The Consequences of the French Revolution in the Short and Longue Durée *

Raphaël Franck
Hebrew University of Jerusalem and Marie Curie Fellow at Brown University

Stelios Michalopoulos
Brown University, CEPR and NBER

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Abstract

This study explores the consequences of the French Revolution in the short and longue durée. Specifically, we trace the impact of the *émigrés*' exodus during the Revolution on regional economic performance over time. Instrumenting emigration intensity with local temperature shocks in the summer of 1792, a period marked by major political events including the abolition of the Constitutional Monarchy and bouts of violence, we find that *émigrés* have a non-monotonic effect on local comparative development unfolding over the subsequent 200 years. During the 19th century there is a significant negative effect of emigration on income per capita which becomes positive in the second half of the 20th century. The reversal can be partially attributed to the reduction in the share of the landed elites in high-emigration regions. The resulting fragmentation of agricultural property reduced labor productivity depressing overall income levels in the short run. However, once education became free at the end of the 19th century, the lower opportunity cost of schooling across high-emigration regions facilitated the rise in human capital investments, eventually leading to a reversal in the pattern of regional comparative development.

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1 Introduction

Tracing the origins and consequences of major political upheavals occupies an increasing part of the research agenda among economists and political scientists. The Age of Revolution in Europe and the Americas, in particular, has received much attention as these major political disruptions are thought to have shaped the economic and political trajectories of the Western World towards industrialization and democracy. This broad consensus concerning their paramount importance, nevertheless, goes in tandem with a lively debate regarding the exact nature of their consequences.

The voluminous literature on the economic legacy of the French Revolution attests to this. On the one hand, there is a line of research that highlights its pivotal role in ushering the French economy into the modern era (Crouzet (2003)). This perspective, which begins with 19*th* century thinkers of different persuasions such as Thiers (1823–1827), Guizot (1829-1832) and Marx (1843 [1970]) and is continued during the 20*th* and 21*st* centuries by broadly left-leaning scholars (Jaurès (1901-1903), Soboul (1962), Hobsbawm (1990), Garrioch (2002), Jones (2002), Heller (2006)), views the 1789 French Revolution as the outcome of the long rise of the bourgeoisie, whose industrial and commercial interests prevailed over the landed aristocracy. These authors, in making their case, stress the benefits from the weakening of the *Ancien Régime* as manifested in the abolition of the feudal system, the consolidation of private property, the simplification of the legal system and the reduction of traditional controls and fiscal hindrances to commerce and industry.

On the other hand, mostly liberal or conservative intellectuals (e.g., Taine (1876 –1893), Cobban (1962), Furet (1978), Schama (1989)) emphasize that France remained an agricultural country vis-à-vis England and Germany until 1914. They argue that the French Revolution was not motivated by differences of economic interests between the nobility and the bourgeoisie (Taylor (1967), Aftalion (1990)), but was rather a political revolution with social and economic repercussions.[1] They consider that the French Revolution was actually "anti-capitalist" (Cobban (1962)), and this explains the persistent agricultural character of France during the 19*th* century. Such studies emphasize the cost of war and civil conflict, the development of an inefficient bureaucracy and the adverse impact of changes in land holdings on agriculture.

In this study we attempt to shed some light on the short and long-run economic consequences of the French Revolution across *départements* (the administrative divisions of the French territory). Specifically, we exploit local variation in the weakening of the *Ancien Régime* reflected in the different emigration rates across *départements*. During the Revolution, close to 129,000 individuals emigrated to various European countries and the United States (Greer (1951)). Among

[1] Along this line of thinking, Maza (2003) argues that there was no genuine French bourgeoisie in 1789 as none of the politicians deemed to represent the bourgeoisie expressed any consciousness of belonging to such a group.

the *émigrés*, nobles, clergy members, and wealthy landowners were disproportionately represented. While the first *émigrés* left as early as 1789, the majority actually fled France, during and after the summer of 1792 (Taine (1876 –1893), Duc de Castries (1966), Bouloiseau (1972), Boisnard (1992), Tackett (2015)), when the Revolution took a radical turn which French historian Georges Lefebvre called the "Second Revolution" (Lefebvre (1962)). After the storming of the Tuileries Palace on August 10th, 1792, King Louis XVI was arrested and a de facto executive was named by the Legislative Assembly. Fear that foreign armies would attack Paris ignited a wave of violence throughout France that culminated in the "September Massacres" in Paris on September 2*th*-6*th*, 1792 (Caron (1935), Bluche (1992)). On September 21*st*, 1792, the hitherto uneasy coexistence of the Monarchy and the Revolutionaries came to an abrupt end with the proclamation of the Republic. Four months later, on January 21*st*, 1793, King Louis XVI was guillotined.

In this backdrop of overall uncertainty and political turmoil, our identification strategy exploits local variation in temperature shocks during the summer of 1792 to get plausibly exogenous variation in the rate of emigration across *départements*. The logic of our instrument rests on a well-developed argument in the literature on the outbreak of conflicts that links variations in economic conditions to the opportunity cost of engaging in violence. To the extent that temperature shocks decrease agricultural output, an increase in the price of wheat (the main staple for Frenchmen in the 18*th* century)[2] would intensify unrest among the poorer strata of the population, thereby magnifying emigration among the wealthy supporters of the falling Monarchy. Indeed we show that, in August and September 1792, there were more riots in *départements* that experienced larger temperature shocks.

To be sure, violence during the French Revolution was rampant and multifaceted. As discussed by Gueniffey (2011), it took several forms including the violence of the crowds, where groups of people vandalized shops and killed politicians (e.g., Jacques de Flesselle, Jean-Bertrand Féraud) or civilians, the top-down planned annihilation of local populations exemplified by the civil war in the *Vendée département*, the use of the judicial system to assassinate political opponents during the Reign of Terror and the war launched against foreign countries. Reassuringly, we show that temperature shocks during the other years of the Revolution do not predict neither emigration rates nor subsequent economic performance. Moreover, the temperature shocks in the summer of 1792 are mild compared to other years during the Revolution, thereby suggesting that ordinary income fluctuations in presence of major aggregate political events may have a persistent effect on subsequent development.

Our findings suggest that *émigrés* have a non-monotonic impact on comparative economic

[2] On the importance of wheat and bread in France in the 18th century, see, e.g., Kaplan (1984) and Kaplan (1996). See also Persson (1999) on grain markets during this period.

growth unfolding over the subsequent 200 years. Namely, high-emigration *départements* have significantly lower GDP per capita during the 19*th* century but the pattern reverses over the 20*th* century. Regarding magnitudes, we find that half-a-percentage point increase in the share of *émigrés* in the population of a *département* (which is the median emigration rate) decreased GDP per capita by 12.7 percent in 1860 but increased it by 8.8 percent in 2010.

The reversal can be partially attributed to changes in the composition of agricultural land holdings. Using the agricultural census of 1862, we show that high-emigration *départements* have fewer large landowners and more small ones. Indeed, the size of the average farm in France in 1862 was 23.12 acres and therefore, much smaller than the average farm in England in 1851 and the average farm in the USA in 1860 whose size amounted to 115 acres and 336.17 acres, respectively (Shaw-Taylor (2005), Fiszbein (2016)).[3] This pattern of fragmented land holdings has remained largely in place in France to this day. Furthermore we show that, during the 19*th* century, this reduction in the preponderance of large private estates and the development of a small peasantry negatively impacted agricultural productivity via limited mechanization and hence, overall income in a stage of development when agriculture constituted the largest share of the economy. Nevertheless, once the French state instituted free and mandatory education in 1881-1882, it is in these initially lagging *départements* where human capital accumulation took off at the turn of the 20*th* century, leading eventually to higher income per capita in the later part of the 20*th* century. This finding is consistent with recent studies in developing countries which show that increases in agricultural productivity reduce school attendance by increasing the opportunity cost of schooling for children,(see, e.g., Shah and Steinberg (2015)). Moreover, we show that the share of rich individuals in the population of high-emigration *départements* during the 19th century was significantly smaller compared to regions where few *émigrés* left. This absence of a critical mass of sufficiently wealthy individuals in the era of capital intensive modes of production may also explain the low degree of industrialization in the high-*émigrés* *départements* during the 19*th* century. By establishing a causal link between the rate of structural transformation across regions in France and the intensity of emigration, we shed new light on an intensely debated topic, i.e., that of the economic legacy of the 1789 Revolution within France.

Our research is related to the literature on the economic consequences of revolutions and conflict. The latter is voluminous (see, e.g. Blattman and Miguel (2010) for a thorough review) and usually focuses on the impact of these events on the proximate factors of production. Recent

[3] In Table A.1 in the Appendix, we distinguish between French *départements* and US counties which were above and below the median value of grain production in 1862 and in 1860, respectively. We also provide descriptive statistics excluding French farms below 5 hectares and US farms below 9 acres so as to focus on farmers who were presumably above subsistence levels (this robustness check is motivated by the 1860 US census does not record plots less than *three* acres). Under all these metrics, Table A.1 shows that French farms were consistently smaller than the US ones.

studies have shifted their attention to the institutional legacies of conflict. In this respect, our work is closely related to Acemoglu, Cantoni, Johnson, and Robinson (2011). The latter explores the impact of institutional reform caused by the French occupation of German territories. Consistent with the view that barriers to labor mobility, trade and entry restrictions were limiting growth in Europe, they find that French-occupied territories within Germany eventually experienced faster urbanization rates during the 19*th* century. In our case, by focusing on *départements* within France where the type of institutional discontinuities exploited by Acemoglu, Cantoni, Johnson, and Robinson (2011) is largely absent, we investigate a complementary issue: we examine whether, conditional on the nationwide consequences of the radical institutional framework brought forward by the French Revolution, the local weakening of the *Ancien Régime*, reflected in the differential rates of emigration across *départements*, had a long-lasting impact on local development. Moreover, thanks to the wealth of French data, we are able to trace the unfolding consequences of one aspect of the French Revolution, that of the weakening of the local elite, over a significantly longer horizon. Thus, our study is also closely related to Dell (2012) on the Mexican Revolution. She finds that land redistribution was more intense across municipalities where insurgent activity was higher as a result of droughts on the eve of the Revolution, leading to lower economic performance today. This negative impact can be traced to the extent of land redistribution in the regions where the Mexican state has maintained ultimate control over the communal land known as *ejidos*.

Moreover, by looking at the impact of emigration across *départements*, our study contributes to a growing literature that investigates the economic consequences of disruptions in the societal makeup of a region.[4] Nunn (2008) and Nunn and Wantchekon (2011), for example, explore the consequences of the slave trade for African countries and affected groups whereas Acemoglu, Hassan, and Robinson (2011) focus on the impact of the mass murder of Jews in the Holocaust during WWII on the subsequent development of Russian cities. Finally, our research is also related to studies by Galor and Zeira (1993) and Galor and Moav (2004) which argue for a non-monotonic role of equality in the process of development. When growth is driven by physical capital accumulation, a larger share of sufficiently wealthy families (as it was the case for the low-emigration *départements*) would be beneficial to local growth during the 19*th* century, whereas having more evenly distributed wealth levels would allow for higher human capital accumulation translating into better economic outcomes during the 20*th* and 21*st* centuries. This intuition may partially rationalize the progressively positive impact of emigration in the long-run, as *départements* with more *émigrés* were characterized by the presence of many small landowners.

The rest of the paper is organized as follows. Section 2 provides some historical background

[4] An early contribution includes the study by Davis and Weinstein (2002) who find that the dramatic population decline of Japanese cities during WWII had no long-lasting consequences on local development.

on emigration and land redistribution during the French Revolution. In Sections 3 and 4 we present the data and our empirical methodology. In Section 5 we analyze our results while in Section 6 we discuss some of the potential mechanisms that can account for the observed pattern. In Section 7 we offer some concluding remarks.

2 Historical Background

2.1 The Outbreak of the Revolution, Violence and Emigration

In 1789, on the eve of the Revolution, France was the most populous country in Europe, with about 23 to 26 millions inhabitants. It was also the largest economy in Europe, although wages were lower in France than in England.[5] Politically, France was a monarchy where King Louis XVI's subjects were divided into three orders: the nobility comprised between 150,000 and 300,000 members, the clergy around 100,000 members while the Third Estate (artisans, bankers, lawyers, salesmen, peasants, etc.) made up the rest. This political structure was to end with the Revolution.

Overall, most historians now agree about the immediate causes of the French Revolution. On the one hand, the *Ancien Régime* experienced a fiscal crisis in the late 1780s, which mainly resulted from the French financial and military support to the American war of independence, and by an inefficient tax system in need of reform. On the other hand, 1788 and 1789 were two consecutive years of abnormal weather conditions throughout the country, leading to bad harvests and peasant revolts (see Aftalion (1990), Tackett (2015) for a discussion).

Other elements pertaining to the structural causes of the French Revolution are still debated. Some have emphasized the rise of the bourgeoisie while others have focused on conflicts within the nobility and within the Third Estate (Furet (1978)). Such a debate is keenly related to the importance of ideas in the unfolding of events, and, in particular, to the violence of the French Revolution, leading to a declaration of war against foreign countries and to internal conflict. As noted by Israel (2014), there were revolts before and after the French Revolution which did not have major political and economic consequences: it is therefore difficult to argue that ideas would not have played a role in the transformation of French society. These ideas actually relate to some of the deeper roots of the French revolution. They include the development of a French national identity encouraged by the Monarchy in the wake of the seven-year war defeat (1756-1763) as well as the development over two centuries of a national state with a centralized administration which gradually made local aristocrats, who used to serve as local justice officers,

[5] On wages and income in France in the 18*th* and 19*th* centuries, see, e.g., Labrousse (1933) and Toutain (1987). For a discussion of wages in Europe during this period, see, e.g., Allen (2001), van Zanden (1999) and Angeles (2008).

costly and redundant (Tocqueville (1856)). These ideas also relate to the thought of enlightenment philosophers and their revolutionary disciples: they were quick to criticize monarchies and revealed religions, but were oblivious to their optimistic faith in reason, in nature and in the people.[6] When every revolutionary thought that he (or she) represented the "people", and that his (or her) actions are guided by the "will of the people", then he (or she) felt legitimized in using violence so that his (or her) revolutionary ideas prevailed.[7] This viewpoint also explains, as Furet (1978) noted, the obsession of revolutionaries with treasons and conspiracies: the revolution was inherently good, seen as freeing the entire population from tyranny, and therefore, only hidden and evil forces would oppose it. This "revolutionary mentality" (Vovelle (1985)) may rationalize the revolutionaries' obsession with finding culprits and conspirators among their royalist opponents but also amidst the most devoted in their own ranks.[8]

Another set of issues which is still debated pertains to the consequences of the French Revolution. As we discussed in the introduction, there are divergent views among scholars. Some have argued that the Revolution changed the economic trajectory of France for the better whereas others stress its relative lack of industrial capacity and agricultural backwardness. Research arguing that the reforms brought about by the French Revolution were conducive to economic growth (e.g., Crouzet (2003)) is not, however, oblivious to the fact that France never caught up with England during the long 19*th* century and was overtaken by Germany by the turn of the twentieth century. It attributes the lackluster economic performance to revolutionary violence and subsequent political upheavals that characterized France during the 19*th* century. Nevertheless, revolutionary violence took several forms and did not affect France uniformly. While violent crowds operated in the major urban centers, mainly in Paris, Lyons and Marseilles (i.e., in the three largest cities), the civil war was mostly confined to the West of France, and was particularly intense in the *Vendée département*. In addition, the Terror, which can be characterized as the use of the judicial system to assassinate political opponents, was more intense in some areas of France than in others (Greer (1935), Gueniffey (2011)). But while these three forms of violence brought about the destruction of human and physical capital, few, if any, have argued that they had long-term negative economic consequences.

In fact, an aspect of revolutionary violence which may have had long-term economic consequences pertains to the individuals who fled France during the Revolution. These individuals were designated by the French revolutionary government as *émigrés* and their property was con-

[6] On the relationship between Enlightenment philosophy and the revolution, see notably, Mornet (1933) and Martin (2006), and specifically Koyré (1948) on Condorcet, the only enlightenment philosopher who took an active part in the Revolution.

[7] On the political role of women during the Revolution, and on the opposition that they faced from male revolutionaries, see, e.g., Landes (1988)

[8] As revolutionary leader Jacques-Pierre Brissot exclaimed in a 1791 speech: "We need great treasons" (Brissot (1792)).

fiscated by the State. Greer (1951) combined different sources and reckoned that around 129,000 *émigrés* left France during the Revolution, i.e., about 0.6% of the population of each *départe-ment.* The data of Greer (1951) also suggest that there was substantial variation in the rates of emigration within France. Panel A of Figure 1 displays the intensity of *émigrés* as a share of the population throughout France, and Panel A of Table 1 lists the *départements* with the highest and lowest emigration rates. Moreover, most, but not all, *émigrés* belonged to the local elite as can be seen in Panel B of Table 1. They were mainly noblemen and clergymen, as well as wealthy urban dwellers and rural landowners from the Third Estate whose property was confiscated and sold (some even lost the property of the Church that they had acquired in the early stage of the Revolution). As we shall argue below, emigration influenced the local economy by curtailing the high end of the local income distribution.

2.2 Land Redistribution During the Revolution

During the French Revolution a significant amount of land was seized and sold by the government under the name of *biens nationaux* (national goods). This land initially belonged to the Church, the *émigrés,* and the counter-revolutionaries. The property of the Church was first seized by the French revolutionaries to pay off the debts of the French state on November 2*nd*, 1789. The property of the *émigrés* and counter-revolutionaries was also seized for that purpose, as well as to punish them for leaving France, by a law passed on July 27*th*, 1792. It is not really clear, however, that the French state recovered much from those sales as the inflationary policies of the revolution made revenue from the sales worthless.[9] In addition, the French Revolution defined clear property rights on the commons of the villages: some of the common land was sold to private individuals while some of it was seized by the municipalities and later on, leased to farmers (Vivier (1998)).

The sale of the *biens nationaux* is considered by some historians as "the most important event of the French Revolution" (Lecarpentier (1908), Bodinier and Teyssier (2000)) and might have influenced long-term economic prospects for at least two reasons. First, the amount of land which was seized and sold by the government during the Revolution was significant; Bodinier (1999) estimates that 10% of land changed hands during the Revolution. Second, even though *émigrés* were invited to return to France in 1802 by Napoléon Bonaparte,[10] he forbade *émigrés* from reclaiming their landed property. Eventually the loss of their property was made definitive when it was reaffirmed by Louis XVIII (Louis XVI's brother) in the December 5*th*, 1814 law.

[9] For an overview of the successive laws pertaining to the sale of the *biens nationaux*, see Bodinier and Teyssier (2000). On macroeconomic policies during the French Revolution, see, e.g., Sargent and Velde (1995).

[10] Many, but the most loyal monarchists, came back to France before Napoleon's fall in 1815 Duc de Castries (1966). For instance, Francois-René de Chateaubriand came back in 1802, even though he had fought in the *armée des émigrés* against the revolutionary armies.

Emigrés (and their descendants) would eventually be compensated by the April 27th, 1825 law, which was known as the "milliard des *émigrés*" since these reparations amounted to nearly one billion of French Francs (nearly 10% of the French GDP in 1825 (Maddison (2001))). Some of the *émigrés* were therefore able to reconstitute their landed estate, others were still able to live a gentry life with more modest means but some became destitute.[11]

There is a lack of consensus as to who ultimately benefited from the sale of the *biens nationaux*. Schama (1989) suggests that the redistribution of land was not from the landed elite to peasants, but rather was a transfer of property within the landed classes. The members of the groups which were gaining economically before the Revolution and who managed to evade violence by adopting a revolutionary stance, among them many relatively wealthy urban bourgeois and small farmers, emerged richer since they bought at a low price the landed properties of the Church and of other landed individuals that fled (see, e.g., Marion (1908), Cobb (1972), Sutherland (2003)). Others have argued that the sale of the *biens nationaux* was detrimental to the living conditions of peasants during the 19*th* century because it created a small peasantry of subsistence, thereby consolidating the agrarian structure of France and delaying economic modernization (Loutchisky (1897), Lefebvre (1924)). Finally, some have argued that the redistribution of land was beneficial to French peasants: they became small-scale agrarian capitalists who focused on market production (Ado (1996)).[12]

Nevertheless, local monographs on the sale of the *biens nationaux* suggest that the eventual extent of land redistribution and its beneficiaries, crucially depended on the extent of local emigration during the French Revolution (see Bodinier and Teyssier (2000), for a survey of local monographs). This is, in itself, to be expected since the *biens nationaux* were partly the property of the *émigrés* which was seized by the government. To illustrate this argument, we provide three examples pertaining to the change in ownership structure as a result of the sale of the *biens nationaux* in three *départements* with a high-, median and low-share of *émigrés* in the local population. First, in Ille-et-Vilaine, which was a relatively high-*émigré département*, many aristocrats lost part or all of their properties. The castle and the domain of the Vaurouault family, near Saint-Malo, were sold as *biens nationaux* in 1793. The family bought back the castle at the beginning of the 19*th* century but permanently lost the domain to small peasants (see Boisnard (1992)). Another aristocratic family in Ille-et-Vilaine that lost some of its land was that of Francois-René de Chateaubriand, the romantic writer, and heir to one of the oldest baronies in

[11] Aristocrats like the Marquis de Dreux-Brézé in Sarthe and Barral de Montferrat in Isère emerged financially unscathed from the Revolution Schama (1989). Lafayette seemed to have lost a lot of his property and led a more modest life (see Furet and Ozouf (1988)). Others, like Mme Lalanne, born Dudevant de Villeneuve, solicited her admission to the poor house in Bordeaux (Gironde) that she had founded before the Revolution. (Boisnard (1992)).

[12] McPhee (1999) provides some positive anecdotal evidence on small landowners who engaged in wine production in Herault. See also Jones (1988) on the peasantry during the French Revolution.

Britanny. This unfortunate turn of event for Francois-René de Chateaubriand's family explains why he was adamant that *émigrés* should be compensated during his political career in the later part of his life (Chateaubriand (1847), pp.517-533). Second, in the Nord *département*, which was a median intensity emigration *département* (2635 *émigrés*, i.e., 0.35% of the *département*'s population), Lefebvre (1924) provides information for 15 villages in the district of Avesnes, which we report in Table 2. There was a substantial transfer of property from nobles to peasants and urban bourgeois. Moreover, part of the land, often commons, whose property was in dispute was acquired by the state, i.e., either the central government or the local towns. Finally, in Cher, which was the third lowest emigration *département*, Marion (1908) documents that there was very little land redistribution or if there was, it benefited individuals who were already well off. For instance, in the commune of Ivoy-le-Pré, not a single plot of land owned by an *émigré* was sold while a large domain was transferred from the abbey of Laurois to a major secular landowner, the local *fermier-général* (a private tax collector under the *Ancien Régime*). Similarly, in the commune of Menetou-Râtel (2801 ha, 1195 inhabitants), only 25 properties were sold and 13 out of the 17 buyers were already major or medium-size landowners.

It is against this background that we argue that the share of *émigrés* in each *département* is a good proxy for the extent of land redistribution and the disappearance of the landed elite which characterized the *Ancien Régime*. Therefore, it can be used to assess the legacy of the 1789 Revolution in France.

3 Data

3.1 Measures of Income, Workforce and Human Capital

This study seeks to examine the effect of emigration during the French Revolution on the evolution of income per capita. To capture the short- and medium-run effects of emigration on income per capita at the *département* level prior to WWII, we use data on GDP per capita as reconstructed by Combes, Lafourcade, Thisse, and Toutain (2011) and Caruana-Galizia (2013) for 1860, 1901 and 1930. To assess the effect of emigration on GDP per capita in the long run, we use data in 1995, 2000 and 2010 from the French National Institute of Statistics (INSEE - Institut National de la Statistique et des Etudes Economiques).[13] We also construct the value added per worker in the agricultural, industrial and service sector using the data of Combes, Lafourcade, Thisse, and Toutain (2011), who assess the value added in each of these three sectors in 1860, 1930, 1982 and 1990, and the occupational data from the governmental surveys carried out from the 19*th* century onwards (Statistique Générale de la France) & (INSEE - Institut National de la Statistique et des Etudes Economiques). The descriptive statistics in Table A.2 indicate that the shares of the

[13] Post-WWII data on income per capita at the departmental level are not available before 1995.

workforce in the industrial and service sectors in the workforce grew, respectively, from 21.6% and 15.3% in 1860 to 30.1% and 24.8% in 1930. Nonetheless those data show that nearly half of the French population still worked in the agricultural sector before WWII. However, by 1990, the share of the agricultural workforce had declined considerably as the shares of the French workforce in the industrial and service sectors amounted to 30.7% and 60.0% respectively.

The study explores the effect of the French Revolution on the evolution of human capital from the 19*th* century until today. Between 1841 and 1936, we focus on French army conscripts, i.e., 20-year old men who reported for their mandatory military service in the *département* where their father lived: we can distinguish between conscripts who could neither read nor write, those who could read but could not write, and those who could read and write. Moreover, between 1874 and 1936, we can also distinguish between French army conscripts who had completed high-school (France - Ministère de la Guerre (1839-1937)).[14] Our data show that 56.1% of Frenchmen could read and write in 1841, 82.2% in 1874 and 93.5% in 1936. However, only a tiny fraction of the French conscripts completed high school, i.e., 0.6% in 1874 and 3.1% in 1936. Our post-WWII measures of human capital rely on the successive population censuses carried out in France in 1968, 1975, 1982, 1990, 1999 and 2010. They enable us to compute the flow of men between the age of 16 and 24 in each *département* who completed high school and/or had a college degree. Finally, we use the data from Bonneuil (1997) on fertility and infant mortality as additional measures of local economic development during the 19th century. The fertility rate is computed as the Coale fertility index (Coale (1969)) for each *département* while the infant mortality is computed as the share of children who died before their first birthday.

3.2 *Emigrés* during the French revolution

Our main independent variable is the share of *émigrés* in the population of each *département*. It is computed with the data compiled by Greer (1951) from several original governmental sources. Indeed the April 8*th*, 1792, law defined as *émigrés* all the individuals absent from the *département* in which they possessed property, and, as a result of the July 27*th*, 1792, law, whose property could be seized by the French state. The sources are mostly official publications such as the *Liste Générale, par Ordre Alphabétique, des Emigrés de toute la République* (1792-1800) (General List in Alphabetical Order of Emigrés throughout the Republic), local lists of *emigrés* as well as the list of individuals who received compensation after 1825 for the property they lost during the Revolution.[15] Greer (1951) lists 129,091 individuals as *émigrés*, which is about 0.6% of

[14] These data are not subject to self-selection because every Frenchman had to report for military service. However, changes in conscription rules meant that not every man eventually served during the 19th century (Crépin (2009)).

[15] France. Ministère des Finances. Etats Detaillés des Liquidations faites par la Commission d'Indemnité, a l'époque du 31 décembre 1826 en Execution de la Loi du 27 avril 1825, Paris, De l'Imprimerie Royale, 1827.

the population of an average *département*. However, (Greer (1951), p.17) acknowledges that his "(...) statistics, then, cannot pretend to absolute exactitude. They include an irregular margin of error. In a few places it may infringe as much as fifty per cent (e.g., in Var), in others it narrows to insignificance (e.g., in Basses-Alpes)".[16]

4 Empirical methodology

4.1 *Emigrés* and Temperature Shocks in the Summer of 1792

The summer of 1792, coined as the "Second Revolution" by Lefebvre (1962), was characterized by major political upheavals and widespread violence. The Legislative Assembly had already declared war on April 20*th*, 1792 against Austria. France attacked the Austrian Netherlands but Prussia joined forces with Austria and, at first, the French army suffered losses. These foreign armies were thought to be about to invade France and rumors spread in the Parisian population that nobles and priests were plotting with the leaders of the foreign armies. The Brunswick Manifesto, issued on July 25*th*, 1792, by Charles William Ferdinand, Duke of Brunswick, and commander of the armies allied against France, heightened the tensions as it threatened that Parisian civilians would be held personally responsible and tried in a military court if the members of the French royal family were harmed. While this measure was intended to intimidate the French revolutionaries, it only galvanized them. On August 10*th*, 1792, the radical Parisian *Sans-Culottes* supported by volunteers from Brittany and the South of France, attacked the King's castle, and jailed Louis XVI and his family. As rumors of foreign invasion intensified, aristocrats and priests who were thought to be a part of the conspiracy against the revolution became targets of violence. Then, on September 2*nd*-6*th*, 1792, the *sans- culottes*, who were mostly of bourgeois background Soboul (1958), slaughtered aristocrats and clergy members who were imprisoned in the Parisian jails, along with petty thieves and prostitutes. Similar episodes of violence occurred in various parts of France (Caron (1935), Bluche (1992), Markoff (1996)). The war took a different turn with the victory of the French revolutionary army on September 20*th*, 1792, at Valmy. The following day, the monarchy was abolished and the republic proclaimed. The trial of King Louis XVI's began on December 11*th*, 1792. On January 20*th*, 1793, the members of the National Convention voted 380 to 310 in favor of his execution and he was guillotined the next day.

In light of these major political events, there are many historical anecdotes describing how emigration accelerated during and immediately after the summer of 1792 (e.g., Taine (1876 –1893), Bouloiseau (1972), Tackett (2015)).[17] For instance, (Tackett (2015), p 215) writes that

[16] Higonnet (1981) suggests, for example, that there were about 25,000 noble émigrés instead of 16,431, as counted by Greer (1951)

[17] Several local historians explicitly trace local episodes of violence during the summer of 1792 (which are listed in Markoff (1996)) to emigration. For instance, in Var, a high emigration *département*, local violence took the

in September 1792: "Conditions had become so frightening that many wealthier families began fleeing Paris (...). Others, however seem to have concluded that the countryside was even more dangerous than Paris.". An additional historical piece of evidence pointing to the intensification of the emigration in the fall of 1792 is the reaction of the British government: it introduced the Aliens Act in the House of Lords on December 19*th*, 1792, in an attempt to regulate the uncontrolled influx of French foreigners which created significant anxiety in governmental circles.[18]

Given the historical background, it is important to realize that the observed relationship between emigration and regional development may reflect omitted variables which could explain both emigration and subsequent economic performance. For instance, if emigration was proportional to the pool of "potential" *émigrés*, then high emigration *départements* would be those with many nobles and many wealthy landowners. In other words, since we do not have data before and after the revolution on the relative size of each order, i.e., the nobility, the clergy and the Third Estate, observed emigration rates may be mechanically linked to the initial regional stock of the old elite in the region, thereby biasing our estimates.

To overcome this inherent bias, we exploit the spatial variation in the temperature shocks in the summer of 1792 as a source of exogenous variation for the share of *émigrés* in the population of each *département*. As such, our identification strategy is motivated by a strand of literature documenting the effect of climate on human activity and the outbreak of conflicts (see, e.g., Blattman and Miguel (2010) and Dell, Jones, and Olken (2014) for surveys). The logic is that abnormal weather conditions cause a temporary decline in agricultural output, i.e., a transitory negative income shock for farming-based economies. Such a shock decreases the opportunity cost of violence which in our historical context can be measured by the intensity of emigration rates across *départements*.

In what follows, we explore the effects of the differential pattern of emigration during the Revolution, which we show to be driven by transitory local weather shocks in the summer of

form of several days of rioting in Toulon, between July 28*th*, 1792 and September 10*th*, 1792, where local Jacobins targeted aristocrats, military officers and wheat traders whom they considered hostile to the revolution (Havard (1911-1913)). Members of these groups fled France to nearby Italy. In Ariège, a low emigration *département*, violence began in late August 1792 (Arnaud (1904)). On August 28*th*, 1792, during the lottery for conscription in the town of Pamiers, a riot began when a man accused the members of the royalist municipal council of stealing the donations for the army soldiers. One municipal council member was killed and the houses of the other members of the municipal council were ransacked. Those riots, which were led by the local Jacobins, spread to other towns in the *département*, notably Mirepoix and Tarascon. Between September 21*st* and October 1*st*, 1792, castles were ransacked and burnt by a band of peasants led by a local Jacobin. According to Arnaud (1904), these events led noblemen, bourgeois and refractory priests to move to Spain.

[18]Arguably, some émigrés had fled France before the summer of 1792. For instance, the count of Artois, who would become King Charles X (r. 1824-1830), left in 1789 and Jean-Joseph Mounier, one of the royalist leaders of the *Amis de la Constitution Monarchique*, fled in 1790. A few also left in the post-Thermidorian period in 1794-1795. But in any case, those who fled during and after the summer of 1792 knew that their property would be confiscated, given the laws on April 8*th*, 1792, and July 27*th*, 1792, laws on *emigrés* and the confiscation of their property, as well as the previous laws on the confiscation of the *biens nationaux* (Bodinier and Teyssier (2000))

1792, on the long-term process of development across French *départements*. Our conjecture is that emigration is likely to have had both medium- and long-run repercussions via the channels of land redistribution and the curtailing of the upper tail of the local income distribution. In this respect, it is worth pointing out that it stands to reason that any direct economic impact of the summer shocks of 1792 beyond their effect on emigration rates is unlikely to be quantitatively relevant several years after the event.

Note. In Appendix *A*, we offer two complementary pieces of evidence regarding the impact of temperature shocks on economic conditions and local violence. First, we show that higher temperature shocks translate into higher local wheat prices using data on the price of wheat during the latter part of the Revolution in the 1797-1800 period. Second, we establish quantitatively that deviations from average temperature in the summer of 1792 are systematically related to the incidence of peasant revolts during this period.

4.2 Confounding Characteristics of Each *Département*

4.2.1 Geographic Characteristics

In the empirical analysis we take into account the potentially confounding impact of the geographical characteristics of each French *département* on the relationship between emigration and subsequent economic growth. These controls are the *département*'s area, land suitability for agriculture, elevation, longitude and latitude (Ramankutty, Foley, Norman, and McSweeney (2002)). These geographic characteristics have an impact on natural land productivity and may consequently have affected the possibility and pace of the transition from agriculture to industry, and ultimately, productivity growth. Moreover, given the importance of deviation from temperature in 1792 for our identification strategy (see below), we control for the average temperature in the summer of 1792 (Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2004),Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2006), Pauling, Luterbacher, Casty, and Wanner (2006)). In addition, we take into account the distance from each *département*'s main administrative center (*chef-lieu*) to the coast, border and to the three largest urban centers (before the French Revolution, and to this day) Paris, Lyons and Marseilles. These variables capture the potential confounding effects of the geographic location of the *départements*, which may have affected their development via the proximity to trade routes.

4.2.2 Pre-Industrial and Institutional Characteristics

Pre-revolutionary differences in local development may have jointly affected emigration during the Revolution and the evolution of income per capita over time. To account for these differences in the empirical analysis we add different proxies. For example, to capture pre-revolutionary levels of human capital, particularly the upper end of the distribution, we use a dummy variable for the presence of a university in 1700 in the *département* (Bosker, Buringh, and van Zanden (2013)) and compute the share of the population that subscribed to the Quarto edition of the *Encyclopédie* in the mid-18th century (Darnton (1973), Squicciarini and Voigtländer (2015)). We also define a variable for the number of mechanical mills in 1789 used in textile production (Bonin and Langlois (1997)). Finally, we add a dummy for the *départements* which Vivier (1998) singles out as having few commons just before the outbreak of the Revolution.

4.3 Temperature Shock Construction

Our temperature data come from the European Seasonal Temperature and Precipitation Reconstruction project, which was developed by paleoclimatologists at the University of Berne (Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2004),Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2006), Pauling, Luterbacher, Casty, and Wanner (2006)). These are season-specific reconstructions for the 1500-1900 period, with a resolution of 0.5 by 0.5 dd. These data are assembled using a multiplicity of indirect proxies such as tree rings, ice cores, corals, ocean and lake sediments as well as historical documentary records. As such, measurement error may be non-trivial. Moreover, climatic records are interpolated over relatively large areas resulting on average in two cells per *département*.[19] According to the authors, the quality and breadth of the underlying sources improve over time, particularly from the end of the 18th century onwards.

We follow Hidalgo, Naidu, Nichter, and Richardson (2010) and Franck (2016) and employ two alternative measures of temperature shocks in the summer of 1792. First, we use the squared deviation of temperature

$$Z_{d,t,s} = \left(\frac{x_{d,t,s} - \overline{x}_{d,s}}{\sigma_{d,s}} \right)^2$$

where the temperature $x_{d,t,s}$ in *département* d in year t of season s is standardized by the mean $\overline{x}_{d,s}$ and the standard deviation $\sigma_{d,s}$ of temperature in each *département* d in season s, where both the mean and standard deviation are computed over a baseline period. The baseline period which we use to compute $\overline{x}_{d,s}$ and $\sigma_{d,s}$ comprises all the summer temperatures in the 25 years before 1792, i.e., from 1767 until 1791. As we discuss below, we consider several robustness checks to this baseline specification.

Second, we define the absolute deviation of temperature

[19] *Départements* were designed in 1790 to be of relatively small size so that it would take at most one day of horse travel to reach the *département*'s administrative center from any location in the *département*. On average, the *département*'s area is $6,000$ km^2, which is approximately the size of the US state of Delaware.

$$Z_{d,t,s} = \left| \frac{x_{d,t,s} - \overline{x}_{d,s}}{\sigma_{d,s}} \right|$$

Panel B of Figure 1 maps the spatial distribution of the mean temperature in the summer of 1792 while Panel C of Figure 1 portrays the squared deviation of temperature in summer 1792. In Panel D we present these temperature shocks after partialling out the time-invariant reflected in the geographic set of controls described above. The depicted variation in temperature shocks of Panel D is our source of identification.

It is important to note that the summer of 1792 was a mild summer compared to the other summers during the Revolution. The descriptive statistics in Tables A.2 and A.23 show that the summer of 1792 is at the median of the summer temperature distribution during the 1788-1799 period. The average temperature in summer 1792 was 17.97, its standard deviation 1.36, the minimum temperature 13.69 was while the maximum temperature was 21.82. The temperature in summer 1792 was therefore less unusual than the summers in 1788 and 1789 which led to the outbreak of the revolution. In fact, the descriptive statistics in Table A.2 show that the average temperature shock in the summer of 1792 (using the 25 previous summers as the baseline period) was milder than any other summer temperature shock during the 1788-1799 period.

4.4 Empirical Model

The effect of emigration during the French Revolution on economic development is estimated using 2SLS. The second stage provides a cross-section estimate of the relationship between the share of *émigrés* in the population in each *département* during the Revolution and measures of GDP per capita, human capital and additional economic outcomes at different points in time:

$$Y_{d,t} = \alpha + \beta E_d + \mathbf{X\prime}_d.\omega + \varepsilon_{d,t}$$

where $Y_{d,t}$ represents some proxy of economic outcomes in *département* d in year t, E_d is the log of the share of *émigrés* in *département* d during the 1789 French Revolution, $\mathbf{X\prime}_d$ is a vector of economic, geographical and institutional characteristics of *département* d and $\varepsilon_{d,t}$ is an i.i.d. error term for *département* d in year t.

In the first stage, E_d, the log of the share of *émigrés* in *département* d during the French Revolution, is instrumented by $Z_{d,1792}$ the squared (or absolute) deviation of temperature in the summer of 1792 standardized by the mean and variance of summer temperatures in the 25 preceding years (1767-1791) as defined in Section 4.3.

$$E_d = \delta_0 + \delta_1 Z_{dt} + \mathbf{X\prime}_d.\omega + \mu_d$$

where $\mathbf{X'}_d$ is a vector of economic, geographical and institutional characteristics of *département d* defined in Section 4.2, and μ_d is an error term for *département d*.

5 Results

5.1 First-stage: Temperature Shocks in the Summer of 1792 and Emigration

The first stage results are reported in column (1) of Tables A.4 and A.5 where the instrumental variable is the squared and the absolute standardized deviations from average temperature in summer 1792, respectively. They show that temperature deviations in the summer of 1792 are positively and significantly correlated at the 1% level with variations in the share of *émigrés* across French *départements*. This effect is also quantitatively large with a beta coefficient equal to 0.549 (on the sample of 86 *départements*). Put it differently, a one standard increase in the squared deviation from temperature in summer 1792 (0.067) increases by 0.42% the share of *émigrés* in the population (relative to a sample mean of 0.47% and a standard deviation of 0.64%). Moreover, we note that the F-statistic in the first stage is equal to 16.86 in the specification where the instrumental variable is the squared deviation of temperature in 1792 and to 13.19 in the specification where the instrumental variable is the absolute deviation of temperature in 1792, suggesting that our instruments are not weak.

The validity of our instrument is confirmed by the reduced form regression results in Table A.6 where we show that both the squared and absolute deviations of temperature in summer 1792 are significantly correlated with GDP per capita in 1860 and 2010. Furthermore, Figure A.8 graphs the first-stage relationship between the squared deviation from average temperature in summer 1792 and the share of *émigrés*, conditional on geographic characteristics (in Panel A) and conditional on geographic and pre-1789 historical characteristics (Panel B).

Note. In the Appendix we provide several robustness checks on the uncovered link between temperature shocks in the summer of 1792 and variation in the share of *émigrés*. In particular, we show that emigration rates are neither explained by deviations from temperatures in the spring, fall or winter of 1792 in Tables A.4 and A.5, nor by deviations from temperatures in all the other summers between 1788 and 1800 in Table A.6 and Figure A.2. We also report in Table A.7 regressions showing that the first stage relationship between the squared temperature deviation in the summer of 1792 and the share of *émigrés* remains statistically significant when we correct for spatial correction in the error structure (Conley (1999)). Moreover, in Table A.8 in the Appendix, we show that our first stage regression results are robust to using other baselines, such as a 50-year rolling window based on summer temperatures between 1747 and 1791, a couple of fixed 25-year windows (1751-1775 and 1776-1800) or a fixed 50-year window (1751-1800). We also show in Table A.11 that squared and absolute deviations from standardized rainfall in the summer of 1792 do not explain variations in the share of *émigrés*. Furthermore, in regressions available upon request, we show that deviations from temperature in the summers from 1788 to 1800 do not systematically map into variations in the number of death sentences across France during the 1793-1794 Reign of Terror (Greer (1935)).[20] We also test in regressions available upon request additional specifications for the first stage regression and find that measures of abnormal temperatures other than the squared and absolute deviation of temperature in summer 1792 are less strongly correlated with the share of *émigrés* variable. In particular, we find that the one-sided deviation of temperature is only weakly correlated with the share of *émigrés,* thus suggesting that both higher and lower than average temperatures in the summer of 1792 contributed to the flight of the *émigrés*.

Finally, we provide in Table A.9 several tests in support of the validity of the exclusion restriction. These tests are meant to show that our instrumental variable, the standardized squared deviation from average temperature in summer 1792, is not correlated with omitted variables which may potentially influence emigration rates and the evolution of income per capita in the medium- and long-run. In Panel *A* of Table A.9, we focus on violence before 1789 and after 1815, as proxied by the "flour war" of 1775, which is viewed as the last major series of riots triggered by bad harvests and hunger before 1789 (Bouton (1993)), and by the post-1815 "white terror", when the royalist regime of Louis XVIII arrested and sentenced to death some of their revolutionary and Bonapartist opponents (Resnick (1966)). In Panel *B* of Table A.9, we examine the demands of the French population in 1789 as expressed in the *cahiers de doléances* (Hyslop (1934),Shapiro and Markoff (1998)). We aggregate at the *département* level the number of times major political and economic issues were mentioned in the *cahiers de doléances.*[21] Such issues include the approval of vote by head (a first step towards democratic voting which was in opposition to the vote by order as was the case under the *Ancien Régime*), state intervention in education, tendency to socialism as well as the abolition of guilds, feudal dues and serfdom. In Panel *C* of Table A.9, we measure human capital before the Revolution proxied by the share of brides and of grooms who could sign their wedding contracts over the 1686-1690 and 1786-1790 periods (Furet and Ozouf (1977)). Lastly, in Panel *D* of Table A.9, we assess the presence of the most prestigious noble families, as listed in the *Almanach de Saxe Gotha*, in 1750, which can be viewed as proxying for both the higher end of local human capital and regional political and economic power (Squicciarini and Voigtländer (2015)).[22] We find that the variables pertaining to

[20]We find that the unconditional relationship between temperature deviation in summer 1792 is significantly and positively correlated at the 10% level with the share of death sentences during the Reign of Terror, but that this effect is driven by the number of death sentences in one *département*, Loire-Inférieure.

[21]*Cahiers de doléances* were redacted at the level of the baillage, which was an administrative division of France under the *Ancien Régime*.

[22]The data of Furet and Ozouf (1977) and Squicciarini and Voigtländer (2015) do not cover all the French *départements* and cannot therefore be included as part of the historical controls in our baseline regressions.

violence, *cahiers de doléances* and pre-revolutionary human capital are not correlated with our instrument. As for the presence of nobles, we find that temperature deviation in the summer 1792 is negatively and significantly correlated at the 10% level with the share of *émigrés*, but that this effect is driven by an outlier *département*, Haut-Rhin. When the latter is removed the relationship becomes both economically and statistically insignificant.

5.2 The Effect of the Emigrés on the Economy in the Medium- and Long-Run

In this sub-section, we discuss the effect of emigration during the Revolution on several economic indicators over time, namely income per capita, sectorial labor productivity and the composition of the workforce.

5.2.1 Emigrés and the Evolution of Income per Capita

The relationship between emigration and income per capita until WWII is presented in Panel A of Table 3. As shown in columns (1), (5) and (9), the unconditional OLS relationship between emigration and GDP per capita is negative in 1860 and 1901, positive in 1930, but always insignificant. The relationship between emigration and income per capita in 1860 remains negative, with a larger estimate, and becomes significant when we account for geographical factors in column (2). Finally, mitigating the effect of omitted variables on the observed relationship, the 2SLS estimates in columns (3)-(4), (7)-(8) and (11)-(12) in Panel A of Table 3, where we use the temperature shocks in the summer of 1792 as the instrumental variable show that there is a negative and significant effect of emigration on income per capita in 1860 and 1901 as well as a negative but insignificant effect in 1930, whether we account for geographic controls only or adding both geographic and pre-historical controls.[23] A one-percent increase in the share of *émigrés* in a *département* decreases GDP per capita by 25.5 percent in 1860 and 37.6 percent in 1901.[24]

An additional way to assess the negative but eventually diminishing impact of emigration during the 19*th* and early 20*th* centuries can be seen in Figure A.4. It reports the coefficients associated with the share of *émigrés* variable in 2SLS regressions (available upon request) where the dependent variable is the Coale fertility index (Panel A) and infant mortality (Panel B) every decade between 1811 and 1901. A high share of *émigrés* has a positive and significant effect on

[23] The effect in 1901 is already insignificant when the instrument is the absolute deviation of temperature in summer 1792 as reported in Table A.10 in the Appendix.

[24] Few of our geographic and historical controls are significant in both 2SLS regressions reported in columns (8) and (12). Longitude is positively correlated with income per capita in 1860 and 1901, probably reflecting the fact that *départements* in the North of France were more industrialized. A lack of commons in the 1780s is also positively correlated with income per capita which could be expected since commons were detrimental to agricultural productivity. Finally, the distance between each *département* and the coast is negatively related to income, as landlocked *départements* could not profit from maritime trade.

fertility and infant mortality until the 1880s, and no significant impact afterwards.

The relationship between emigration and income per capita in the long-run is presented in Panel B of Table 3. As shown in columns (1), (5) and (9) unconditionally, emigration during the Revolution has an insignificant positive association with income per capita across *départements* in 1995, 2000 and 2010. This relationship remains positive, and becomes significant, once geographical features are accounted for in columns (2), (6) and (10). Finally, the 2SLS estimates in columns (3)-(4), (7)-(8) and (11)-(12) in Panel B of Table 3, suggest that emigration had a positive effect in the long-run. A one-percent increase in emigration increases GDP per capita in 1995 by 17.4 percent, in 2000 by 19.6 percent, and in 2010 by 17.6 percent.[25] Similar results are reported in Table A.10 in the Appendix where the instrumental variable is the absolute deviation from standard temperature in summer 1792.

As such, our 2SLS estimates in Tables 3 and A.10 indicate that there was a reversal of fortune regarding the effect of emigration on income per capita: *départements* with more emigration were poorer until World War I but by the turn of the 21*st* century were already richer. We illustrate this reversal by plotting in Panel A of Figure 3 the coefficients associated with the share of *émigrés* variables in the 2SLS regressions reported in Columns (4), (8) and (12) of Panels A and B in Tables 3 and A.10. Moreover, to show that the pattern of reversal is not driven by a specific group of *départements*, we plot in Panel B of Figure 3 the coefficients from 2SLS regressions on GDP per capita in 1860 and 2010 where we remove one "nuts" region at a time.[26]

This reversal in the impact of emigration is corroborated by the reduced form regressions reported in Table A.6 in the Appendix, where our instrument is found to be negatively and significantly correlated with income per capita in 1860 but positively and significantly correlated with income per capita in 2010. Figure 4 portrays the reduced form relationships between temperature shocks in 1792 and GDP per capita in 1860 and 2010. Moreover, the reduced form regressions in Table A.6 in the Appendix show that no temperature shock in the summers between 1788 and 1800, other than that of 1792, can explain this reversal. Finally we show that the sign and statistical significance in the reduced form relationship between temperature shocks in 1792 and GDP per capita in 1860 and 2010 is robust to using other baselines than the 25 years preceding 1792, i.e., using the 50 years before 1792 (1743-1791), or the 1751-1800, 1751-1775 and 1776-1800

[25] In the 2SLS regressions, only three of our geographical and historical variables have a systematic significant effect on GDP per capita in 1995, 2000 and 2010. We find that the distances from each *département* to Paris and to Lyons are negatively correlated with income, indicating the importance of these two major urban centers on income. Furthermore we find that the *département*'s area is positively correlated with income, suggesting that a relatively larger territory would be more conducive to the concentration of activities, especially in the service sector.

[26] The *nomenclature of territorial units for statistics* (or "nuts") is a standard for referencing administrative divisions within European Union countries. In this study, we use the first level of "nuts" for France.

periods in Table A.8 in the Appendix.

5.2.2 Emigrés, Labor Productivity and the Workforce

This subsection explores the effect of emigration on productivity and the workforce. In Panel A of Table 4, we examine the impact of emigration on the value added per worker in the agricultural, industrial and service sectors in 1860, 1930, 1982 and 1990, respectively. The 2SLS regressions in columns (1)-(3) show that emigration had a significant and negative impact on productivity in all three sectors in 1860. The regressions in columns (4)-(6) indicate that there was still a negative effect of emigration on agricultural productivity in 1930. However, in columns (7)-(12), the effect of share of *émigrés* on productivity in each sector in 1982 and 1990 is positive and significant.

The negative effect of the share of *émigrés* on agricultural productivity in the mid-19*th* century can be partially rationalized by the results in Table 5 where we assess the effect of emigration during the Revolution on the mechanization in agriculture in 1862. In all the 2SLS regressions in Table 5, we find a negative impact of emigration on all outcome variables, which is statistically significant for the quantity of fertilizer used and for a number of agricultural instruments (scarifiers, grubbers, searchers, seeders and tedders) per worker in the agricultural sector. These results are in line with the view that French agriculture remained relatively backward as a result of the French Revolution.[27]

In Panel B of Table 4, we examine the impact of emigration on the share of the workforce employed in the agricultural, industrial and service sectors. The 2SLS regressions in columns (1)-(3) show that emigration had a positive but insignificant impact on the share of the workforce in the agricultural sector in 1860, a positive and significant effect at the 10% level on the share of the workforce in the service sector but a negative and significant effect at the 1% level on the share of the workforce in the industrial sector. This last result suggests that the French Revolution delayed the structural transformation of France towards the industrial era (Cobban (1962)). Moreover, the regressions in columns (4)-(6) show that emigration still had an insignificant effect on the share of the workforce in the agricultural sector in 1930, a negative and significant effect at the 10% level on the share of the workforce in the industrial sector and a positive and significant effect at the 5%-level on the share of the workforce in the service sector. Finally, the regressions in columns (7)-(9) show that emigration had a negative and significant effect at the 1% level on the share of the workforce in the agricultural sector in 2010, as well as a positive and significant effect on the shares of the workforce in the industrial sector at the 5% level and in the service sector at the 1% level.

[27] In regressions available upon request, which are motivated by the study of Rosenthal (1988) on irrigation in the aftermath of the Revolution, we analyze the impact of emigration during the Revolution on the area drained in each department and the number of pipe factories using the information in Barral (1858). We find that emigration had a negative and insignificant impact on both variables.

All in all, the results in Tables 4 and 5 are in line with the baseline regressions in Table 3. They suggest that emigration during the French Revolution disproportionately and inversely affected agricultural productivity up until the WWII and slowed down the structural transformation towards industry during the 19th century. Nevertheless, since the second half of the 20*th* century high emigration regions have been hosting a more productive workforce in the industrial and service sectors.[28] In the next section, we discuss the potential channels for the observed pattern.

6 Mechanisms

In this section we explore potential channels which may rationalize the negative effect of emigration during the Revolution on the standards of living in the 19*th* century and its positive effect towards the end of the 20*th* century. First, we investigate how the absence of *émigrés* seems to have impacted the size and the composition of the local elites during the 19*th* century. Second, we analyze the impact of *émigrés* on land redistribution. Finally, we examine the effect of *émigrés* on the evolution of human capital in each *département* over time.

6.1 Emigration during the Revolution and the Economic Elites in the 19th Century

This section investigates whether the negative effect of emigration on the standards of living during the 19*th* century may be attributed to its impact on the local elites during this period. The 2SLS estimates in Table 6 focus on electors in 1839 under the regime of the July Monarchy (1830-1848). At that time, the voting franchise was restricted to men above the age of 25 who could pay 200 Francs worth of direct annual taxes. This was a significant amount; for instance, the average daily wage of bakers in Paris in 1840 was equal to four Francs (Chevallier (1887), p.46). The 2SLS estimates in column (1) in Table 6 show that the share of *émigrés* had a negative effect on the share of electors in the population in 1839. A smaller economic elite in high-*émigrés* areas reveals that the local elites were severely weakened by emigration during the Revolution, leaving these *départements* with fewer wealthy individuals who could eventually undertake the costly investments of industrialization. This finding is in line with the evidence in Table 4, that *départements* with a high share of *émigrés* were characterized by a lower productivity and employment in the industrial sector.[29]

[28] In Table A.12, we examine the impact of emigration during the Revolution on the population in *département* in Panel A as well as in the *chef-lieu* (i.e., administrative center) of the *département* in Panel B. We find that emigration during the Revolution has no impact on population density until WWII. We, however, find that at the turn of the 21st century, emigration during the Revolution has a positive impact on the size of the local population.

[29] In Table A.13, we examine the impact of emigration on financial development, as proxied by the amount of loans (in French Francs) granted by local savings banks and by the number of contracts sealed by notaries in each

Moreover, the estimates in Table 6 suggest that emigration had a negative effect on the share of landowners among the electors (column (2)), a positive but insignificant effect on the share of businessmen and professionals (i.e., doctors and lawyers) (columns (3)-(4)), as well as a positive and significant effect on the share of civil servants (column (5)). The finding in column (2) highlights the relative paucity of sufficiently wealthy landowners which may help explain the lower agricultural productivity in 1860 in high-emigration *départements*. We come back to this issue in the next section where we discuss in more detail the role of the composition of agricultural land holdings in shaping local development.

The estimate in column (5) in Table 6, which supports the idea that emigration contributed to the growth of the French administration and of the central state, is corroborated in Table A.14 in the Appendix that examines the impact of emigration on the share of civil servants in each *département* in 1851, 1866 and 1881. The results show that emigration had a positive and significant effect on the share of civil servants in 1851 and 1866 as well as a positive but insignificant effect in 1881. All in all, it is worth noting that these results are in line with the analysis of Tocqueville (1856) regarding the role of the French Revolution in the growth of the French State; they indeed suggest that there were relatively more civil servants, and presumably, a more powerful administrative machine, in the *départements* where the Revolution had been more intense, as proxied by the share of *émigrés* in the population.

6.2 Emigration during the Revolution and the Composition of Agricultural Holdings

In this section, we examine the impact of emigration on land redistribution. We already noted above that labor agricultural productivity was lower in *départements* with a higher share of *émigrés* characterized by fewer rich landowners that voted in the elections of 1839. Here we explore the latter in greater detail.

In the agricultural census of 1862 land holdings are categorized in brackets according to their size. The largest land holdings are those in the category above 40 hectares. Given the historical account and the evidence on the composition of the elites, one would expect to find that high-emigration *départements* have a dearth of large landowners. Indeed this is shown to be the case in column 1 of Table 7 where the dependent variable is the share of farms above 40 hectares: a 1% increase in the share of *émigrés* in the population decreases the share of farms above 40 hectares in 1862 by 1.54%. It is instructive to link this finding with the work of David

département (even though notaries had lost by the second half of the 19th century their central role as financial intermediaries which they had held prior to the Revolution Hoffman, Postel-Vinay, and Rosenthal (2000)). We find that emigration is negatively correlated with both measures during the 19th century (the effect is however only significant on the number of contracts sealed by notaries in 1861). Overall, the results suggest that the negative effect of *émigrés* on GDP per capita stemmed, partly if only weakly, from financial underdevelopment.

(1975) (pp.221-231) on the adoption of the mechanical reaper for harvesting wheat in 1854-1857 in the USA. He finds that the latter was economically viable only for farms of at least 15 to 22 hectares. In 1862 only 13% of farms were above 20 hectares in the median French *département*, while 52.9% and 58.5% of farms were above that threshold in the USA in 1860 and in England in 1851 respectively (Grigg (1992)). Moreover, as we show in column 2, French *départements* that experienced a larger exodus during the Revolution have systematically fewer farms above this scale-efficient size. Namely we find that a 1% increase in the share of *émigrés* in the population decreases the share of farms above 20 hectares in 1862 by 0.87%. This absence of sufficiently large land holdings is entirely consistent with the delayed mechanization of French agriculture in high-*émigrés départements* found in Table 5.

In columns 3-5 of Table 7 we use as a dependent variable the ratio of the number of farms of 40 hectares and above to the number of farms below 10 hectares in 1862 and the ratio of the number of farms of 50 hectares and above to the number of farms below 10 hectares in 1929 and 2000. These variables are meant to capture the relative abundance of large to small-sized farms within a *département*. Over the last 150 years, regions in France where emigration was intense during the Revolution of 1789 consistently feature an agricultural landscape dominated by small to medium sized farmers and a scarcity of large ones.[30] The demise of large landed elites and the creation of a small peasantry mainly working for self-subsistence, at least until WWII, was part of the legacy of the *émigrés*' flight during the French Revolution. Panels C and D of Figure 4 plot the residuals of the reduced form regressions between the summer 1792 temperature shocks and the ratio of farms above 40 ha to farms below 10 ha in 1862 and between the summer 1792 temperature shocks and the share of farms above 20 ha 1862 variables.

One may naturally wonder why market forces did not "correct" over time this inefficient size of small landholdings. In other words, why did this lopsided ownership structure in agriculture survive when one would expect consolidation to take place? Although a thorough exploration of this subject would take us beyond the confines of the current study, we venture below a tentative explanation.

First of all, it must be noted that there was no deliberate, official policy designed specifically to perpetuate the fragmentation of land-ownership status quo during the 19*th* century. Nevertheless, the existence of the "octrois" might help explain why the tendency towards consolidation to reap the benefits of efficient production in large scale might have been less pronounced. The "octrois" were the local taxes levied on almost all goods entering towns (e.g., meat, wine, fruits, vegetables, coal, etc.) and, de facto, functioned as internal trade barriers within France (before and after 1789, as they were only finally abolished in 1943). These "octrois" favored small

[30] Additional results available upon request show that the share of *émigrés* had a positive but insignificant effect on the total number of farms and total number of farms per inhabitant in 1862.

local farmers whose production would be exempt from paying the "octrois" taxes. Throughout the 19th century, the central government progressively reined into the ability of towns to levy "octrois", and on December 29*th*, 1897, the French parliament passed a law which came into effect on January 1*st*, 1901, dictating a substantial decrease in "octrois" rates. This law, which was the outcome of the lobbying from "progressives" who sought to improve citizens' health by promoting the consumption of wine as opposed to liquor, benefited large wine producers in the South, who were able to produce cheap wine in large quantities. The law, thus, crowded out small wine producers who successfully lobbied for costly anti-competitive legislation which was adopted in 1905 to reduce fraud and adulteration in the wine market and which, de facto, protected small producers of local wine.[31] This example suggests that local demand for barriers to entry would be stronger in regions dominated by small landowners since competition from large efficient farmers would be damaging to their revenues. In fact this is what we find in the regression results reported in Table A.15: *départements* with a larger share of *émigrés* had more communes which were protected by "octrois" taxes in 1875 and the magnitude of these taxes for various products were also likely to be significantly higher.

Another potential explanation for the negative impact of emigration on agricultural productivity may pertain to the positive and significant effect of emigration on the share of commons in each *département* in 1863, as can be seen in column (6) of Table 7. A 1% increase in the share of *émigrés* in the population increases the share of commons in 1863 by 1.72%. As discussed by Vivier (1998), there is anecdotal evidence that the central state and the local governments seized the commons during the Revolution in places where there were more *émigrés*. In turn, the local governments leased those lands to farmers for a limited number of years. Such leases in agriculture may have had negative effect on agricultural productivity by limiting investments in machinery and promoting intensive production methods which would be damaging for land productivity in the long-run.[32]

The evidence in this section provides a possible foray into understanding why local incomes were depressed during the 19*th* century in regions that *émigrés* left in large numbers. Can the same economic forces, reflected in the distribution of agricultural land holdings help explain the take off of these initially lagging regions? This is what we ask below.

[31] For a discussion on the 29 December 1897 law and its consequences on small wine producers, see Franck, Johnson, and Nye (2014).

[32] French towns ("communes") could lend their land under ordinary leases or grant long-time leases. The "ordinary" leases were limited to 9 years in 1791 for all communes, but exceptions could be granted by the national administration. The 9-year limit was soon extended to 18 years. Moreover, in 1859, the law was changed so that the ordinary leases of the communes were of a minimum of 9 years and a maximum of 27. This changed was undoubtedly implemented because it reflected a situation on the ground and relieved the national administration to rubber stamp the decisions of the communes. Furthermore, communes had the right to deliver life-long leases on commons as well as "baux emphytheotiques" (emphytheusis) which gave a 99-year lease on the commons.

6.3 Emigration during the Revolution and Human Capital Accumulation

This section examines whether the positive effect of emigration on the standards of living in the long run can be explained by its impact on the formation of human capital. In particular, we explore the potential effect of emigration on the level and composition of human capital in each *département* before and after WWII.

6.3.1 The Effect of *Emigrés* on Human Capital Accumulation

Even before the passing of the 1881-1882 laws on free and mandatory schooling until age 13, there had been a general increase in human capital in France. While the data of Furet and Ozouf (1977) suggest that only 42.4% of grooms were able to sign their wedding contract during the 1786-1790 period (instead of marking it with a cross), the share of French army conscripts, i.e., 20-year old men who reported for military service, who could read and write increased progressively from 55.5% in 1841 to 82.6% in 1880 (just before the 1881-1882 laws) and to 90.4% in 1936. In fact, data on school enrollment in France in 1876, i.e., five years before the mandatory schooling laws were adopted, suggest that only 24.06% of the children age 5-15 did not attend school (Diebolt and Trabelsi (2009)). At the same time, very few conscripts completed high-school. It is only after WWII that high-school completion rates take off along with college attendance. Specifically, the share of high-school graduates among men age 16-24 increased from 10.8% in 1968 to 23.5% in 2010 while the share of college graduates increased from 0.3% in 1968 to 13.7% in 2010.

Our empirical analysis shows that literacy rates were already significantly higher in high-emigration *départements* before the outbreak of WWII. This can be seen in Figure 5 which graphs in three separate panels the coefficients associated with the share of *émigrés* in 2SLS regressions on the human capital of French army conscripts. In Panel A of Figure 5, the dependent variable in the 2SLS regressions is the share of conscripts who could read and write between 1841 and 1936 while in Panel B, it is the share of conscripts who were high-school graduates between 1874 and 1936. Panel A shows that *émigrés* had an insignificant effect on the share of conscripts who could read and write until 1908; from 1911 to 1936, however, the effect of *émigrés* on the share of conscripts who could read and write is always positive and significant. Moreover, Panel B shows that in high emigration *départements*, there were more high-school graduates among conscripts between 1874 and 1936: the coefficient associated with the share of *émigrés* in the 2SLS regressions is positive in all the regressions; it is significant in a few years (1880, 1888, 1901 and 1904) before 1909, when it becomes systematically significant until WWII.

Moreover since WWII, *départements* with high emigration during the French Revolution have maintained their edge in human capital formation. This can be seen in Panel A of Figure A.5, where we report the coefficient associated with the share of *émigrés* in 2SLS regressions when the dependent variable is the share of men age 16-24 with only a high-school degree: the share of *émigrés* has a positive effect on the share of men age 16-24 with only a high-school degree between 1968 and 2010, which is significant in 1975, 1982 and 1990 at the 5% level in the 2SLS estimates. Moreover, in Panel *B* of Figure A.5, we report the coefficients associated with the share of *émigrés* in 2SLS regressions where the dependent variable is the share of men age 16-24 with a college degree. We find that the share of *émigrés* has a positive and significant effect on the share of men age 16-24 with a college degree between 1968 and 2010. These results suggest that there might have been a possible convergence in terms of human capital at the high-school level, but the relatively earlier transition to widespread literacy in high-*émigrés* departements has conferred an edge still reflected in a greater share of college graduates today.

Furthermore, the 2SLS estimates in columns (1) and (2) in Table A.16 in the Appendix show that emigration had a positive and significant effect on the share of men age 15-17 enrolled in school and of men age 18-24 enrolled in school, i.e., who presumably attend college, in 2010. In particular, given that school is mandatory until age 16, the positive and significant coefficient in the 2SLS regression in column (1) suggests that there were fewer high-school dropouts in 2010 in the *départements* which experienced more emigration during the Revolution. If anything, it appears that most individuals in regions with more emigration during the French Revolution live nowadays in an environment which values human capital accumulation.[33] This can be seen in the 2SLS regression in column (3) in Table A.16, which shows that the share of *émigrés* is associated with a lower share of individuals who put less value on education and human capital formation, as measured by the share of individuals who express no interest in science in a survey carried out in 2001 (Centre de recherches politiques de Sciences Po, Enquête science 2001).

6.3.2 The Opportunity Cost of Education and Child Labor

Naturally, when the levels of attained literacy change over time, one needs to tease out the forces that shape the demand and supply of schooling locally.[34] This is not an easy task. However, one element that makes the case of France a bit easier to analyze is the fact that primary schooling became free and mandatory until the age of 13 after the adoption of the 1881-1882 laws. Although this would imply that supply of schooling over time should become more uniform across regions we find that high-emigration *départements* experience systematic under provision of primary schools per school-aged (5-15 years of age) population until WWI. This is shown in Panel *A* of Table A.17. Similar is the pattern found in Panel *B* where the dependent variable is the total public spending per pupil between 1876 and 1901. Panel *C* of Table A.17 in fact suggests that the

[33] See Alesina and Giuliano (2015) for a survey on culture, which highlights the importance of the intergenerational transmission of norms.

[34] On education in France in the 19*th* century, see, e.g., Mayeur (2003) and Franck and Galor (2016).

limited supply of schooling reflects an overall under-provision of public goods in high-emigration *départements*, which also had a less dense transportation network up until at least WWI. In this light, the fact that literacy becomes more widespread in precisely the regions which receive less public goods (including primary schools) is all the more striking. But what may rationalize this pattern?

A potential explanation for the increase in human capital in high emigration areas from the late 19*th* century onwards may pertain to the opportunity cost of acquiring education. Besides the direct, monetary cost of attending school, a relevant but often under appreciated part of the decision on whether to acquire schooling would be the foregone wages that a child would bring home. In the case of 19th century France this outside option would be tightly linked to productivity in agriculture. The adverse effect of higher agricultural productivity on human capital accumulation has been recently documented by Shah and Steinberg (2015) in the context of India. Taking into account both the depressed labor productivity in the agricultural sector of high-*émigrés* areas until WWII and the decline in monetary costs of primary schooling after 1881, it is plausible to expect individuals in high-*émigrés départements* to eventually accumulate human capital at a faster pace instead of working in the agricultural sector.

We examine the conjecture that children and teenagers would be less likely to work in the agricultural sector after the adoption of the 1881-1882 laws on mandatory schooling, by using data from the 1929 agricultural survey. This survey provides data at the *département* level on the number of individuals below the age of 15 working in the agricultural sector. The 2SLS regression results reported in Table 8 show that in 1929, individuals below the age of 15 were less likely to work in the agricultural sector, and presumably more likely to stay in school, in high-emigration *départements*. Specifically, we find that the share of *émigrés* had a negative impact on the share of French daily agricultural workers below the age of 15 in the agricultural sector in 1929, whether the baseline is the overall workforce in the agricultural sector, the number of daily agricultural workers, the total number of daily agricultural workers (including foreign workers) below the age of 15, or the total number of French and foreign daily agricultural workers above the age of 15.[35]

Emigration, Land Ownership and Comparative Development Weaving together the evidence so far, one may wonder whether the time-varying impact of *émigrés* on comparative development may be quantitatively explained by the persistent differences in the composition of agricultural land holdings brought about by the emigration during the Revolution. In other words, can the relative increase in the number of small landowners account for the inverse relationship between emigration rates and agricultural productivity in the medium-run, as well as higher

[35] Since the law of 22nd of March 1841, there were restrictions regarding child labor in France; children below the age of 14 could not work in factories.

human capital accumulation and better economic performance after WWII?

We examine this hypothesis in Table 9 where we assess the change in the magnitudes of our baseline findings regarding the value added per worker in agriculture in 1860 (Table 4) and GDP per capita in 2010 (Table 3) when we account for the ratio of farms above 40 ha to farms below 10 ha in 1862, which reflects the degree of concentration in land redistribution. Table 9 reports the results. First, the association between the ratio of large to small farms and economic performance changes sign over time similar to the effect of emigration during the Revolution. A *département* dominated by large farms in the mid-19th century France was significantly more productive in agriculture in 1862; however, *départements* where agriculture was undertaken by overwhelmingly small and medium-sized farmers in 1862 are more developed in 2000. Moreover, accounting for the composition of agricultural holdings decreases the estimated coefficient on the share of *émigrés* by roughly a half when the dependent variable is the value added per worker in agriculture in 1860, and by approximately 40% when the variable of interest is the GDP per capita in 2010. This implies that a sizeable fraction of the observed reversal in the relationship between emigration rates during the Revolution and subsequent economic performance is indeed driven by the non-monotonic impact of the concentration in land ownership on comparative development.

All in all, the results in Table 9 provide additional evidence that the composition of farms tilted towards small landowners is a significant channel for understanding the reversal in the relationship between the share of *émigrés* and income per capita over time.

7 Conclusion

It is still debated whether the 1789 Revolution enabled economic growth and industrialization in France or stalled French development by consolidating an agrarian structure of small self-subsistent farmers. In this study, we focus on the economic consequences of the local weakening of the *Ancien Régime*, as proxied by the share of *émigrés*, mostly aristocrats and clergymen, who fled France during the 1789-1799 period and whose property was confiscated and sold by the revolutionaries. Our identification strategy exploits local variation in temperature shocks during the summer of 1792 to obtain plausibly exogenous variation in the share of *émigrés* across French *départements*. In August and September of 1792 the Revolution took a radical turn when King Louis XVI was imprisoned, the first French Republic was proclaimed and emigration intensified. At this critical juncture of the French Revolution, we show that local shocks in the economic environment (captured by temperature shocks) are a strong predictor of local emigration.

The study establishes that emigration during the French Revolution has had a non-monotonic effect on regional income per capita within France over the subsequent 200 years. While emigration had a negative impact on income during the 19*th* century, it had a positive and significant effect in the long run. This reversal can be traced to the divergence of human capital formation across *départements*. Specifically, high-emigration regions started accumulating human capital at a faster pace at the turn of the 20*th* century and have kept their lead till today. We suggest several mechanisms that may rationalize this pattern.

In *départements* with more *émigrés* there was more land redistribution which took two forms. First, the central state and local governments established their own property rights on land which served as commons before the Revolution. Second, large estates were fragmented into smaller farms. This led to the emergence of more subsistence farming and fewer industries, as well as to several individuals renting the land from the local communes, with no incentive to innovate in agricultural mechanization. Both instances may explain the archaic means of agricultural production in France and its delayed industrialization.

The size and the composition of the local elites were also differentially shaped by emigration during the Revolution. Specifically, we find that there were fewer wealthy individuals as a share of the population as well as fewer rich landowners and more civil servants in high-emigration areas.

We conjecture that the changes in the economic environment due to emigration during the Revolution shaped the incentives for human capital accumulation over time. Specifically, we find that high-emigration *départements* have systematically higher shares of literate conscripts after WWI. This is consistent with the fact that costly schooling acted as a deterrent for literacy in high *émigrés* areas which suffered from lower incomes generated by subsistence farming. But when schooling became free at the onset of the second Industrial Revolution, it facilitated investments in human capital precisely in regions where agriculture was less productive. Indeed using data from 1929, we show that child labor in agriculture was higher in regions with low-emigration rates (high-agricultural productivity *départements*) underlying the adverse dynamic impact of high opportunity cost on the spread of schooling. After WWII, these regions have kept their edge in education as reflected in higher rates of college graduation. All in all, the reduction in the share of wealthy individuals in the local population and the fragmentation of agricultural property in the wake of the French revolution are consistent with studies (e.g., Galor and Zeira (1993), Galor and Moav (2004)) predicting a non-monotonic role of equality in the process of development.

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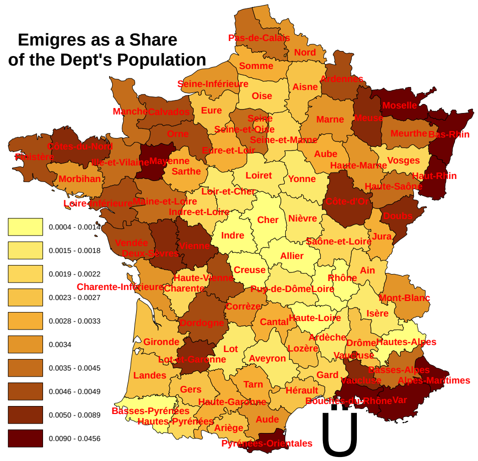
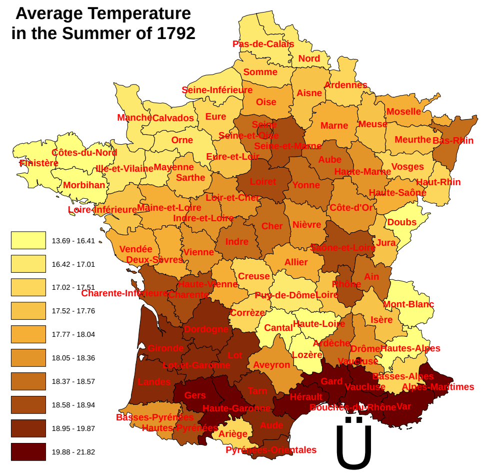
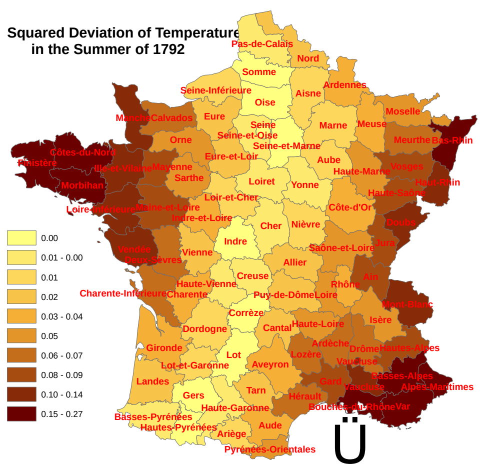


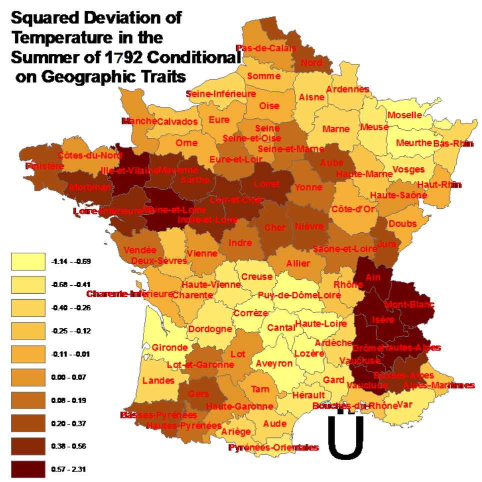
A. *Emigrés* as a Share of the Département's Population



B. Average Temperature in Summer 1792



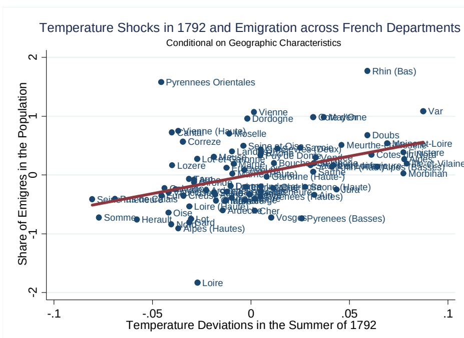
C. Squared Deviation from Temperature in Summer 1792 (baseline 1767-1791)



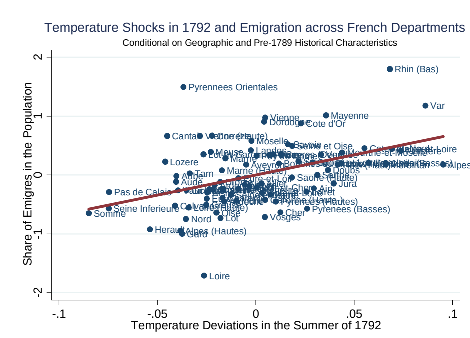
D. Squared Deviation from Temperature in Summer 1792 (baseline 1767-1791) partialling out geographic controls

Figure 1: Share of *Emigrés* in Population and Summer Temperature in 1792 in French *Départements*

Source: Greer (1951),Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2004),Luterbacher, Dietrich, Xoplaki, Grosjean, and Wanner (2006); Pauling, Luterbacher, Casty, and Wanner (2006).



A. IV is the Squared Deviation from Temperature in Summer 1792, Conditional on Geographic Controls



B. IV is the Squared Deviation from Temperature in Summer 1792, Conditional on Geographic & Historical Controls

Figure 2: Temperature Deviation in the Summer of 1792 and the Share of *Emigrés*, Controlling for Geographic and pre-1789 Historical Characteristics

Note: These figures depict the partial scatterplots of the effect of temperature shocks in summer 1792 on the share of *émigrés* in the population of each French *département*. Panel A presents the relationship with the squared deviation from temperature in summer 1792 (1767-1791) while Panel B reports the relationship with the absolute deviation from temperature in summer 1792 (1767-1791). Thus, the x- and y-axes in Panels A and B plot the residuals obtained from regressing the share of émigrés in the population against the squared and absolute deviations from temperature in the summer of 1792, conditional on geographic and historical controls.

Table 1: Emigrés during the Revolution

Five départements with largest				Five départements with smallest			
Number of émigrés		Share of émigrés		Number of émigrés		Share of émigrés	
Moselle	3827	Alpes-Maritimes	1.26%	Loire	105	Loire	0.04%
Pyrenees Orientales	3854	Bouches-du-Rhone	1.80%	Hautes-Alpes	105	Hautes-Alpes	0.09%
Bouches-du-Rhone	5125	Var	1.96%	Cher	239	Cher	0.11%
Var	5331	Pyrenees Orientales	3.48%	Haute-Loire	271	Rhone	0.11%
Bas-Rhin	20510	Bas-Rhin	4.56%	Indre	278	Haute-Loire	0.12%

Panel B. Social Groups

Nobles	23%	Priests	34%
Upper-Middle Class	10%	Lower-Middle Class	3%
Working Class	6%	Peasants	7%
Unidentified	17%		

Source: Greer (1951).

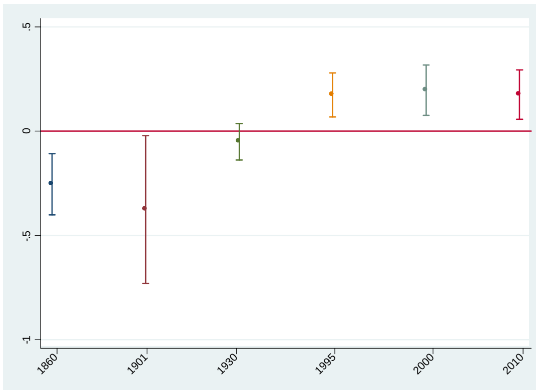
Table 2: Property Ownership before and after the French Revolution in 15 Villages in the District of Avesnes in the Nord *Département*

	Ownership	
	Before	After
	the Revolution	
Peasants	33.52%	44.18%
Bourgeois	4.73%	25.68%
Nobility	37.08%	14.35%
Church	18.80%	0.03%
Poor Institutions & Hospitals	0.69%	0.58%
Commons*	5.18%	15.80%

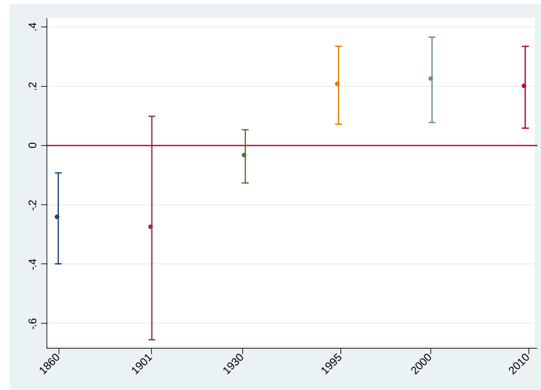
Note: * Before the Revolution, there was no clear ownership of the commons.

Source: Lefebvre (1924, Tableau II, pp.892-893)

Panel A. GDP per capita, 1860-2010

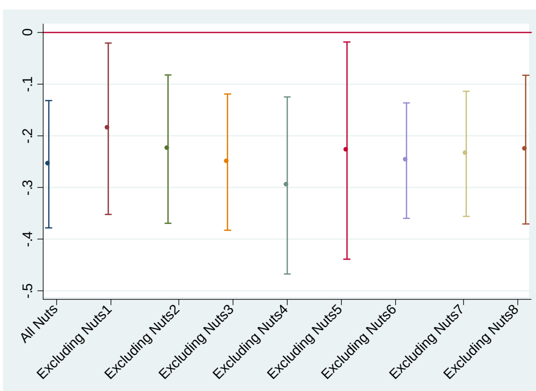


IV is the Squared Deviation from Temperature in
Summer 1792, Conditional on Geographic & Historical Controls

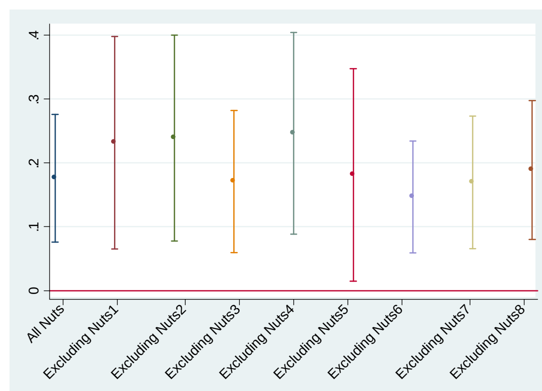


IV is the Absolute Deviation from Temperature in
Summer 1792, Conditional on Geographic & Historical Controls

Panel B. GDP per capita in 1860 and 2010 removing one "nuts" at a time



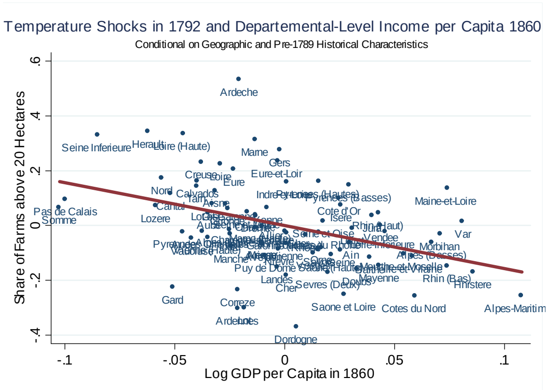
GDP per capita in 1860, removing one "nuts" at a time.
IV is the Squared Deviation from Temperature in
Summer 1792, Conditional on Geographic & Historical Controls



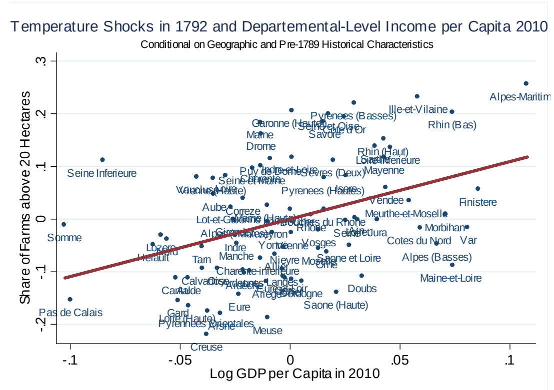
GDP per capita in 2010, removing one "nuts" at a time.
IV is the Squared Deviation from Temperature in
Summer 1792, Conditional on Geographic & Historical Controls

Figure 3: The Effect of Share of *Emigrés* in Population on GDP per capita in 1860 and 2010

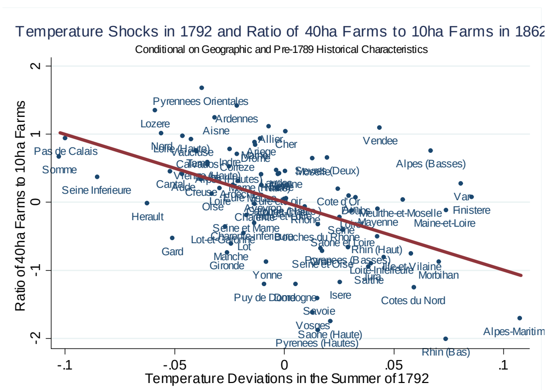
Note: Panel A. displays the estimated coefficients of the share of émigrés variable on GDP per capita 1860, 1901, 1930, 1995, 2000 and 2010 in the 2SLS regressions in Table 3, conditional on all the geographic & historical controls. Panel B displays the estimated coefficients of share of émigrés on GDP per capita in 1860 and 2010 in the 2SLS regressions, conditional on all the geographic & historical controls, where we remove one "nuts" at a time (the detailed regressions are available upon request) Intervals reflect 90%-confidence levels.



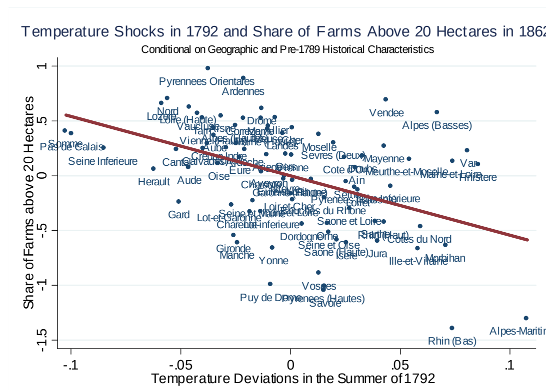
A. IV is the Squared Deviation from Temperature in Summer 1792



B. IV is the Squared Deviation from Temperature in Summer 1792



C. IV is the Squared Deviation from Temperature in Summer 1792



D. IV is the Squared Deviation from Temperature in Summer 1792

Figure 4: Temperature Deviation in the Summer of 1792 and GDP per Capita in 1860 and 2010 Controlling for Geographic Traits

Note: These figures depict the partial scatterplots of the association between the squared deviation of temperature in the summer of 1792 (1767-1791) on GDP per capita in 1860 (Panel A), GDP per capita in 2010 (Panel B), the ratio of farms above 40 ha to farms below 10 ha in 1862 (Panel C) as well as the ratio of farms above 20 ha in 1862 (Panel D). Thus, the x- and y-axes plot the residuals obtained from regressing émigrés in the population against the squared deviations from temperature in the summer of 1792, conditional on the geographic and historical set of covariates.

Table 3: Emigrés and GDP per capita (IV the Squared Deviation of Temperature in Summer 1792)

Panel A. GDP per capita 1860-1930

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	GDP per capita 1860				GDP per capita 1901				GDP per capita 1930			
Share of Emigres in Population	-0.0109	-0.0811***	-0.257***	-0.255***	-0.00861	-0.0681	-0.376**	-0.376**	0.0340	-0.00614	-0.0532	-0.0505
	[0.0322]	[0.0304]	[0.0853]	[0.0749]	[0.0388]	[0.0534]	[0.184]	[0.181]	[0.0289]	[0.0288]	[0.0542]	[0.0443]
Adjusted R2	-0.011	0.585			-0.012	0.278			0.002	0.608		
Geographical Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Historical Controls	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	85	85	85	85	83	83	83	83	85	85	85	85
First stage: the instrumented variable is Share of Emigres in Population												
Squared Deviation from Temperature in Summer 1792 (1767-1791)			5.929***	6.159***			4.967***	4.895***			5.929***	6.159***
			[1.393]	[1.499]			[1.267]	[1.209]			[1.393]	[1.499]
F-stat (1st stage)			18.113	16.881			15.359	16.378			18.113	16.881

Panel B. GDP per capita 1995-2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	GDP per capita 1995				GDP per capita 2000				GDP per capita 2010			
Share of Emigres in Population	0.0237	0.0478**	0.174***	0.174***	0.0238	0.0553**	0.201***	0.196***	0.0201	0.0493*	0.171***	0.176***
	[0.0195]	[0.0212]	[0.0525]	[0.0541]	[0.0199]	[0.0222]	[0.0600]	[0.0617]	[0.0225]	[0.0254]	[0.0602]	[0.0607]
Adjusted R2	0.003	0.472			0.001	0.470			-0.005	0.466		
Geographical Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Historical Controls	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	86	86	86	86	86	86	86	86	86	86	86	86
First stage: the instrumented variable is Share of Emigres in Population												
Squared Deviation from Temperature in Summer 1792 (1767-1791)			5.950***	6.216***			5.950***	6.216***			5.950***	6.216***
			[1.378]	[1.487]			[1.378]	[1.487]			[1.378]	[1.487]
F-stat (1st stage)			18.647	17.476			18.647	17.476			18.647	17.476

Note: This table reports the effect of the share of émigrés in the population on GDP per capita in 1860, 1901 and 1930 (Panel A) and in 1995, 2000 and 2010 (Panel B) in OLS and 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table 4: The Effect of Emigrés on the Value Added Per Capita and the Workforce in Agriculture, Industry and Services, 1860-1990

Panel A. Value Added per Worker in Agriculture, Industry and Services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	1860 Value Added per Worker in			1930 Value Added per Worker in			1982 Value Added per Worker in			1990 Value Added per Worker in		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
Share of Emigres	-0.444***	-0.178*	-0.193***	-0.478***	-0.0272	-0.0434	0.531***	0.603**	0.517**	0.694***	0.628***	0.521**
	[0.129]	[0.0965]	[0.0630]	[0.144]	[0.0523]	[0.0443]	[0.185]	[0.250]	[0.224]	[0.227]	[0.240]	[0.223]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	86	86	86	86	86	86
	First stage: the instrumented variable is Share of Emigres in Population											
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.216***	6.216***	6.216***
	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.487]	[1.487]	[1.487]
F-stat (1st stage)	16.881	16.881	16.881	16.881	16.881	16.881	17.476	17.476	17.476	17.476	17.476	17.476

Panel B. Share of Workforce in Agriculture, Industry and Services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Share of Workforce in								
	Agriculture 1860	Industry 1860	Services 1860	Agriculture 1930	Industry 1930	Services 1930	Agriculture 2010	Industry 2010	Services 2010
Share of Emigres in Population	0.0514	-0.321***	0.201*	-0.103	-0.130*	0.139**	-0.787***	0.168**	0.151***
	[0.0669]	[0.115]	[0.104]	[0.0968]	[0.0743]	[0.0641]	[0.215]	[0.0684]	[0.0501]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	86	86	86
	First stage: the instrumented variable is Share of Emigres in Population								
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.216***	6.216***	6.216***
	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.487]	[1.487]	[1.487]
F-stat (1st stage)	16.881	16.881	16.881	16.881	16.881	16.881	17.476	17.476	17.476

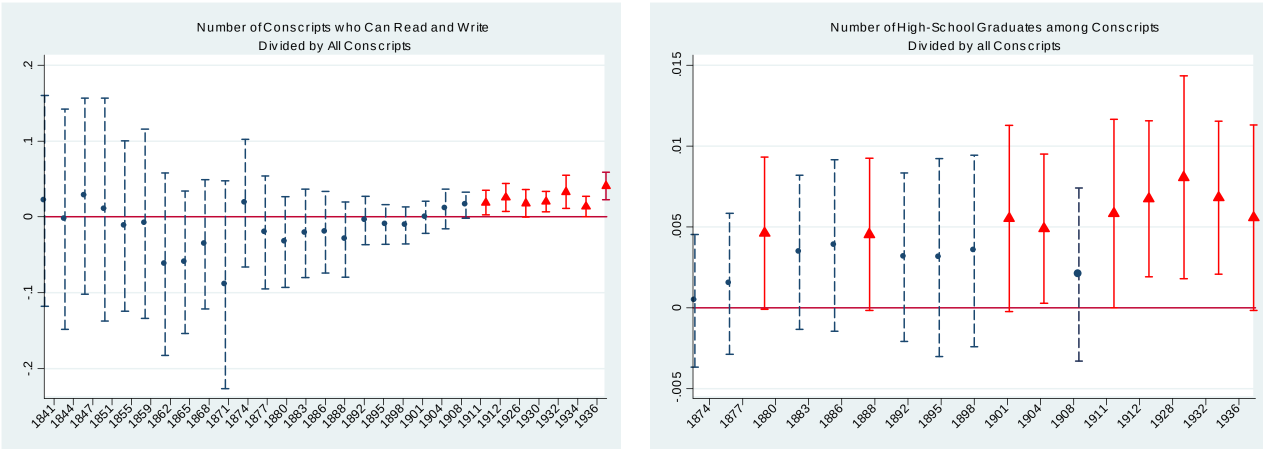
Note: This table reports the effect of the share of émigrés in the population on the value added per worker in agriculture, industry and services in 1860, 1930 and 1990 (Panel A) and the shares of the workforce in agriculture, industry and services in 1860, 1930,and 2010 (Panel B) in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table 5: Emigrés and the Mechanization of Agriculture, 1862

	(1) 2SLS Fertilizer	(2) 2SLS Ploughs	(3) 2SLS Scarifiers	(4) 2SLS Grubbers	(5) 2SLS Searchers	(6) 2SLS Horse Hoes	(7) 2SLS Harrows
	per Worker in Agricultural Sector, 1862						
Share of Emigres	-0.413***	-0.199	-1.893***	-2.568***	-1.229**	-0.746	0.00302
	[0.147]	[0.131]	[0.560]	[0.766]	[0.551]	[0.467]	[0.301]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	85
	First stage: the instrumented variable is Share of Emigres in Population						
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***
	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]
F-stat (1st stage)	16.881	16.881	16.881	16.881	16.881	16.881	16.881

	(1) 2SLS Ridgers	(2) 2SLS Seeders	(3) 2SLS Root Cutters	(4) 2SLS Tedders	(5) 2SLS Reapers	(6) 2SLS Croppers	(7) 2SLS Steam-Powered Threshers	(8) 2SLS Animal-Powered Threshers
	per Worker in Agricultural Sector, 1862							
Share of Emigres	-0.535	-1.268**	-0.366	-1.873***	-0.997	-0.695	0.394	-0.454
	[0.466]	[0.545]	[0.434]	[0.698]	[0.872]	[0.754]	[0.368]	[0.514]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	85	85
	First stage: the instrumented variable is Share of Emigres in Population							
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***	6.159***
	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]	[1.499]
F-stat (1st stage)	16.881	16.881	16.881	16.881	16.881	16.881	16.881	16.881

Note: This table reports the effect of the share of the share of émigrés in the population on the number of agricultural instruments per agricultural worker in the agricultural sector in 1862 in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.



A. Share of Conscripts who Could Read but Could not Write, 1841-1936

B.Share of High-School Graduates Among Conscripts, 1874-1936

Figure 5: *Emigrés* and the Human Capital of French Army Conscripts, 1838-1936

Note: This graph displays the estimated coefficients of share of émigrés on the share of conscripts who could read and write (Panel A) and the share of high-school graduates (Panel B) among French army conscripts, i.e., 20-year old men reporting for military service. The IV is the squared deviation from temperature in summer 1792 Intervals reflect 90%-confidence levels. A red triangle indicates significance at the 10%-level.

Table 6: Emigrés and Electors in 1839 under the Censitory Regime of the July Monarchy

	(1) 2SLS Share of Electors in Department Population	(2) 2SLS Share of Landowners among Electors	(3) 2SLS Share of Businessmen among Electors	(4) 2SLS Share of Professionals among Electors	(5) 2SLS Share of Civil Servants among Electors
Share of Emigres	-0.546***	-0.101**	0.0917	0.147	0.425**
	[0.168]	[0.048]	[0.098]	[0.112]	[0.172]
Geographic controls	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes
Observations	81	67	67	67	67
First stage: the instrumented variable is Share of Emigres in Population					
Squared Deviation from Temperature in Summer 1792 (1767-1791)	7.733***	7.872***	7.872***	7.872***	7.872***
	[1.514]	[1.600]	[1.600]	[1.600]	[1.600]
F-stat (1st stage)	26.093	24.195	24.195	24.195	24.195

Note: This table reports the effect of the share of the share of émigrés in the population on the share of voters in the population and the shares of landowners, businessmen, professionals (i.e., lawyers and doctors), and civil servants among those voters in 1839, under the censitory regime of King Louis Philippe (1830-1848), in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792 .Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table 7: Size Distribution of Private Land Holdings over Time and Share of Commons in 1863

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Share of Farms above		Ratio of the Number of Farms			Share of Commons
	40ha, 1862	20ha, 1862	40 ha to 10 ha, 1862	50 ha to 10 ha, 1929	50 ha to 10 ha, 2000	1863
Share of Emigres in Population	-1.535***	-0.873***	-1.603***	-1.755***	-0.768***	1.720**
	[0.453]	[0.290]	[0.481]	[0.494]	[0.266]	[0.811]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86	86	86	86	86	84
	First stage: the instrumented variable is Share of Emigres in Population					
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.216***	6.216***	6.216***	6.216***	6.216***	5.131***
	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]	[1.221]
F-stat (1st stage)	17.476	17.476	17.476	17.476	17.476	17.657
	Reduced Form					
Squared Deviation from Temperature in Summer 1792 (1767-1791)	-9.542***	-5.426***	-9.967***	-10.91***	-4.774***	8.826**
	[1.903]	[1.426]	[2.056]	[2.298]	[1.530]	[3.477]

Note: This table reports the effect of the share of the share of émigrés in the population on the share of farms above 40 ha and 20 ha in 1862 (columns (1)-(2)), on the ratio of farms above 40 ha to farms below 10 ha in 1862 (column (3)), on the ratio of farms above 50 ha to 10 ha in 1929 (column (4)), on the ratio of farms above 40ha to 10ha in 2000 (column (5)) and on the share of the commons within the *département* in 1863 (column (6)) in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table 8: Emigres and French Workers below Age 15 in the Agricultural Sector, 1929

	(1)	(2)	(3)	(4)
	2SLS	2SLS	2SLS	2SLS
	Share of	Share of	Share of	Ratio of
		French agricultural workers below age 15 among		
	the agricultural workforce	agricultural workers	agricultural workers below age 15	agricultural workers above age 15
Share of Emigres in Population	-1.087**	-0.794**	-0.833**	-0.804**
	[0.444]	[0.394]	[0.344]	[0.403]
Geographic controls	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes
Observations	85	86	86	86
	First stage: the instrumented variable is Share of Emigres in Population			
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.877***	6.863***	6.863***	6.863***
	[1.685]	[1.678]	[1.678]	[1.678]
F-stat (1st stage)	16.656	16.724	16.724	16.724

Note: This table reports the effect of the share of the share of émigrés in the population on the share of French agricultural workers below age 15 among the agricultural workforce (column (1)), agricultural workers (column (2)), agricultural workers below age 15 (column (3)) and agricultural workers above age 15 (column (4)) in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table 9: Can Land Redistribution Explain the Impact of Emigrés?

	(1)	(2)	(3)	(4)
	2SLS	2SLS	2SLS	2SLS
	1860 Value Added per Worker in Agriculture		GDP per capita 2010	
Share of Emigres	-0.444***	-0.224**	0.176***	0.105**
	[0.129]	[0.0988]	[0.0607]	[0.0413]
Ratio of 40ha Farms to 10ha Farms, 1862		0.134***		-0.0441***
		[0.0367]		[0.0160]
Geographic controls	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes
Observations	85	85	86	86
	First stage: the instrumented variable is Share of Emigres in Population			
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	7.309***	6.216***	7.446***
	[1.499]	[1.405]	[1.487]	[1.403]
F-stat (1st stage)	16.881	27.071	17.476	28.147

Note: This table reports the effect of the share of the share of émigrés in the population on the value added per worker in agriculture in 1860 (as in Table 4) and on GDP per capita in 2010 (as in Table 3), accounting for the ratio of farms above 40ha to farms below 10ha in 1862 in columns (2) and (4) in 2SLS regressions. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Appendix for Online Publication

Appendix A. Temperature Shocks, Wheat Prices, Local Violence and Emigration

A.1. The Impact of Temperature Shocks on Wheat Prices

In late 18th century France, there is ample anecdotal evidence suggesting that abnormal weather conditions would negatively impact crops, and in particular wheat production, which was usually the main crop cultivated and consumed in most French *départements* (Kaplan (1984), Kaplan (1996)). More generally, late spring and summer climatic conditions are important determinants of the yield of winter wheat (Triticum aestivum), which is planted in the fall and harvested in the summer or early autumn of the next year.[36]

Therefore, an aspect of our identification strategy is that temperature shocks lower yields in each *département*, causing local wheat prices to rise because of a lack of complete market integration.[37] In turn, these high wheat prices in the summer of 1792 would cause local riots, and such a conjecture is supported by anecdotal evidence from historians such as Soboul (1962) (pp.342-346) and Johnson (1986) (p.256),[38]. Unfortunately, there is no comprehensive dataset on wheat prices in 1792 but such data exist for the later part of the Revolution (1797-1800) (Labrousse, Romano, and Dreyfus (1970)). They enable us to run panel data regressions where the price of wheat in each *département* is explained by the temperature shocks in the summer in that *département* over the 1797-1800 period

$$P_{d,t} = \alpha_d + \alpha_t + \alpha_1 Z_{d,t} + u_{dt}$$

where $P_{d,t}$ is the price of wheat in *département* d in year t, $Z_{d,t}$ is the temperature shock as constructed above in *département* d in the summer of year t, α_d and α_t are *département* and year-fixed effects, $u_{d,t}$ is an error term for *département* d in year t. We consider several specifications for $Z_{d,t}$: the squared deviation of summer temperature and the absolute deviation defined above, and for robustness checks, measures where we separately focus on negative (respectively, positive) deviations whose value we square or take the absolute while we normalize the positive (negative) deviations to zero.

We report the regression results in columns (1)-(5) of Table A.3. In the first column, our explanatory variable is the squared deviation from standardized temperature; this specification does not include *département* fixed effects so as to highlight the source of geographic variation

[36] On the growth and developmental stages of wheat, and the impact of weather conditions, see, e.g., Haun (1973) and Zadoks, Chang, and Konzak (1974) .

[37] On market integration (and lack thereof) during the Revolution, see, e.g., Daudin (2010).

[38] In a study of the Revolution in the South of France between 1789 and 1793, Johnson (1986) writes (p.256): "The great concentration of violent episodes occurred in March 1789, July and August 1789, July 1791, March and April 1792, and July and August 1792. All occurred in either the spring or summer and were for the most part the results of poor harvests and food shortages."

which we use in our identification strategy. The other regressions in columns (2)-(5) include the *département* fixed effects to account for the time-invariant *département*-level characteristics: the main explanatory variable is the squared deviation from standardized temperature in column (2), the absolute deviation from standardized temperature in column (3), the positive and negative squared deviations in column (4) and the positive and negative absolute deviations in column (5).

Reassuringly, increases in temperature shocks at the *département* level led systematically to higher wheat prices during the 1797-1800 period, consistent with an economy composed of fragmented markets where local weather fluctuations would have major impacts. This can be seen in Figure A.3 in the Appendix which graphs the positive relationship between the change in wheat prices and the differences in summer temperature shock between 1797 and 1798.

A.2. The "Second Revolution", Violence and Emigration during the Summer of 1792

To provide some support for the rationale that emigration in each *département* was driven by local violence which would itself result from abnormal weather conditions, we can test whether the temperature shocks in summer 1792 are significantly related to local riots during the "Second Revolution". For this purpose, we use the data of Markoff (1996), who provides information on local riots in August and September 1792, which we aggregate at the level of the *département*. We then run OLS regressions where R_d, the log of the number of riots in August and September 1792 in *département* d, is explained by $Z_{d,1792}$ the squared (or absolute) deviation of temperature in the summer of 1792 standardized by the mean and variance of summer temperatures in the 25 preceding years (1767-1791).

$$R_d = \beta_0 + \beta_1 Z_{d,1792} + \mathbf{X\prime}_d.\gamma + v_d$$

where $\mathbf{X\prime}_d$ is a vector of economic, geographical and institutional characteristics of *département d*, and v_d is an error term for *département d*.

We report the regression results in columns (5) and (6) of Table A.3 in the Appendix. In line with the rationale for our identification strategy, increases in temperature shocks at the *département* level in the summer of 1792 are found to have a significant and positive effect on the number of local riots This can be seen in Figure A.1 which graphs the positive relationship between the number of riots in August and September 1792 and the squared deviation of temperature in the summer of 1792 in each *département*.

Appendix A.3. Figures and Tables

Table A.1: Average Farm Size in France in 1862 and in the USA in 1860

	Observations	Mean	Median	Std.Dev.	Min.	Max.
Average Farm Size, France 1862						
Average Farm Size	88	23.12	18.12	13.14	4.57	62.83
Average Farm Size, Above Median Temperature Shock in Summer 1792	43	27.35	25.98	14.39	7.97	62.83
Average Farm Size, Below Median Temperature Shock in Summer 1792	45	17.02	19.08	10.46	4.57	49.80
Average Farm Size, Above Median Wheat Production 1862	44	29.86	28.51	13.20	8.56	62.83
Average Farm Size, Below Median Wheat Production 1862	44	16.38	14.47	9.05	4.57	49.27
Average Farm Size, USA 1860						
Average Farm Size	1944	336.17	562.54	218.64	10.78	15172.6
Average Farm Size, Above Median Wheat Production 1860	979	248.49	189.38	301.30	10.78	5610.0
Average Farm Size, Below Median Wheat Production 1860	964	425.42	291.56	728.33	11.71	15172.6
Average Farm Size, France 1862, , Excluding Farms below 5 ha (=12.36 acres)						
Average Farm Size, Excluding Farms below 5 ha (=12.36 acres)	88	102.99	78.59	91.33	36.32	705.58
Average Farm Size, Excluding Farms below 5 ha (=12.36 acres), Above Median Temperature Shock in Summer 1792	43	107.01	92.09	81.61	46.33	484.77
Average Farm Size, Excluding Farms below 5 ha (=12.36 acres), Below Median Temperature Shock in Summer 1792	45	99.16	75.48	100.51	36.32	705.58
Average Farm Size, Excluding Farms below 5 ha (=12.36 acres), Above Median Wheat Production 1862	44	108.74	78.98	107.87	42.29	705.58
Average Farm Size, Excluding Farms below 5 ha (=12.36 acres), Below Median Wheat Production 1862	44	97.25	77.91	71.91	36.32	484.77
Average Farm Size, USA 1860, Excluding Farms Below 9 acres						
Average Farm Size Excluding Farms Below 9 acres	1944	354.74	231.11	639.89	12.14	17403.0
Average Farm Size, Excluding Farms Below 9 acres, Above Median Wheat Production 1860	979	256.89	194.18	310.37	12.14	5610.0
Average Farm Size, Excluding Farms Below 9 acres, Below Median Wheat Production 1860	965	454.00	309.44	841.41	26.00	17403.0

Note: Farm size is measured in acres.

Table A.2: Descriptive Statistics

	Obs.	Mean	Std.Dev	Min.	Max.
Explanatory variables					
Share of Emigres in Population	86	0.0047	0.0064	0.00	0.05
Altitude	88	353.37	344.24	36.02	1729.22
Land Suitability	88	0.75	0.19	0.21	0.98
Latitude	88	46.54	2.11	42.60	50.49
Longitude	88	2.62	2.66	-4.06	7.55
Distance to Paris	88	357.07	178.66	0.00	693.86
Distance to Lyon	88	322.25	145.85	0.00	709.62
Distance to Marseille	88	448.50	210.44	0.00	879.23
Department Area	88	618807.00	148900.10	61087.20	1084890.00
Distance to Border	88	191.11	134.17	16.56	557.59
Distance to Coast	88	159.54	111.61	10.42	411.07
Temperature in Summer 1792	88	17.97	1.36	13.69	21.82
Lack of Commons in Department	88	0.32	0.47	0	1
Mechanical Mills 1789	88	0.08	0.31	0	2
Encyclopedie Subscribers	86	1.00	0.00	1	1.00
University in 1700	88	0.18	0.39	0	1
Temperature Deviations					
Deviation from Temperature in Summer 1788 (1763-1787)	87	0.85	0.32	0.13	1.51
Devation from Temperature in Summer 1789 (1764-1788)	87	-1.05	0.48	-1.93	0.01
Devation from Temperature in Summer 1790 (1765-1789)	87	0.22	0.47	-0.64	1.12
Devation from Temperature in Summer 1791 (1766-1790)	87	0.27	0.28	-0.34	0.72
Devation from Temperature in Summer 1792 (1767-1791)	87	-0.05	0.22	-0.55	0.42
Devation from Temperature in Summer 1793 (1768-1792)	87	0.78	0.61	-0.33	2.33
Devation from Temperature in Summer 1794 (1769-1793)	87	0.51	0.42	-0.30	1.27
Devation from Temperature in Summer 1795 (1770-1794)	87	-1.14	0.22	-1.47	-0.56
Devation from Temperature in Summer 1796 (1771-1795)	87	-1.20	0.22	-1.51	-0.56
Devation from Temperature in Summer 1797 (1772-1796)	87	-0.43	0.36	-1.16	0.51
Devation from Temperature in Summer 1798 (1773-1797)	87	0.68	0.17	-0.02	0.98
Devation from Temperature in Summer 1799 (1774-1798)	87	-2.27	0.36	-3.05	-1.30
Deviation from Temperature in Spring 1792 (1767-1791)	87	1.15	0.14	0.82	1.39
Deviation from Temperature in Autumn 1792 (1767-1791)	87	-0.22	0.21	-0.53	0.38
Deviation from Temperature in Winter 1792 (1767-1791)	87	0.66	0.37	0.00	1.43
GDP per capita					
GDP per capita 1860	87	498.18	144.20	273.00	1105.00
GDP per capita 1901	86	863.42	269.40	255.30	1816.40
GDP per capita 1930	87	6464.61	1500.21	4033.47	14109.90
GDP per capita 1995	88	17.64	3.17	13.23	38.83
GDP per capita 2000	88	20.37	3.99	15.49	47.72
GDP per capita 2010	88	24.65	5.60	18.36	63.22
Value added by workforce in each sector					
1860 Value Added per Worker in Agriculture	87	0.00	0.00	0.00	0.00
1930 Value Added per Worker in Agriculture	87	0.01	0.00	0.00	0.02
1982 Value Added per Worker in Agriculture	88	3699.27	6510.40	225.52	55433.29
1990 Value Added per Worker in Agriculture	88	6069.24	6372.52	320.53	36589.30
1860 Value Added per Worker in Industry	87	0.00	0.00	0.00	0.00
1930 Value Added per Worker in Industry	87	0.02	0.00	0.01	0.03
1982 Value Added per Worker in Industry	88	5182.49	9865.68	304.84	88828.12
1990 Value Added per Worker in Industry	88	10524.74	23123.32	685.78	210220.80
1860 Value Added per Worker in Services	87	0.00	0.00	0.00	0.00
1930 Value Added per Worker in Services	87	0.01	0.00	0.01	0.02
1982 Value Added per Worker in Services	88	6716.78	12338.99	670.73	111846.40
1990 Value Added per Worker in Services	88	10455.12	20475.20	1034.12	186043.20
Workforce in agriculture, industry and services					
Share of the Workforce in Agriculture 1860	87	0.63	0.16	0.01	0.89
Share of the Workforce in Agriculture 1930	87	0.45	0.16	0.00	0.73
Share of the Workforce in Agriculture 1982	88	0.13	0.07	0.00	0.34
Share of the Workforce in Agriculture 1990	88	0.09	0.05	0.00	0.26
Share of the Workforce in Agriculture 1999	88	0.07	0.04	0.00	0.19
Share of the Workforce in Agriculture 2010	88	0.22	0.09	0.00	0.47
Share of the Workforce in Industry 1860	87	0.22	0.11	0.06	0.52
Share of the Workforce in Industry 1930	87	0.30	0.11	0.13	0.63
Share of the Workforce in Industry 1982	88	0.34	0.07	0.20	0.49
Share of the Workforce in Industry 1990	88	0.31	0.06	0.15	0.44
Share of the Workforce in Industry 1999	88	0.26	0.05	0.14	0.36
Share of the Workforce in Industry 2010	88	0.23	0.03	0.14	0.33
Share of the Workforce in Services 1860	87	0.15	0.07	0.05	0.47
Share of the Workforce in Services 1930	87	0.25	0.08	0.13	0.54
Share of the Workforce in Services 1982	88	0.53	0.07	0.40	0.71
Share of the Workforce in Services 1990	88	0.60	0.06	0.47	0.76
Share of the Workforce in Services 1999	88	0.68	0.06	0.57	0.85
Share of the Workforce in Services 2010	88	0.53	0.09	0.37	0.86
Child Labor, Agricultural Survey 1929					
Share of French agricultural workers below age 15 in the agricultural sector	87	0.01	0.01	0.00	0.07
Share of French agricultural workers below age 15 among agricultural workers	89	0.01	0.01	0.00	0.06
Share of French agricultural workers below age 15 among agricultural workers below age 15	89	1.00	0.00	1.00	1
Share of French agricultural workers below age 15 among agricultural workers above age 15	89	0.07	0.05	0.01	0.26
Voters in 1839					
Share of Electors in Departmental Population	82	0.01	0.00	0.00	0.01
Share of Landowners Among Electors	67	0.56	0.09	0.28	0.72
Share of Businessmen Among Electors	67	0.24	0.09	0.10	0.60
Share of Professionals Among Electors	67	0.11	0.04	0.04	0.24
Share of Civil Servants Among Electors	67	0.09	0.04	0.02	0.18
Enrollment in 2010					
School Enrollment of Men Age 15-17 in 2010 (in percent)	88	95.58	1.00	93.1	97.7
School Enrollment of Men Age 18-24 in 2010 (in percent)	88	96.70	0.87	94.4	98.1
No Interest in Science 2001					
Share of Individuals who Express no Interest in Science, 2001	66	0.09	0.09	0	0.44
Price of Wheat 1797-1800					
Wheat Price, 1797-1800	337	18.28	4.92	9.08	38.48

Table A.3: Do Temperature Deviations Influence Local Food Prices and Local Violence?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	Price of Wheat 1797-1800					Riots in Aug. & Sept. 1792	
Squared Deviation from Temperature	0.030***	0.028***					
in Summer 1797-1800	[0.006]	[0.006]					
Absolute Deviation from Temperature			0.063***				
in Summer 1797-1800			[0.020]				
Negative Squared Deviation from Temperature				0.029***			
in Summer 1797-1800				[0.006]			
Positive Squared Deviation from Temperature				0.159**			
in Summer 1797-1800				[0.077]			
Negative Absolute Deviation from Temperature					0.065***		
in Summer 1797-1800					[0.020]		
Positive Absolute Deviation from Temperature					0.200***		
in Summer 1797-1800					[0.064]		
Squared Deviation from Temperature						6.077***	
in Summer 1792 (1767-1791)						[1.536]	
Absolute Deviation from Temperature							2.553***
in Summer 1792 (1767-1791)							[0.784]
Within R2	0.148	0.522	0.511	0.529	0.519		
Adjusted R2	0.522	0.516	0.506	0.522	0.512		
Department fixed effects	No	Yes	Yes	Yes	Yes		
Year fixed effects	Yes	Yes	Yes	Yes	Yes		
Clusters	85	85	85	85	85		
Geographic controls						Yes	Yes
Historical controls						Yes	Yes
F-stat (1st stage)						15.654	10.592
Observations	337	337	337	337	337	85	85

Note: This table reports the effect of the absolute and squared deviation from standardized temperature in summer 1797-1800 on the price in wheat in OLS regressions with *département*- and year-fixed effects in 1797-1800 period (columns 1-4) and in summer 1792 on the number of riots in August and September 1792 accounting for geographic and historical controls (Columns 5-6). All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.4: First Stage Regressions: Squared Deviations from Temperature in Summer, Spring, Fall and Winter 1792

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	First stage: the instrumented variable is Share of Emigres in Population							
Squared Devation from Temperature in Summer 1792 (1767-1791)	6.159***				10.26***	5.983***	7.203***	11.48***
	[1.499]				[2.151]	[1.533]	[1.715]	[2.295]
Squared Devation from Temperature in Spring 1792 (1767-1791)		-1.029			3.221**			3.225**
		[1.063]			[1.317]			[1.409]
Squared Devation from Temperature in Autumn 1792 (1767-1791)			2.807			1.600		3.661
			[2.780]			[2.348]		[2.331]
Squared Devation from Temperature in Winter 1792 (1767-1791)				-0.200			0.721*	1.119**
				[0.444]			[0.412]	[0.508]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat (1st stage)	16.862	7.506	6.578	6.046	14.700	15.543	29.136	29.174
Observations	85	85	85	85	85	85	85	85

Note: This table reports robustness checks to our baseline first stage specification in the 2SLS regressions where the IV is the squared deviation of standardized summer temperature in 1792 and where the instrumented variable is the share of emigres in the population (the dependent variable in the second stage of the 2SLS regression is GDP per capita in 1860 as shown in Table 3). The robustness checks consider the effect of the squared deviation from standardized temperature in spring, fall and winter 1792. The dependent variable is in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.5: First Stage Regressions: Absolute Deviations from Temperature in Summer, Spring, Fall and Winter 1792

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	First stage: the instrumented variable is Share of Emigres in Population							
Absolute Devation from Temperature in Summer 1792 (1767-1791)	2.590***				3.772***	2.518***	2.679***	3.492***
	[0.770]				[0.974]	[0.860]	[0.777]	[1.046]
Absolute Devation from Temperature in Spring 1792 (1767-1791)		-2.647			5.326			4.817
		[2.704]			[3.215]			[3.189]
Absolute Devation from Temperature in Autumn 1792 (1767-1791)			1.511			0.319		1.330
			[1.500]			[1.283]		[1.386]
Absolute Devation from Temperature in Winter 1792 (1767-1791)				0.591			0.827	1.216
				[0.589]			[0.528]	[0.756]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat (1st stage)	13.190	7.404	6.452	7.251	11.320	12.069	17.602	14.921
Observations	85	85	85	85	85	85	85	85

Note: This table reports robustness checks to our baseline first stage specification in the 2SLS regressions where the IV is the absolute deviation of standardized summer temperature in 1792 and where the instrumented variable is the share of *émigrés* in the population (the dependent variable in the second stage of the 2SLS regression is GDP per capita in 1860 as shown in Table A.10). The robustness checks consider the effect of the squared deviation from standardized temperature in spring, fall and winter 1792. The dependent variable is in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.6: Robustness Checks. Deviations from Temperature in Summer 1792 on GDP per capita 1860: Summers 1788-1800

Panel A. GDP per capita 1860

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Reduced Form GDP per capita 1860												
Squared Deviation from Temperature in Summer 1792 (1767-1791)	-1.572***	-1.485***	-1.551***	-1.510***	-1.775***	-1.651***	-1.656***	-1.085**	-1.578***	-2.356***	-1.245**	-1.750***	-1.582***
	[0.381]	[0.373]	[0.391]	[0.400]	[0.518]	[0.395]	[0.482]	[0.450]	[0.385]	[0.508]	[0.514]	[0.460]	[0.384]
Squared Deviation from Temperature in Summer 1788 (1763-1787)		0.225											
		[0.188]											
Squared Deviation from Temperature in Summer 1789 (1764-1788)			0.0267										
			[0.0576]										
Squared Deviation from Temperature in Summer 1790 (1765-1789)				0.142									
				[0.115]									
Squared Deviation from Temperature in Summer 1791 (1766-1790)					0.259								
					[0.415]								
Squared Deviation from Temperature in Summer 1793 (1768-1792)						0.0260							
						[0.0348]							
Squared Deviation from Temperature in Summer 1794 (1769-1793)							0.0535						
							[0.146]						
Squared Deviation from Temperature in Summer 1795 (1770-1794)								0.290**					
								[0.141]					
Squared Deviation from Temperature in Summer 1796 (1771-1795)									0.0855				
									[0.152]				
Squared Deviation from Temperature in Summer 1797 (1772-1796)										0.316**			
										[0.156]			
Squared Deviation from Temperature in Summer 1798 (1773-1797)											0.141		
											[0.171]		
Squared Deviation from Temperature in Summer 1799 (1774-1798)												-0.0154	
												[0.0254]	
Squared Deviation from Temperature in Summer 1800 (1775-1799)													-0.0891
													[0.210]
Adjusted R2	50.745	48.659	51.532	48.843	53.864	49.995	47.751	56.946	44.806	56.396	49.938	50.004	49.379
F-stat	0.643	0.646	0.638	0.642	0.639	0.640	0.638	0.655	0.639	0.654	0.641	0.639	0.639
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	85	85	85	85	85	85	85

Panel B. GDP per capita 2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Reduced Form GDP per capita 2010												
Squared Deviation from Temperature in Summer 1792 (1767-1791)	1.093***	1.077***	1.151***	1.141***	1.123**	0.896***	1.022**	1.217***	1.088***	0.839*	0.812*	0.702*	1.102***
	[0.316]	[0.328]	[0.318]	[0.336]	[0.440]	[0.320]	[0.422]	[0.365]	[0.313]	[0.438]	[0.463]	[0.421]	[0.320]
Squared Deviation from Temperature in Summer 1788 (1763-1787)		-0.0406											
		[0.113]											
Squared Deviation from Temperature in Summer 1789 (1764-1788)			0.0739										
			[0.0453]										
Squared Deviation from Temperature in Summer 1790 (1765-1789)				0.108									
				[0.103]									
Squared Deviation from Temperature in Summer 1791 (1766-1790)					-0.0386								
					[0.331]								
Squared Deviation from Temperature in Summer 1793 (1768-1792)						0.0650**							
						[0.0260]							
Squared Deviation from Temperature in Summer 1794 (1769-1793)							0.0452						
							[0.121]						
Squared Deviation from Temperature in Summer 1795 (1770-1794)								0.0735					
								[0.107]					
Squared Deviation from Temperature in Summer 1796 (1771-1795)									0.0709				
									[0.125]				
Squared Deviation from Temperature in Summer 1797 (1772-1796)										0.102			
										[0.113]			
Squared Deviation from Temperature in Summer 1798 (1773-1797)											-0.120		
											[0.120]		
Squared Deviation from Temperature in Summer 1799 (1774-1798)												-0.0338	
												[0.0214]	
Squared Deviation from Temperature in Summer 1800 (1775-1799)													0.0878
													[0.112]
Adjusted R2	0.596	0.590	0.601	0.596	0.590	0.618	0.591	0.592	0.591	0.594	0.595	0.602	0.593
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	69.199	64.722	63.743	72.482	68.747	81.521	62.906	68.585	64.497	73.169	62.912	73.857	63.111
Observations	86	86	86	86	86	86	86	86	86	86	86	86	86

Note: This table reports reduced form regressions that assess the effect of the squared deviation from standardized temperature in summer 1792 on GDP per capita in 1860 (Panel A) and GDP per capita in 2010 (Panel B), accounting for the squared deviation standardized temperature in the summers over the 1788-1800 period. It shows that only the squared deviation from standardized temperature in 1792 has a negative effect impact on GDP per capita in 1860 and a positive impact on GDP per capita in 2010. The dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.7: First Stage Regressions: The Impact of Summer Deviations from Temperature in Summer 1792 on Emigration, Accounting from Spatial Correlation

	(1)	(2)	(3)
	OLS	OLS	OLS
	Share of Emigres		
Squared Deviation from Temperature in Summer 1792 (1767-1791)	4.336	5.950	6.216
White Robust Standard Errors	[1.140]***	[1.445]***	[1.481]***
Spatial std. errors, 25 km	[1.038]***	[1.278]***	[1.332]***
Spatial std. errors, 50 km	[1.043]***	[1.279]***	[1.333]***
Spatial std. errors, 100 km	[1.141]***	[1.278]***	[1.319]***
Spatial std. errors, 200 km	[1.449]***	[1.185]***	[1.177]***
Spatial std. errors, 300 km	[1.634]***	[1.154]***	[1.102]***
Spatial std. errors, 400 km	[1.732]**	[1.185]***	[1.071]***
Spatial std. errors, 500 km	[1.761]**	[1.229]***	[1.069]***
Geographic controls	No	Yes	Yes
Historical controls	No	No	Yes
Observations	86	86	86

Note: This table reports White robust standard errors and spatial Conley (1999) standard errors for the first stage of our 2SLS regressions between our IV, the squared deviation from standardized temperature in summer 1792, and the instrumented variable, the share of *émigrés* in the population. The dependent variable is in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.8: Robustness Checks. Baseline Deviations from Temperature in Summer 1792 and GDP per capita 1860 & 2010

Panel A. GDP per capita 1860

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reduced Form GDP per capita 1860									
Squared Devation from Temperature in Summer 1792 (1767-1791)	-1.572*** [0.381]									
Absolute Devation from Temperature in Summer 1792 (1767-1791)		-0.637*** [0.167]								
Squared Devation from Temperature in Summer 1792 (1742-1791)			-1.050*** [0.282]							
Absolute Devation from Temperature in Summer 1792 (1742-1791)				-0.740*** [0.177]						
Squared Devation from Temperature in Summer 1792 (1776-1800)					-3.524*** [0.819]					
Absolute Devation from Temperature in Summer 1792 (1776-1800)						-1.152*** [0.334]				
Squared Devation from Temperature in Summer 1792 (1751-1775)							-0.614*** [0.183]			
Absolute Devation from Temperature in Summer 1792 (1751-1775)								-0.618*** [0.153]		
Squared Devation from Temperature in Summer 1792 (1751-1800)									-1.731*** [0.432]	
Absolute Devation from Temperature in Summer 1792 (1751-1800)										-0.748*** [0.209]
Adjusted R2	0.643	0.627	0.635	0.638	0.654	0.639	0.623	0.628	0.641	0.629
F-stat	50.745	44.345	41.400	39.224	58.143	49.856	36.158	34.390	45.597	40.144
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	85	85	85	85

Panel B. GDP per capita 2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Reduced Form GDP per capita 2010									
Squared Devation from Temperature in Summer 1792 (1767-1791)	1.093*** [0.316]									
Absolute Devation from Temperature in Summer 1792 (1767-1791)		0.516*** [0.140]								
Squared Devation from Temperature in Summer 1792 (1742-1791)			0.627*** [0.229]							
Absolute Devation from Temperature in Summer 1792 (1742-1791)				0.304** [0.144]						
Squared Devation from Temperature in Summer 1792 (1776-1800)					2.439*** [0.632]					
Absolute Devation from Temperature in Summer 1792 (1776-1800)						0.951*** [0.209]				
Squared Devation from Temperature in Summer 1792 (1751-1775)							0.388*** [0.144]			
Absolute Devation from Temperature in Summer 1792 (1751-1775)								0.213* [0.121]		
Squared Devation from Temperature in Summer 1792 (1751-1800)									1.168*** [0.366]	
Absolute Devation from Temperature in Summer 1792 (1751-1800)										0.471*** [0.167]
Adjusted R2	0.596	0.599	0.569	0.544	0.608	0.620	0.564	0.534	0.589	0.569
F-stat	69.199	70.393	74.461	81.776	69.595	74.409	72.049	90.221	72.318	69.639
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86	86	86	86	86	86	86	86	86	86

Note: This table reports reduced form regressions that assess the effect of our IVs,the squared and absolute deviations from standardized temperature in summer 1792, on GDP per capita in 1860 (Panel A) and GDP per capita in 2010 (Panel B), where we consider other baseline periods than the 25 years preceding 1792. In all specifications, the squared deviation from standardized temperature in 1792 has a negative effect impact on GDP per capita in 1860 and a positive impact on GDP per capita in 2010. The dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.9: Summer Temperature Shock 1792 and Emigration: Falsification Tests

Panel A. Violence before and after 1789-1815.

	(1) OLS Riots during Flour May - June 1775	(2) OLS White Terror - Convictions in Ordinary Court 1815-1816	(3) OSLS White Terror - Convictions in Provost Courts 1816-1818	(4) OSLS White Terror Arrests 1815-1816
Squared Deviation from Temperature in Summer 1792 (1767-1791)	-2.807	-6.521	0.127	0.051
	[1.954]	[4.265]	[0.243]	[0.367]
Observations	86	84	84	84

Panel B. Cahiers de Doleances.

	(1) OLS Approving Vote by Head	(2) OLS State Intervention in Education	(3) OLS Abolition of Guilds	(4) OLS Mercantilist Demands	(5) OLS Reform or Abolition of Feudal Dues	(6) OLS Abolition of Serfdom	(7) OLS Tendency Towards Socialism
Squared Deviation from Temperature in Summer 1792 (1767-1791)	0.764	0.575	0.113	-0.131	0.772	-0.115	-0.106
	[0.632]	[0.507]	[0.335]	[0.346]	[0.687]	[0.144]	[0.214]
Observations	77	77	77	77	77	77	77

Panel C. Human Capital before the Revolution.

	(1) OLS Share of husbands who signed their wedding contract 1686-1690	(2) OSLS Share of wives who signed their wedding contract 1686-1690	(3) OLS Share of husbands who signed their wedding contract 1786-1790	(4) OLS Share of wives who signed their wedding contract 1786-1790
Squared Deviation from Temperature in Summer 1792 (1767-1791)	-0.876	0.101	-0.273	-1.732
	[1.363]	[1.425]	[1.521]	[1.390]
Observations	75	75	78	78

Panel D. Number of Noble Families in Gotha Almanach 1790.

	(1) OLS Number of Noble Families in Gotha Almanach 1790	(2) OLS Share of Noble Families in Gotha Almanach in Population 1790
Squared Deviation from Temperature in Summer 1792 (1767-1791)	-2.456*	-2.957*
	[1.408]	[1.666]
Observations	83	83

Note: This table reports reduced form regressions between our IV, the squared deviation from standardized temperature in summer 1792 and several variables which could potentially be endogenous to our economic growth, and which could bias our estimates if they were correlated with our IV. These are variables pertaining to violence before 1789 and after 1815, demands from the cahiers de *doléances* (Panel B), measures of human capital before the Revolution (Panel C), and the number of noble families in Gotha Almanach in1790 (Panel D). All the dependent variables are in logarithm Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.10: Emigrés and GDP per capita (IV is the Absolute Deviation of Temperature in Summer 1792)

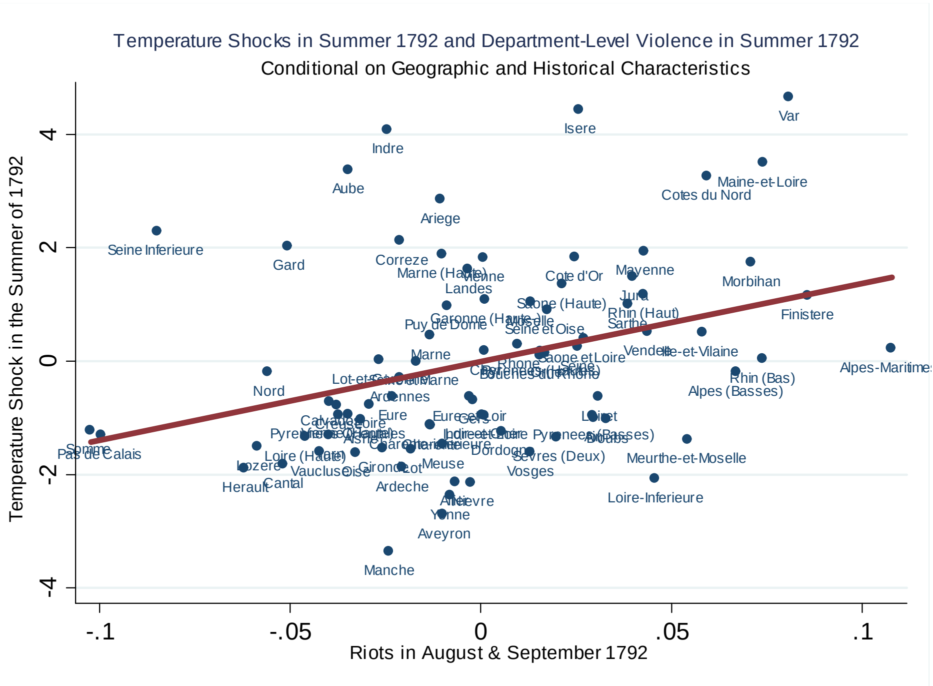
Panel A. GDP per capita 1860-1930

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) OLS	(7) 2SLS	(8) 2SLS	(9) OLS	(10) OLS	(11) 2SLS	(12) 2SLS
	GDP per capita 1860				GDP per capita 1901				GDP per capita 1930			
Share of Emigres in Population	-0.0109	-0.0811***	-0.186**	-0.246***	-0.00861	-0.0681	-0.214	-0.278	0.0340	-0.00614	-0.0386	-0.0370
	[0.0322]	[0.0304]	[0.0729]	[0.0784]	[0.0388]	[0.0534]	[0.158]	[0.193]	[0.0289]	[0.0288]	[0.0535]	[0.0459]
Adjusted R2	-0.011	0.585			-0.012	0.278			0.002	0.608		
Geographical Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Historical Controls	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	85	85	85	85	83	83	83	83	85	85	85	85
First stage: the instrumented variable is Share of Emigres in Population												
Absolute Deviation from Temperature in Summer 1792 (1767-1791)			2.612***	2.590***			2.163***	1.937***			2.612***	2.590***
			[0.708]	[0.770]			[0.651]	[0.641]			[0.708]	[0.770]
F-stat (1st stage)			13.616	11.320			11.050	9.139			13.616	11.320

Panel B. GDP per capita 1995-2010

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) OLS	(7) 2SLS	(8) 2SLS	(9) OLS	(10) OLS	(11) 2SLS	(12) 2SLS
	GDP per capita 1995				GDP per capita 2000				GDP per capita 2010			
Share of Emigres in Population	0.0237	0.0478**	0.205***	0.204***	0.0238	0.0553**	0.223***	0.215***	0.0201	0.0493*	0.195***	0.197***
	[0.0195]	[0.0212]	[0.0615]	[0.0670]	[0.0199]	[0.0222]	[0.0675]	[0.0704]	[0.0225]	[0.0254]	[0.0660]	[0.0706]
Adjusted R2	0.003	0.472			0.001	0.470			-0.005	0.466		
Geographical Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Historical Controls	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	86	86	86	86	86	86	86	86	86	86	86	86
First stage: the instrumented variable is Share of Emigres in Population												
Absolute Deviation from Temperature in Summer 1792 (1767-1791)			2.632***	2.620***			2.632***	2.653***			2.632***	2.620***
			[0.701]	[0.757]			[0.701]	[0.739]			[0.701]	[0.757]
F-stat (1st stage)			14.107	11.970			14.107	12.871			14.107	11.970

Note: This table reports the effect of the share of émigrés in the population on the logarithm of GDP per capita in OLS and 2SLS regressions in 1860, 1901 and 1930 (Panel A) and in 1995, 2000 and 2010 (Panel B). The IV in the first stage of the 2SLS regressions is the absolute standardized deviation from temperature in summer 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.



IV is the Squared Deviation from Temperature in Summer 1792

Figure A.1: Temperature Deviation in Summer 1792 and Local Violence in Summer 1792, Controlling for Geographic and Historical Characteristics

Note: This figure depicts the partial scatterplot of the effect of temperature shocks in summer 1792 on the logarithm of the number of riots in August and September 1792 in each French *département*. Thus, the x- and y-axes plots the residuals obtained from regressing the logarithm of the number of riots in August and September 1792 against the squared deviation from temperature in the summer of 1792, conditional on geographic and historical controls.

Table A.11: First Stage Regressions: Squared & Absolute Deviations from Temperature and Rainfall in Summer 1792

	(1)	(2)	(3)	(4)
First stage: the instrumented variable is Share of Emigres in Population				
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.159***	6.458***		
	[1.499]	[1.524]		
Squared Deviation from Rainfall in Summer 1792 (1767-1791)		0.980*		
		[0.525]		
Absolute Deviation from Temperature in Summer 1792 (1767-1791)			2.590***	2.840***
			[0.770]	[0.828]
Absolute Deviation from Rainfall in Summer 1792 (1767-1791)				0.617
				[0.420]
Geographic controls	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes
F-stat (1st stage)	85	85	85	85
Observations	16.862	28.958	13.190	18.876

Note: This table reports robustness checks to our baseline first stage specification in the 2SLS regressions where the IV is the squared and absolute deviation of standardized summer temperature in 1792 and where the instrumented variable is the share of emigres in the population (the dependent variable in the second stage of the 2SLS regression is GDP per capita in 1860 as shown in Table 3). The robustness checks consider the effect of the squared and absolute deviation from standardized rainfall in summer 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.12: Emigrés and Population Size, 1801-2010

Panel A. Population of *Département, 1801-2010*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Population of *Département*										
	1801	1821	1841	1861	1881	1901	1921	1968	1982	1999	2010
Share of Emigres	0.0600	0.0778	0.0975	0.0630	-0.139	-0.0447	0.202	0.398**	0.492**	0.554***	0.594***
	[0.0927]	[0.0956]	[0.0989]	[0.107]	[0.148]	[0.165]	[0.148]	[0.182]	[0.195]	[0.204]	[0.208]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	84	84	84	86	84	84	86	86	86	86	86
First stage: the instrumented variable is Share of Emigres in Population											
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.834***	6.834***	6.834***	6.216***	5.131***	5.131***	6.216***	6.216***	6.216***	6.216***	6.216***
	[1.547]	[1.547]	[1.547]	[1.487]	[1.221]	[1.221]	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]
F-stat (1st stage)	19.515	19.515	19.515	17.476	17.657	17.657	17.476	17.476	17.476	17.476	17.476

Panel B. Population of *Chef-Lieu* of *Département, 1806-2006*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Population of *Chef-Lieu* of *Département*											
	1806	1821	1841	1861	1881	1901	1921	1946	1968	1982	1999	2006
Share of Emigres	-0.188	-0.0795	-0.186	0.0696	0.143	0.517	0.585	0.700	0.802	0.867*	0.942*	0.972**
	[0.273]	[0.240]	[0.219]	[0.270]	[0.298]	[0.475]	[0.508]	[0.518]	[0.498]	[0.491]	[0.492]	[0.482]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86	86	84	85	86	86	86	86	86	86	86	86
First stage: the instrumented variable is Share of Emigres in Population												
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.216***	6.216***	6.834***	6.209***	6.216***	6.216***	6.216***	6.216***	6.216***	6.216***	6.216***	6.216***
	[1.487]	[1.487]	[1.547]	[1.484]	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]	[1.487]
F-stat (1st stage)	17.476	17.476	19.515	17.514	17.476	17.476	17.476	17.476	17.476	17.476	17.476	17.476

Note: This table reports the effect of the share of émigrés in the population on the population in each *département* (Panel A) and in the *chef-lieu* (i.e., main administrative center) of each *département* over the 1801-2010 period. All the dependent variables are in logarithm. The IV in the first stage of the 2SLS regressions is the squared standardized deviation from temperature in summer 1792. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.13: Emigrés and Financial Development: Savings Banks' Loans and Contracts Sealed by Notaries

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Amount of Loans from Savings Banks			Contracts Sealed by Notaries		
	1875	1881	1900	1861	1901	1931
Share of Emigres	-0.122	-0.166	0.0108	-0.197*	-0.141	0.167
	[0.290]	[0.256]	[0.195]	[0.112]	[0.131]	[0.133]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	83	83	83	86	83	86
	First Stage: the Instrumented variable is Share of Emigres in the Population					
Squared Deviation from Temperature	4.895***	4.895***	4.895***	6.216***	4.895***	6.216***
in Summer 1792 (1767-1791)	[1.209]	[1.209]	[1.209]	[1.487]	[1.209]	[1.487]
F-stat (1st stage)	16.378	16.378	16.378	17.476	16.378	17.476
	Reduced Form					
Squared Deviation from Temperature	-0.600	-0.813	0.0527	-1.225*	-0.689	1.039
in Summer 1792 (1767-1791)	[1.611]	[1.430]	[1.068]	[0.692]	[0.702]	[0.853]

Note: This table reports the effect of the share of émigrés in the population on the amount of loans given by savings banks (columns 1-3) and the number of contract sealed by notaries (columns 4-6) where the IV is the squared standardized deviation from summer temperature in 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.14: Emigrés and Civil Servants in the Workforce in the 19th century

	(1)	(2)	(3)
	2SLS	2SLS	2SLS
Share of Civil Servants in Workforce			
	1851	1866	1881
Share of Emigres	0.814***	0.363**	0.150
	[0.217]	[0.180]	[0.262]
Geographic controls	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes
Observations	84	86	83
First stage: the instrumented variable is Share of Emigres in Population			
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.834***	6.216***	4.895***
	[1.547]	[1.487]	[1.209]
F-stat (1st stage)	19.515	17.476	16.378

Note: This table reports the effect of the share of émigrés in the population on the share of civil servants in the workforce during the 19th century where the IV is the squared of standardized summer temperature in 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.15: Emigrés and Octroi Tax Rates, 1875

	(1)	(2)	(3)	(4)	(5)
	2SLS	2SLS	2SLS	2SLS	2SLS
	Share of Communes with Octroi in 1875 Out of Total Number of Communes in *Département*)	Octroi Tax Rates by *Département* in 1875 on			
		Pure Alcohol	Beef	Sheep	Pork
Share of Emigres in Population	1.281***	0.199	0.261**	0.319*	0.337**
	[0.428]	[0.248]	[0.116]	[0.174]	[0.164]
Geographical controls	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes
Observations	83	83	83	83	83
	First stage: the instrumented variable is Share of Emigres in Population				
Squared Deviation from Temperature in Summer 1792 (1767-1791)	4.895***	4.895***	4.895***	4.895***	4.895***
	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]
F-stat (1st stage)	16.378	16.378	16.378	16.378	16.378
	Reduced Form				
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.269***	0.973	1.278**	1.559*	1.650**
	[2.140]	[1.351]	[0.579]	[0.881]	[0.812]

Note: This table reports the effect of the share of émigrés in the population on the share of communes with an octroi in each *département* in 1875 as well as on the tax rates on several goods in 1875 where the IV is the squared standardized deviation from summer temperature in 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.16: Emigrés, Male School Enrollment in 2010 and Lack of Interest in Science in 2001

	(1) 2SLS School Enrollment of Men Age 15-17 in 2010	(2) 2SLS School Enrollment of Men Age 18-24 in 2010	(3) 2SLS Share of Individuals who Express no Interest in Science, 2001
Share of Emigres in Population	1.713***	4.173*	-0.0717**
	[0.500]	[2.231]	[0.0359]
Geographic controls	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes
Observations	86	86	65
	First stage: the instrumented variable is Share of Emigres in Population		
Squared Deviation from Temperature in Summer 1792 (1767-1791)	6.216***	6.216***	6.703***
	[1.487]	[1.487]	[1.409]
F-stat (1st stage)	17.476	17.476	22.630

Note: This table reports the effect of the share of émigrés in the population on the share of men age 15-17 (column 1) and age 18-24 (column 2) in 2010 as well as the share of individuals who express no interest in science in 2001 where the IV is the squared standardized deviation from summer temperature in 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.17: Emigrés and Public Spending before WWI

Panel A. Primary schools and male & female population age 5-15

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Ratio of schools to male and female population age 5-15					
	1876	1881	1886	1891	1896	1901
Share of Emigres	-0.387**	-0.407**	-0.389**	-0.335*	-0.277	-0.427***
	[0.156]	[0.167]	[0.157]	[0.183]	[0.187]	[0.156]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	83	83	82	82	83	83
	First Stage: the instrumented variable is Share of Emigres					
Squared Deviation from Temperature in Summer 1792 (1767-1791)	4.895***	4.895***	4.893***	4.811***	4.895***	4.895***
	[1.209]	[1.209]	[1.210]	[1.239]	[1.209]	[1.209]
F-stat (1st stage)	16.378	16.378	16.359	15.065	16.378	16.378

Panel B. Total Public Spending on Education per Pupil in Primary Schools

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Total Public Spending per Pupil					
	1876	1881	1886	1891	1896	1901
Share of Emigres in Population	0.0005	-0.184*	-0.133	-0.393**	-0.127	-0.358**
	[0.0971]	[0.102]	[0.0908]	[0.165]	[0.103]	[0.139]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	83	83	83	83	83	83
	First Stage: the Instrumented variable is Share of Emigres in the Population					
Squared Devation from Temperature in Summer 1792 (1767-1791)	4.895***	4.895***	4.895***	4.895***	4.895***	4.895***
	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]
F-stat (1st stage)	16.378	16.378	16.378	16.378	16.378	16.378

Panel C. Roads & Railroads

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	Area Covered by Roads within Department'sTerritory			Area Covered by Railroad within Department'sTerritory			Total Spending on Road Maintenance		
	1881	1900	1913	1881	1900	1913	1881	1900	1913
Share of Emigres	-0.526***	-0.447***	-0.671***	-0.443**	-0.172	-0.155	-0.153	-0.587***	-0.417***
	[0.160]	[0.143]	[0.225]	[0.223]	[0.130]	[0.117]	[0.179]	[0.175]	[0.134]
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	83	83	83	83	83	83	83	83	83
	First Stage: the Instrumented variable is Share of Emigres in the Population								
Squared Deviation from Temperature in Summer 1792 (1767-1791)	4.895***	4.895***	4.895***	4.895***	4.895***	4.895***	4.895***	4.895***	4.895***
	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]	[1.209]
F-stat (1st stage)	16.378	16.378	16.378	16.378	16.378	16.378	16.378	16.378	16.378

Note: This table reports the effect of the share of émigrés in the population on measures pertaining to public spending on education per pupil (Panel A), the number of primary schools with respect to the male and female population age 5-15 (Panel C) and the infrastructure of roads and railroads (Panel C) where the IV is the squared standardized deviation from summer temperature in 1792. All the dependent variables are in logarithm. Robust standard errors are reported in brackets. *** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table A.18: Descriptive Statistics for Variables in Robustness Analysis

	Obs.	Mean	Std.Dev	Min.	Max.
Infant Mortality (Age 0-1)					
Infant Mortality (Age 0-1) 1811	85	0.30	0.08	0.16	0.53
Infant Mortality (Age 0-1) 1821	85	0.29	0.10	0.14	0.60
Infant Mortality (Age 0-1) 1831	85	0.32	0.09	0.16	0.53
Infant Mortality (Age 0-1) 1841	85	0.27	0.08	0.14	0.46
Infant Mortality (Age 0-1) 1851	85	0.30	0.08	0.16	0.48
Infant Mortality (Age 0-1) 1861	88	0.29	0.10	0.12	0.63
Infant Mortality (Age 0-1) 1871	86	0.31	0.08	0	0.49
Infant Mortality (Age 0-1) 1881	86	0.25	0.08	0	0.48
Infant Mortality (Age 0-1) 1891	86	0.22	0.06	0	0.40
Infant Mortality (Age 0-1) 1901	86	0.19	0.04	0	0.29
Infant Mortality (Age 0-1) 1911	86	0.04	0.01	0.02	0.07
Infant Mortality (Age 0-1) 1931	89	0.07	0.01	0.01	0.10
Coale Fertility Index					
Coale Fertility Index 1811	87	0.40	0.10	0.24	0.87
Coale Fertility Index 1821	87	0.39	0.11	0.24	0.82
Coale Fertility Index 1831	87	0.37	0.11	0.23	0.74
Coale Fertility Index 1841	87	0.34	0.08	0.21	0.61
Coale Fertility Index 1851	87	0.34	0.07	0.21	0.54
Coale Fertility Index 1861	90	0.31	0.06	0.21	0.48
Coale Fertility Index 1871	88	0.29	0.06	0.18	0.50
Coale Fertility Index 1881	88	0.29	0.06	0.20	0.57
Coale Fertility Index 1891	88	0.25	0.05	0.16	0.45
Coale Fertility Index 1901	88	0.25	0.04	0.18	0.42
Coale Fertility Index 1911	87	0.21	0.03	0.14	0.30
Coale Fertility Index 1931	90	0.19	0.03	0.12	0.25

Table A.19: Descriptive Statistics for Variables in Robustness Analysis

	Obs.	Mean	Std.Dev	Min.	Max.
Literate Conscripts, Including High-School Graduates					
Share of Literate Conscripts 1841	85	0.561	0.200	0.183	0.978
Share of Literate Conscripts 1844	85	0.581	0.189	0.196	0.955
Share of Literate Conscripts 1847	85	0.609	0.177	0.284	0.978
Share of Literate Conscripts 1851	85	0.612	0.193	0.222	0.954
Share of Literate Conscripts 1855	85	0.636	0.180	0.284	0.942
Share of Literate Conscripts 1859	85	0.671	0.181	0.311	0.957
Share of Literate Conscripts 1862	88	0.717	0.163	0.335	0.999
Share of Literate Conscripts 1865	88	0.758	0.143	0.409	0.979
Share of Literate Conscripts 1868	88	0.790	0.134	0.450	0.994
Share of Literate Conscripts 1871	86	0.780	0.143	0.373	0.989
Share of Literate Conscripts 1874	86	0.82	0.11	0.54	0.99
Share of Literate Conscripts 1877	86	0.84	0.10	0.52	0.98
Share of Literate Conscripts 1880	86	0.84	0.10	0.56	0.97
Share of Literate Conscripts 1883	86	0.86	0.09	0.56	0.99
Share of Literate Conscripts 1886	86	0.88	0.08	0.62	0.99
Share of Literate Conscripts 1888	86	0.89	0.07	0.66	0.99
Share of Literate Conscripts 1892	86	0.92	0.06	0.74	0.99
Share of Literate Conscripts 1895	86	0.94	0.04	0.80	1.00
Share of Literate Conscripts 1898	86	0.94	0.04	0.80	1.00
Share of Literate Conscripts 1901	86	0.95	0.04	0.83	1.00
Share of Literate Conscripts 1904	86	0.95	0.04	0.81	1.00
Share of Literate Conscripts 1908	86	0.96	0.03	0.87	1.00
Share of Literate Conscripts 1911	86	0.96	0.02	0.87	1.00
Share of Literate Conscripts 1912	86	0.96	0.02	0.88	0.99
Share of Literate Conscripts 1926	90	0.91	0.03	0.81	0.96
Share of Literate Conscripts 1930	90	0.92	0.02	0.87	0.96
Share of Literate Conscripts 1932	89	0.93	0.03	0.82	0.97
Share of Literate Conscripts 1934	90	0 .93	0.02	0.88	0.97
Share of Literate Conscripts 1936	89	0.93	0.02	0.89	0.97

Table A.20: Descriptive Statistics for Variables in Robustness Analysis

	Obs.	Mean	Std.Dev	Min.	Max.
Share of High-School Graduates Among Conscripts					
Share of High-School Graduates Among Conscripts 1874	86	0.006	0.006	0.000	0.040
Share of High-School Graduates Among Conscripts 1877	86	0.008	0.007	0.00	0.043
Share of High-School Graduates Among Conscripts 1880	86	0.01	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1883	86	0.01	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1886	86	0.01	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1888	86	0.02	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1892	86	0.02	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1895	86	0.02	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1898	86	0.02	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1901	86	0.02	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1904	86	0.02	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1908	86	0.02	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1911	86	0.02	0.01	0.00	0.05
Share of High-School Graduates Among Conscripts 1912	86	0.02	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1928	89	0.02	0.01	0.01	0.06
Share of High-School Graduates Among Conscripts 1932	89	0.03	0.01	0.01	0.05
Share of High-School Graduates Among Conscripts 1936	89	0.03	0.01	0.02	0.06

Table A.21: Descriptive Statistics for Variables in Robustness Analysis

	Obs.	Mean	Std.Dev.	Min.	Max
Octroi Tax Rates					
Octroi Tax Rates Pure Alcohol 1875	86	13.07	7.12	3.8	45
Octroi Tax Rates Oil of First Quality 1875	86	9.50	6.12	0	42.65
Octroi Tax Rates Beef 1875	86	7.62	2.61	3	20
Octroi Tax Rates Veal 1875	86	8.21	3.91	0	20
Octroi Tax Rates Sheep 1875	86	8.27	3.04	0	20
Octroi Tax Rates Pork 1875	86	7.02	3.02	0	20
Octroi Tax Rates Charcoal 1875	86	0.71	1.14	0	10
Cahiers de Doleances					
Approving Vote by Head	77	0.06	0.25	0	1
Etatisme in Education	77	0.05	0.28	0	2
Abolition in Guilds	77	0.03	0.16	0	1
Mercantilist Demands	77	0.04	0.19	0	1
Reform or Abolition of Feudal Dues	77	0.08	0.27	0	1
Abolition of Serfdom	77	0.01	0.11	0	1
Tendency towards Socialism	77	0.0	0.1	0	1
Noble Families					
Number of Noble Families in Gotha Almanach 1790	85	13.67	7.66	1	41
Share of Noble Families in Gotha Almanach in 1790 Population	83	0.00005	0.000025	0.000003	0.0001
Total Public Spending per Pupil					
Total Public Spending per Pupil 1876	86	4.12	10.29	0	93.28
Total Public Spending per Pupil 1881	86	8.35	4.52	0	22.88
Total Public Spending per Pupil 1886	86	18.43	4.97	3.06	37.10
Total Public Spending per Pupil 1891	86	26.70	5.81	16.05	50.17
Total Public Spending per Pupil 1896	86	32.39	7.06	18.92	53.67
Total Public Spending per Pupil 1901	86	39.25	29.79	16.97	302.18
Commune Public Spending per Pupil					
Commune Public Spending per Pupil 1876	86	12.36	3.76	4.04	29.68
Commune Public Spending per Pupil 1881	86	10.27	5.60	2.47	43.19
Commune Public Spending per Pupil 1886	86	9.78	12.36	1.57	111.28
Commune Public Spending per Pupil 1891	86	8.43	14.31	1.01	128.01
Commune Public Spending per Pupil 1896	86	7.12	10.07	1.52	82.45
Commune Public Spending per Pupil 1901	86	12.28	15.31	1.16	127.04
Pre-revolutionary human capital					
Share of grooms who signed their wedding contract 1686-1690	77	0.26	0.15	0.06	0.64
Share of brides who signed their wedding contract 1686-1690	77	0.12	0.07	0.01	0.33
Share of grooms who signed their wedding contract 1786-1790	80	0.42	0.24	0.05	0.92
Share of brides who signed their wedding contract 1786-1790	80	0.23	0.17	0.02	0.69
Violence before and after the Revolution					
Riots during Flour May-June 1775	88	3.50	13.94	0	101
White Terror- Convictions in Ordinary Court 1815-1816	85	44.07	43.69	0	185
White Terror- Convictions in Provost Court 1815-1816	85	3.15	3.92	0	24
White Terror - Arrests 1815-1816	85	39.79	59.32	0	494

Table A.22: Descriptive Statistics for Variables in Robustness Analysis

	Obs.	Mean	Std.Dev.	Min.	Max
Population of Departement					
Population of Departement 1801	85	641577.8	2933688	110732	27300000
Population of Departement 1821	86	706318.6	3249226	121418	30500000
Population of Departement 1841	86	793475.5	3651846	132584	34200000
Population of Departement 1861	89	837300.4	3925182	125100	37400000
Population of Departement 1881	87	862890.3	4005441	74244	37700000
Population of Departement 1901	87	892279.3	4150369	92304	3.90E+07
Population of Departement 1921	89	876884.7	4138580	89275	3.92E+07
Population of Departement 1968	88	593623.9	791113.2	80736	6648664
Population of Departement 1992	88	649898	821404.6	76948	6285496
Population of Departement 1999	88	698841.7	878124.3	75644	6340619
Population of Departement 2010	88	747640.3	942826	79096.9	6860285
Population of Chef-Lieu of Departement					
Population of Chef-Lieu of Departement 1806	88	28030.7	70275.86	857	649412
Population of Chef-Lieu of Departement 1821	88	28839.17	71452.48	2792	657172
Population of Chef-Lieu of Departement 1841	85	38780.45	102935.3	4465	935261
Population of Chef-Lieu of Departement 1861	87	58251.8	184675.9	5139	1696141
Population of Chef-Lieu of Departement 1881	88	73552.09	245154.9	6749	2269023
Population of Chef-Lieu of Departement 1901	88	98459.64	311575.6	7065	2714068
Population of Chef-Lieu of Departement 1921	88	111380.4	353485.3	6109	2906472
Population of Chef-Lieu of Departement 1946	88	122694.7	367106	6010	2725374
Population of Chef-Lieu of Departement 1968	88	158219.7	441138.5	9331	3224442
Population of Chef-Lieu of Departement 1982	88	154265.8	427001.5	9282	3370085
Population of Chef-Lieu of Departement 1999	88	155334.1	428480.4	9109	3427738
Population of Chef-Lieu of Departement 2006	88	154276.4	435911.3	8681	3479900
Ratio of schools to male and female population age 5-15					
Ratio of schools to male and female population age 5-15 1876	86	0.013	0.005	0.004	0.029
Ratio of schools to male and female population age 5-15 1881	86	0.013	0.006	0.004	0.054
Ratio of schools to male and female population age 5-15 1886	85	0.013	0.004	0.004	0.028
Ratio of schools to male and female population age 5-15 1891	84	0.011	0.004	0.003	0.021
Ratio of schools to male and female population age 5-15 1896	86	0.014	0.006	0.003	0.029
Ratio of schools to male and female population age 5-15 1901	86	0.016	0.006	0.004	0.033
Infrastructure and Spending on Infrastructure					
Roads in Departement's Territory 1881 (in percent)	86	12.53	3.46	5.00	21.20
Roads in Departement's Territory 1900 (in percent)	86	5.47	1.86	2.34	12.86
Roads in Departement's Territory 1913 (in percent)	86	12.70	3.53	1.81	20.65
Area Covered by Railroad withiin Departement's Territory 1881 (in percent)	85	0.62	0.70	0.14	5.97
Area Covered by Railroad withiin Departement's Territory 1901 (in percent)	85	0.84	0.53	0.25	4.55
Area Covered by Railroad withiin Departement's Territory 1913 (in percent)	85	1.00	0.65	0.32	5.91
Total Spending on Road Maintenance 1881	86	3101386	1962050	335044	16200000
Total Spending on Road Maintenance 1900	86	1624075	1062873	218520	7595945
Total Spending on Road Maintenance 1912	86	2757364	1466609	353330	8948850
Contracts Sealed by Notaries					
Contrats Sealed by Notaries 1861	88	40001.82	18805.45	8644	139690
Contrats Sealed by Notaries 1901	85	31436.32	22222.62	6157	179727
Contrats Sealed by Notaries 1931	88	33577.77	35862.64	4662	306451
Amount of Loans from Savings Banks					
Amount of Loans from Savings Banks 1875	86	3132973	2964086	300374	18500000
Amount of Loans from Savings Banks 1881	86	5864920	5311230	716117	37400000
Amount of Loans from Savings Banks 1900	85	13200000	15800000	2360311	139000000

Table A.23: Descriptive Statistics for Variables in Robustness Analysis

	Obs	Mean	Std. Dev.	Min	Max
Average Temperature in Summers 1788-1800					
Average Temperature in Summer 1788	88	18.48	1.38	14.18	22.31
Average Temperature in Summer 1789	88	17.37	1.3	12.66	20.87
Average Temperature in Summer 1790	88	18.09	1.43	14.03	22.04
Average Temperature in Summer 1791	88	18.16	1.37	13.93	21.95
Average Temperature in Summer 1792	88	17.97	1.36	13.69	21.82
Average Temperature in Summer 1793	88	18.49	1.44	14.72	22.53
Average Temperature in Summer 1794	88	18.38	1.33	14.16	22.13
Average Temperature in Summer 1795	88	17.39	1.38	13.23	21.34
Average Temperature in Summer 1796	88	17.37	1.37	13.21	21.34
Average Temperature in Summer 1797	88	17.84	1.41	13.58	21.93
Average Temperature in Summer 1798	88	18.48	1.37	13.83	22.13
Average Temperature in Summer 1799	88	16.82	1.32	12.88	20.77
Average Temperature in Summer 1800	88	17.86	1.42	13.39	21.57

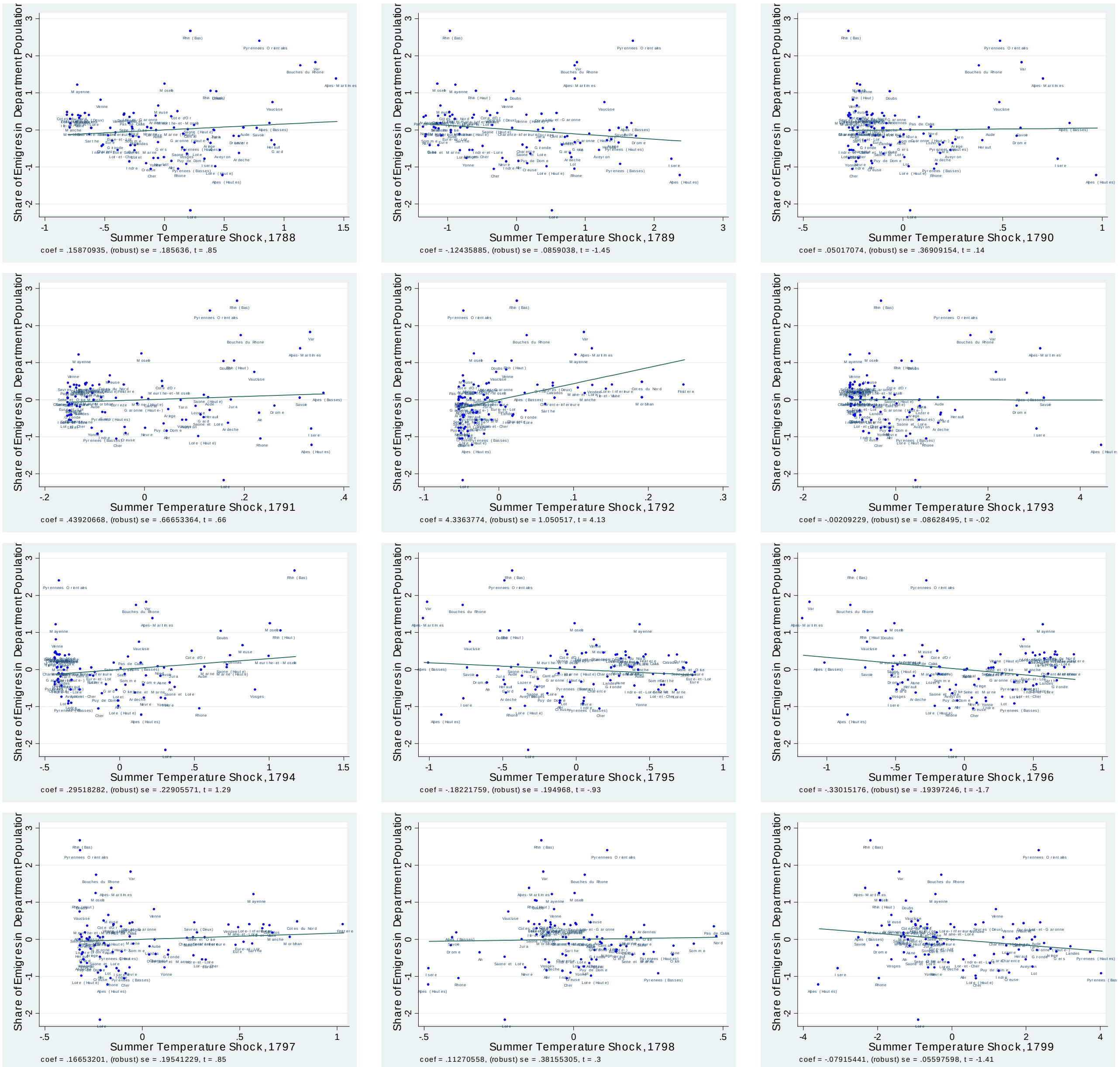
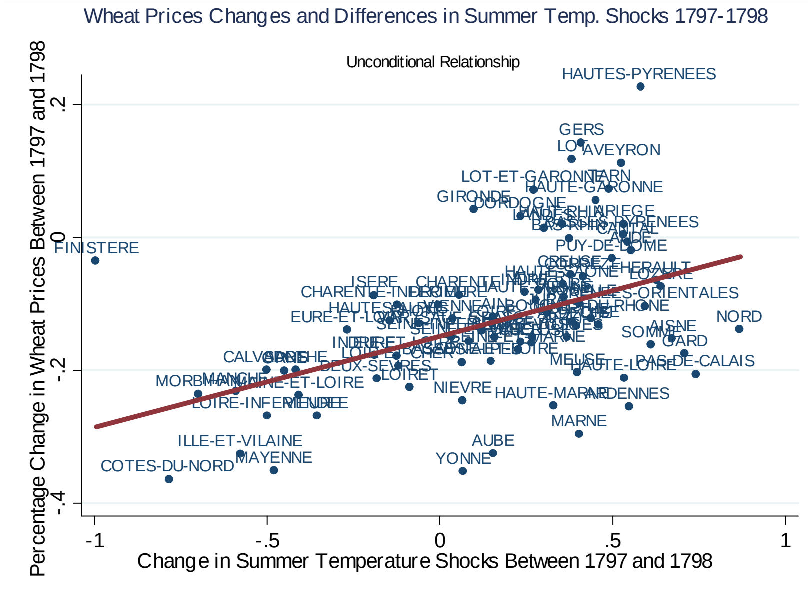


Figure A.2: Unconditional Correlation between the Squared Deviation from Temperature in Summers 1788-1799 and Share of Emigrés in the Population

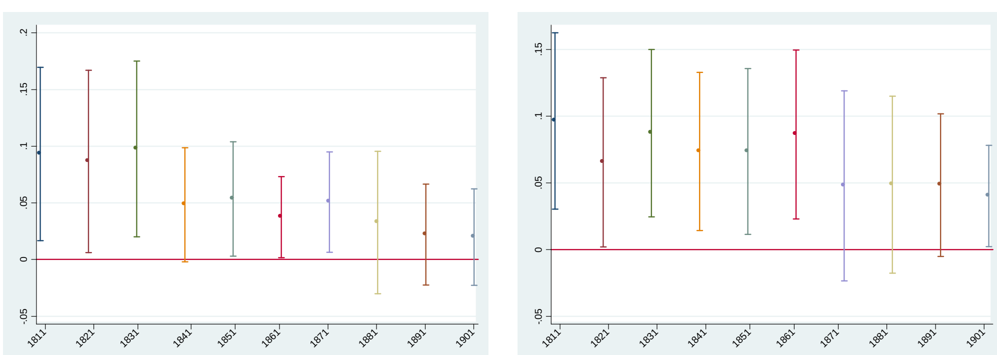
Note: This figure graphs the relationship between the squared deviation from standardized temperature in all the summers between 1788 and 1799 and the share of *émigrés* in the population. It shows that the negative and significant relationship between the squared deviation from standardized temperature in summer 1792 and the share of *émigrés* does not hold for any other summer between 1788 and 1799.



Wheat Price Changes,1797-1798

Figure A.3: Wheat Price Changes and Differences in Summer Temperature Shocks, 1797 &1798

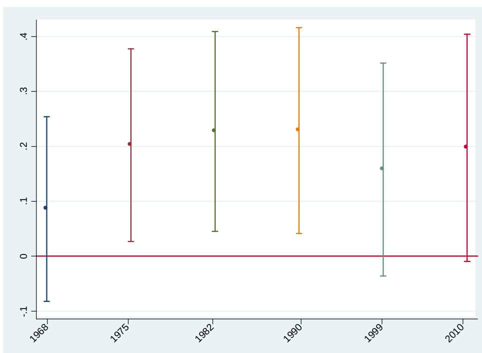
Note: This figure graphs the relationship between the change in the summer temperature shocks between 1797 and 1800 and the percent change in wheat prices between 1797 and 1798.



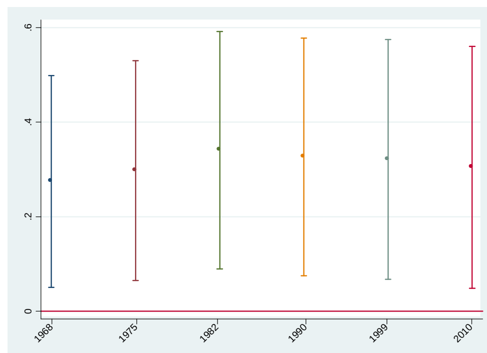
A. Fertility B. Infant Mortality

Figure A.4: Emigres, Fertility & Infant Mortality, 1811-1936

Note: This graph displays the estimated coefficients of share of émigrés on fertility and infant mortality between 1811 and 1901 in 2SLS regressions where the IV is the squared deviation from temperature in summer 1792. All the dependent variables are in logarithms. Intervals reflect 95%-confidence levels.



A. Share of High-School Graduates among Men Age 16-24, 1968-2010



B. Share of College Graduates among Men Age 16-24, 1968-2010

Figure A.5: Emigres and the Human Capital of Frenchmen Age 16-24, 1968-2010

Note: This graph displays the estimated coefficients of share of émigrés on the share of high-school graduates among men age 16-24 and on the share of college graduates among men age 16-24, 1968-2010 in 2SLS regressions. The IV is the squared deviation from temperature in summer 1792. All the dependent variables are in logarithms. Intervals reflect 95%-confidence levels.