CIRJE-F- 1253

Postal Growth: How the State-Sponsored Post Affected Growth in Preindustrial France, 1500–1850

Yu Sasaki
The University of Tokyo

June 2025

Postal Growth: How the State-Sponsored Post Affected Growth in Preindustrial France, 1500–1850*

Yu Sasaki†

This version: November 16, 2024

Abstract

This paper investigates the role of postal service in city growth in pre-industrial France. Extant research shows that modern-day state-funded infrastructure projects, such as railways, predict growth. I examine the consequences of the post when the pace of expansion was slow and technological innovations were few. I highlight how the French post evolved from the crown-only information tool to a public service and how investments on the physical infrastructure lagged behind. Digitizing untapped published sources, I construct market access via postal routes on the city level from 1500–1850. My analysis finds that it is strongly negatively associated with growth. It also highlights how the proximity to rivers matters to growth, while more geographically-bounded interactions are not impactful. My instrumental-variable estimation points to how post-Roman political consolidation in Gaul misaligned the subsequent urban networks from contemporary perspectives, leaving an ill-conceived design on which the French post was built.

*I thank Tine Paulsen, Tetsuji Okazaki, and participants at the HPE Horizons 2023 workshop and the Economic History seminar at the University of Tokyo for their constructive feedback to the previous draft. Financial support from the Japan Society for the Promotion of Science (20K13413) is gratefully acknowledged. All errors are mine.

†Assistant Professor, Graduate School of Economics and Faculty of Economics, University of Tokyo. E-mail: yusasaki253@gmail.com. See yusasaki.squarespace.com for the most updated version.

Introduction

Transportation was crucial in premodern growth, but its costs always constituted a major impediment. Then, seafaring was among the most reliable means, while overland transport remained much slower (de Vries 1984). Indeed, the latter was so inefficient that Paul Bairoch (1988, 11–2) calls it the "tyranny of distance," because the greater distance a courier travelled, the more energies he needed to consume from the cargo for himself to carry on, and the less merchandise he could deliver. Thus polities with a large territory tended to incur high transportation costs. In Europe, geography helps explain why France had a smaller population density and bore greater trade costs than England, which, in turn, played a role in the former's lagged industrialization (Daudin 2010).[1]

Extant scholarship indicates that postal networks contributed to preindustrial growth by reducing the costs of transportation. They facilitated the faster diffusion of—and the knowledge of—new inventions as well as helped integrate the economy (Mokyr 1990, 69). They also promoted the growth of a pan-European intellectual community by bringing together scientists, engineers, and writers through the exchange of their writings (Mokyr 2016, 195). In the agrarian economy, an easier access to information and knowledge could create new opportunities and play a role of reducing inequalities between already-developed towns and less fortunate ones (Hoffman 1996, 171).

Yet, in preindustrial Europe, evidence on the linkage between postal networks as a mode of infrastructure and growth seems to have been indirect. Relevant empirical research suggests that infrastructure-building and investment in institutions generally yield positive consequences. In a recent study on Roman roads, Flückiger et al. (2022) show that regular connectivity facilitated by Roman roads led to interregional trade, bringing about the long-term convergence of preferences among traders. The expansion of the postal infrastructure is shown to be associated with growth-enhancing activity in modern times (Acemoglu, Moscona, and Robinson 2016; Rogowski et al. 2022).[2] In addition, investment in a postal-service reform resulted in greater innovations in an

[1]Note that Daudin (2010)'s analysis finds that some French industries, particularly that of textile, had supply centers whose access to domestic markets comparable to those of Britain in the late eighteenth century.

[2]However, Geloso and Makovi (2022), drawing on the case of nineteenth-century Québec, report that the introduction of postal service had no effect on the value of agricultural output.

industrializing United States toward the turn of the twentieth century (Aneja and Xu 2022). At the same time, investment in institutions as well as infrastructure-building were slow to come in preindustrial Europe. One reason was that the post was initially created *by* and *for* the state and, critically, not designed to be a source of revenue. Its initial function was political in that the couriers delivered messages to and from the ruler, in which the postal stations installed on the way were meant to be secure places for rest. Although the post was eventually allowed for public use and came to provide greater services, the extent to which it was conducive to growth as strongly as demonstrated in contemporary cases has not been widely studied.

In this paper, I provide systematic evidence on the relationship between the expansion of the postal network and city-level growth in preindustrial France. The postal system, primarily operated by a man on horseback, carried letters and clothes among others—essentially non-bulky goods—and assisted the more efficient exchange of goods and services in this capacity. As an economic institution, it constituted a means through which to facilitate Smithian growth by reducing transaction costs. In so doing, it created a structured economic life through the circulation of information (Caplan 2016, 177–80). The ability to have this rhythm can beget enhanced productivity and organizational skills via the coordination of one's economic activity. When individuals lived in separate towns, the standardized system of delivery installed in both locales made coordination easier. Such a system was particularly important for merchants, because the access to information—as well as an access earlier than others—affected their business decisions (Dorhn-van Rossum 1998, ch. 10).[3] At the same time, waterways such as rivers and canals were the ones to carry bulky goods, particularly wheat and other kinds of grain. This is because it was much cheaper by boat than by horse. An access to a navigable river was crucial particularly to those living in inland regions, as canal construction did not gain momentum until the nineteenth century. As I explain more fully below, roads were not quite accommodating of this type of goods.

[3]Dorhn-van Rossum (1998, 323–4) suggests that postal expansion facilitated communications and transactions between cities bearing public mechanical clocks not just by connecting these cities but also making coordination easier among them. On the technology's impact on economic activity in late medieval and early-modern Europe, see Landes (1983), Le Goff (1980), Mokyr (1990), and Dorhn-van Rossum (1998). See also Boerner and Severgnini (2019) and Boerner, Rubin, and Severgnini (2021) for empirical analyses.

Preindustrial France constitutes an instructive case for two reasons. First, it was one of the forerunners on European soil to begin postal operations in the 1480s. Initially it was restricted solely to the crown communications but in 1672 became open to the public due to the high demand for private uses. The network grew throughout premodern times albeit at a varying pace and, as I document empirically, only in the early nineteenth century did it cover virtually all France. The post, carried by men and horse-drawn carriages where possible, continued to function as the primary means of delivery until the 1840s when steam engine-driven trains began to replace it (Caplan 2016, 7). Second, despite the institutional expansion, the roads remained in "pitiful" conditions (Arbellot 1973, 766). Only in the mid- to late eighteenth century did Paris *begin* to invest in them (Lepetit 1984). This investment resulted in major improvements in the speed of delivery (Vidal de La Blache 2009, 380). Yet the fruits of the investment were concentrated in the north, especially in the areas surrounding Paris, and overall the infrastructure was poorly managed (Marchand 2006; Letaconnoux 1908, 1909*a*). These two reasons refer to distinct sources of growth. The post channel means growth through the greater exchange of goods and services as the method of delivery became faster and more reliable. The road channel means growth through innovations as the infrastructure improved so that it became more accessible and cheaper to use. In practice, these are interconnected because an efficient delivery requires accommodating and well-paved roads. In France the first channel developed earlier and expanded with little investment in the second in much of the time. This sequence allowed me to capture empirically how one source affected city growth as well as how the second channel facilitated the first.

I examine the role of the post in preindustrial growth in France based on a new time-series and cross-sectional data set of 341 cities from 1500–1850 that I have constructed. I document evidence in two broad approaches. First, I compute market access *via postal routes* by drawing on the literature on the railway (Donaldson and Hornbeck 2016; Hornbeck and Rotemberg 2021). My measure is intended to assess the extent to which postal expansion affected the demand for goods from the entire country. The data are drawn from the postal networks in five periods across three centuries—1553, 1690, 1731, 1792, and 1835—by tapping hitherto undigitized published sources. These reveal two features: First, despite the absence of documentary evidence on the origins, the network clearly follows the hub-and-spokes model with Paris as the hub. Second, access to postal services grew over time, but the pace was incremental in much of the time. The initial network of 1553 covered approximately 48 percent of the observations whose figure made little progress for the next two hundred years (approximately 56 percent in the 1731 network). Only toward the end of the ancien régime did the pace of coverage take off by passing the two-thirds mark (over 71 percent in the 1792 network). This approach allows me to explore the impact of postal growth over time on market activity in terms of reduction in transaction costs across the country.

In the second approach, I consider infrastructure improvements in both roads and water over time. In a seminal article, Guy Arbellot (1973) describes how France by 1785 achieved significant improvements in the road conditions in a state-directed as well as state-funded project. Prior to the reform, travel speed was chronically slow given a large territory: by the mid-eighteenth century, it was estimated to take at least twelve days from Paris to Marseille on the Mediterranean. The conditions dramatically changed in what Arbellot portrays as the "grande mutation" in the period between 1765 and 1780. Through the biggest construction project in French history at the time (Arbellot 1973, 767), travel time in the same itinerary was reduced by one third—to eight days. The reduction of travel cost is reflected in calculating market access. By the turn of the eighteenth century, Paris had also designated certain routes to receive favorable treatment on improvements. I take these developments into account when estimating how the road reform affected city growth. On waterways, I exploit varying distances in a city's access to rivers and canals. Like roads, water transportation received little sustained investment until the same period. Yet given the relatively cheaper cost and the role it historically played in carrying grain, the impact of improvements in this mode of transportation can be substantial.

A main finding of this study is that the expansion of the postal network has adverse consequences to city growth. In a saturated model with city and period fixed effects, a 1-percent increase in market access via postal routes leads to a 10-percent decrease in population. The roads prioritized by Paris is positively but not significantly correlated to growth. A counterfactual measure of market access, where travel speed was set the post-reform pace, has no discernible effect. Then I examine the role of canals and rivers at various distances of access. While the measure on the canal is negative and mostly lacks significance, access to rivers shows a positive and significant impact on growth between the 20-km and 50-km range. These findings suggest that the post channel as well as the road channel are negatively linked or bear no discernible impact while riverine transport matters to growth. Next I consider a geographically-bounded approach to explore the relationship between market access and growth. Given that market access assumes interactions among all cities in the country, interactions in a more confined range may be suitable to the preindustrial economy. My findings are that market access between the 100-km and 250-km distances is positively but not significantly linked to growth.

My analysis points to the possibility that the postal network on which market access is built was perhaps ill-conceived from the beginning. Although the constructed network followed a hub-and-spokes pattern, the original plan is yet to be documented. To explore the possibility of a poor design, I turn to an instrumental-variables (IVs) approach. More specifically, I use the distance to Roman-era posts as a source of exogenous variation. The historical scholarship suggests that Paris was not a center and also that the Roman network bore no institutional connections to the early-modern one. Moreover, Michaels and Rauch (2018) demonstrate in an empirical study that French towns were unfavorably located relative to those in Britain in terms of the cost of access to waterways. The misalignment was traced to the fall of the Western Roman Empire circa 476. In its wake Germanic tribes were unified under Merovingians who took control over the heartland of France between the sixth and eighth centuries (Wickham 2009, 92). As a result, France was much less politically fragmented than in Britain. Clovis's conversion to Christianity meant that sanctuaries and churches were built near cities in Gaul (Nicholas 1997, 18). Due to the relatively quick political unification, the location of the urban networks during Rome largely remained intact. This continuity was deleterious to growth later as the value of access to waterways grew. Yet the relocation of French towns for economic motives occurred less due to the path dependence (Michaels and Rauch 2018). This particular political development shows how the less-than-ideal urban network formed in the wake of the Roman Empire could adversely affect the "French" network from a modern economic perspective.

To explore this linkage empirically, I first present evidence that the distance to Paris in Roman times is unrelated to the Roman posts. Then, using two-stage least-squares estimation I show that the proximity to the Roman post is positively and significantly linked to the proximity to the French post in the sixteenth century. In the second stage, the proximity to the French post leads to greater population. I further explore this association across geographical and socioeconomic dimensions. These provide evidence that cities that used to be a Roman settlement have a significant advantage and that the proximity to the post matters for those cities with an access to rivers at a 100-km distance (but not those at shorter distances). I also show evidence that the proximity to the initial postal network is strongly correlated to city growth in subsequent periods. In short, my analysis offers a specific channel through which the path dependence of the suboptimal Roman network may be identified.

The principal contribution of this study is empirical. My analysis demonstrates that introducing postal service itself does not necessarily beget beneficial economic outcomes. My time-varying data on both the postal network and roads as well as water transport in preindustrial France indicate that improvements in both channels were at best incremental and occasional investments were too little to make the fruits of the repair sustainable. This paper addresses the impact of a specific preindustrial institution in the long run, but my analysis points to how historical peculiarities in Roman times, which occurred nearly a millennium prior to the rise of the postal institution, helped shape a poor design yielding even longer implications.

Historical Background

In Europe, postal service underwent an *institutional* transformation at the turn of the fifteenth century. It was Germany in 1490 that introduced the imperial post (*Kaiserliche Reichspost*), which substantially improved the speed of operation. Previously, a single courier on horseback was responsible for an entire assigned route, including the return trip. The man and the horse therefore had to take periodic rest for food as well as lodging at postal stations along the way. The German innovation was to allow both postmen and horses to switch at relay stations placed at much shorter (i.e., two- to three-mile) intervals. These roadhouses were placed specifically for the operation, where commissioned officials served as "masters of the post" to take care of horses and lodging (Allen 1972, ch. 1). This system increased the pace of delivery by several folds. For instance, couriers in 1505 carried mails in a 765-km route from Mechelen, the town near Brussels, to Innsbruck for 131 hours (or five days and eleven hours) (Behringer 1990, 10–1); if they traveled at the pace of 25 km as before, it would have taken thirty days.[4]

France started a state-funded post in the 1480s under Louis XI (r. 1461–1483) by investing in paving postal roads.[5] At the time, relay stations were placed at approximately seven-league intervals (30 km or 18.6 miles), the distance a mailman was expected to travel in a single day. It was expanded to 90 km in the following century (Caplan 2016, 35). Under this system (called *poste aux chevaux*), the postmaster retained the exclusive privilege over a given route, in which a mailman could rent a horse and other supplies for travel. This policy was in place so that couriers had an incentive to receive the service by postmasters and keep using the designated route (Vaillé 2016, 33). The position of a postmaster (*maître des postes*) was a venal one and typically purchased by members of the richest families in a parish. It was also an essential condition for recruitment for the crown. The state, in exchange, allowed the postmasters to retain all of the privileges they had acquired, in addition to an annual compensation (Vaillé 2016, 34). This was a *practical* arrangement. Prior to the railway, the fixed costs of keeping the horses and couriers fresh as well as keeping the business afloat were high so that only wealthy individuals could afford them (Marchand 2006, 224). In this environment, horses occupied a large portion of the operational costs. Using data on England, Barker and Gerhold (1993, 4–7) shows that provender constituted more than 60 percent by the start of the eighteenth century.

[4] The German imperial post was also innovative in that the German state outsourced the operation from the start to the noble family of the Taxis who made the service *public*.

[5] Some attribute the origin of the French post to the royal decree issued on June 19, 1464, only to be proven inauthentic in subsequent research (Vaillé 2016, 31–2).

Given the absence of documentary evidence on an original plan (Vaillé 2016, 16), one could only imagine how Louis XI and his officials wanted the postal network to look.[6] However, how it was used is obvious: The French post was originally to carry only the personal communications for the crown (Vaillé 2016, 36). This is partly because there were privately-run communal postal services in operation prior to the state-run post. These include clerical mail services as well as university messengers, in which faculty and students circulated copies of books across the participating institutions. In addition, beginning in the seventeenth century the state intended to consolidate authority over the postal matters by issuing a series of royal decrees. For instance, one edict granted the head of the postal institutions the sole right to install new relay stations. It was designed to undermine the private messenger services (Vaillé 2016, 43).

In 1672 came the next major institutional change, which created a letter-post system (*poste aux lettres*). Through this system, the state granted a monopoly farm (*Ferme générale des postes*) the exclusive right to run the postal business for a fixed term. For the state, it was beneficial because of the predictable flow of revenue through the lease. The farm, in exchange, retained all the profits from the sale of letters (Caplan 2016, 39). Importantly, the new service was now open to the public for a fee throughout the territory. This change was based on the demand for private use, which was on the rise since the start of the state-directed post. Under the previous system, any profits went to the postmaster as the proprietor of a relay station.

These institutional developments could, in theory, facilitate economic activity primarily through the more efficient exchange as well as provision of goods and services. Couriers on horseback carried not just letters and clothes but also money, jewelry, and samples of spices among others in packets (Behringer 2006, 342). Letters may, for instance, contain the knowledge of harvest sizes and prices or of troubles with cargoes and shipwrecks sent from one merchant to another (Dorhn-van Rossum 1998, 331). A regular and reliable access to such information would aid traders and investors in their sound decision-making. At the same time, the mode of transportation beyond a man on horseback faced technical challenges that remained pervasive throughout the preindustrial

[6] For England, one motive to determine where to assign posts was that of defense, particularly with regard to information on continental Europe (Campbell-Smith 2011).

period. These included horse-drawn carts and wagons, but as I discuss later their use necessarily depended on the road infrastructure that permitted it. In the late sixteenth century, for example, farmers living in the Paris Basin began to use larger carts than before (Hoffman 1996, 179). This happened thanks to the 1671 decree, issued by the Conseil d'État, stipulating that the roads classified as *chemins vicinaux* be of 16 pieds (5.2 m) of width (and 8 pieds for the pedestrian paths called *chemins de traverse*) (Meuvret 1988*b*, 64–5). Therefore, if the postal service through the expanded network stimulated preindustrial growth, this must be based on the lower transaction costs by the faster communications and the greater exchange of goods.

It was water transport, via navigable rivers and canals, that carried bulky goods. These were primarily sacks of grain and, above all, wheat, one of the most important commodities in preindustrial France. Throughout the period, the cost of water transport remained, on average, much cheaper than overland transport. In the second half of the eighteenth century, the average price of wheat over a 100-league distance (approximately 430 km) doubled when delivered overland as opposed to shipment by water (Kaplan 1984, 84). It is clear that given the choice, water was preferred though one was meant to complement the other (Meuvret 1988*b*, 48–50). Thus one would find riverine transport thriving in inland regions, where roads were harder to reach (Letaconnoux 1909*a*). The importance of water access stands out in a report, where people in Avallon, an inland town northwest of Dijon, were impoverished because they had to travel for five leagues (21.5 km) by foot to reach the Cure then to Vermenton by boat, a larger city nearby (Meuvret 1988*b*, 48; Meuvret 1988*a*, 15).

The transportation infrastructure was generally underdeveloped until at least the beginning of Louis XI's reign (r. 1710–1774). The conditions of the roads, especially those in the countryside, long remained in disrepair. Since the same roads were used over and over again, ruts were a typical feature (Meuvret 1988*b*, 65). Peasants would take advantage of this by draining off fields in them as well as by digging up mud from them for their own land. Following a repair, a policeman in the Pyrenees was disheartened to find: "The farmers have encroached on them or plowed over the whole road, leaving only one furrow" (Weber 1976, 199). Not surprisingly, these obstacles on the road made delivery highly inefficient, because carts were not able to bypass them as nimbly as human travelers (Behringer 2006, 360). In this environment, a wagon drawn by four horses carrying 4,000 pounds was expected to cover a little more than 30 km a day at best. Poorly-maintained roads could accommodate only two horses with a much lighter cart (Kaplan 1984, 84). Until the eighteenth century, state officials kept relying on the roads previously constructed, including those from Roman times, and kept using narrow and unfit roads (Arbellot 1973, 766). The policy began to change in the 1720s, when the crown started to issue edicts on pavement to allow more horse-drawn carriages. But much of the construction had to wait until the 1760s and the 1770s when the state launched the road-construction and road-improvement project of a historic scope. I will discuss this eighteenth-century reform in more detail in the Empirical Strategy section.

The infrastructure for water transport was in a similar state. The lack of state resources had left it underdeveloped until the eighteenth century (Letaconnoux 1909*a*). This is so despite that grain shipment by boat was highly subject to deterioration due to weather, accident, or neglect (Kaplan 1984, 75; Meuvret 1988*b*, 47). Seasonal occurrences such as ice and floods determined when rivers and canals may be used. Parts of the Seine, for instance, were navigable only four months a year; the Marne functioned well from May through October (Kaplan 1984, 85). In the case of the roads, the state took incremental steps in upgrading. In 1740 it first saved some funds to study the subject and accelerate the ongoing projects of canal-building (Letaconnoux 1909*a*, 114). Only in the late 1770s did the state begin to pay regular and more serious attention to water transport and regard it as a public good (Letaconnoux 1909*a*, 114).

In this section, I described how the postal system could affect growth in preindustrial France based on the development of the network as well as of road and water transport. The channel is largely through reduction in transaction costs. An easier access can speed up the exchange of information, goods, and services. At the same time, the pace at which road and water transport grew makes the path of growth through innovation less likely. Because of the dearth of state investment, its improvement was incremental at best and the major change began to take shape toward the end of the eighteenth century. In the rest of the paper, I discuss a data set that takes this background into consideration and present evidence on the impact of the post on preindustrial growth.

Empirical Strategy

The principal unit of analysis in the study of pre-modern economic activity is the city. On Europe, the database in Bairoch, Batou, and Chévre (1988) is a standard source which compiles city-level population from 800–1850 at mostly hundred-year intervals. In my analysis, I use all 341 French cities over six periods (1500, 1600, 1700, 1750, 1800, and 1850) compiled therein, yielding 2,046 city-periods. More recently, Bosker, Buringh, and van Zanden (2013) revisit the Bairoch et al. data, and I follow their corrections and updates on the population data. This is my outcome variable.

My main explanatory variable is the market access *via postal routes*. Market access is a concept intended to capture how changes in the transportation network affect economic activity throughout the geographical domain, both directly and indirectly (Donaldson and Hornbeck 2016). The measure has thus far been used to estimate productivity changes in cross-regional trade due to significant reductions in travel cost by the introduction of railways (Donaldson and Hornbeck 2016; Hornbeck and Rotemberg 2021; Paik and Vechbanyongratana 2024). In my case, the concept represents how improvements in the postal network stimulated a greater market activity in preindustrial France through the regular and more efficient flow of information and the circulation of less bulky goods. It is defined as:

$$\mathrm{MA}_{it} = \sum_{j} \tau_{ijt}^{-\theta} N_{jt} \tag{1}$$

where τ_{ijt} is the cost of trading between city i and city j in period t, θ is the trade elasticity, and N_{jt} is the population in thousands in a given period. Following Hornbeck and Rotemberg (2021), trading cost τ_{ijt} is calculated as:

$$\tau_{ijt} = 1 + t_{ijt}/P_t \tag{2}$$

where t_{ijt} is the travel cost via postal routes between cities i and j in period t. Calculating it requires the speed of travel and, as discussed below, the speed substantially increased in the latter half of the eighteenth century following the state-directed project. These changes are reflected in the calculation. P_t is the average price of transported goods. In my case, I draw on a monthly series on wheat prices, in centimes per hectoliter, from Toulouse between 1486 and 1913. The nearly-complete documentation of an everyday and high-demand good over the past five centuries is available on this product. The same data for all other cities in France seem yet to be documented. The wheat data comprise part of the price series in Jacks (2005) which was originally compiled from Drame et al. (1991).[7] I compute the five-year moving average and use it for each year of the postal networks in Figure 1.

In the analysis, θ is set one. It usually ranges from three to thirteen in the literature, although its value depends on the context (Donaldson and Hornbeck 2016, 831). When θ equals one, it essentially denotes the "market potential" (Harris 1954), which considers the demand for goods from all locations weighted by transport costs. Since the data on city-to-city trade and productivity is unavailable, I use $\theta = 1$ as the benchmark to explore the extent to which postal expansion affects the demand throughout France.

I draw on a variety of published sources for preindustrial French postal networks. On this subject, Arbellot (1992) offers a stock of knowledge on the archival sources of maps, including those of postal routes. It highlights the evolution of the postal routes beginning with the historic 1632 map, in which cartographer Nicolas Sanson drew the known routes and relay stations throughout the country for the first time (Arbellot 1992, 20). Thereafter, the Jaillot family became the primary editor by publishing postal maps annually under the title, *Liste générale des postes de France*, in much of the eighteenth century.[8] Since only partial maps are printed in Arbellot (1992), I turn to other sources. For the sixteenth century, I use Boissière (2016) that identifies the known postal routes in 1553. For the seventeenth century, I draw on the first map that the Jaillot family published in 1690,

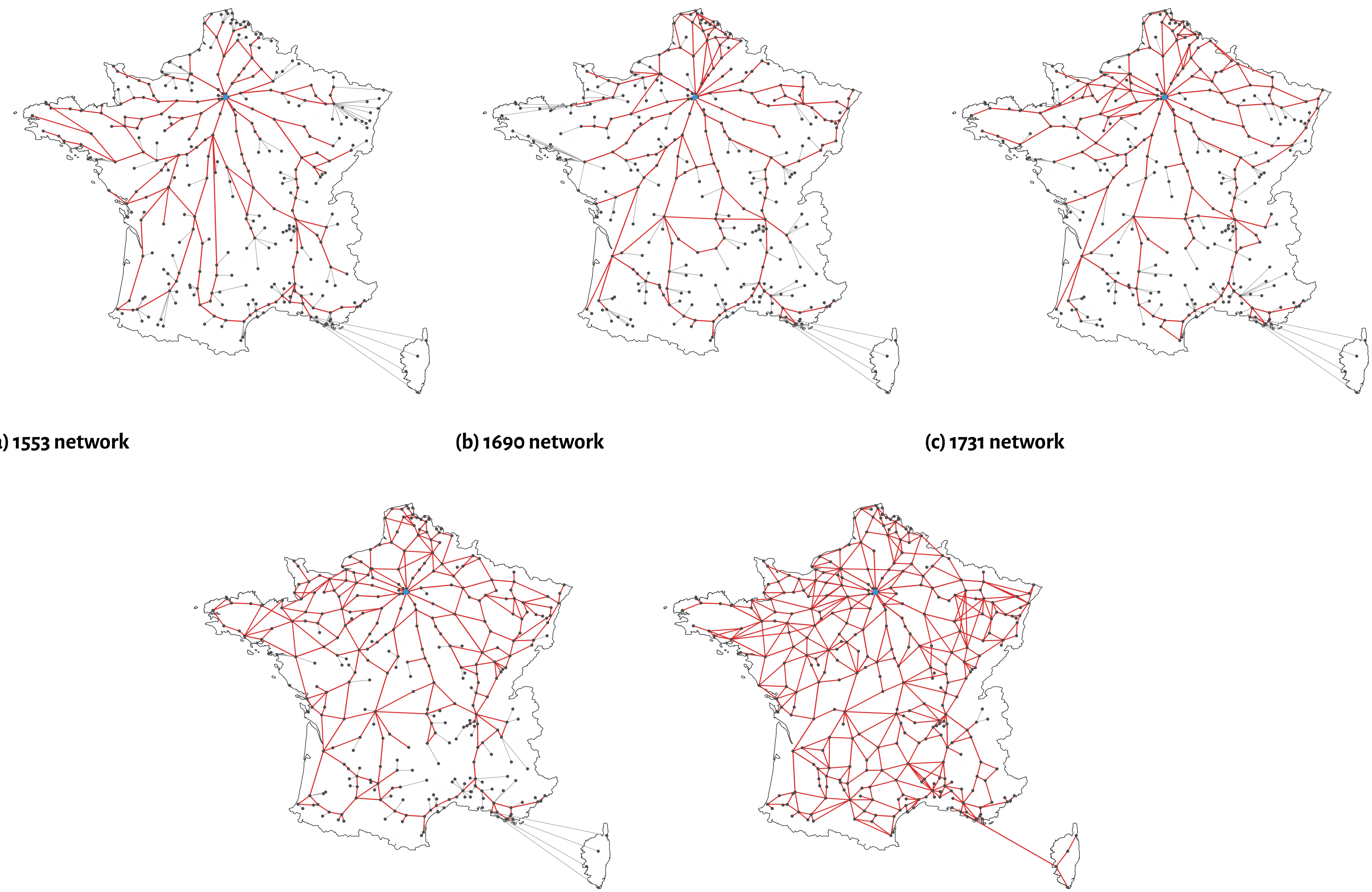
[7] I thank David Jacks for his enormous generosity in sharing the compiled series.

[8] See Appendix I of Arbellot (1992).

which is available at the Bibliothèque nationale de France (BnF) (Jaillot 1690).[9] For the eighteenth century, I use the 1731 map (Jaillot 1731) as well as the 1792 one (Arbellot and Lepetit 1987). For the first half of the nineteenth century, I draw from the 1835 map made by Tardieu (1835), one of the engravers discussed in Arbellot (1992), also stored at BnF.

[9] The BnF gives 1695 as the date of publication, while the U.S. Library of Congress gives 1690 and Arbellot (1992) gives 1689. All three refer to the same map.

Figure 1: Postal networks in France, 1553–1835.



(a) 1553 network

(b) 1690 network

(c) 1731 network

(d) 1792 network

(e) 1835 network

Note: The number of postal relays is 163 in 1553 (47.8 percent of the 341 observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). The blue dot indicates Paris. The red lines indicate the postal routes. The gray lines indicate the off-route paths to the nearest post-bearing cities. For Corsica, Marseille is set as the nearest major Mediterranean port for access.
Source: See the Empirical Strategy section. The source maps are available in the Appendix.

Figure 1 displays these maps. In 1553, relay stations were established in less than a half of the 341 cities (47.8 percent). These made little progress over the next 150 years, as 50.7 percent was covered by the end of the seventeenth century. This is in line with an assessment in the literature that post offices were still rare at the time (Arbellot 1992, 20). The pace quickened in the eighteenth century, by the end of which more than two-thirds of the cities received a post. Finally, by 1835 virtually all cities were covered. These findings are consistent with those of an earlier work by Bretagnolle and Verdier (2014) which digitizes France's postal networks between 1708 and 1833. Their contributions include the development of postal roads in length, which more than doubled during the eighteenth century (Bretagnolle and Verdier 2014, 199).

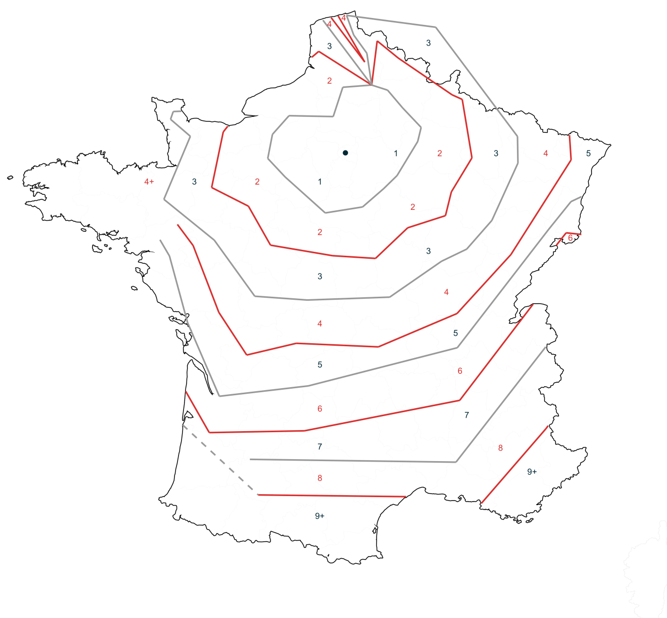
Although the existing literature provides no design or plan about how the network should be expanded, Figure 1 clearly indicates that it followed a hub-and-spokes model in which Paris served as the hub. The model suggests that those cities close to Paris would be more likely to receive a relay or be part of the network, a finding that postal roads and relay stations tended to be concentrated in the northern half (Bretagnolle and Verdier 2014). I take this pattern of development into consideration in my identification strategy.

In addition to the expansion, the postal network enjoyed increases in the speed of communication in the latter half of the eighteenth century thanks to improvements in the road conditions. It was through a state-directed project in 1716, when a specialized bureaucracy overseeing the bridges and roads, *Le Corps des ingénieurs des Ponts et Chaussées*, was founded. Two directors were later appointed, one responsible for the finances and the other for the engineers. Then in 1738 the new corvée instruction was issued not only to bring in a number of specialists but also to secure the necessary manpower for the projects (Arbellot 1973, 766). These engineers were tasked with drawing up network plans in the provinces where roads were lacking as well as deciding on connecting the roads in as short routes as possible (Arbellot 1992, 16). The reform included major roads required to be of certain width along with other specifications. For instance, coaches ought to be permitted on the routes that the state considered the most important, which would require 60 pieds (or 19.5 m) in width, including 20 pieds of ballast in the middle (called *empierrement* or *cailloutis*) and 6 pieds of built-in pits for the wheels on either side of the road (Arbellot 1973, 767–70). The source map of the 1792 postal network exhibits these "prioritized" routes (see the Appendix). I create an indicator if a city lies on them, because this classification could affect which cities Paris wanted to take advantage from the reform and thus informs my estimation strategy.

By the time these undertakings finished in 1780, it was the biggest infrastructure project in French history at the time (Arbellot 1973, 767). Still, the geographical impact of the reform was uneven. The improvements on pavement were concentrated largely in the greater region surrounding Paris (Marchand 2006, 77). The main constraint was the mounting cost of construction with which the state was simply unable to keep up. It is estimated that at best three-quarters of the planned lengths of roads were built or repaired (Arbellot 1973, 770, 772). Figure 2 displays the changes in travel speed through the state-sponsored project.

Figure 2: Changes in travel duration days from Paris between 1765 and 1780.

(a) 1765 travel duration

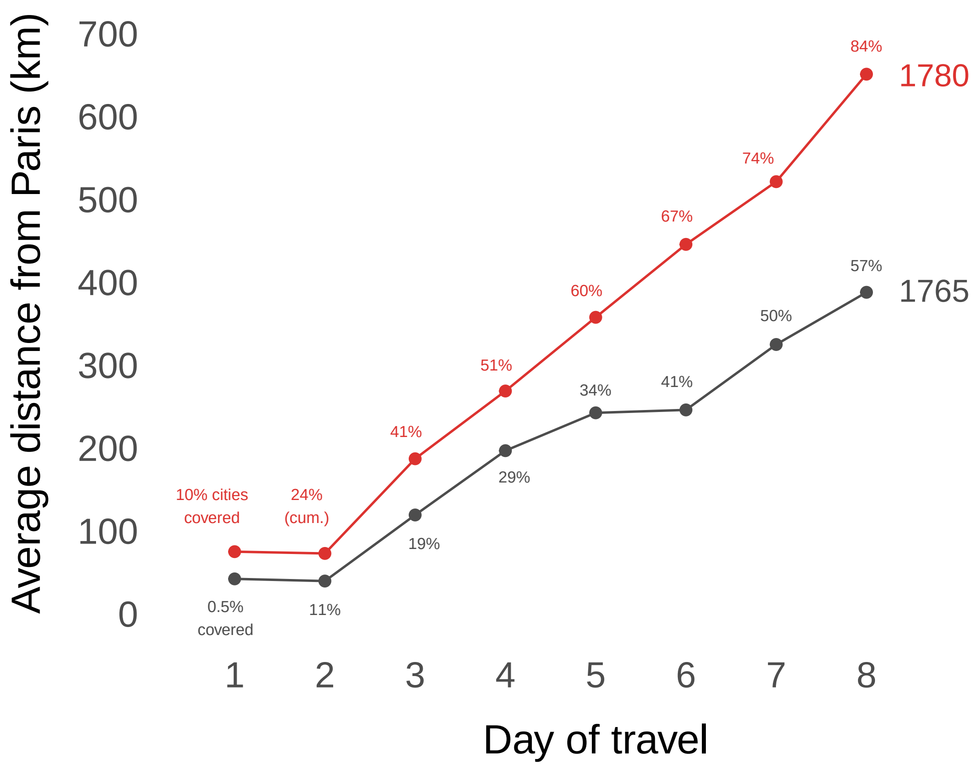


(b) 1780 travel duration

Note: The black dot in the north denotes the location of Paris. The number within each shape, or inside the border, represents the travel duration, in days, from Paris as reported in Arbellot (1973). The alternating colors of black and red are used for each day for visibility. The source maps are available in the Appendix.

While a visual inspection would indicate that the road conditions unmistakably transformed, how much did they improve? To do so, I exploit data underlying these maps for quantitative evidence. First, I georeference the 341 cities in my data set and identify them with the reported travel duration from Paris (in days). For comparison I use the first eight days, because duration estimates for cities that lie beyond nine days in the 1765 map have greater uncertainty. Second, I calculate the distance from the capital and the average for each day. Figure 3 summarizes the exercise.

Figure 3: Comparison of changes in travel distance from Paris between 1765 and 1780.

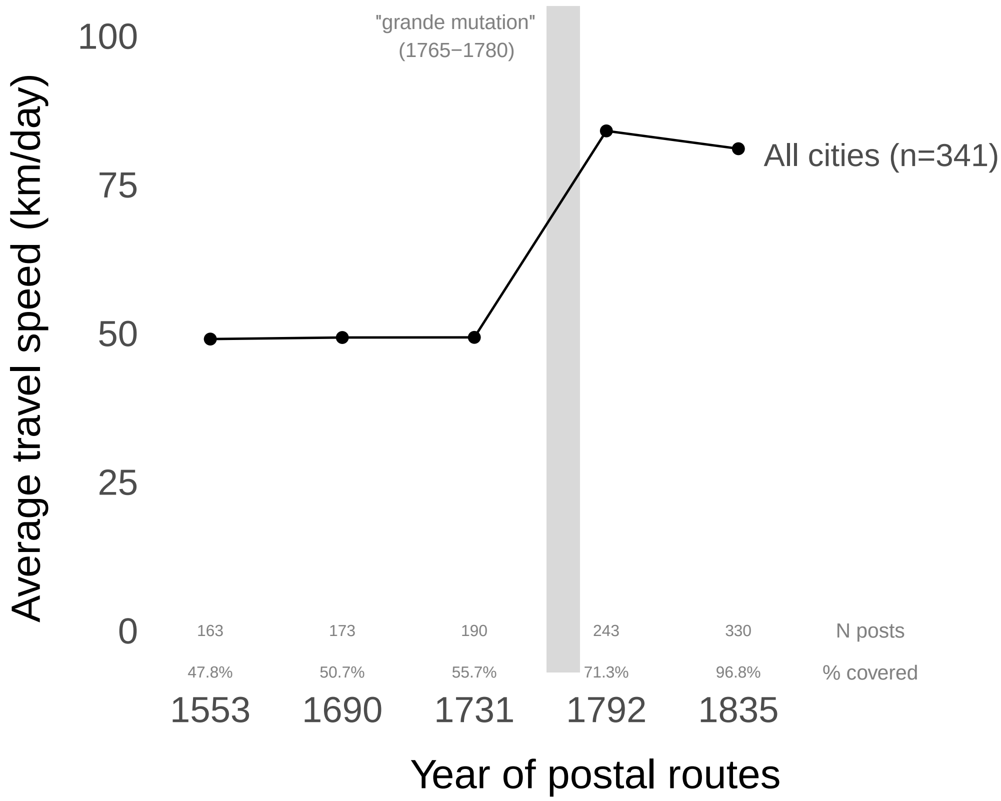


Note: The plot shows the distance from Paris for cities that can be reached within a certain number of days, averaged for the day. The black line denotes data for 1765 and the red line for 1780. The figure around the solid circle show the percentage of the 341 cities in my data set covered for each day cumulatively. *Sources:* Bairoch, Batou, and Chévre (1988) for the observations and Arbellot (1973) for travel durations.

Concrete evidence of improvement emerges from the comparison. The black line in the bottom denotes data for 1765 and the red line represents data for 1780. It is clear that more cities are covered from the first day in 1780, meaning that one could tread a greater distance. The figure around the dot shows the percentage of the cities covered, cumulatively, for each day of travel. Although 0.5 percent was reached in 1765, the number dramatically rises to 10 percent fifteen years later. Figure 3 also indicates that the infrastructure reform was geographically extensive. One reason is that the pace of distance steadily increases for 1780: The average distance for Day 8 (388 km) in 1765 is roughly achieved by Day 5 in 1780 (357 km). Another reason is the fact that a greater number of the cities could be reached by the eighth day—84 percent compared to 57 percent.

I draw on this data to compute the average per-day travel speed. The market access measure requires the calculation of travel cost which comes from the travel speed for each city. It is important to note that the information on the travel time in Arbellot (1973) is incomplete for all observations in my data set, especially those far afield from Paris (see, for instance, the Brittany region in Panel (a) of Figure 2). To estimate, I first take the average distance of travel from Paris for each travel day for the observations covered in Arbellot (1973)'s analysis. Then I divide the distance from Paris by this value to estimate the travel time for those cities not covered. Figure 4 presents the average travel speed. Before the reform of the late eighteenth century, the speed was around 50 km a day, but post-reform it increased by 50 percent. It adds further evidence that the reform reduced travel cost in this period.

Figure 4: Changes in travel speed across the five postal networks, 1553–1835.



Note: The line plots the average travel speed, denoted in km per day, over the five postal map-periods for all observations. The numbers atop the postal periods indicate the number of posts and the percentage covered in each period. *Sources:* Bairoch, Batou, and Chévre (1988) for the observations and Arbellot (1973) for travel durations.

A host of covariates are included in my data set. The first is the access to water transport by canals and rivers. As discussed above, water transport remained cheaper and more reliable to carry bulky goods during the preindustrial period. In particular, the use of canals—both engineered de novo and adapted from naturally-existing water courses—was a distinct solution for France given the abundance of rivers small and large. I draw on the database compiled in Berg (2024), which provides information not just about the length of these waterways but also practically-relevant attributes such as the starting year of operation and whether the canalization project on a river was completed. It lists 235 canals as well as derived channels and 120 navigable rivers that were either accessible or available for service by the end of the nineteenth century. Par the previous discussion that a 20-km distance (a little shorter than five leagues) to waterways constituted a significant burden at the time, I use a 20-km access as the benchmark but also records longer distances.

The second is a set of geographical determinants. These include the distances to the nearest border and to the nearest coast, which may vary over time as France's territory changes. I draw on the shape files in Nüssli (2011), which offers GIS (geographical information system)-based information on the location, administrative divisions, and political status for the subunits that existed at the final year of each century, to identify the nearest points for each measure. Two additional geographical measures include land elevation above the sea level and terrain ruggedness, both of which are drawn from the GLOBE (Global Land One-kilometer Base Elevation project) database (GLOBE Task Team and others 1999).[10] It is a 1 km-by-1 km gridded data on land terrain that covers the entire world. For elevation and terrain ruggedness, standardized values are used to capture differences from the average.

The third set of controls refers to access to private communal postal services, specifically the university networks and the church networks. Since these came into force before the state-sponsored post but no routes are available, I take the following approach. For the university services, I first draw on Frijhoff (1996), Rüegg (2004), and Darby and Fullard (1970) to obtain the foundation date of universities and then create an indicator variable that equals one if a city hosts a university in a given period. I take into account if universities were suppressed. For the church services, I create a similar indicator, based on Chaney (2023) that contains information about the history of bishoprics across the world, that equals one whether a bishopric (either a diocese or an archdiocese) was established before 1500. The institutional changes, such as suppression or merger, are noted. As mentioned in the Introduction, in post-Roman Gaul early churches were built near Roman settlements. Northern towns such as Boulogne, Arras, and Cambrai retained inhabitants continuously from Roman times and played the role of government in Gaul through local churches (Nicholas 1997, 24). Finally, I include an additional institutional measure that describes a city's time under French rule. Territorial change means that some cities were governed by non-French polities and came under French rule at various points of time. It happened particularly to the northeastern and

[10] The terrain ruggedness index (TRI) is originally proposed by Riley, DeGloria, and Elliot (1999).

eastern region of France, where territorial changes were frequent. I use Darby and Fullard (1970) to identify when cities joined and sometimes rejoined France and compute time under French rule since 1477.

Estimation Results

Baseline Estimation

My baseline specification is a model with fixed effects. For city *i* in year *t*, it is a linear estimator

$$\ln \text{Population}_{it} = \alpha + \beta \ln \text{market access via postal routes}_{it} + \gamma X_{it} + \delta_i + \eta_t + \epsilon_{it} \tag{3}$$

where the outcome variable is the log population of city *i* in year *t*, where $t \in \{1500, 1600, 1700, 1750, 1800, 1850\}$. The main explanatory variable is β, which is the log market access via postal routes. Equation 3 also includes a vector of covariates, described above and denoted in X. The inclusion of city fixed effects and time fixed effects, δ and η respectively, means that the remaining variation comes from characteristics within city. Standard errors are corrected for spatial autocorrelation.[11]

[11] I use Düben (2022)'s conleyreg package in R to obtain standard errors corrected for spatial autocorrelation. It is based on Conley (1999) while incorporating insights from subsequent modifications and extensions, including those developed by Colella et al. (2019). Given the descriptive evidence that the average travel speed per day for much of the period under study is approximately 50 km, the distance cutoff is set at that value.

Table 1: Baseline estimation on the impact of market access via postal routes on city growth in France, 1500–1850.

Dependent variable	Log population, 1500–1850			
	(1) No covariates	(2) Saturated	(3) Saturated	(4) Unweighted
Log market access via postal routes	-9.974^{***}	-10.055^{***}	-9.996^{***}	
	(1.977)	(1.993)	(1.986)	
Prioritized roads			0.022	
			(0.016)	
Log market access via postal routes with 1780 travel speed				-0.001
				(0.044)
All controls		✓	✓	✓
City FE	✓	✓	✓	✓
Period FE	✓	✓	✓	✓
N cities	341	341	341	341
Observations	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). The full results are reported in the Appendix. *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 1 reports the results of the baseline estimation. In Column 1 with only the fixed effects, the coefficient of -0.974 means that a 1-percent increase in market access via postal routes, on average, decreases the city population by 9.97 percent. The coefficient rises to over 10 percent when all covariates are included in Column 2. The substantive impact is quite large: the market activity based on the postal network had significant adverse effects on city growth throughout preindustrial times. As descriptive evidence in Figures 1 and 2 documents, the postal network grew and travel speed increased over time. The evidence here suggests that these improvements came too slowly to aid growth in this period. Still, some positive linkage might appear in locales where road improvements in the late eighteenth century were prioritized for the state. The result is considered in Column 3. The indicator for the highly-ranked roads is positively liked and the magnitude for the market access drops a little. But the inclusion of road ranks is not significant to city growth. Finally, Column 4 considers a scenario, where the faster rate of travel speed is used throughout the time to compute market access. The goal here is to maximize the improvements in travel speed, as documented in Figure 3, in creating market access. Column 4 suggests that this has no impact on city growth, adding to the evidence that increases in travel speed were, on average, not substantively meaningful to preindustrial growth.

The evidence from Table 1 suggests that reduction in transaction cost by postal expansion was, at least, insufficient to induce growth. Similarly, improvements on the road conditions were themselves not strong enough and lower travel cost through them did not make a change. It is also important to note that this result is based on the "market potential" scenario with $\theta = 1$, where the access to all cities is considered weighted by the transport cost. When the cost further decreases, economic activity via the postal network may be conducive to growth. This possibility is reported in the Appendix, where θ is set from 3–13 in accordance with the literature (Donaldson and Hornbeck 2016). The coefficients of market access turn positive but not significant—while the 50-km access to the river is significant. The result suggests that given the large territory on which market access is computed, the measure could highlight the limitations on the preindustrial economy where the society is sparsely populated and the pace of innovations is incremental. These inform my next estimation strategy which explores channels through which the negative linkage may be identified or moderated.

Heterogeneous Effects

This section considers heterogeneous effects of market access via postal expansion in two approaches. The first explores the access to canals and rivers. As described earlier, water transport played a distinct role in agrarian France by shipping bulky goods, particularly wheat and other types of grain. Besides the use of natural and navigable rivers, many were canalized to enable navigation and shipment and canals were also engineered particularly for those inland. At the same time, waterways received little attention for investment at least until the nineteenth century for the shortage of state resources (Letaconnoux 1909*b*, 112–3). In the analysis, I use different distance cutoffs up to 100 km given that the lack of access to water transport within the radius of 20 to 30 km could constitute a significant impediment to market activity.

Table 2: The role of canals and rivers as alternative means of transportation in city growth.

Dependent variable	Log population, 1500–1850			
	(1)	(2)	(3)	(4)
Canals and rivers within	20 km	40 km	50 km	100 km
Log market access via postal routes	−10.174***	−10.127***	−10.169***	−10.116***
	(1.996)	(2.004)	(2.000)	(1.998)
Canals within 20km	−0.012*			
	(0.006)			
Rivers within 20km	0.025*			
	(0.015)			
Canals within 40km		−0.004		
		(0.003)		
Rivers within 40km		0.015**		
		(0.007)		
Canals within 50km			−0.002	
			(0.002)	
Rivers within 50km			0.011**	
			(0.005)	
Canals within 100km				−0.0003
				(0.001)
Rivers within 100km				0.002
				(0.003)
All controls	✓	✓	✓	✓
City FE	✓	✓	✓	✓
Period FE	✓	✓	✓	✓
N cities	341	341	341	341
Observations	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 2 reports the outcome of these scenarios. When a city has an access to canals within 20 km through 100 km, its impact on city growth is negative across the four cutoff distances. The sign of the coefficients stays negative even though more canals should be available with a greater distance. This might reflect the fact that out of 235 canals, only 61 (or 26 percent) became operational before the nineteenth century. By contrast, access to rivers is positive and significant up to the 50-km range. This suggests that riverine access was valuable and constituted a reliable means of transportation in relation to city growth. Given that 50 km represent the average speed of travel in a day, I keep this cutoff distance for the waterways in the next analysis. The magnitude of the market access variable remains stable.

The second approach in heterogeneous effects examines various cutoff distances for the market access measure. While the average impact across the entire postal network might be negative, market activity in the localized context, i.e., within a contained geographical range, could shed a different light. This approach draws from Donaldson and Hornbeck (2016) which considers the impact of exchange only from certain distances afield while removing the impact of the local context.

Table 3: Geographically-bounded activity and city growth.

Dependent variable	Log population, 1500–1850								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bounded within	50 km	100 km	150 km	200 km	250 km	300 km	400 km	500 km	Beyond 500 km
Log market access via postal routes within 50 km	−0.002								
	(0.011)								
Log market access via postal routes within 100 km		0.012							
		(0.010)							
Log market access via postal routes within 150 km			0.009						
			(0.011)						
Log market access via postal routes within 200 km				0.007					
				(0.013)					
Log market access via postal routes within 250 km					0.002				
					(0.014)				
Log market access via postal routes within 300 km						−0.002			
						(0.015)			
Log market access via postal routes within 400 km							0.0003		
							(0.015)		
Log market access via postal routes within 500 km								0.001	
								(0.017)	
Log market access via postal routes beyond 500 km									−0.013
									(0.027)
Canals within 50 km	−0.001	−0.002	−0.002	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Rivers within 50 km	0.009*	0.009	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
All controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
City FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
N cities	341	341	341	341	341	341	341	341	341
Observations	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835

(96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 3 documents evidence on geographically-bounded market activity. The market-access coefficient is positive between the 50-km and the 500-km cutoffs except at 50 km and 300 km. Although no range is significantly linked to city growth, the results yield two possibilities. One is that postal expansion and road improvements might have played some role within a highly-bounded range, say 100 or 150 km. This is consistent with the narrative evidence about the localized nature of the preindustrial economy. Yet the size of the coefficients suggests that the substantive impact is not discernible. Another possibility is that postal expansion did little to enlarge the geography of market activity. Despite the expansion of the postal network, the incentive to engage in longer-distance trade overland seems quite muted. Column 9, which estimates the impact of market access beyond 500 km, points to this possibility.

Instrumental-Variables Analysis

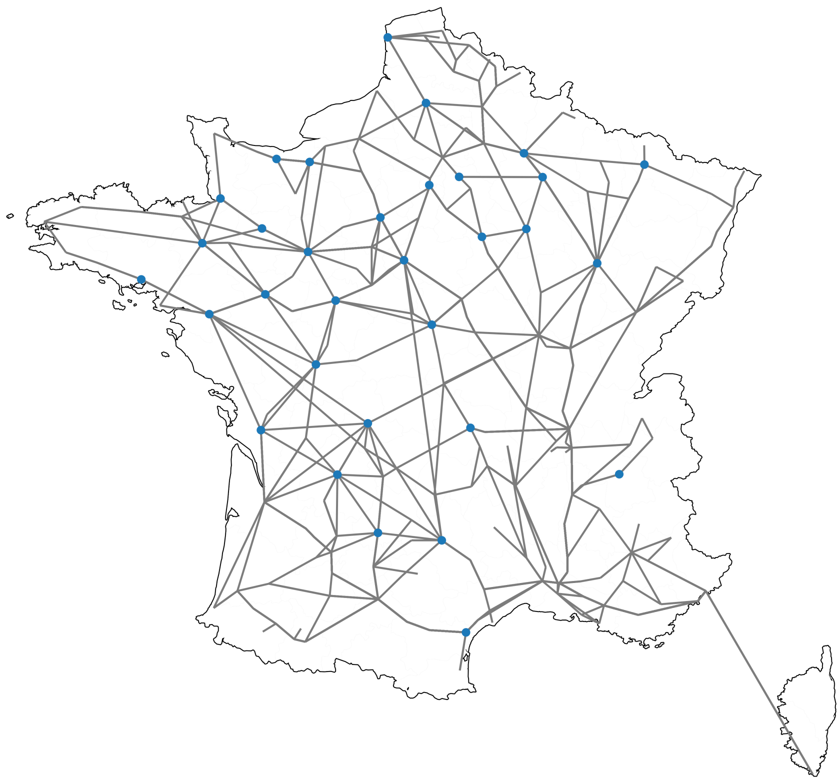
The empirical analysis has thus far provided evidence that the postal network was negatively linked to economic growth in preindustrial France. One identification challenge is that some unobserved factors determine postal routes, economic growth, or both. Another challenge comes from the fact that despite the absence of an original design, the established routes clearly had Paris as the hub. To address these endogeneity issues, I employ an instrumental-variables (IVs) approach.

In this paper I draw on the location of relay stations built in the Roman era. This is an ideal instrument, because the historical literature as well as the available evidence drawn from the reconstructed network in the scholarship indicate that Paris, the hub in the "French" system in later times, did *not* constitute a center. In a classic work, Vidal de La Blache (2009, 378) points out that the strategic advantage on the location of Paris is only suggestive and nothing seemed predetermined at the time. Moreover, Vaillé (2016, 23) holds that there is no *institutional* linkage between the Roman-era post and the French one, suggesting that the rationales as to where to place posts in Roman times would be distinct from those of the French ones. If one is to discern Rome's legacy, it would be the remnants of infrastructure that French officials found convenient to reduce the cost of building their routes. Indeed, these roads remained active after Rome and the higher density in the north suggests where the center of communication lay (Vidal de La Blache 2009, 380). Thus, this IV captures the variation in geographical proximity to the Roman-era posts to minimize the cost of building French postal routes.

Two sources provide relevant attributes. First, I draw on the Digital Atlas of the Roman Empire (DARE), hosted and managed by the Centre for Digital Humanities at the University of Gothenburg (Åhlfeldt 2020).[12] It is a georeferenced source of Roman-era settlements, forts, and other types of places. Crucially, it also provides road networks, allowing me to exploit information on cross-settlement travel. Second, I draw on a map, archived at BnF, reconstructed in 1785. It is unique in that it offers information on postal locations in the Imperial Era (27 BCE–476 CE) (d'Anville 1785). Figure 5 displays this map that incorporates these attributes.

[12]The standard source on Roman-era atlases is Talbert (2000). Åhlfeldt (2020) is different in that it has added more than 9,000 places and buildings whose sources come outside of Talbert (2000) and is transparent regarding its updates and corrections.

Figure 5: Roman-era road network with postal locations in France.



Note: The gray lines indicate the road network and the blue dots indicate the location of the relay station-bearing cities during the Roman Imperial Era (27 BCE–476 CE). The location of other cities in the data set is omitted for visual simplicity. *Source:* Digital Atlas of the Roman Empire (DARE) (Åhlfeldt 2020) for the road network and d'Anville (1785) for the postal locations.

Table 4: Predictors of Roman posts.

Dependent variable	City with post or not				Log distance to city with post			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log distance to Paris in Roman times	−0.027			−0.010	0.219*			0.014
	(0.022)			(0.022)	(0.128)			(0.124)
South		−0.090***		−0.115***		1.085***		1.219***
		(0.035)		(0.035)		(0.190)		(0.194)
Settlement in Roman times			0.167***	0.182***			−0.715***	−0.879***
			(0.031)	(0.030)			(0.178)	(0.170)
Observations	341	341	341	341	341	341	341	341

Notes: *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

To assess drivers of Roman posts, I undertake mostly bivariate regressions on plausible predictors and report the results in Table 4. Columns 1 and 5 provide quantitative evidence on the idea that Paris did not constitute a hub in the Roman-era network. In Column 1, a city's shortest route to Paris is negatively but not significantly linked to whether a city had a relay station. Column 5 uses one's shortest distance to a post-bearing city as the outcome variable. In contrast to Column 1, this specification suggests that proximity to Paris by road is significantly associated. As portrayed in Figure 5, most Roman-era posts are found in the north and many appear clustered around Paris. This evidence provides somewhat mixed evidence about the centrality of Paris. To investigate further, the rest of the models tests other possible channels. In Columns 2 and 6, cities located in the south are significantly correlated to both sets of the outcome variable, suggesting that the region was at a disadvantage in terms of access to postal relays. In Roman times the north was far more militarized region, while the south was politically more integrated: following Rome's collapse Visigothic and Burgundian kings used Roman civilian officials and created an integrated army composed of Roman and their own ("barbarian") men (Wickham 2009, 87–8). Similarly in Columns 3 and 7, Roman posts would tend to be built close to a settlement.[13] These settlements, especially in the north, served as centers of government in post-Roman times especially in collaboration with Christian churches (Nicholas 1997, 24). The three predictors are put together in Columns 4 and 8 to see if the coefficient of each remains stable. While south and Roman settlement do, the distance-to-Paris variable does not. This analysis suggests that while the location of Paris does not seem to be uncorrelated to the proximity to other Roman-post cities, other geographical and socioeconomic factors appear more influential for the placement of the post. These results provide insights about estimating the impact of the distance to Roman post in the ensuing analysis.

To investigate the role of the French post specifically, I use the shortest distance to a city with a relay station in the sixteenth century as the outcome of the first stage of the two-stage least squares regressions. The rationale is that this approach allows for assessing directly the extent to which the patterns of roads and the postal network in the distant past informed the development of those in subsequent centuries. Since market access is computed via postal routes, it is critical to understand

[13] "Settlement" is defined as those locales classified as such in Åhlfeldt (2020), including "major settlement," "civitas," and "Late Roman oppidum."

how such routes formed. In addition, this approach engages the empirical findings of Michaels and Rauch (2018). The authors' argument is that because of the manner in which the Franks consolidated authority after Rome, the Roman-era network human activity persisted and the connections in a confined geographical range remained crucial for growth in France despite the lowered cost of using rivers and oceans based on technological innovations. Empirically, Michaels and Rauch (2018, 406) provide evidence that among the French towns, those in the north tended to be relocated to the coast in response to the reduced cost as compared to those in the south. My IV estimation strategy draws on this insight, particularly in documenting variations in the impact of the instrument.

Table 5 documents the results of the two-stage least-squares estimations. In the first stage (Column 1), the distance-to-Roman-post instrument is strongly positively and significantly associated with the post in the sixteenth century. This means that the proximity to the Roman post informs that of the French one. The *F*-statistic on the weak instrument is 15. I then provide second-stage evidence in a host of contexts. The average impact of the distance to the French post is reported in Column 2. The negative association indicates that shorter distances to on-route cities lead to greater population in the sixteenth century. This evidence yields two crucial implications. First, it sets how the subsequent market activity over the long distances would be conducted in a certain way. Since the access measure is computed via postal routes, the initial network, though favoring thriving cities at the time, could have created a path dependence subsequently. As seen in the evidence thus far, it was in the direction that *undermined* city growth throughout the preindustrial period. Second, this evidence is compatible with the findings in Michaels and Rauch (2018) in that despite improvements in the postal network as well as in water transport across the country, the concentration of human activity in a relatively small distance mattered more. My evidence supports Michaels and Rauch (2018)'s argument these improvements had a limited impact on France, because they *reinforced* rather than overcame the far-from-ideal network of market activity that became entrenched centuries before their introduction.

Table 5: Two-Stage Least-Squares regressions on city growth.

	First stage	Second stage				
Dependent variable	Log distance to post in 1553	Log population in 1500				
Panel A Data subsetted			Within south	Within north	Roman settlement	No settlement
	(1)	(2)	(3)	(4)	(5)	(6)
Log distance to post in 1553		-0.330^{**}	0.231	-0.312	-0.343^{*}	0.331^{*}
		(0.158)	(0.234)	(0.194)	(0.178)	(0.190)
Log distance to Roman post	0.252^{***}					
	(0.065)					
All controls	✓	✓	✓	✓	✓	✓
Observations	341	341	99	242	192	149
F-statistic for weak instrument	15.00					

Panel B City with river access within	20 km	40 km	50 km	100 km
	(7)	(8)	(9)	(10)
Log distance to post in 1553	-0.423	-0.268	-0.227	-0.261^{**}
	(0.334)	(0.164)	(0.147)	(0.127)
All controls	✓	✓	✓	✓
Observations	97	196	230	320

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. In Panel B, access to canals is omitted for collinearity (There were fifteen out of 235 canals in service before 1500). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

The rest of Table 5 presents variations in the impact of the distance to the French post in terms of the two attributes related to Roman posts. Columns 3 and 4 split the data set along the north-south regions to see if the Roman-post instrument would be informative of subsequent city growth. In line with the finding in Table 4, the proximity to the post is negatively linked to city growth among the southern cities (Column 3), while the opposite happens among the northern cities (Column 4). In the latter, the significance is nearly at the 10 percent level ($p = 0.109$). Similarly, the variation in Roman settlement exhibits a significant impact. Columns 5 and 6 suggest that being a settlement had an advantage in the assignment of a post and growth in the sixteenth century. Finally, drawing on the argument in Michaels and Rauch (2018), I explore the impact of a city's access to river at varying distances in Panel B. The observations are constrained to those with an access to at least one river within 20, 40, 50, or 100 km. In the relatively short distances (up to 40 km in Columns 7–8), the proximity to the post is negative but not significant. This can mean that cities enjoy an easier access to a navigable river and put a priority on it over land-based transportation. The importance of the postal network seems to grow as riverine transport becomes more difficult in Columns 9 and 10. Combined with the OLS findings earlier, the results here offer additional evidence in the role of an access to rivers in understanding market activity.

Table 6: Long-term impact of the proximity to post in the sixteenth century on subsequent growth.

Dependent variable	Log population in 1600	1700	1750	1800	1850
	(1)	(2)	(3)	(4)	(5)
Log distance to post in 1553	-0.330^{**}	-0.444^{***}	-0.511^{***}	-0.226^{**}	-0.349^{***}
	(0.158)	(0.155)	(0.142)	(0.104)	(0.097)
All controls	✓	✓	✓	✓	✓
Observations	341	341	341	341	341

Notes: The data set is subsetted for each period. Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Finally, I further investigate the long-term impact of the initial postal network. In so doing, I divide the data set for each time period beyond 1500 and estimate the second-stage regression for one period at a time in Table 6. The negative and significant relationship across all models suggests that the initial assignment has a long-term impact on subsequent city growth. Since the postal roads form the basis on which market access is constructed and my earlier analysis shows that it undercut preindustrial growth, the evidence suggests that the postal network could have saddled the economic activity with more, as opposed to less, trading costs.

Conclusion

This paper explored the relationship between the postal system and city-level growth in preindustrial France. The institution began in the late fifteenth century as the communications service exclusively for the crown, until it became open to the public two centuries later. Network expansion was overall incremental. Not until the toward the Revolutionary period were more than two-thirds of the cities covered. The system carried essentially non-bulky items, while waterways played the role of delivering wheat and other bulky goods. At the same time, the road conditions were generally poor. Only in the late eighteenth century was the infrastructure reform undertaken as the largest construction project in French history at the time. Post-led growth was primarily through reduction in transaction cost.

My analysis finds that market access via postal routes has adverse consequences to city growth. Improvements in roads, when added to the estimation, are not impactful. When I consider varying distances to a city's access to canals and rivers, riverine access between 20 km and 50 km is positively linked to growth while the market access remains negative. Given that market access is an aggregate measure that incorporates interactions across the country, the geographically-bounded approach shows that the measure exhibits positive but not significant associations. This evidence is based on the "market potential" scenario, which considers the demand for goods from all cities. The IV analysis seeks to locate the origins of the postal network that turned out to be far less than ideal. One hypothesis is path dependence from the immediate post-Roman period, in which Merovingians achieved political unification in Gaul and left the urban networks under Rome relatively intact. The "French" network that subsequently grew were thus more distant from access to waterways, the means of transport critical to growth. I provide evidence that lends support to this argument. Thus the French postal network may have been founded on an ill-conceived design from a modern perspective.

Ultimately, postal expansion, along with the belated infrastructure reform, did not form part of the "wheels of civilization" story in the preindustrial economy as roads and railways did as part of the great motors of civilization toward the end of the nineteenth century in France. The latter is well told in many places. In the United States, the railroad was complimentary to other means of transportation by extending to waterways (Donaldson and Hornbeck 2016). Countryside roads were also improved. By contrast, a comparable development did not take place in preindustrial France. Transportation remained costly as a result.[14] A radical change must wait until railways began to be placed and extended. As Weber (1976, 217) vividly portrays it: “Roads and rails brought men into the market, permitted them to drink wine or sell it profitably, or to develop crops that could not be marketed before, and to give up growing others that could now be bought more cheaply.” They were radical enough to unload the historical burden from Roman times. Until their appearance, the French post seemed to be kept entrapped.

[14] Berger (2019) makes a similar point in terms of the substantial economic impact that Swedish canals and roads failed to bring about prior to the railway that started in the mid-nineteenth century.

References

Acemoglu, Daron, Jacob Moscona, and James A. Robinson. 2016. "State Capacity and American Technology: Evidence from the Nineteenth Century." *American Economic Review: Papers and Proceedings* 106(5): 61–7.

Åhlfeldt, Johan. 2020. "Digital Atlas of the Roman Empire.".
URL: https://imperium.ahlfeldt.se/

Allen, E. John B. 1972. *Post and Courier Service in the Diplomacy of Early Modern Europe*. The Hague: Marinus Nijhoff.

Aneja, Abhay, and Guo Xu. 2022. "Strengthening State Capacity: Postal Reform and Innovation during the Gilded Age." Mimeo.

Arbellot, Guy. 1973. "La grande mutation des routes de France au XVIII^e siècle." *Annales: Économies, Sociétés, Civilisations* 28(3): 765–91.

Arbellot, Guy. 1992. *Autour des routes de poste. Les premières cartes routières de la France, XVII^e–XIX^e siècle*. Paris: Bibliothèque Nationale Musée de la Poste.

Arbellot, Guy, and Bernard Lepetit. 1987. *Atlas de la Révolution française*. Vol. 1: *Routes et communications*. Paris: École des Hautes Études en Sciences Sociales.

Bairoch, Paul. 1988. *Cities and Economic Development: From the Dawn of History to the Present*. Chicago: University of Chicago Press.

Bairoch, Paul, Jean Batou, and Pierre Chévre. 1988. *La Population des villes Européennes de 800 à 1850: Banque de données et analyse sommaire des résultats*. Genéve: Librairie Droz.

Barker, Theo, and Dorian Gerhold. 1993. *The Rise and Rise of Road Transport, 1700–1990*. Cambridge: Cambridge University Press.

Behringer, Wolfgang. 1990. *Thurn und Taxis: Die Geschichte ihrer Post und ihrer Unternehmen*. München: Piper Verlag.

Behringer, Wolfgang. 2006. "Communications Revolutions: A Historiographical Concept." *German History* 24(3): 333–74.

Berg, Charles. 2024. "Dictionnaire des rivières et canaux de France.".
URL: http://projetbabel.org/fluvial/index.htm

Berger, Thor. 2019. "Railroads and Rural Industrialization: Evidence from a Historical Policy Experiment." *Explorations in Economic History* 74: 101277.

Boerner, Lars, and Battista Severgnini. 2019. "Time for Growth." Mimeo.

Boerner, Lars, Jared Rubin, and Battista Severgnini. 2021. "A Time to Print, a Time to Reform." *European Economic Review* 138: 103826.

Boissière, Aurélie. 2016. *Atlas de l'histoire de France, 481–2005*. Saint-Étienne: Belin.

Bosker, Maarten, Eltjo Buringh, and Jan Luiten van Zanden. 2013. "From Baghdad to London: Unraveling Urban Development in Europe, the Middle East, and North Africa, 800–1800." *Review of Economics and Statistics* 95(4): 1418–37.

Bretagnolle, Anne, and Nicolas Verdier. 2014. "Expanding the Network of Postal Routes in France, 1708–1833". In *Post Offices of Europe, 18th–21st Century: A Comparative History*, ed. Muriel Le Roux. New York: P.I.E. Peter Lang, pp. 183–202.

Campbell-Smith, Duncan. 2011. *Masters of the Post: The Authorized History of the Royal Mail*. Middlesex: Penguin.

Caplan, Jay. 2016. *Postal Culture in Europe, 1500–1800*. Oxford: Voltaire Foundation.

Chaney, David M. 2023. "The Hierarchy of the Catholic Church: Current and Historical Information about Its Bishops and Dioceses.".
URL: www.catholic-hierarchy.org

Colella, Fabrizio, Rafael Lalive, Seyhun Orcan Sakalli, and Mathias Thoenig. 2019. "Inference with Arbitrary Clustering." Mimeo.

Conley, Timothy G. 1999. "GMM Estimation with Cross Sectional Dependence." *Journal of Econometrics* 92(1): 1–45.

d'Anville, Jean-Baptiste Bourguignon. 1785. "Carte de la Gaule: divisée en 17 grandes Provinces Romaines au tems des Empereurs.".
URL: https://gallica.bnf.fr/ark:/12148/btv1b10678810p

Darby, H.C., and Harold Fullard, eds. 1970. *The New Cambridge Modern History*. Vol. 14: *Atlas*. Cambridge: Cambridge University Press.

Daudin, Guillaume. 2010. "Domestic Trade and Market Size in Late-Eighteenth-Century France." *Journal of Economic History* 70(3): 716–43.

de Vries, Jan. 1984. *European Urbanization, 1500–1800*. Cambridge, MA: Harvard University Press.

Donaldson, Dave, and Richard Hornbeck. 2016. "Railroads and American Economic Growth: A 'Market Access' Approach." *Quarterly Journal of Economics* 132(2): 799–858.

Dorhn-van Rossum, Gerhard. 1998. *History of the Hour: Clocks and Modern Temporal Orders*. Chicago: University of Chicago Press.

Drame, Sylvie, Christian Gonfalone, Judith A. Miller, and Bertrand Roehner. 1991. *Un siècle de commerce du blé en France, 1825–1913: Les fluctuations du champ des prix*. Paris: Economica.

Düben, Christian. 2022. conleyreg*: Estimations using Conley Standard Errors*. R package version 0.1.7.
URL: https://CRAN.R-project.org/package=conleyreg

Flückiger, Matthias, Erik Hornung, Mario Larch, Markus Ludwig, and Allard Mees. 2022. "Roman Transport Network Connectivity and Economic Integration." *Review of Economic Studies* 89(2): 774–810.

Frijhoff, Willem. 1996. "Patterns". In *A History of the University in Europe*, ed. Hilde de Ridder-Symoens. Vol. 2: *Universities in Early Modern Europe*. Cambridge: Cambridge University Press, pp. 43–110.

Geloso, Vincent, and Michael Makovi. 2022. "State Capacity and the Post Office: Evidence from Nineteenth-Century Quebec." *Journal of Government and Economics* 5: 100035.

GLOBE Task Team and others. 1999. "The Global Land One-kilometer Base Elevation (GLOBE) Digital Elevation Model.".
URL: http://www.ngdc.noaa.gov/mgg/topo/globe.html

Harris, Chauncy D. 1954. "The Market as a Factor in the Localization of Industry in the United States." *Annals of the Association of American Geographers* 44(4): 315–48.

Hoffman, Philip T. 1996. *Growth in a Traditional Society: The French Countryside, 1450–1815*. Princeton: Princeton University Press.

Hornbeck, Richard, and Martin Rotemberg. 2021. "Railroads, Market Access, and Aggregate Productivity Growth." Mimeo.

Jacks, David S. 2005. "Intra- and International Commodity Market Integration in the Atlantic Economy, 1800–1913." *Explorations in Economic History* 42: 381–413.

Jaillot, Alexis-Hubert. 1690. "Carte particulière des postes de France.".
URL: https://gallica.bnf.fr/ark:/12148/btv1b531194921/

Jaillot, Bernard-Antoine. 1731. "Nouvelle carte des postes de France.".
URL: https://gallica.bnf.fr/ark:/12148/btv1b53083374j

Kaplan, Steven Laurence. 1984. *Provisioning Paris: Merchants and Millers in the Grain and Flour Trade during the Eighteenth Century*. Ithaca: Cornell University Press.

Landes, David S. 1983. *Revolution in Time: Clocks and the Making of the Modern World*. Cambridge, MA: Belknap Press of Harvard University Press.

Le Goff, Jacques. 1980. *Time, Work, and Culture in the Middle Ages*. Translated by Arthur Goldhammer. Chicago: University of Chicago Press.

Lepetit, Bernard. 1984. *Chemins de terre et voies d'eau: Réseaux de transports et organisation de l'espace en France, 1740–1840*. Paris: École des Hautes Études en Sciences Sociales.

Letaconnoux, Joseph. 1908. "Les transports en France au XVIII^{e} siècle." *Revue d'histoire moderne et contemporaine* 11(2): 97–114.

Letaconnoux, Joseph. 1909*a*. "Les transports en France au XVIII^{e} siècle (Suite et fin)." *Revue d'histoire moderne et contemporaine* 11(4): 269–92.

Letaconnoux, Joseph. 1909*b*. "Les voies de communication en France, au XVIII^{e} siècle." *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 7(1): 94–141.

Marchand, Patrick. 2006. *Le Maître de postes et le messager. Les Transports publics en France au temps des chevaux*. Paris: Belin.

Meuvret, Jean, ed. 1988*a*. *Le problème des subsistances à l'époque Louis XIV.* Vol. III: *Le commerce des grains et la conjoncture (Notes)*. Paris: École des Hautes Études en Sciences Sociales.

Meuvret, Jean, ed. 1988*b*. *Le problème des subsistances à l'époque Louis XIV.* Vol. III: *Le commerce des grains et la conjoncture (Texte)*. Paris: École des Hautes Études en Sciences Sociales.

Michaels, Guy, and Ferdinand Rauch. 2018. "Resetting the Urban Network: 117–2012." *The Economic Journal* 128(608): 378–412.

Mokyr, Joel. 1990. *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press.

Mokyr, Joel. 2016. *A Culture of Growth: The Origins of the Modern Economy*. Princeton: Princeton University Press.

Nicholas, David. 1997. *The Growth of the Medieval City: From Late Antiquity to the Early Fourteenth Century*. London: Addison Wesley Longman.

Nüssli, Christos. 2011. "Euratlas.".
URL: http://www.euratlas.com/about.html

Paik, Christopher, and Jessica Vechbanyongratana. 2024. "Reform, Rails, and Rice: Political Railroads and Local Development in Thailand." *Journal of Economic History* 84(3): 807–37.

Riley, Shawn J., Stephen D. DeGloria, and Robert Elliot. 1999. "A Terrain Ruggedness Index That Quantifies Topographic Heterogeneity." *Intermountain Journal of Sciences* 6(1–4): 23–7.

Rogowski, Jon C., John Gerring, Matthew Maguire, and Lee Cojocaru. 2022. "Public Infrastructure and Economic Development: Evidence from Postal Systems." *American Journal of Political Science* 66(4): 885–901.

Rüegg, Walter, ed. 2004. *A History of the University in Europe*. Vol. 1–4. Cambridge: Cambridge University Press.

Talbert, Richard J.A., ed. 2000. *Barrington Atlas of the Greek and Roman World*. Princeton: Princeton University Press.

Tardieu, Pierre-Antoine. 1835. "Carte spéciale des postes de France.".
URL: https://gallica.bnf.fr/ark:/12148/btv1b53035319f

Vaillé, Eugène. 2016. *Histoire des postes Française jusqu'en 1939*. Brussels: P.I.E. Peter Lang.

Vidal de La Blache, Paul. 2009. *Tableau de la géographie de la France*. Vol. 1 of *Histoire de France depuis les origines jusqu'à la Révolution*. Edited by Ernest Lavisse. Sainte-Marguerite-sur-Mer: Éditions des Équateurs.

Weber, Eugen. 1976. *Peasants into Frenchmen: The Modernization of Rural France, 1870–1914*. Stanford: Stanford University Press.

Wickham, Chris. 2009. *The Inheritance of Rome: Illuminating the Dark Ages, 400–1000*. New York: Penguin.

Appendix for "Postal Growth"

November 16, 2024

Contents

1 Source Maps of Post Offices in France Used to Construct the Main Explanatory Variable A2
1.1 1553 . . . . . A2
1.2 1690 . . . . . A3
1.3 1731 . . . . . A4
1.4 1792 . . . . . A5
1.5 1835 . . . . . A7

2 Source Maps of "Grande Mutation" or Changes in Travel Time A8
2.1 Map of Pre-Reform Travel Time, 1765 . . . . . A8
2.2 Map of Post-Reform Travel Time, 1780 . . . . . A9

3 Estimation Results A10
3.1 Baseline Estimate A10
3.2 Canals and Rivers A11
3.3 Geographically-Bounded Interactions A12
3.4 Instrumental-Variables (IV) Approach A13
3.4.1 Map of Roman Posts during the Imperial Period A13
3.4.2 Southern France A14
3.4.3 Predictors of Roman Posts A15
3.4.4 Location of Roman Posts as an IV 1/3 . . . . . A16
3.4.5 Location of Roman Posts as an IV 2/3 . . . . . A17
3.4.6 Location of Roman Posts as an IV 3/3 . . . . . A18
3.5 Estimates with Varying Values of θ A19

1 Source Maps of Post Offices in France Used to Construct the Main Explanatory Variable

1.1 1553

Figure A1 shows the distribution of the known postal relays in France in 1553. It is drawn by cartographer Aurélie Boissière and documented in *Atlas de l'histoire de France, 481–2005* (2016).

Figure A1: Geographical distribution of post offices in France in 1553.

1.2 1690

Figure A2 exhibits the distribution of the known relay stations of the French post published in 1690. Titled "Carte particulière des postes de France," it is drawn by Alexis-Hubert Jaillot. The map is available online as part of the World Digital Library project of the U.S. Library of Congress. The date of publication is 1695 according to the Bibliothèque nationale de France (BnF).

Figure A2: Geographical distribution of post offices in France in 1690.

1.3 1731

Figure A3 presents the distribution of France's post offices published in 1731. Titled "Nouvelle carte des postes de France," it is drawn by Bernard-Antoine Jaillot. The map is available online at BnF.

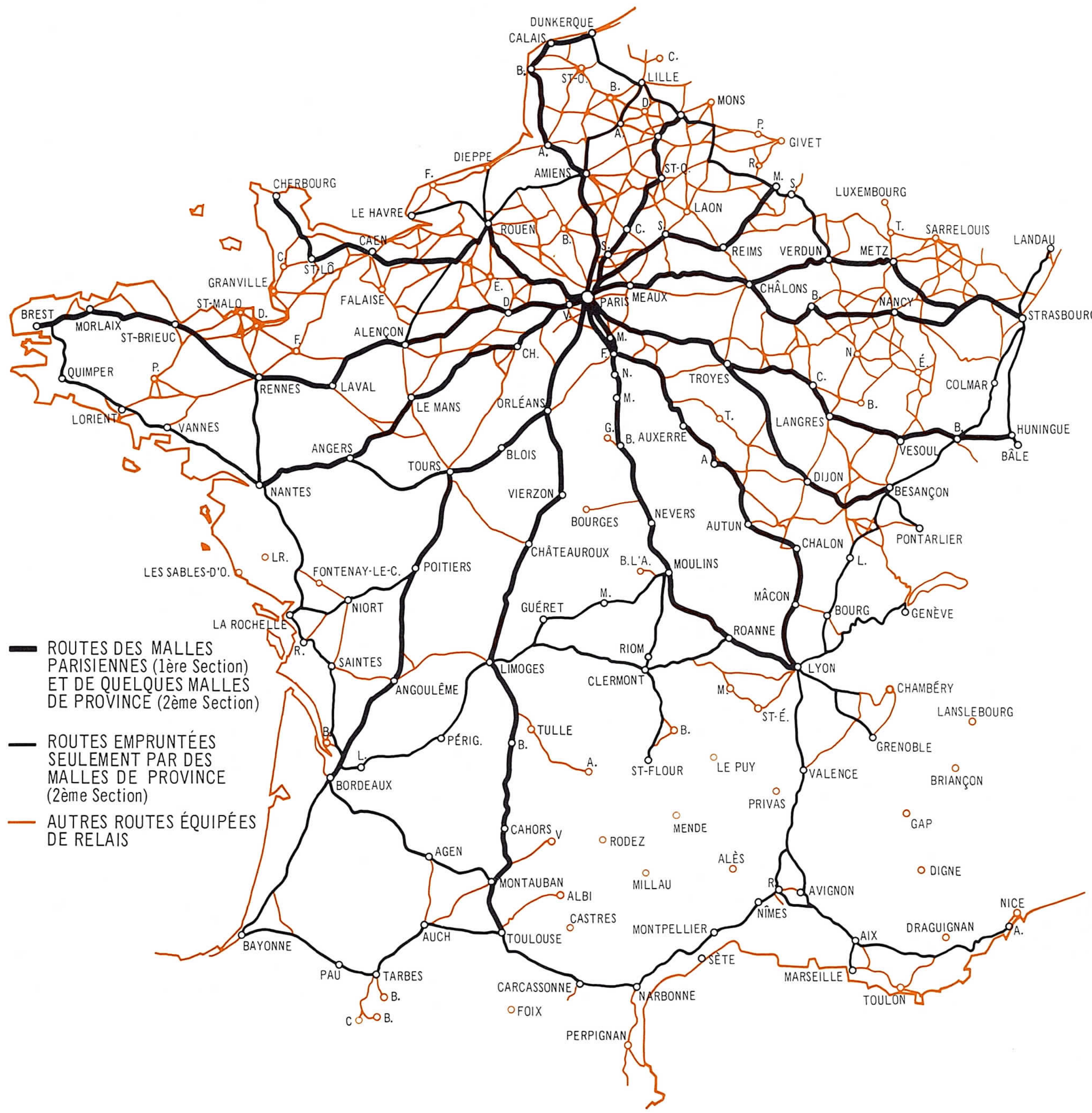
Figure A3: Geographical distribution of post offices in France in 1731.

Source gallica.bnf.fr / Bibliothèque nationale de France

1.4 1792

Figure A4 presents the distribution of France's post offices in 1792. It comes from Guy Arbellot and Bernard Lepetit in *Atlas de la Révolution française*, vol. 1: *Routes et communications* (1987). It is part of the 11-volume series on the French Revolution published by the École des Hautes Études en Sciences Sociales. The "main" or prioritized roads used in Table 1 in text refer to "Routes des malles parisiennes (1ère section) et de quelques malles de province (2ème section)," highlighted in bold black. These routes allowed horse-drawn coaches to pass through, which, in turn, required the road to be ideally of certain width and be paved for smooth passage.

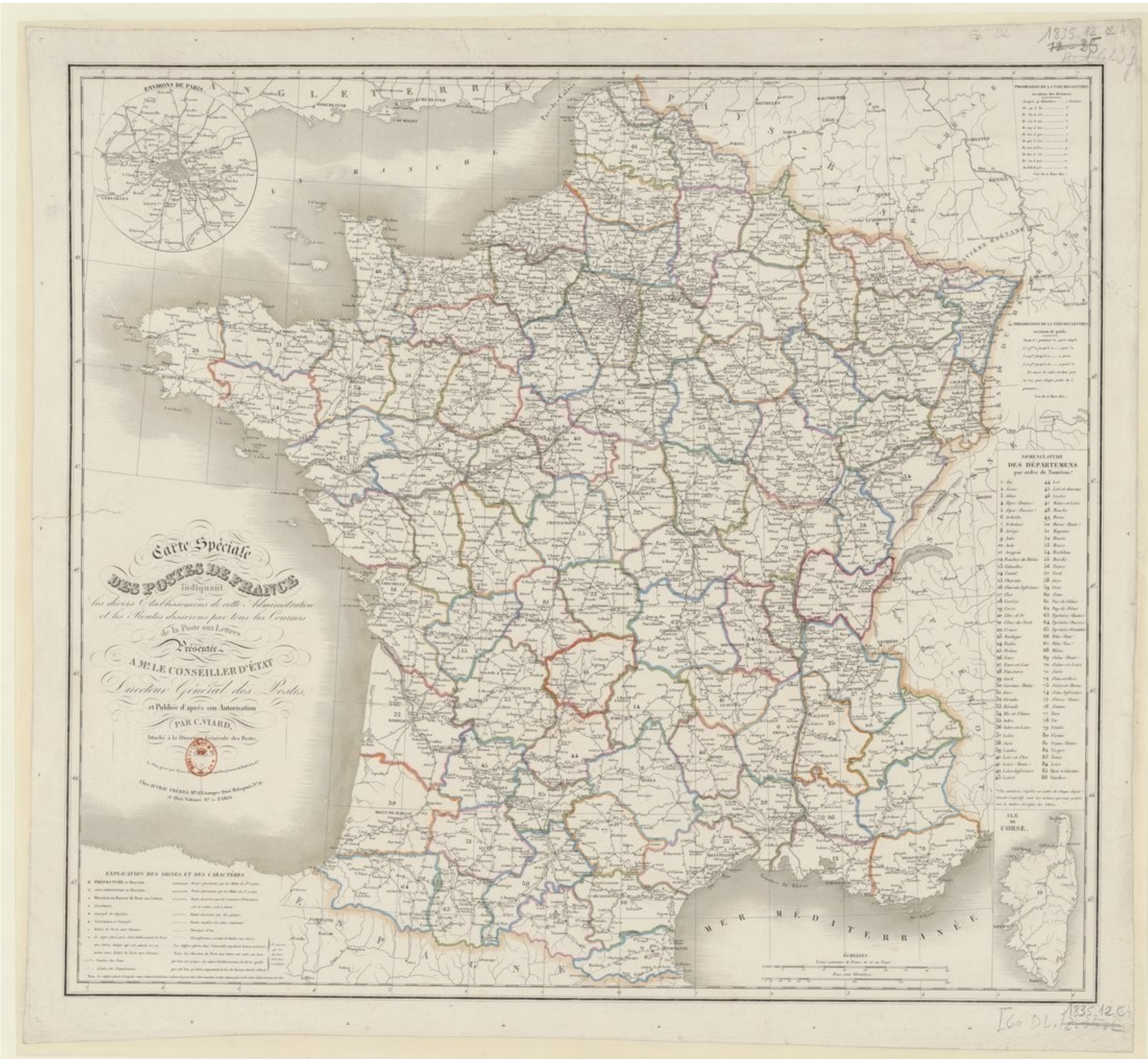
Figure A4: Geographical distribution of post offices in France in 1792.



1.5 1835

Figure A5 presents the distribution of France's post offices published in 1835. The map is titled "Carte spéciale des postes de France," in which Pierre-Antoine Tardieu is the engraver. The map is available online at BnF.

Figure A5: Geographical distribution of post offices in France in 1835.

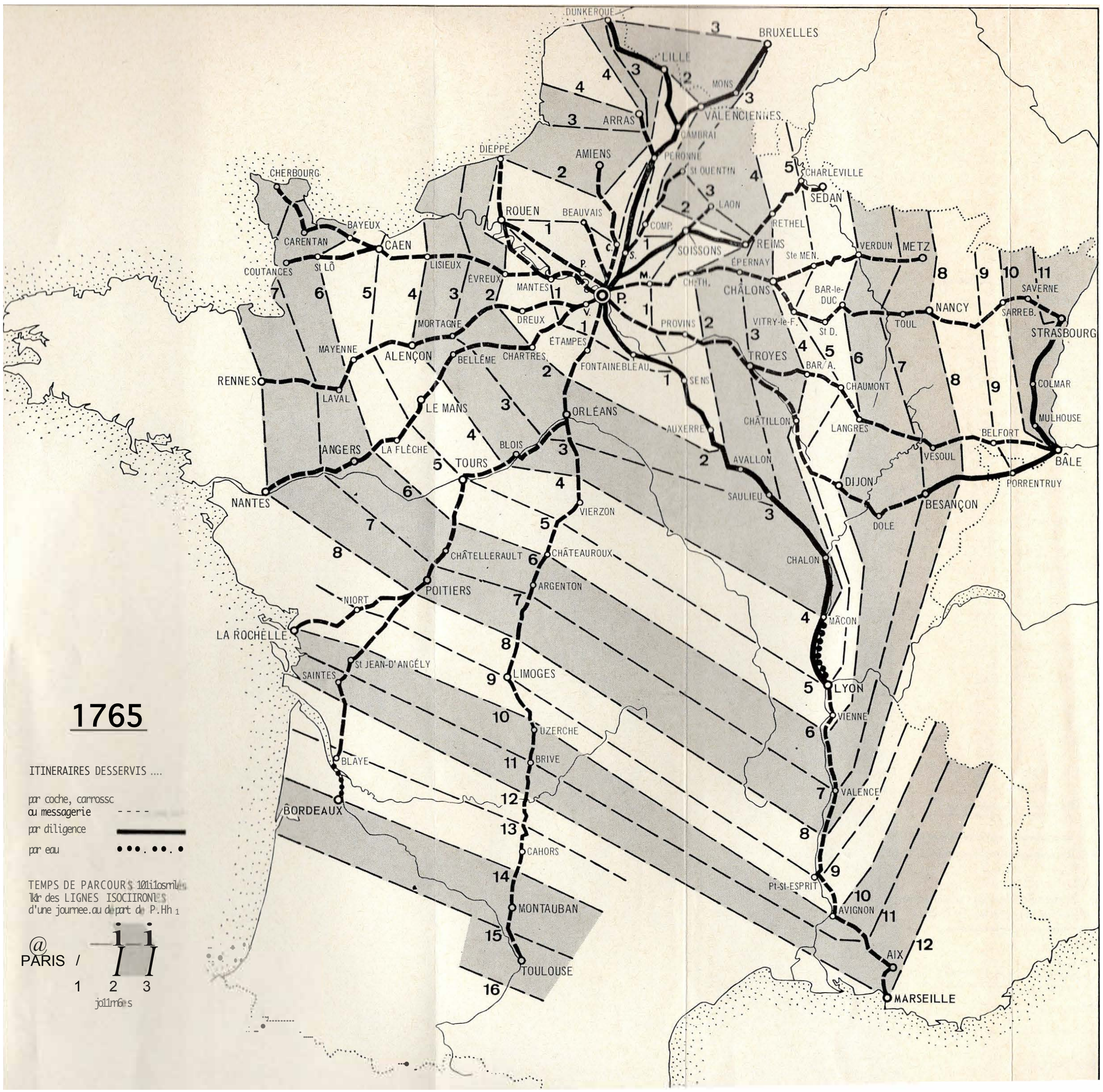


2 Source Maps of "Grande Mutation" or Changes in Travel Time

2.1 Map of Pre-Reform Travel Time, 1765

Figure A6 is the source map for travel duration days from Paris in 1765 as well as for computing travel time via postal routes. The map comes from: Arbellot, Guy. 1973. "La grande mutation des routes de France au XVIII^{e} siècle." *Annales: Économies, Sociétés, Civilisations* 28(3): 765–91.

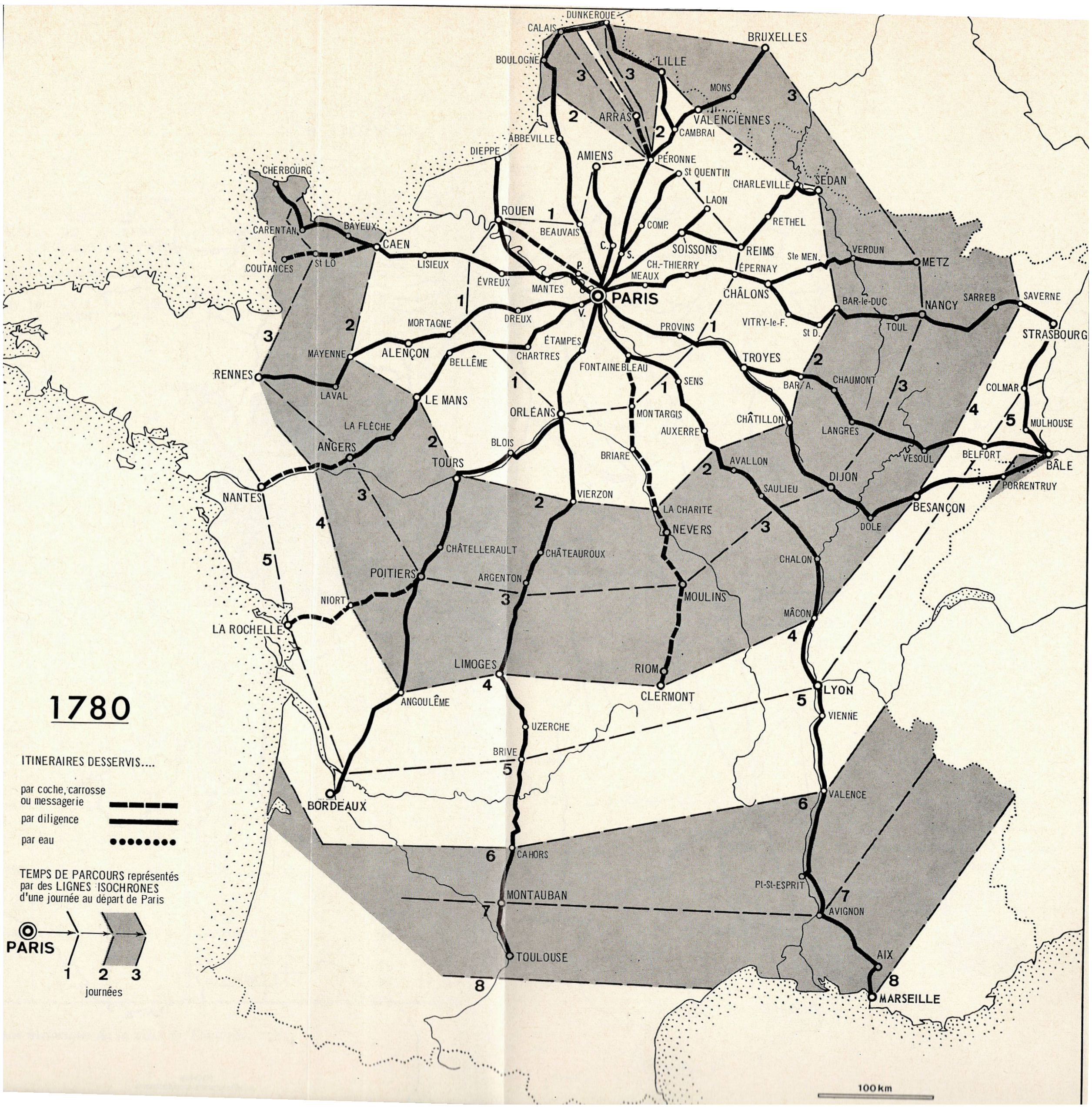
Figure A6: Travel Days from Paris Before the Reform as Estimated by Arbellot (1973).



2.2 Map of Post-Reform Travel Time, 1780

Figure A7 is the source map for travel duration days from Paris in 1765 as well as for computing travel time via postal routes. The map comes from: Arbellot, Guy. 1973. "La grande mutation des routes de France au XVIIIe siècle." *Annales: Économies, Sociétés, Civilisations* 28(3): 765–91.

Figure A7: Travel Days from Paris After the Reform as Estimated by Arbellot (1973)



3 Estimation Results

3.1 Baseline Estimate

Table A1 presents the full result of Table 1 in the paper.

Table A1: Baseline estimation on the impact of distance to commercial hubs via postal routes on city growth in France, 1500–1850.

Dependent variable	Log population, 1500–1850			
	(1) No covariates	(2) Saturated	(3) Saturated	(4) Saturated
Log market access via postal routes	-9.974^{***}	-10.055^{***}	-9.996^{***}	
	(1.977)	(1.993)	(1.986)	
Prioritized roads			0.022	
			(0.016)	
Log market access with 1780 travel speed				-0.001
				(0.044)
Log distance to nearest border		0.002	0.001	-0.005
		(0.013)	(0.013)	(0.013)
Log distance to nearest coast		0.014	0.011	0.015
		(0.010)	(0.010)	(0.010)
Elevation		-0.020	-0.016	-0.020
		(0.020)	(0.021)	(0.021)
Terrain ruggedness		0.028	0.030^{*}	0.023
		(0.018)	(0.018)	(0.018)
Bishopric established before 1500		0.063^{*}	0.055^{*}	0.056^{*}
		(0.033)	(0.034)	(0.033)
University		-0.065	-0.071	-0.071
		(0.051)	(0.052)	(0.053)
Time under French rule since 1477		-0.00002	-0.00002	0.00000
		(0.0001)	(0.0001)	(0.0002)
City FE	✓	✓	✓	✓
Period FE	✓	✓	✓	✓
N cities	341	341	341	341
Observations	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.2 Canals and Rivers

Table A2 presents the full result of Table 2 in the paper.

Table A2: The role of canals and rivers as alternative means of transportation in city growth.

Dependent variable	Log population, 1500–1850			
	(1)	(2)	(3)	(4)
Canals and rivers within	20 km	40 km	50 km	100 km
Log market access via postal routes	-10.174^{***}	-10.127^{***}	-10.169^{***}	-10.116^{***}
	(1.996)	(2.004)	(2.000)	(1.998)
Canals within 20km	-0.012^{*}			
	(0.006)			
Rivers within 20km	0.025^{*}			
	(0.015)			
Canals within 40km		-0.004		
		(0.003)		
Rivers within 40km		0.015^{**}		
		(0.007)		
Canals within 50km			-0.002	
			(0.002)	
Rivers within 50km			0.011^{**}	
			(0.005)	
Canals within 100km				-0.0003
				(0.001)
Rivers within 100km				0.002
				(0.003)
Log distance to nearest border	-0.0002	0.001	0.0004	-0.001
	(0.013)	(0.013)	(0.013)	(0.013)
Log distance to nearest coast	0.012	0.014	0.014	0.013
	(0.010)	(0.010)	(0.010)	(0.010)
Elevation	-0.014	-0.013	-0.013	-0.016
	(0.021)	(0.021)	(0.021)	(0.021)
Terrain ruggedness	0.022	0.027	0.027	0.028
	(0.018)	(0.018)	(0.018)	(0.018)
Bishopric established before 1500	0.061^{*}	0.064^{*}	0.065^{**}	0.065^{**}
	(0.033)	(0.033)	(0.033)	(0.033)
University	-0.071	-0.066	-0.065	-0.067
	(0.051)	(0.051)	(0.051)	(0.051)
Time under French rule since 1477	0.00001	-0.00001	-0.00002	-0.00003
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
City FE	✓	✓	✓	✓
Period FE	✓	✓	✓	✓
N cities	341	341	341	341
Observations	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.3 Geographically-Bounded Interactions

Table A3 presents the full result of Table 3 in the paper.

Table A3: Geographically-bounded activity and city growth.

Dependent variable	Log population, 1500–1850								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bounded within	50 km	100 km	150 km	200 km	250 km	300 km	400 km	500 km	Beyond 500 km
Log market access via postal routes within 50 km	−0.002								
	(0.011)								
Log market access via postal routes within 100 km		0.012							
		(0.010)							
Log market access via postal routes within 150 km			0.009						
			(0.011)						
Log market access via postal routes within 200 km				0.007					
				(0.013)					
Log market access via postal routes within 250 km					0.002				
					(0.014)				
Log market access via postal routes within 300 km						−0.002			
						(0.015)			
Log market access via postal routes within 400 km							0.0003		
							(0.015)		
Log market access via postal routes within 500 km								0.001	
								(0.017)	
Log market access via postal routes beyond 500 km									−0.013
									(0.027)
Canals within 50 km	−0.001	−0.002	−0.002	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Rivers within 50 km	0.009*	0.009	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Log distance to nearest border	−0.007	−0.006	−0.007	−0.007	−0.007	−0.006	−0.007	−0.007	−0.008
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Log distance to nearest coast	0.016	0.014	0.014	0.014	0.015	0.016	0.015	0.015	0.014
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Elevation	−0.014	−0.009	−0.011	−0.011	−0.013	−0.015	−0.013	−0.013	−0.011
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Terrain ruggedness	0.023	0.022	0.023	0.022	0.023	0.024	0.023	0.023	0.022
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Bishopric established before 1500	0.059*	0.059*	0.058*	0.058*	0.058*	0.059*	0.059*	0.059*	0.058*
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
University	−0.070	−0.081	−0.077	−0.074	−0.072	−0.072	−0.072	−0.072	−0.068
	(0.054)	(0.053)	(0.053)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.053)
Time under French rule since 1477	0.00000	−0.0001	−0.0001	−0.00004	−0.00001	0.00000	−0.00001	−0.00001	0.00005
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
City FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
N cities	341	341	341	341	341	341	341	341	341
Observations	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.4 Instrumental-Variables (IV) Approach

3.4.1 Map of Roman Posts during the Imperial Period

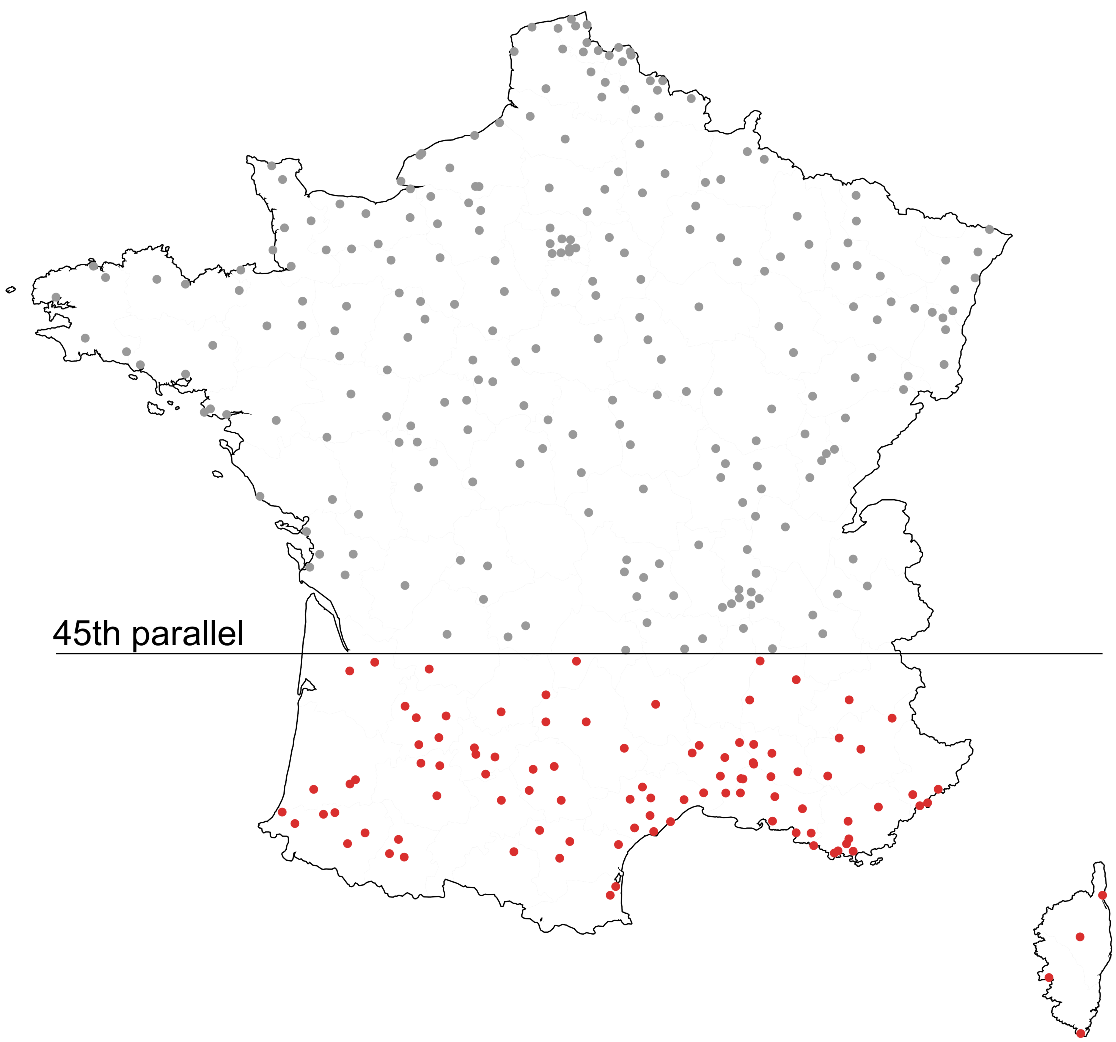
Figure A8 shows the location of postal relays during the Roman Imperial Era (27 BCE–476 CE) within the current French territory. It was drawn and published in 1785 by Jean-Baptiste Bourguignon d'Anville, who reconstructed the information on Roman roads and postal relays. The map is available online at BnF. As discussed in text, the source map for the road network in my analysis is not this one but the Digital Atlas of the Roman Empire, the project led by Johan Åhlfeldt.

Figure A8: Geographical distribution of post offices in France during the Roman Imperial Era.

3.4.2 Southern France

Figure A9 shows the south of France or the "Midi" as colloquially called. It is typically designated as below the 45th parallel which can be drawn straight from Bordeaux in the wet through Valence in the east. Geographically it can be demarcated in part by the Massif Central lying the central region of the south (into the north of the 45th parallel), a hilly and upland region. Political integration by Paris came much later than in the north. As a result, the Mediterranean culture had long remained influential on the south. Of the 341 cities in my data set, there are 99 cities in the south.

Figure A9: Map of France highlighting the south or the Midi.



3.4.3 Predictors of Roman Posts

Table A4 replicates the regression results of Table 4 in text.

Table A4: Predictors of Roman posts.

Dependent variable	City with post or not				Log distance to city with post			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log distance to Paris	-0.027			-0.010	0.219^{*}			0.014
in Roman times	(0.022)			(0.022)	(0.128)			(0.124)
South		-0.090^{***}		-0.115^{***}		1.085^{***}		1.219^{***}
		(0.035)		(0.035)		(0.190)		(0.194)
Settlement in Roman times			0.167^{***}	0.182^{***}			-0.715^{***}	-0.879^{***}
			(0.031)	(0.030)			(0.178)	(0.170)
Observations	341	341	341	341	341	341	341	341

Notes: *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.4.4 Location of Roman Posts as an IV 1/3

Table A5 presents the full result of Table 5 in text.

Table A5: Two-Stage Least-Squares regressions on city growth.

	First stage	Second stage				
Dependent variable	Log distance to post in 1553	Log population in 1500				
Data subsetted			Within south	Within north	Roman settlement	No settlement
	(1)	(2)	(3)	(4)	(5)	(6)
Log distance to post in 1553		-0.330^{**}	0.231	-0.312	-0.343^{*}	0.331^{*}
		(0.158)	(0.234)	(0.194)	(0.178)	(0.190)
Log distance to Roman post	0.252^{***}					
	(0.065)					
Canals within 50 km	0.171^{**}	0.043	-0.054	0.045	-0.021	-0.020
	(0.075)	(0.039)	(0.078)	(0.046)	(0.053)	(0.034)
Rivers within 50 km	-0.043	0.002	-0.023	0.004	-0.013	0.030^{**}
	(0.038)	(0.019)	(0.025)	(0.023)	(0.024)	(0.015)
Log distance to nearest border	-0.063	0.001	0.048	-0.021	0.014	0.062
	(0.110)	(0.041)	(0.090)	(0.054)	(0.066)	(0.040)
Log distance to nearest coast	-0.067	-0.007	-0.099	0.014	-0.009	0.044^{*}
	(0.086)	(0.036)	(0.081)	(0.046)	(0.051)	(0.027)
Elevation	0.384^{**}	0.049	0.033	-0.040	0.020	-0.145^{*}
	(0.158)	(0.079)	(0.093)	(0.112)	(0.114)	(0.079)
Terrain ruggedness	-0.138	-0.068	-0.139^{*}	-0.020	-0.098	0.014
	(0.137)	(0.053)	(0.073)	(0.083)	(0.106)	(0.029)
Bishopric established	-0.501^{**}	0.319^{*}	0.461^{**}	0.413^{*}	0.255	0.262
before 1500	(0.215)	(0.168)	(0.219)	(0.227)	(0.200)	(0.234)
University	-0.480	0.942^{***}	1.240^{***}	1.230^{***}	1.129^{***}	0.598
	(0.310)	(0.312)	(0.428)	(0.427)	(0.346)	(0.439)
Time under French rule	-0.004	-0.003^{**}	0.006^{*}	-0.004^{**}	-0.001	-0.003^{**}
since 1477	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)
Observations	341	341	99	242	192	149
F-statistic for weak instrument	15.00					

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.4.5 Location of Roman Posts as an IV 2/3

Table A6 presents the full result of Table 5 in text. This is a continuation of Table A5 from the previous page.

Table A6: Variation in the access to rivers on city growth (second stage of two-stage least-squares regression).

Dependent variable	Log population in 1500			
City with river access within	20 km	40 km	50 km	100 km
	(1)	(2)	(3)	(4)
Log distance to post in 1553	-0.423	-0.268	-0.227	-0.261^{**}
	(0.334)	(0.164)	(0.147)	(0.127)
Log distance to nearest border	-0.028	-0.022	-0.031	-0.008
	(0.082)	(0.060)	(0.053)	(0.044)
Log distance to nearest coast	-0.023	0.032	0.048	-0.017
	(0.077)	(0.046)	(0.038)	(0.040)
Elevation	0.135	-0.008	-0.044	-0.002
	(0.255)	(0.097)	(0.090)	(0.075)
Terrain ruggedness	-0.039	-0.054	-0.043	-0.059
	(0.189)	(0.087)	(0.078)	(0.065)
Bishopric established before 1500	0.485	0.404^{*}	0.421^{**}	0.390^{**}
	(0.455)	(0.225)	(0.206)	(0.165)
University	0.991	1.525^{***}	1.423^{***}	1.040^{***}
	(0.739)	(0.431)	(0.390)	(0.306)
Time under French rule since 1477	-0.007^{***}	-0.005^{***}	-0.005^{***}	-0.003^{**}
	(0.003)	(0.002)	(0.002)	(0.001)
Observations	97	196	230	320

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. Access to canals is omitted for collinearity (There were fifteen out of 235 canals in service before 1500). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.4.6 Location of Roman Posts as an IV 3/3

Table A7 presents the full result of Table 6 in text. This is the second-stage result only.

Table A7: Long-term impact of the proximity to post in the sixteenth century on subsequent growth.

	Log population in				
Dependent variable	1600	1700	1750	1800	1850
	(1)	(2)	(3)	(4)	(5)
Log distance to post in 1553	-0.330^{**}	-0.444^{***}	-0.511^{***}	-0.226^{**}	-0.349^{***}
	(0.158)	(0.155)	(0.142)	(0.104)	(0.097)
Canals within 50 km	0.043	0.028^{*}	-0.007	0.006	0.009
	(0.039)	(0.015)	(0.011)	(0.005)	(0.006)
Rivers within 50 km	0.002	-0.014	-0.028	-0.009	-0.015
	(0.019)	(0.022)	(0.020)	(0.010)	(0.011)
Log distance to nearest border	0.001	-0.061	-0.045	0.038	0.036
	(0.041)	(0.049)	(0.053)	(0.040)	(0.044)
Log distance to nearest coast	-0.007	-0.091^{*}	-0.074	-0.032	-0.067^{**}
	(0.036)	(0.050)	(0.050)	(0.028)	(0.028)
Elevation	0.049	0.069	0.106	0.055	0.144^{**}
	(0.079)	(0.098)	(0.110)	(0.067)	(0.063)
Terrain ruggedness	-0.068	-0.019	-0.113	-0.094^{*}	-0.100^{**}
	(0.053)	(0.079)	(0.080)	(0.050)	(0.040)
Bishopric established before 1500	0.319^{*}	0.213	0.366^{**}	0.244^{**}	0.276^{***}
	(0.168)	(0.178)	(0.169)	(0.102)	(0.105)
University	0.942^{***}	1.296^{***}	1.202^{***}	1.176^{***}	1.049^{***}
	(0.312)	(0.254)	(0.273)	(0.191)	(0.194)
Time under French rule since 1477	-0.003^{**}	0.0001	-0.001	-0.001^{**}	-0.002^{***}
	(0.001)	(0.001)	(0.001)	(0.0005)	(0.0005)
Observations	341	341	341	341	341

Notes: The data set is subsetted for each period. Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

3.5 Estimates with Varying Values of θ

Table A8 presents the full result of market-access estimations with varying values of θ from 3 to 13. For visual simplicity I split the table into two. This page displays θ from 3 to 7 and 8 to 13 on the next page.

Table A8: Estimation with varying values of θ from 3 to 13.

Dependent variable	Log population, 1500–1850				
	(1) $\theta = 3$	(2) $\theta = 4$	(3) $\theta = 5$	(4) $\theta = 6$	(5) $\theta = 7$
Log market access via postal routes	0.002	0.003	0.003	0.003	0.003
	(0.041)	(0.040)	(0.038)	(0.037)	(0.036)
Canals within 50 km	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Rivers within 50 km	0.009*	0.009*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Log distance to nearest border	−0.006	−0.006	−0.006	−0.006	−0.006
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Log distance to nearest coast	0.015	0.015	0.015	0.015	0.015
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Elevation	−0.014	−0.014	−0.014	−0.014	−0.014
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Terrain ruggedness	0.023	0.023	0.023	0.023	0.023
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Bishopric established before 1500	0.059*	0.059*	0.059*	0.059*	0.059*
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
University	−0.072	−0.072	−0.072	−0.072	−0.073
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Time under French rule since 1477	−0.00001	−0.00002	−0.00002	−0.00002	−0.00002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
City FE	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓
N cities	341	341	341	341	341
Observations	2,046	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table A9: Estimation with varying values of θ from 3 to 13.

Dependent variable	Log population, 1500–1850					
	(6) $\theta = 8$	(7) $\theta = 9$	(8) $\theta = 10$	(9) $\theta = 11$	(10) $\theta = 12$	(11) $\theta = 13$
Log market access via postal routes	0.004	0.004	0.004	0.004	0.004	0.004
	(0.035)	(0.034)	(0.033)	(0.032)	(0.031)	(0.030)
Canals within 50 km	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Rivers within 50 km	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Log distance to nearest border	−0.006	−0.006	−0.006	−0.006	−0.006	−0.006
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Log distance to nearest coast	0.015	0.015	0.015	0.015	0.015	0.015
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Elevation	−0.014	−0.014	−0.014	−0.014	−0.014	−0.014
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Terrain ruggedness	0.023	0.023	0.023	0.023	0.023	0.023
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Bishopric established before 1500	0.059*	0.059*	0.059*	0.059*	0.059*	0.059*
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
University	−0.073	−0.073	−0.073	−0.073	−0.073	−0.073
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Time under French rule since 1477	−0.00002	−0.00002	−0.00002	−0.00003	−0.00003	−0.00003
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
City FE	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓
N cities	341	341	341	341	341	341
Observations	2,046	2,046	2,046	2,046	2,046	2,046

Notes: Standard errors corrected for spatial autocorrelation. Elevation and terrain ruggedness are standardized. The number of postal relays is 163 in 1553 (47.8 percent of the observations), 173 in 1690 (50.7 percent), 190 in 1731 (55.7 percent), 243 in 1792 (71.3 percent), and 330 in 1835 (96.8 percent). *** denote $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.