spatial correlation

In this appendix, we test for spatial correlation in our main regressions on the impact of steam engines on GDP per capita in Tables 2 and 3 by implementing spatial LM tests on the residuals of the OLS regressions with control variables. The results in Table F.1 suggest that there is no statistical evidence of spatial autocorrelation in the residuals.

Similarly, we run our tests of spatial correlation over our the OLS regressions with control variables for our various measures of human capital reported in Tables 5, 6, D.1, 7 and D.2. These are the literacy of conscripts (1874-1883 & 1894-1903), the school enrollment in 2010 for men and

women age 15-17 and 18-24, as well as the share of men and women age 25 and above with at least a secondary degree.

The test results reported in Tables F.5 to F.8 suggest that there is evidence of spatial correlation for the regressions where the dependent variable is the Gini coefficient (2001-2008 average), the gross income of the individuals at the bottom 25th percentile of the income distribution over the 2001-2010 period, the share of the workforce in industry in 1901, 1931 and 2010, as well as the school enrollment of men and women age 15-17 in 2010.

We then rerun the OLS and IV regressions with Conley (1999) standard errors with a radius of 100km. The results are reported in Tables F.9 and F.11. We find that the statistical significance of our variables remains identical to those in our main regressions.

**Table F.1:** LM tests of spatial correlation: GDP per capita in 1872, 1901, 1930 and 2001-2010

|                       | GDP per capita, 1872 | GDP per capita, 1901 | GDP per capita, 1930 | GDP per capita, 2001-2010 |
|-----------------------|----------------------|----------------------|----------------------|---------------------------|
| Spatial error LM test | 0.779                | 0.000                | 0.454                | 0.001                     |
| p-value               | 0.377                | 0.993                | 0.500                | 0.974                     |
| Spatial lag LM test   | 0.185                | 0.354                | 2.037                | 1.348                     |
| p-value               | 0.667                | 0.552                | 0.154                | 0.246                     |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns (4) and (9) in Tables 2 and 3.

**Table F.2:** LM tests of spatial correlation: Unemployment, Gini inequality coefficient and the distribution of income, after 2000

|                       | Unemployment rate<br>2002-2011 | Gini coefficient<br>2001-2008 | 25th Percentile - Fiscal Income per Person<br>in Household, 2001-2010 |
|-----------------------|--------------------------------|-------------------------------|---|
| Spatial error LM test | 2.202                          | 7.348                         | 5.599   |
| p-value               | 0.138                          | 0.007                         | 0.014   |
| Spatial lag LM test   | 2.104                          | 3.098                         | 9.532   |
| p-value               | 0.147                          | 0.078                         | 0.002   |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 in Table 4.

**Table F.3:** LM tests of spatial correlation: Share of the workforce in industry

|                       | Share of the workforce in industry |       |        |       |       |       |       |       |       |
|-----------------------|------------------------------------|-------|--------|-------|-------|-------|-------|-------|-------|
|                       | 1872                               | 1901  | 1931   | 1968  | 1975  | 1982  | 1990  | 1999  | 2010  |
| Spatial error LM test | 0.010                              | 1.264 | 2.836  | 0.102 | 0.286 | 0.72  | 0.046 | 0.025 | 3.234 |
| p-value               | 0.921                              | 0.261 | 0.092  | 0.749 | 0.593 | 0.396 | 0.830 | 0.873 | 0.072 |
| Spatial lag LM test   | 2.532                              | 6.806 | 20.705 | 2.456 | 0.123 | 0.606 | 2.25  | 1.816 | 0.212 |
| p-value               | 0.112                              | 0.009 | 0.000  | 0.117 | 0.726 | 0.436 | 0.134 | 0.178 | 0.646 |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 of Table C.1 and in Columns 2, 5, 8, 11, 14 and 17 of Table C.2.

**Table F.4:** LM tests of spatial correlation: Share of the workforce in services

|                       | Share of the workforce in services |       |       |       |       |       |       |       |       |
|-----------------------|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                       | 1872                               | 1901  | 1931  | 1968  | 1975  | 1982  | 1990  | 1999  | 2010  |
| Spatial error LM test | 1.851                              | 0.002 | 0.556 | 0.508 | 0.039 | 0.021 | 0.203 | 0.166 | 1.458 |
| p-value               | 0.174                              | 0.963 | 0.456 | 0.476 | 0.843 | 0.885 | 0.652 | 0.683 | 0.227 |
| Spatial lag LM test   | 1.218                              | 0.003 | 1.053 | 0.060 | 0.357 | 0.235 | 1.878 | 0.987 | 1.295 |
| p-value               | 0.27                               | 0.960 | 0.305 | 0.806 | 0.550 | 0.628 | 0.171 | 0.320 | 0.255 |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 of Table C.3 and in Columns 2, 5, 8, 11, 14 and 17 of Table C.4.

**Table F.5:** LM tests of spatial correlation: Literacy of conscripts, 1874-1893 & 1894-1903

|                       | Share of Literate Individuals among Conscripts |                   |
|-----------------------|--|-------------------|
|                       | 1874-1883 average                              | 1894-1903 average |
| Spatial error LM test | 1.573  | 0.606             |
| p-value               | 0.210  | 0.436             |
| Spatial lag LM test   | 0.849  | 0.008             |
| p-value               | 0.357  | 0.930             |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 in Table 5.

**Table F.6:** LM tests of spatial correlation: Share of men age 25 and above with a secondary or post-secondary degree, 1968-2010

|                       | Share of Men Age 25 and above<br>with a Secondary or Post-Secondary Degree |       |       |       |       |       |
|-----------------------|--|-------|-------|-------|-------|-------|
|                       | 1968   | 1975  | 1982  | 1990  | 1999  | 2010  |
| Spatial error LM test | 0.108  | 0.015 | 0.019 | 0.080 | 0.674 | 0.724 |
| p-value               | 0.743  | 0.901 | 0.890 | 0.777 | 0.412 | 0.394 |
| Spatial lag LM test   | 0.005  | 0.015 | 0.012 | 0.011 | 0.155 | 0.203 |
| p-value               | 0.945  | 0.903 | 0.914 | 0.916 | 0.694 | 0.652 |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 in Panels A and B of Table 7.

**Table F.7:** LM tests of spatial correlation: Share of women age 25 and above with a secondary or post-secondary degree, 1968-2010

|                       | Share of Women Age 25 and above<br>with a Secondary or Post-Secondary Degree |       |       |       |       |       |
|-----------------------|--|-------|-------|-------|-------|-------|
|                       | 1968   | 1975  | 1982  | 1990  | 1999  | 2010  |
| Spatial error LM test | 0.006  | 0.052 | 0.184 | 0.247 | 1.100 | 1.028 |
| p-value               | 0.936  | 0.819 | 0.668 | 0.619 | 0.294 | 0.311 |
| Spatial lag LM test   | 0.011  | 0.027 | 0.013 | 0.092 | 0.378 | 0.51  |
| p-value               | 0.916  | 0.869 | 0.91  | 0.762 | 0.529 | 0.475 |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2, 5 and 8 in Panels A and B of Table D.2.

**Table F.8:** LM tests of spatial correlation: School enrollment in 2010

|                       | School Enrollment of Men<br>Age 15-17 in 2010 | School Enrollment of Women<br>Age 15-17 in 2010 | School Enrollment of Men<br>Age 18-24 in 2010 | School Enrollment of Women<br>Age 18-24 in 2010 |
|-----------------------|---|---|---|---|
| Spatial error LM test | 13.429  | 11.913  | 1.412   | 1.510   |
| p-value               | 0.000   | 0.001   | 0.235   | 0.219   |
| Spatial lag LM test   | 0.024   | 1.084   | 0.955   | 0.646   |
| p-value               | 0.876   | 0.298   | 0.328   | 0.422   |

Note: The table reports LM tests of spatial correlation for the residuals in the OLS regressions in Columns 2 and 5 in Tables 6 and D.1.

**Table F.9:** Gini inequality coefficient and the distribution of income, after 2000: regressions with spatial Conley (1999) standard errors

|                              | (1)<br>OLS           | (2)<br>OLS<br>Gini coefficient<br>2001-2008 average | (3)<br>IV              | (4)<br>OLS<br>25th Percentile - Fiscal Income per Person<br>in Household, 2001-2010 Average | (5)<br>OLS             | (6)<br>IV            |
|------------------------------|----------------------|---|------------------------|---|------------------------|----------------------|
| Horse Power of Steam Engines | -0.149<br>[0.002]*** | 0.008<br>[0.0009]***                                | 0.028<br>[0.002]***    | 1.307<br>[0.019]***   | -0.012<br>[0.003]***   | -0.093<br>[0.009]*** |
| Average Rainfall             |                      | -0.070<br>[0.013]***                                | -0.092<br>[0.010]***   |   | 0.177<br>[0.021]***    | 0.270<br>[0.042]***  |
| Average Temperature          |                      | -0.067<br>[0.008]***                                | -0.075<br>[0.009]***   |   | 0.211<br>[0.026]***    | 0.245<br>[0.029]***  |
| Latitude                     |                      | -0.130<br>[0.021]***                                | -0.124<br>[0.020]***   |   | 1.839<br>[0.034]***    | 1.811<br>[0.061]***  |
| Land Suitability             |                      | 0.053<br>[0.003]***                                 | 0.050<br>[0.005]***    |   | -0.138<br>[0.009]***   | -0.124<br>[0.016]*** |
| Maritime Department          |                      | 0.014<br>[0.005]***                                 | 0.004<br>[0.005]       |   | -0.073<br>[0.010]***   | -0.033<br>[0.009]*** |
| Border Department            |                      | 0.028<br>[0.005]***                                 | 0.029<br>[0.003]***    |   | 0.006<br>[0.017]       | 0.004<br>[0.012]     |
| Distance to Paris            |                      | 0.0001<br>[0.00002]***                              | 0.0002<br>[0.00001]*** |   | 0.0003<br>[0.00004]*** | -0.0001<br>[0.0001]  |
| Paris and Suburbs            |                      | 0.094<br>[0.005]***                                 | 0.094<br>[0.004]***    |   | 0.608<br>[0.019]***    | 0.608<br>[0.022]***  |
| Alsace-Lorraine              |                      | -0.026<br>[0.006]***                                | -0.064<br>[0.005]***   |   | 0.073<br>[0.017]***    | 0.234<br>[0.031]***  |
| Urban Population in 1700     |                      | 0.008<br>[0.0007]***                                | 0.003<br>[0.0008]***   |   | 0.017<br>[0.003]***    | 0.037<br>[0.005]***  |
| Observations                 | 89                   | 89  | 89                     | 89  | 89                     | 89                   |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. The table reports spatial Conley (1999) standard errors with a radius of 100km.

**Table F.10:** Share of the workforce in industry in 1901, 1931 and 2010: regressions with spatial Conley (1999) standard errors

|                              | (1)                                      | (2)        | (3)          | (4)                                      | (5)        | (6)          | (7)                                      | (8)          | (9)          |
|------------------------------|--|------------|--------------|--|------------|--------------|--|--------------|--------------|
|                              | OLS                                      | OLS        | IV           | OLS                                      | OLS        | IV           | OLS                                      | OLS          | IV           |
|                              | Share of the workforce in industry, 1901 |            |              | Share of the workforce in industry, 1931 |            |              | Share of the workforce in industry, 2010 |              |              |
| Horse Power of Steam Engines | 0.044                                    | 0.037      | 0.072        | 0.0523                                   | 0.044      | 0.089        | 0.034                                    | 0.005        | -0.002       |
|                              | [0.001]***                               | [0.002]*** | [0.004]***   | [0.0009]***                              | [0.002]*** | [0.004]*     | [0.001]***                               | [0.001]***   | [0.002]      |
| Average Rainfall             |  | -0.001     | -0.037       |  | 0.045      | -0.008       |  | 0.037        | 0.046        |
|                              |  | [0.010]    | [0.015]**    |  | [0.013]*** | [0.014]      |  | [0.009]***   | [0.009]***   |
| Average Temperature          |  | -0.068     | -0.078       |  | -0.133     | -0.152       |  | 0.011        | 0.014        |
|                              |  | [0.009]*** | [0.012]***   |  | [0.012]*** | [0.017]***   |  | [0.008]      | [0.008]*     |
| Latitude                     |  | 0.054      | 0.055        |  | 0.010      | 0.025        |  | -0.016       | 0.006        |
|                              |  | [0.020]*** | [0.023]**    |  | [0.027]    | [0.029]      |  | [0.015]      | [0.004]      |
| Land Suitability             |  | 0.058      | 0.050        |  | 0.074      | 0.066        |  | 0.005        | -0.018       |
|                              |  | [0.006]*** | [0.008]***   |  | [0.008]*** | [0.011]***   |  | [0.004]      | [0.014]      |
| Maritime Department          |  | -0.015     | -0.032       |  | 0.005      | -0.018       |  | 0.006        | 0.010        |
|                              |  | [0.005]*** | [0.005]***   |  | [0.005]    | [0.006]***   |  | [0.002]**    | [0.003]***   |
| Border Department            |  | 0.043      | 0.044        |  | 0.089      | 0.090        |  | -0.001       | -0.001       |
|                              |  | [0.006]*** | [0.005]***   |  | [0.006]*** | [0.007]***   |  | [0.002]      | [0.002]      |
| Distance to Paris            |  | 0.00001    | 0.0002       |  | -0.00001   | 0.0002       |  | -0.00005     | -0.0001      |
|                              |  | [0.00001]  | [0.00002]*** |  | [0.00001]  | [0.00002]*** |  | [0.00001]*** | [0.00001]*** |
| Paris and Suburbs            |  | 0.025      | 0.025        |  | 0.103      | 0.103        |  | -0.047       | -0.047       |
|                              |  | [0.005]*** | [0.005]***   |  | [0.006]*** | [0.006]***   |  | [0.004]***   | [0.003]***   |
| Alsace-Lorraine              |  | 0.075      | -0.048       |  | 0.028      | -0.063       |  | 0.022        | 0.037        |
|                              |  | [0.009]*** | [0.013]**    |  | [0.007]*** | [0.009]***   |  | [0.004]***   | [0.005]***   |
| Urban Population in 1700     |  | 0.009      | 0.0001       |  | 0.017      | 0.005        |  | -0.002       | -0.0001      |
|                              |  | [0.001]*** | [0.002]      |  | [0.001]*** | [0.002]***   |  | [0.001]***   | [0.0004]     |
| Observations                 | 89                                       | 89         | 89           | 89                                       | 89         | 89           | 89                                       | 89           | 89           |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. The table reports spatial Conley (1999) standard errors with a radius of 100km.

**Table F.11:** Early industrialization and school enrollment for men and women age 15-17 in 2010: regressions with spatial Conley (1999) standard errors

|                              | (1)  | (2)         | (3)         | (4)  | (5)         | (6)         |
|------------------------------|--|-------------|-------------|--|-------------|-------------|
|                              | OLS  | OLS         | IV          | OLS  | OLS         | IV          |
|                              | School Enrollment of Men Age 15-17 in 2010 |             |             | School Enrollment of Women Age 15-17 in 2010 |             |             |
| Horse Power of Steam Engines | 14.086                                     | -0.102      | -0.678      | 14.252                                       | -0.080      | -0.619      |
|                              | [0.213]***                                 | [0.028]***  | [0.054]***  | [0.214]***                                   | [0.024]***  | [0.055]***  |
| Average Rainfall             |  | 2.662       | 3.321       |  | 1.372       | 1.989       |
|                              |  | [0.236]***  | [0.194]***  |  | [0.174]***  | [0.172]***  |
| Average Temperature          |  | 0.596       | 0.838       |  | 0.230       | 0.457       |
|                              |  | [0.139]***  | [0.173]***  |  | [0.147]     | [0.170]***  |
| Latitude                     |  | -0.831      | -0.733      |  | -0.830      | -0.738      |
|                              |  | [0.064]***  | [0.089]***  |  | [0.065]***  | [0.077]***  |
| Land Suitability             |  | 19.601      | 19.405      |  | 22.300      | 22.117      |
|                              |  | [0.417]***  | [0.420]***  |  | [0.341]***  | [0.363]***  |
| Maritime Department          |  | -0.518      | -0.236      |  | -0.597      | -0.332      |
|                              |  | [0.125]***  | [0.140]*    |  | [0.089]***  | [0.106]***  |
| Border Department            |  | -0.659      | -0.674      |  | -0.606      | -0.620      |
|                              |  | [0.095]***  | [0.064]***  |  | [0.100]***  | [0.075]***  |
| Distance to Paris            |  | 0.004       | 0.001       |  | 0.005       | 0.002       |
|                              |  | [0.0003]*** | [0.0004]*** |  | [0.0002]*** | [0.0004]*** |
| Paris and Suburbs            |  | 1.276       | 1.274       |  | 1.488       | 1.487       |
|                              |  | [0.093]***  | [0.104]***  |  | [0.070]***  | [0.094]***  |
| Alsace-Lorraine              |  | -0.554      | 0.584       |  | -0.711      | 0.356       |
|                              |  | [0.145]***  | [0.269]**   |  | [0.139]***  | [0.258]     |
| Urban Population in 1700     |  | 0.109       | 0.252       |  | 0.035       | 0.169       |
|                              |  | [0.015]***  | [0.016]***  |  | [0.011]***  | [0.018]***  |
| Observations                 | 89   | 89          | 89          | 89   | 89          | 89          |

Note: All regressions, except for the unconditional ones, include a dummy variable for the three departments which had no steam engine in 1860-1865. The table reports spatial Conley (1999) standard errors with a radius of 100km.

## Appendix G. Variable definitions and sources

### Dependent variables

#### Income.

*GDP per capita, 1872 and 1901.* Each department's GDP per capita in 1872 and 1901. Source: Caruana-Galizia (2013).

*GDP per capita, 1930.* Each department's GDP per capita in 1930. Source: Combes et al. (2011).

*GDP per capita, 2001-2010 average.* Each department's GDP per capita averaged over the 2001-2010 period. Source: French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*).

#### Unemployment, Gini coefficient and 25th percentile of the income distribution.

*Unemployment rate, 2002-2011 average.* Each department's unemployment rate averaged over the 2002-2011 period. Source: French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*).

*Gini coefficient, 2001-2008 average.* Each department's Gini coefficient averaged over the 2001-2008 period. Source: French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*)

*25<sup>th</sup> percentile of the income per person in household, 2001-2010 average.* Each department's 25<sup>th</sup> percentile of the gross income per person in household averaged over the 2001-2010 period. Source: French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*)

#### Workforce, Pre-WWII.

*Share of workforce in industry, 1872, 1901, 1931.* Each department's share of the workforce in the industrial sector in 1872, 1901 and 1931 (the control group is made of the agricultural sector). Sources: *Annuaire Statistique De La France* (1878-1939) and 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>.

*Share of workforce in services, 1872, 1901 and 1931.* Source: Each department's share of the workforce in the service sector in 1872, 1901 and 1931 (the control group is made of the agricultural sector). Sources: *Annuaire Statistique De La France* (1878-1939) and 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>.

#### Education Measures, Pre-WWI.

*Share of literate individuals among conscripts, 1874-1883 and 1894-1903.* 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 1874-1883 and 1894-1903 periods. Source: *Annuaire Statistique De La France* (1878-1939).



## **Education Measures, Post-WWII.**

*Share of men age 25 and above with a secondary or post-secondary degree, 1968, 1975, 1982, 1990, 1999 and 2010.* The share of men age 25 and above in the population of each department who at least completed secondary schooling. Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*Share of women age 25 and above with a secondary or post-secondary degree, 1968, 1975, 1982, 1990, 1999 and 2010.* The share of women age 25 and above in the population of each department who at least completed secondary schooling. Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*School enrollment of men/women age 15-17/18-24, in 2010.* The shares of men and women in the age groups 15-17 and 18-24 enrolled in an educational institution. Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 2010.

## **Workforce, Post-WWII.**

*Share of workforce in industry, 1968, 1975, 1982, 1990, 1999 and 2010.* The share of the workforce working in the industrial sector (the control group is made of the agricultural sector). Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*Share of workforce in services, 1968, 1975, 1982, 1990, 1999 and 2010.* The share of the workforce working in the service sector (the control group is made of the agricultural sector). Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*Share of Executives in Workforce (age 25-54), 1968, 1975, 1982, 1990, 1999 and 2010.* The share of executives and other intellectual professions (i.e., engineers, executives, journalists, wage-earners in the arts, information, entertainment sectors, secondary school and university teachers) in the workforce age 25-54. Individuals in this group have a high-level of human capital. Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*Share of Intermediary Professionals in Workforce (age 25-54), 1968, 1975, 1982, 1990, 1999 and 2010.* Source: The share of middle management professionals (i.e., technicians, foremen, supervisors, primary school teachers, nurses) and employees (unqualified or qualified industrial and farm workers, as well as workers working for craftsmen) in the workforce age 25-54. Individuals in this group have a medium-level of human capital. Source: The successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

*Share of Employees in Workforce (age 25-54), 1968, 1975, 1982, 1990, 1999 and 2010.* The share of employees (unqualified or qualified industrial and farm workers, as well as workers working for craftsmen) in the workforce age 25-54. Individuals in this group have a low-level of human capital (the control group is made of farmers, artisans and other self-employed individuals). Source: The

successive censuses conducted by the French bureau of statistics (INSEE - *Institut National de la Statistique et des Etudes Economiques*) in 1968, 1975, 1982, 1990, 1999 and 2010.

## Explanatory variables

*Horse power of steam engines.* This variable reports the total horse power of the steam *Engines* in the firms of each department, which is computed from the industrial survey carried out by the French government between 1860 and 1865. See Chanut et al. (2000) for details on the implementation of this survey.

*Town 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).

*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.

*No engine in 1860-1865.* This dummy variable takes the value one if the industrial survey carried out by the French government between 1860 and 1865 indicate that there was not any steam engine in the firms of a department 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 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  $\text{cm}^3$ , 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.

## Instrumental variable

*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.

## Variables for robustness analysis

### Education before 1840

*Percentage of conscripts who could read, 1827-1829, 1831-1835 and 1836-1840.* 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>.

### Economic development before 1815

*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).

### 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).

### 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>.

### Share of the native population

*Share of the native population in each department, 1901.* This variable is constructed as the share of the population born in a given department, out of the total population inhabiting this department in the 1901 census of the French population. Source: *Annuaire Statistique De La France* (1878-1939).

*Share of the native population in each department, 2010.* This variable is constructed as the share of the population born in a given department, out of the total population inhabiting this department in the 2010 census of the French population. Source: (INSEE - *Institut National de la Statistique et des Etudes Economiques*).

## **Soldier deaths in World Wars**

*Soldier deaths, World War I and World War II.* Number of soldiers born in each department who died in World War I and in World War II. Source: French Ministry of Defense's website [www.memoiredeshommes.sga.defense.gouv.fr](http://www.memoiredeshommes.sga.defense.gouv.fr).

## **Share of unionized workers in workforce**

*Share of unionized workers in workforce, 1901.* The share of individuals in the workforce who belonged to an union in 1901 in each department. Source: France. Ministère du travail et de la prévoyance sociale (1911).

*Share of unionized workers in workforce, 1930.* The share of individuals in the workforce who belonged to an union in 1930 in each department. Source: *Annuaire Statistique De La France* (1878-1939).

## **Average wage, 1901 (in French Francs)**

*Average male wage, 1901.* Each department's average wage for men in 1901. Source: France. Ministère du travail et de la prévoyance sociale (1911).

## **Concentration index, 1861**

*Concentration index.* This variable computes the Herfindahl index of industry concentration for each department using the 16 different industries listed in the 1860-1865 industrial survey (textile, mines, metallurgy, metal objects, leather, wood, ceramics, chemistry, construction, lighting, furnitures, clothing, food, transportation, sciences & arts, and luxury goods). The Herfindahl index of industry concentration is defined as,  $H_d = \sum_{i=1}^{16} (E_{i,d}/E_d)^2$ , where  $H_d$  is the Herfindahl concentration index for department  $d$ ,  $E_{i,d}$  is the horse power of the steam engines in the firms in sector  $i$  of department  $d$  and  $E_d$  is the horse power of the steam engines in the firms of department  $d$ . Source: Chanut et al. (2000)

## **Weighted tariffs across sectors**

*Weighted tariffs across sectors.* The weighted average of the tariff rates for each of the 16 sectors listed in the 1860-1865 industrial survey (textile, mines, metallurgy, metal objects, leather, wood, ceramics, chemistry, construction, lighting, furnitures, clothing, food, transportation, sciences & arts, and luxury goods) in 1865, 1872, 1901 and 1924, where the weights by the shares of the horse power of the steam engine horse in each department. Source: Chanut et al. (2000) for the industrial survey and Dormois (2006, 2009) for the tariffs..