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# Externally Imposed Institutions and Regional Growth Differences: Evidence from France and Germany

**Summary:** This paper provides a critical examination of effect of French Revolution institutions on regional economic development variations in 19<sup>th</sup> century by focusing on the experience of France. The argument in Daron Acemoglu et al. (2011) that differences in long-run economic performance of German states stem from differences in externally imposed French and domestic German institutions needs to be investigated further. A difference-in-difference estimation is used to identify a treatment effect causing growth differences between border and interior departments. The proposed treatment effect is the faster industrialization due to intensified minerals mining and railway construction in northern and northeastern France after 1850. It is shown that border departments experienced higher economic growth primarily after 1850 even though Revolution institutions and reforms were imposed in all of French departments. Therefore, externally imposed French Revolution institutions and reforms shouldn't be counted as primary factors of causing variation in economic development across German polities.

**Key words:** French Revolution, Externally imposed institutions, Regional growth differences, Urbanization, French departments.

**JEL:** J11, N43, N93, O43, O52, P16.

In this paper we argue that since the French Revolution reforms and institutions were enforced across all regions in France, if, as hypothesized, it is found that there were significant regional growth differences in France, it would count as evidence against the hypothesis that the variations in regional economic development between the invaded and non-invaded German polities were caused by the Revolution institutions as proposed in Acemoglu et al. (2011). In order to examine this issue for the case of France, we use historical urbanization rates at the department level between the years 1800 and 1901 as a proxy for regional economic development. First, taking advantage of a statistical test, I show that significantly different urbanization rates were observed in French departments. This finding suggests that the departments went through different economic development experiences after the French Revolution embarked. Second, I use a difference-in-difference estimation to show that there was a treatment effect which was different than the Revolution institutions and reforms causing the regional growth variations in France. The proposed treatment effect is that after 1850, coal-iron ore-steel mining and railway construction in the northeast-

ern and eastern border departments led the way to faster economic growth compared to the interior departments in France. The treatment effect is found to be statistically significant at 10% and 5% levels in different model specifications. Third, I examine the effects of industrialization, education, and health services on the departments' urbanization rates, which are used as proxies for economic development around 1861 in an ordinary least squares (OLS) setting. The results of this three-level analysis indicate that the externally imposed French Revolution reforms and institutions might affect the variation in economic growth between the French-invaded German polities and non-invaded polities, but there were additional factors contributing to the formation of these regional development differences.

## 1. Literature Survey

### 1.1 An Overview of Acemoglu et al. (2011) Paper

The French Revolution resulted in a large scale and long-term institutional transformation in Europe. It permanently changed the social and political setting in France, and then in continental Europe through invasions of French Revolutionary armies and Napoleon. Whether or not externally imposed French Revolution reforms and institutions positively affected economic development in Europe is a long debated topic. In one of the recent studies, Acemoglu et al. (2011) provide empirical evidence that externally imposed, radical French Revolution institutions fostered faster long-term economic growth in the invaded German polities compared to non-invaded polities in the second half of the 19<sup>th</sup> century. This paper focuses on the case of France, examines regional economic prosperity variations within France during the 19<sup>th</sup> century, and proposes a counterargument saying that the regional differences in institutions were not the only or leading reason in causing regional economic growth differences.

In this study, I develop a counterargument to the argument developed in Acemoglu et al. (2011) by comparing differences in the long-run economic performance of French regions. Acemoglu et al. (2011) recently attempted to explore the effect of the French Revolution on German institutions and long-run German economic growth. To do this they compare the differences in the economic performance of those German states that were invaded by Napoleonic armies and adopted French institutions with other German states that retained particularly German legal and economic institutions throughout. Their empirical analysis results indicate that there remained a sustained difference in economic performance long after the invaders retreated, and they argue that the externally imposed French Revolution reforms and institutions were effective in leading the way to these regional economic development differences, especially in the second half of the 19<sup>th</sup> century.

Acemoglu et al. (2011) use the evidence of regional growth differences within Germany to test the hypothesis that radical and externally imposed reforms of the French Revolution caused higher and more rapid economic growth in the German polities where they were imposed. Acemoglu et al. (2011) investigate the relationship between the length of the French Revolutionary armies' occupation (their treatment variable) and economic prosperity in both a reduced-form analysis and a two-stage

least squares framework. One of the main results of Acemoglu et al. (2011) is that their different empirical analysis results indicate that particularly after 1850 the German polities where French Revolution institutions and reforms were imposed experienced faster economic growth that is proxied by urbanization rates. However, they emphasize positive institutional effects of the Revolution only in the long-run, arguing that due to disruptive impacts of the invasion, the French reforms might have created negative development results in the short-run. Furthermore, the authors point out certain caveats and weaknesses about their findings, such that the positive urbanization effects of the externally imposed French Revolution institutions and reforms are statistically significant only in some of the econometric specifications. They also acknowledge that their findings are valid for a limited, specifically defined historical period for which relevant historical data are available and should not necessarily be adapted to other periods and geographical settings.

They argue that the externally imposed French Revolution reforms and institutions generated an environment where entrepreneurship and technological innovations could blossom, and then these paved the way for the industrial revolution in the second half of 19<sup>th</sup> century in continental Europe. Nevertheless, during the same time period intensive coal-iron ore-steel mining and railway construction (the proposed treatment effect in this study) took place in northeast-eastern France, Belgium, and southwest-western Germany. These manufacturing and heavy industrial activities could also very well have been effective in triggering further entrepreneurship and innovations, and then generating more rapid and higher economic development in the above mentioned affected areas, ultimately leading the way to the industrial revolution in continental Europe. The situation that Acemoglu et al.'s (2011) result of positive long-term effects of externally imposed Revolution institutions and reforms, and the intensive coal-iron ore-steel mining and railway construction took place in the same time period, weakens the strength of Acemoglu et al.'s (2011) arguments and findings.

## 1.2 Other Related Literature

The effect of institutions on economic performance has remained a long debated and unresolved issue in literature. Examples of institutional reform failures in Africa, Latin America, the former Soviet Union in the 1980s and 1990s, and the recent cases of Afghanistan and Iraq support the view that radical changes in institutions do not necessarily have a positive effect on economic outcomes (Acemoglu et al. 2011). According to Friedrich Hayek (1960), institutions cannot be designed, and have to emerge and form under natural and local conditions. A related view states that the externally imposed institutions and reforms should be in harmony with a set of circumstances in the host countries (Daniel Berkowitz, Katharina Pistor, and Jean-Francois Richard 2003a, b; Dani Rodrik 2007). Nevertheless, there are successful external institutional reform cases such as the post Second World War institutional transformations in Germany and Japan designed by the US.

The related debate about economic outcomes of the French Revolution has also not reached an agreement. On one hand, some economic historians identify the French Revolution and following wars as an obstacle slowing down technology

adoption and industrial revolution in continental Europe (David S. Landes 1969 and Francois Crouzet 2001). For instance, Erik Buyst and Joel Mokyr (1990) argue that the Napoleonic wars hampered economic development in the Netherlands. On the other hand, the view that enactment of the civil code, abolition of guilds and serfdom, and agricultural reforms caused by the French Revolution led the way to industrial revolution and institutional enlightenment in continental Europe suggests that the French Revolution fostered economic development in parts of Europe affected by the Revolution and subsequent invasion (Mancur Olson 1982 and Acemoglu 2008).

## 2. The Economic and Social Environment in France before and during the Revolution

The French Revolution reforms and institutions can be gathered under three categories: legal, commerce, and agricultural reforms. The enactment of commercial courts and the civil code introduced the notion of everyone's equality before the law. The abolishment of the seigneurial regime and guilds contributed to the emergence of a more free labor market. These institutions and reforms helped to build a solid basis for an economic environment friendly to newly emerging commercial and industrial businesses. In the agricultural sector, serfdom was officially banned. Political control and feudal landholding privileges of the elite and the Church were also abolished.

The French Revolution took place under negative economic conditions. The monarchical authority was in bankruptcy. Agricultural production in northern France was damaged by poor weather conditions, causing the price of bread, the main staple food for most of the population, to rise. Since consumers spent the majority of their earnings on food, demand for other goods decreased (William Doyle 2001). Moreover, the manufacturing sector was negatively affected by British competition and by the ensuing lower prices under the commercial treaty of 1786. In addition to this, the unemployment rate was increasing, and an unexpectedly cold winter hampered production done by mills and bulk transport.

Before the French Revolution, social life and economy were controlled by a few dominant groups. The landlords were imposing a light version of serfdom by putting peasants under a burden of heavy taxes and tributes, limiting the mobility of peasants, and hindering the emergence of a free labor market. The urban oligarchy dominant in trade and production sectors strictly controlled important occupations for their own economic benefit by restricting new entries into professions and the use of new technology (Doyle 2001). In rural areas, the nobility and Church clergy had the privilege of not paying taxes, and they were not subject to the same laws and courts as peasants, which created an inequitable political and economic atmosphere.

This long-term and widespread economic crisis and social inequality led to a meeting of the Estates-General in 1789 for the first time in 175 years. The Estates-General took the name National Constituent Assembly with the promise of gathering more political power in itself and writing a constitution. It abolished feudalism, the nobility's special privileges and rights, and the Church clergy's authority of taxation. The constitution that was finalized on September 29, 1791, declared France as a constitutional monarchy. The abolition of guilds followed this. In 1804 Napoleon declared himself as emperor, and between 1799 and 1815 he pursued a widespread in-

vasion of continental Europe. Hence, it can be said that the French Revolution was triggered by social injustice and economic crisis, it caused the removal of the institutions of the *ancien régime*, and had profound political and economic consequences within France and in Europe.

### 3. Data Collection and Empirical Analysis

#### 3.1 Data Details

The data on historical output/income *per capita* are usually not available, so to measure economic development in the past centuries, historical city size and urbanization are often used as proxies (Acemoglu, Simon Johnson, and James A. Robinson 2002 and Guido Tabellini 2010). The motivation behind this assumption is that in the 17<sup>th</sup> and 18<sup>th</sup> centuries in Europe, cities were the trade centers, and most of the economic activities were happening in the center or in the proximity of these urban regions. In addition to this, significant industrialization movements in Europe mostly started in the cities. Hence, historical city size and urbanization rate data can give us information about how developed a region was, and so these variables can be used to represent economic prosperity in a region.

The administrative area of France is divided into 95 departments. The related map of the French departments can be seen in Figure 1. Urbanization rate at the department level is used as a proxy for economic development. In the literature, urbanization rate is commonly defined as the fraction of the population living in cities with more than 5,000 inhabitants (Tertius Chandler 1987 and Paul Bairoch, Jean Batou, and Ch`evre Pierre 1988). Historical city size and department size data are collected from Chandler (1987) and Population Statistics (2014)<sup>1</sup> website. Since the historical department population statistics compiled by Population Statistics website start only in 1800, this year also marks the earliest year for the urbanization rates in the sample.

During the 19<sup>th</sup> century the number of departments was changing through treaties and wars with neighboring countries. Nevertheless, in our sample the number of departments is set at 95, so in a specific sample year if the region in question was not defined as a French department, then there are no relevant data for that department in that year, and it would be recorded as a missing observation. It would make the analysis unnecessarily complicated if we changed the number of departments for any sample year according to the border changes due to treaties and wars with neighboring countries.

Both in Chandler (1987) and on Population Statistics (2014) website the available city and department size statistics are clustered in the years 1810 and 1901 (there are still substantial missing data in 1800). We carry out an interpolation technique to fill in the missing observations on the assumption that the city and department populations followed relatively smooth and predictable trends between 1810 and 1901 (Dietrich Vollrath 2007). Hence, the missing observation in year  $a$  which is between the actual observations in years  $t$  and  $t + n$  is calculated as:

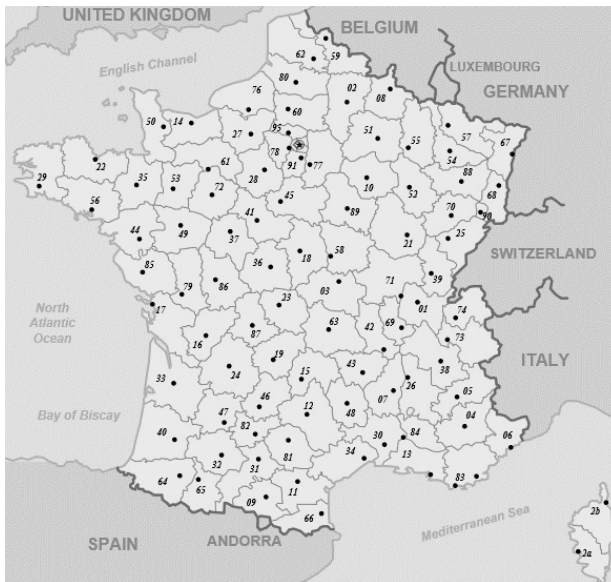
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<sup>1</sup> **Population Statistics.** 2014. Growth of the Population per Country in a Historical Perspective, Including Their Administrative Divisions and Principal Towns. <http://www.populstat.info/> (accessed May 05, 2014).

$$x_a = x_t + (a - t)(x_{t+n} - x_t)/n, \quad (1)$$

where years  $t$  and  $t + n$  correspond to 1810 and 1901, respectively. In this way, by using the available city size and department size data, and the simple linear interpolation technique, urbanization rates at the department level are computed for the years 1800, 1810, 1820, 1831, 1851, 1861, 1876, and 1901 based on the population statistics of 697 cities.

The French departments are divided into 24 border and 71 interior departments. This classification can be seen in Table 1. Paris and its surrounding area, northeastern, and eastern regions close to Belgium, Netherlands, Luxembourg, Germany, and Switzerland, are classified as border departments. This classification of the departments is motivated by the findings and arguments in the economic history literature that the industrial revolution in continental Europe initially started as a regional development based on the availability of the mining of coal-iron ore-steel, which served as critical inputs in fledgling industrial sectors, and was additionally based on railway construction (John Harold Clapham 1936; Thomas Garden Barnes, Jerome Blum, and Rondo E. Cameron 1966; Sidney Pollard 1981; Cameron and Larry Neal 2003). The regions where these important mines and inputs were readily available formed a corridor that ran from parts of Belgium through northeastern France down to the border of France with Switzerland. Much of Germany occupied by Napoleonic armies also happened to be part of this natural resource-rich region in northern and northeastern Europe. This situation suggests another probable mechanism for the differential growth within France and Germany independent of the institutional framework imposed in the related areas.



Source: Adopted from [https://en.wikipedia.org/wiki/Departments\\_of\\_France](https://en.wikipedia.org/wiki/Departments_of_France).

**Figure 1** Map of the French Departments

**Table 1** French Departments

Department	No	Capital	Region
Ain	1	Bourg-en-Bresse	Border
Aisne	2	Laon	Border
Allier	3	Moulins	Interior
Alpes-de-Haute-Provence	4	Digne	Interior
Alpes (Hautes-)	5	Gap	Interior
Alpes-Maritimes	6	Nice	Interior
Ardèche	7	Privas	Interior
Ardennes	8	Charleville-Mézières	Border
Ariège	9	Foix	Interior
Aube	10	Troyes	Interior
Aude	11	Carcassonne	Interior
Aveyron	12	Rodez	Interior
Bouches-du-Rhône	13	Marseille	Interior
Calvados	14	Caen	Interior
Cantal	15	Aurillac	Interior
Charente	16	Angoulême	Interior
Charente-Maritime	17	La Rochelle	Interior
Cher	18	Bourges	Interior
Corrèze	19	Tulle	Interior
Corse	20	Ajaccio	Interior
Côte-d'Or	21	Dijon	Interior
Côtes-d'Armor	22	Saint-Brieuc	Interior
Creuse	23	Guéret	Interior
Dordogne	24	Périgueux	Interior
Doubs	25	Besançon	Border
Drôme	26	Valence	Interior
Eure	27	Évreux	Interior
Eure-et-Loir	28	Chartres	Interior
Finistère	29	Quimper	Interior
Gard	30	Nîmes	Interior
Garonne (Haute-)	31	Toulouse	Interior
Gers	32	Auch	Interior
Gironde	33	Bordeaux	Interior
Hérault	34	Montpellier	Interior
Ille-et-Vilaine	35	Rennes	Interior
Indre	36	Châteauroux	Interior
Indre-et-Loire	37	Tours	Interior
Isère	38	Grenoble	Interior
Jura	39	Lons-le-Saunier	Border
Landes	40	Mont-de-Marsan	Interior
Loir-et-Cher	41	Blois	Interior
Loire	42	Saint-Étienne	Interior
Loire (Haute-)	43	Le Puy	Interior
Loire-Atlantique	44	Nantes	Interior
Loiret	45	Orléans	Interior
Lot	46	Cahors	Interior
Lot-et-Garonne	47	Agen	Interior
Lozère	48	Mende	Interior
Maine-et-Loire	49	Angers	Interior
Manche	50	Saint-Lô	Interior
Marne	51	Châlons-sur-Marne	Border

Marne (Haute-)	52	Chaumont	Interior
Mayenne	53	Laval	Interior
Meurthe-et-Moselle	54	Nancy	Border
Meuse	55	Bar-le-Duc	Border
Morbihan	56	Vannes	Interior
Moselle	57	Metz	Border
Nièvre	58	Nevers	Interior
Nord	59	Lille	Border
Oise	60	Beauvais	Border
Orne	61	Alençon	Interior
Pas-de-Calais	62	Arras	Border
Puy-de-Dôme	63	Clermont-Ferrand	Interior
Pyrénées-Atlantiques	64	Pau	Interior
Pyrénées (Hautes-)	65	Tarbes	Interior
Pyrénées-Orientales	66	Perpignan	Interior
Rhin (Bas-)	67	Strasbourg	Border
Rhin (Haut-)	68	Colmar	Border
Rhône	69	Lyon	Interior
Saône (Haute-)	70	Vesoul	Interior
Saône-et-Loire	71	Mâcon	Interior
Sarthe	72	Le Mans	Interior
Savoie	73	Chambéry	Interior
Savoie (Haute-)	74	Anancy	Border
Paris	75	Paris	Border
Seine-Maritime	76	Rouen	Interior
Seine-et-Marne	77	Melun	Border
Yvelines	78	Versailles	Interior
Sèvres (Deux-)	79	Niort	Interior
Somme	80	Amiens	Border
Tarn	81	Albi	Interior
Tarn-et-Garonne	82	Montauban	Interior
Var	83	Toulon	Interior
Vaucluse	84	Avignon	Interior
Vendée	85	La Roche-sur-Yon	Interior
Vienne	86	Poitiers	Interior
Vienne (Haute-)	87	Limoges	Interior
Vosges	88	Épinal	Border
Yonne	89	Auxerre	Interior
Belfort (Territoire de)	90	Belfort	Border
Essonne	91	Évry	Interior
Hauts-de-Seine	92	Nanterre	Border
Seine-Saint-Denis	93	Bobigny	Border
Val-de-Marne	94	Créteil	Border
Val-d'Oise	95	Pontoise	Border

Source: Based on the author's own classifications.

### 3.2 Statistical Inference

A statistical  $t$ -test is performed for the years in which the majority of original data (not interpolated) are available, 1800, 1810, and 1901, to examine whether the interior departments and border departments had different urbanization rates on average, and so experienced different economic growth performances. The null hypothesis here is that there was no difference in the mean urbanization rates between border



departments and interior departments, and the alternative hypothesis is that on average, border departments experienced a higher urbanization compared to interior departments.

Table 2 below shows the *t*-test results in the three years. We do not find supporting evidence for the alternative hypothesis only for the year 1801. The test results for the years 1810 and 1901 show that we can reject the null hypothesis at the 5% level. It is found that in 1810 the mean urbanization rate in border departments was 16%, and it was 10.5% in interior departments. In 1901, the mean urbanization rate was 34.1% in border departments and 20.3% in interior departments. Hence, we can say that the urbanization gap between border departments and interior departments increased in 90 years. Therefore there is evidence supporting the argument that border departments had higher urbanization rates compared to interior departments, suggesting that French departments went through different economic development experiences both in the short-run and long-run after the French Revolution. This result indicates that, within France, significant regional economic growth differences occurred after the Revolution and enforcement of institutional reforms.

**Table 2** *t*-test Results for Urbanization Gap between Border and Interior Departments

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Urbanization in 1800: *t*-statistic = 0.8766; Probability ( $T > t$ ) = 0.1933 at  $p < 0.05$ .

Urbanization in 1810: *t*-statistic = 1.62; Probability ( $T > t$ ) = 0.0545 at  $p < 0.05$ .

Urbanization in 1901: *t*-statistic = 3.2388; Probability ( $T > t$ ) = 0.0008 at  $p < 0.05$ .

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Source: Based on the author's own calculations.

### 3.3 Difference-in-Difference Estimation

In their paper Acemoglu et al. (2011) argue that some German polities grew faster than others because these polities were subjected to the treatment of French Revolution reforms and institutions through French invasion while others were not. One way to test this argument is to carry out a difference-in-difference regression for the French case, as it is already shown in the previous section that there were differences in regional growth within France. Since the French Revolution institutions and reforms were imposed in all of the French departments, the regional economic growth differences between the interior and border departments should be caused by a different treatment effect.

In continental Europe the industrial revolution took a faster pace with increasing coal-iron ore-steel mining and railway construction, particularly after 1850 (Clapham 1936 and Pollard 1981). In France natural resource mining, railway construction, and industrialization were more intense in the northeastern and eastern border regions. The proposed treatment effect here is that the speedy industrialization in the border departments, which was supportively reinforced by natural resource mining and railway construction, intensified after 1850. In order to show the impact of this treatment effect on urbanization, we use a difference-in-difference model similar to the one used in David Card and Alan Krueger (1994). In this model, the period of interest is the time period after 1850, and the treatment group is the border departments. Therefore, the urbanization rates for the eight years, 1800, 1810, 1820,

1831, 1851, 1861, 1876, and 1901, are divided into two groups; the years before 1850 which are 1800, 1810, 1820, and 1831, and the years after 1850 which are 1851, 1861, 1876, and 1901. For each group an average urbanization rate is calculated. The difference-in-difference regression equation we use is as the following:

$$\text{urbanization}_{it} = \beta_0 + \beta_1 \text{department}_{it} + \beta_2 \text{time}_{it} + \beta_3 (\text{department}_{it} * \text{time}_{it}) + \varepsilon_{it}, \quad (2)$$

where the dependent variable is the average urbanization rate. The variable  $\text{department}_{it}$  takes the value 1 if it is a border department and 0 if it is an interior department, and the variable  $\text{time}_{it}$  takes the value 1 if the period is after 1850 and 0 otherwise. The interaction term ( $\text{department}_{it} * \text{time}_{it}$ ) demonstrates the proposed treatment effect which is the faster, more intense industrialization carried through coal-iron ore-steel mining and railway construction in the border departments after 1850. Hence  $\beta_3$  is the coefficient of interest here.

Paris is classified as a border department. This interpretation primarily carries geographical and economic motivations. Since Paris was a major knot in the railways network, Paris had a crucial role in railway development and coal-iron ore-steel transportation to other departments. Nonetheless, whether or not Paris is classified as a border department does not cause much change in the impact of the treatment effect, as can be seen in Table 3. Table 3 shows the estimation results of 15 model selections where urbanization rate is the dependent variable, and Paris is identified as either a border or an interior department, or not included into the regressions at all. The effects of being a border department, the time period after 1850, and the interaction term on urbanization rate are positive and statistically significant at 5% when they are controlled individually regardless of the classification of Paris. When the three variables are controlled simultaneously in models (5), (10), and (15), the coefficient of department loses its statistical significance. The time period after 1850 is positively correlated with higher urbanization rate. The treatment effect measured by the interaction term “ $\text{department}_{it} * \text{time}_{it}$ ” shows a positive and statistically significant effect on urbanization rates, again independent of the classification of Paris. The regression results suggest that there is evidence in support for the treatment effect of the more speedy and intense industrialization in the border departments after 1850 in France.

The difference-in-difference model examines whether there was a treatment factor affecting primarily the border departments after 1850. The proposed treatment effect is the location of natural resources and railways necessary to transporting the natural resources to the production points. France did not search and work of most of its coal resources that were gathered mainly at the Luxembourg border in eastern France, and in northeastern France lining into the corridor of Belgium and Germany, until after 1850 (Clapham 1936 and Pollard 1981). Furthermore, France was suffering from an insufficient railway network for a long time, hampering coal and iron ore transportation. Railway construction gained momentum after 1850, and the coal and other natural resource clustered regions were given priority to be the first routes for the new rail network (Cameron 1970). Therefore, the industrial revolution in France initially started in the eastern and northeastern border regions where coal and iron ore were extracted and transported with the railway after 1850.

This finding counts as a counterargument against the argument in Acemoglu et al. (2011) that it was the French Revolution institutions and reforms that paved the way to higher economic growth in the German polities invaded by French armies, compared to other polities which were not invaded. One possible explanation for the differences in regional growth observed both in Germany and France could be the mining of coal and other valuable minerals, and railway network construction, which is also the proposed treatment effect here, and its positive impact on subsequent industrialization in continental Europe (Barnes, Blum, and Cameron 1966).

**Table 3** Difference-in-Difference Estimation

Paris as a border department					
	(1)	(2)	(3)	(4)	(5)
Department	0.129** (0.031)			0.123** (0.0303)	0.0600 (0.045)
Time		0.09** (0.027)		0.084** (0.0256)	0.058** (0.029)
Department*time			0.199** (0.038)		0.114* (0.061)
Constant	0.136** (0.0149)	0.119** (0.0192)	0.139** (0.0137)	0.0934** (0.0195)	0.106** (0.0206)
Observations	182	182	182	182	182
R <sup>2</sup>	0.087	0.059	0.134	0.139	0.156
Paris as an interior department					
	(6)	(7)	(8)	(9)	(10)
Department	0.077** (0.033)			0.071** (0.0318)	-0.0074 (0.047)
Time		0.09** (0.0266)		0.086** (0.0264)	0.0562* (0.0294)
Department*time			0.164** (0.0394)		0.140** (0.0634)
Constant	0.149** (0.0153)	0.119** (0.0192)	0.145** (0.0140)	0.105** (0.0200)	0.120** (0.0210)
Observations	182	182	182	182	182
R <sup>2</sup>	0.030	0.059	0.088	0.085	0.109
Paris not included as a department					
	(11)	(12)	(13)	(14)	(15)
Department	0.09** (0.028)			0.084** (0.027)	0.00646 (0.04)
Time		0.092** (0.023)		0.088** (0.0224)	0.058** (0.025)
Department*time			0.176** (0.033)		0.138** (0.053)
Constant	0.136** (0.0132)	0.108** (0.0166)	0.134** (0.0119)	0.0912** (0.0171)	0.106** (0.0178)
Observations	180	180	180	180	180
R <sup>2</sup>	0.055	0.083	0.135	0.131	0.162

**Notes:** Urbanization is the dependent variable. Standard errors are in parentheses. \* significant at 10%; \*\* significant at 5%.

**Source:** Based on the author's own estimations.

### 3.4 OLS Estimation

An OLS regression is used as an exercise to examine some of the other factors which could affect economic development. The log value of the industrial production in the year 1861 is used as a variable indicating industrialization. The total number of med-

ical and law students in 1866, weighted by the departments' populations, is used as an education indicator. The tertiary education data are not available for the year 1861 and 1866 is the closest year with the available data. As an indication of the level and availability of health services, the total numbers of doctors and health officers in 1847 and 1866, weighted by the departments' populations and interpolated to the year 1861, are also controlled. To obtain the statistics for 1861, the same interpolation technique which is used to calculate the missing urbanization rates before is also adopted here. These data are collected from L'Atelier du Centre de Recherches Historiques (2014)<sup>2</sup> to examine the effects of industrialization, health services, and education on economic development around 1861.

The complete sample is divided into the border departments and interior departments subsamples. The general estimation equation can be written as the following:

$$\text{urbanization} = \beta_0 + \beta_1 \text{industrial production} + \beta_2 \text{education} + \beta_3 \text{health} + \varepsilon_i, \quad (3)$$

where the dependent variable is the urbanization rate in 1861 in either border departments or interior departments. The estimation results can be seen in Table 4 below. Due to the limited available data, this econometric analysis is done for a single year. For the interior departments, industrial production and the availability of health services show statistically significant positive effects on economic development proxied by urbanization rate. For the border departments it is found that industrial production and tertiary education exert statistically significant and positive effects on economic development. On the other hand, the coefficient of health services appears to be insignificant.

**Table 4** OLS Estimation

<b>Interior departments</b>				
	(1)	(2)	(3)	(5)
Industrial production	0.0665** (0.0134)			0.0694** (0.0126)
Education		-2.477 (9.377)		-2.358 (7.539)
Health			178.9** (72.12)	203.9** (60.66)
Constant	-0.711** (0.175)	0.156** (0.0155)	0.0686* (0.0375)	-0.845** (0.169)
Observations	69	69	69	69
R <sup>2</sup>	0.268	0.001	0.084	0.377
<b>Border departments</b>				
	(1)	(2)	(3)	(5)
Industrial production	0.0677** (0.0201)			0.0544** (0.0203)
Education		785.2** (303.3)		604.9* (306.5)
Health			150.8 (282.2)	-153.9 (228.8)

<sup>2</sup> L'Atelier du Centre de Recherches Historiques. 2014. Revue électronique du CRH. <http://acrh.revues.org/2890> (accessed June 28, 2014).

Constant	-0.763** (0.278)	-0.0110 (0.0736)	0.114 (0.111)	-0.661** (0.271)
Observations	18	18	18	18
R <sup>2</sup>	0.416	0.295	0.018	0.544

**Notes:** Urbanization is the dependent variable. Standard errors are in parentheses. \* significant at 10%; \*\* significant at 5%.

**Source:** Based on the author's own estimations.

## 4. Conclusion

In this paper, by using the evidence of regional economic growth differences in France, where the Revolution reforms and institutions originated, and by investigating the causes of differences in development in the host country of the Revolution, we develop an argument that externally imposed institutions may not be the dominant reason leading to the variations in regional economic prosperity in the second half of the 19<sup>th</sup> century in continental Europe. Furthermore, the treatment effect of coal-iron ore-steel mining and railway construction that happened after 1850, and the following improvements in industrialization, education, and health services are found to have positive effects on urbanization within France in the medium-run after the onset of the Revolution. It can be said that the limited availability of reliable regional historical data has brought about empirical analysis challenges in this paper. Detailed historical European statistics at the country level can be found in Brian R. Mitchell (1981). Future research about the industrial revolution in continental Europe appears promising if more detailed, micro-level historical data related to coal-iron ore-steel mining, railway construction, and infant industrialization are made available.

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