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# "The Limits of Informational Capacity: Evidence from the French Napoleonic Cadaster"

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# The Limits of Informational Capacity:
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Informational capacity is widely viewed as a fundamental dimension of state power and a factor of economic development. However, there is little direct evidence on the consequences of historical investments in legibility. I analyze the case of the French Napoleonic cadaster, an ambitious land survey which aimed at equalizing the distribution of taxation following the Revolution. Exploiting detailed spatial and temporal variation over four decades and 2,697 cantons, I find that the cadaster had little impact on state power, including fiscal capacity. In the long run, areas that received a centralized cadaster collect more taxes than others, suggesting that how information capacity is built matters for fiscal capacity. The cadaster also led to shifts in land use, promoting public works and the privatization of communal land, but had no clear impact on economic development.

# INTRODUCTION

Accurate information on citizens and their income is widely viewed as essential to the development of modern states and their capacity to extract fiscal revenue (Scott, 1998). Accordingly, scholars have emphasized the impact of informational capacity, or "legibility", on outcomes such as taxation and public good provision (Soifer, 2013; Lee and Zhang, 2017; D'Arcy and Nistotskaya, 2017; Brambor et al., 2020; Vom Hau, Peres-Cajías and Soifer, 2023). Informational investments - civil registration and identification systems, cadasters, statistical agencies - are also prominent in capacity building efforts by states in the developing world, making the question of their effectiveness all the more important (Gelb and Clark, 2013; Muralidharan, Niehaus and Sukhtankar, 2016; Bowles, 2023; Ferree et al., 2023).

However, there is little direct evidence on how informational investments contribute to broader state development. On the one hand, much of the existing scholarship on the consequences of states investing in legibility comes from long run cross-country analyses and case studies, which can rarely disentangle the effect of legibility from other legal or economic reforms (D'Arcy and Nistotskaya, 2017; Lee and Zhang, 2017; Brambor et al., 2020; D'Arcy, Nistotskaya and Olsson, 2021). On the other hand, sub-national studies cast doubt on a straightforward link between informational investments and state power, as elites can manipulate land registries to their advantage or influence states' incentives to build informational systems (Bowles, 2023; Sánchez-Talanquer, 2020; Christensen and Garfias, 2021; Suryanarayan, 2023). Scholars have also argued that the legibility (of land) may be important to citizens even if it is not directly provided by the state (Ferree et al., 2023), suggesting that informational capacity could be built to respond to demand from certain groups, but not necessarily advance state power.

In this article, I focus on the consequences of land cadasters, a prominent form of legibility investment, considered as crucial to the extraction of fiscal revenue and economic development (D'Arcy, Nistotskaya and Olsson, 2021). Cadasters are "state-led compre-

hensive recordings of the location, dimension and value of individual landed property",
and have a long history as instruments of tax reform and property right enforcement
(Kain and Baigent, 1992). Scott (1998, p.36) famously viewed the cadastral map as the
"crowning artefact of [the] mightly simplication" central to modern state-building. I in-
terrogate this argument, investigating whether building a cadaster does indeed increase
state power, and whether it has downstream effects on land use and broader economic
development.

I argue that while the creation of a cadaster technically makes land legible to the state,
it may have little impact on state power, and in particular on the extraction of fiscal rev-
enue, which is often a primary motivation of cadastral projects (Kain and Baigent, 1992).
These limitations of cadasters are especially likely under two conditions, which are not
mutually exclusive. First, when implementation is not top-down (i.e. centralized with ex-
ternal surveyors), with instead landowners influencing the way in which they are made
legible. Second, when the complete implementation of cadastral surveys requires a long
time, during which political priorities may shift away from extracting revenue from land.
I also argue that a cadaster, even if it does not fulfill extractive goals, may have important
consequences on land use unrelated to the extension of state power.

This argument is supported by the analysis of the French Napoleonic cadaster, a promi-
nent and influential case of fiscal legibility. In 1791, revolutionary legislators asserted the
principles of equal taxation and consent, creating a proportional land tax, which was to be
the cornerstone of a new and fairer fiscal system. In practice however, the tax collection
process remained uneven and arbitrary, in part due to the tumult of the first revolutionary
decade (Marion, 1919; Schnerb, 1933; Wolikow, 2000; Clergeot, 2007).

Napoleon Bonaparte, in power from 1799, tackled this fiscal fairness issue by initiat-
ing a national individual cadaster (*cadastre parcellaire*) from 1807. Every individual land
plot was to be mapped and valued by state-appointed experts, and a third of the French
territory was thus surveyed at the fall the Empire in 1814. After an interruption in the
beginnings of the Bourbon Restoration, it continued as a decentralized policy with lim-

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ited top-down control from 1821 and greater involvement of landowners in the surveying process. It was finalized by the mid-1840s.

The French Napoleonic cadaster is an ideal case to analyze the limitations of legibility and the importance of top-down control when building it. Indeed, the 19th French state was very centralized, suggesting that a cadaster was more likely to be successful relative to weaker states. Empirically, not only does is it characterized by temporal and spatial variation, but it also varies in the centralization of its implementation. Finally, the French cadaster is itself an important case as it was influential both through Napoleonic conquests and the French colonial empire.

I build a novel dataset of the timing of cadastral surveys in 2,697 cantons (93% of 1807 French metropolitan cantons) between 1807 and 1845, leveraging the digitization of the cadaster by departmental archives. Empirical analyses exploit detailed temporal and spatial variation in the roll-out of the cadaster at the department and canton level from 1807 to 1845, as well as variation in the centralization of the surveying process (comparing areas surveyed before or after 1821). I measure the effectiveness of fiscal revenue extraction using novel data on tax amounts, the identity and career of tax collectors, and the use of coercion in tax collection. I also analyze data on land use - the building of public works and the privatization of communal land - and economic development - urbanization, financial development, and agricultural productivity.

Using a difference-in-differences (DID) strategy at the department level, I first show that over the course of its implementation, the cadaster had a limited to negative impact on fiscal capacity. As the implementation of the cadaster progressed, amounts of collected land tax decreased, tax collectors did not professionalize, and did not resort less to coercion, suggesting that the cadaster did not make the tax collection process more efficient. Discussing the historical context, I argue that this lack of effect on state power can be explained by landed elites' willingness to restrict the scope of the cadaster from a top-down centralized cadaster to one more controlled by landowners.

Using a DID approach at the canton level, I also show suggestive evidence of the

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cadaster promoting the privatization of communal land and the building of public works, both areas closely linked to the availability of maps. I find no clear effects on urbanization and financial development (measured by the number of banks in a canton), although there is some evidence that the cadaster promoted the convergence between areas close to administrative capitals and the rest of the territory.

Next, I investigate the long run impact of the centralized pre-1821 cadaster, expecting greater impact on fiscal capacity and economic development relative to the post-1821 decentralized cadaster. I use a spatial regression discontinuity within close pairs of cantons that were surveyed under a different type of cadaster, centralized or decentralized. In 1881, approximately 35 years after its completion, areas with a centralized cadaster do collect higher taxes per capita. This suggests that the long run improvement in fiscal capacity is conditional on top down control of the cadastral process by the state. I find no evidence that the cadaster promoted economic development, measured either through population and the number of banks in 1881, or agricultural productivity in 1962.

This article makes both empirical and conceptual contributions. On the empirical front, it provides uniquely detailed data on a prominent case of state-led legibility. Existing cross-country databases on informational capacity typically do not take into account the gradual process necessary to build a national cadaster (e.g. D'Arcy and Nistotskaya (2017)). This is important because many historical (and contemporary) cadastral projects often take decades to complete (Kain and Baigent, 1992). The detailed data analyzed in this article also allow us to disentangle the effect of legibility from the effect of other simultaneous legal and economic reforms.

Conceptually, this article nuances the common argument that information capacity strengthens state power (D'Arcy and Nistotskaya, 2017; Lee and Zhang, 2017; Garfias and Sellars, 2021; Brambor et al., 2020). The Napoleonic cadaster, implemented in either a centralized or decentralized manner, ultimately had limited effects on the tax collection process and broader state capacity. These results complement existing literature showing the links between informational capacity and elites' priorities (Vom Hau, Peres-Cajías

and Soifer, 2023; Sánchez-Talanquer, 2020; Bowles, 2020; Christensen and Garfias, 2021). In particular, they suggest that the positive and self-reinforcing consequences of informational capacity on state capacity are conditional on elites tolerating a top-down cadaster on which they have limited influence. They also support recent findings using cross-country data that cadasters are not associated with improved collection of direct taxation, implying that their effects are indirect (D'Arcy, Nistotskaya and Olsson, 2021). An important implication is that scholars should be cautious in using the creation of a cadaster as a measure of fiscal capacity without interrogating the way its information is actually used by the state (Chambru, Henry and Marx, 2021; D'Arcy, Nistotskaya and Olsson, 2021).

I extend this literature by demonstrating that such limitations of cadastral legibility hold for the case of France, whose state-building approach is typically viewed as a successful in the political economy literature (Levi, 1997; Zhang and Lee, 2020; Chambru, Henry and Marx, 2021). This article thus contributes to further our understanding of in which areas the French state was particularly effective, and in which areas it was not. It also shows limitations of legibility in the context of its initial formation (Loveman, 2005), where scholars have focused on long run effects or cadastral updates (Bowles, 2020; Sánchez-Talanquer, 2020; Christensen and Garfias, 2021).

## THE CONSEQUENCES OF LEGIBILITY

State capacity can be defined as "the state's ability to perform the core functions most commonly deemed necessary for modern states: protection from external threats, the maintenance of internal order, the administration and provision of basic infrastructure necessary to sustain economic activity, and the extraction of revenue" (Hanson and Sigman, 2021).[1] Recent works on state capacity emphasize *informational capacity*, or "legibility", defined as the extent of state's information on citizens and their activities, measured through the existence or precision of censuses, yearbooks, civil registration systems, cen-

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[1]See also Besley and Persson (2009) for a broader definition that does not put restrictions on the type of policies the state implements: "the institutional capability of the state to carry out various policies".

tral statistical agency, and cadasters (Lee and Zhang, 2017; D'Arcy and Nistotskaya, 2017; Brambor et al., 2020). It is expected to promote and complement other forms of state capacity, as a "resource" (Lindvall and Teorell, 2016; Brambor et al., 2020; Lee and Zhang, 2017; Hanson and Sigman, 2021). The connection between legibility and the extraction of fiscal revenue is particularly emphasized by scholars. Hanson and Sigman (2021) provide empirical evidence of its positive association with extractive and coercive state capacity during the second half of the 20th century, a link that is confirmed by historical sub-national studies (Garfias and Sellars, 2021; Vom Hau, Peres-Cajías and Soifer, 2023).[2]

Among forms of legibility, cadasters have received particular attention for their presumed consequences on both state power and economic development. First, cadasters provide information on the ownership and value of land, allowing the state to raise taxation more effectively, thus strengthening extractive capacity (D'Arcy and Nistotskaya, 2017; D'Arcy, Nistotskaya and Olsson, 2021). Several theoretical works show that reduced information asymmetries about land productivity promote state centralization, as they allow the state not to depend on better-informed local officials or elites to collect taxation (Ahmed and Stasavage, 2020; Mayshar, Moav and Neeman, 2017; Slantchev and Kravitz, 2019). Second, as public records available to all economic agents, cadasters reduce transaction costs in land markets, promote property right security and their formalization, all factors of economic growth (Libecap and Lueck, 2011; Yoo and Steckel, 2016; D'Arcy, Nistotskaya and Olsson, 2021). The literature also suggests second order effects. Lee and Zhang (2017) use the example of the 1628 Swedish cadaster to argue that it allowed the state to monitor citizens more effectively, leading to greater enforcement of formal rules, including curbing fiscal free-riding, and that this explains high rates of militarization and formalization of the economy.

A wide literature thus supports the idea that legibility and other forms of state capac-

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[2]A direct link between information capacity and extractive capacity is often assumed rather than a topic of inquiry. For instance, Charnysh (2020) argues that low legibility implies low fiscal capacity, and Chambru, Henry and Marx (2021) use the existence of a cadaster as a measure of fiscal capacity.

ity are mutually reinforcing. In particular, building a cadaster should lead to an increase in the state's extractive capacity. Then, either indirectly because the resulting increase in extractive capacity promotes public good provision or because the existence of a cadaster lowers transaction costs in the economy, the cadaster should promote economic development. There are however several problems with this account.

First, as Suryanarayan (2023) argues in a recent review, "legal, fiscal, and informational capacities often do not develop in tandem", suggesting that the link between informational and fiscal capacities is not straightforward. The cross-country literature on state capacity discussed earlier cannot fully disentangle the effect of legibility investments from the effect of other reforms adopted at the same time (D'Arcy, Nistotskaya and Olsson, 2021). For instance, the 1807 Napoleonic cadaster began in the same decade as major administrative and legal reforms, including the creation of a national civil code and regular censuses. Similarly, the Swedish cadaster was adopted in a context of a wider "interest in the gathering and mapping information about the nation", beyond cadastral mapping (Kain and Baigent, 1992, p. 57). In both cases, it is challenging to measure the specific effect of the cadaster.[3]

Second, scholars show that elite influence can weaken the link between legibility and fiscal capacity. Vom Hau, Peres-Cajías and Soifer (2023) argue that informational capacity is crucial to fiscal capacity, but while doing so they show how the development of 19th century cadasters in Argentina and Chile was highly dependent on elite cooperation. Even when elites cannot block the creation of a cadaster, they can subvert it to minimize their tax burden and enforce their claims on property, as shown by the cases of land registration and property taxation in 20th century Colombia and Brazil (Sánchez-Talanquer, 2020; Christensen and Garfias, 2021).[4] In the context of European cadasters, elite pressure on the implementation of the cadaster is likely as the conflict between landed and

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[3]Garfias and Sellars (2021) shows a strong positive impact of "fiscal legibility" on various dimensions of state capacity, including centralization and extractive capacity, but by using an exogenous source of fiscal legibility, they do not measure the effect of intentional, state-led, investments in informational capacity.

[4]Common citizens may also resist the imposition of legibility (Loveman, 2005).

industrial elites was an important driver of 19th century Western fiscal development (Beramendi, Dincecco and Rogers, 2019; Mares and Queralt, 2020).

The importance of elite cooperation is compounded by the fact that building a national cadaster typically takes a long time, during which policy goals can change. As we will see with the French case, a state may begin a cadaster for fiscal purposes but never use it to revise the allocation of the tax burden due to political pressure. Multiple European cadastral projects other than the Napoleonic cadaster took more than thirty years to complete, and shifting goals were also ubiquitous. For instance, the 1628 Swedish cadaster was "never directly used for a revision of tax, whatever [its] original purpose" (Kain and Baigent, 1992, p. 56). In such contexts, the impact on fiscal capacity is unclear. Interestingly, the more recent policy literature on cadasters also makes clear that their effectiveness depends on the involvement of non-state stakeholders, suggesting that building a cadaster is far from a strictly top-down endeavor (Dale and McLaughlin, 1989).

Finally, cadasters differ in their degree of centralization, which has implication for their ability to strengthen state capacity. In Scott (1998)'s view, legibility is fundamentally top-down and centralized, and most of the literature does not discuss in detail which level of government implements informational capacity. However, legibility projects, and cadasters in particular, are not always implemented in a top-down manner. For the Colombian case, Sánchez-Talanquer (2020) distinguishes between pre-1935 cadasters which are influenced by local elites and a post-1935 centralized cadaster, with only the latter an instance of legibility. Ferree et al. (2023) shows that non-state actors can provide legible property rights independent of state control. As we will see, the Napoleonic cadaster includes a centralized cadaster prior to 1821 and a decentralized one afterwards. In general, the literature suggests that we should expect a cadaster to have larger positive effects on state power and economic development when it is implemented in a centralized manner, as the influence of local elites is lower.

In summary, we should not expect a cadaster to necessarily have a positive effect on state power, including on fiscal capacity. Such an effect, if it exists, should be greater

when the cadastral process is centralized. As a result, it is also unclear whether cadasters promote economic development, particularly when they are not fully centralized.

## BACKGROUND

To test this argument, I analyze the case of the French Napoleonic cadaster, built between 1807 and approximately 1845. By the time it was completed, four regime transitions through either war or revolution took place (in 1814, 1815, 1830, and 1848), and implementation shifted from top-down centralized policy to decentralization after 1821.

### *Initial goals*

Under the Ancien Regime, attempts to create a comprehensive cadaster had been opposed by privileged elites, although local cadasters existed in some regions (Kain and Baigent, 1992; Touzery, 2013).[5] After the Revolution, legislators proclaimed the principles of equal taxation and consent: a proportional tax on income from land, the *contribution foncière*, was created in 1791 as the cornerstone of a new, fairer, fiscal system. However, there was no systematic information on land value, and this issue was magnified by the turbulent context of the Revolution and locals' incentives to undervalue land. As a consequence, in practice, the land tax was not proportional. Bureaucrats allocated tax amounts between administrative levels according to opaque criteria, which resulted in large disparities within communes and across locations in effective tax rates. These issues are discussed at length both by contemporary administrators (Hennet, 1817; Gaudin, 1826) and historians (Marion, 1919; Schnerb, 1933; Wolikow, 2000). For instance, a 1817 progress report on the cadaster revealed that while in the Cantal department the average tax rate was 16.6%,[6] it was only 10% in the neighboring department Haute-Loire. Within each

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[5]Local cadasters were created in the Paris généralité and in the Haute-Guyenne province. They were widespread at the local level in the South (Kain and Baigent, 1992).

[6]"Average tax rate" for a locality is defined as tax amount/tax base. This is different from the effective tax rates individuals were paying, which could vary widely.

department, some taxpayers paid as low as 2.4% while other paid 50% (Hennet, 1817).

Table 1: Timeline of cadastral reforms

| | |
|---|---|
| Before 1789 | Local cadasters in some provinces |
| December 1, 1790 | Proportional land tax (*contribution foncière*). |
| September 16, 1791 | Cadaster is optional; local funding. |
| November 3, 1802 | Cadaster of cultivated areas (*cadastre par masses de culture*). |
| September 15, 1807 | **Individual cadaster** (*cadastre parcellaire*). |
| July 31, 1821 | Cadaster is optional; funding delegated to departments. |
| approx. 1846 | All communes are cadastered. |

Napoleon Bonaparte, who established the Consulate in 1799, decided to address this longstanding tax distribution issue. After an early failed attempt,[7] the Finance ministry started over with a cadaster of *individual* property in 1807. The cadaster was to be gradually implemented by canton, the smallest administrative division above the commune, and within each department, insuring an even progress over the territory. Within each department, at the end of the year, one or two cantons would be selected to be cadastered. The process then had three steps: in the first year, mapping of communal boundaries; in the following year(s), mapping of individual properties (i.e. the actual cadastral map); finally, experts assign a value to each property, which is then used to assess the land tax (Hennet, 1811).[8]

State officials emphasized that the primary purpose of the cadaster was fairness and not fiscal revenue (Hennet, 1817; Gaudin, 1826).[9] Administrators argued that because

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[7]The 1802 cadaster only distinguished land use types (e.g. wheat, vines, forests). According to then Finance minister Gaudin (1826), this first step was disappointing, as landowners were primarily interested in improving individual distribution within communes.

[8]See Appendix E. for more detail on the cadastral process.

[9]Unlike other European cadasters, the Napoleonic cadaster was not primarily motivated by the goal of formalizing property rights, due to the contentious question of the legality of revolutionary land confiscations (Bodinier and Teyssier, 2000). Still today, the cadastral map has no legal value.

of this, individual landowners would welcome the reform even if it increased their tax burden (*Compte Général de l'Administration des Finances*, 1807). In 1810, legislators stated that: "in the cadastered communes, (...) already the landowner is no longer exposed to arbitrary increases; he no longer fears that hatred or jealousy denounce his industry to tax distributors ; he no longer fears the passions of men ; finally he fears no authority, because he knows that the supreme authority watches over the preservation of his rights." (*Corps Législatif*, January 16, 1810). The cadaster commissioner writes in 1817 that "the individual cadaster (...) does not have any other interest for government than to be just and paternal" (Hennet, 1817, 17). From the state's point of view, the beginnings of the cadaster were thus an unqualified success.

*Diminished ambitions under the decentralized cadaster*

The collapse of the Napoleonic regime in 1814 led to an interruption of the cadastral operations, soon followed by significant changes in implementation. Under the restored Bourbon monarchy, communes whose fiscal burden had increased as a result of the cadaster complained and obtained the cancellation of its effects (Schnerb, 1938, p.122). More fundamentally, the new royalist majority was hostile to the cadastral project, which was viewed as a legal confirmation of revolutionary land confiscations and as an instance of excessive centralization (Vivier, 2008). Funding was cut, resulting in a marked slowdown of operations between 1815 and 1821 (see Figure 1).

In 1821, a new law was passed which diminished the scope of the cadaster. It became optional, with its funding delegated to the departments, and the crucial evaluation part of the surveying process left to local landowners, as opposed to a centrally appointed expert. Finally, the scope of the cadaster was restricted to the commune, which meant abandoning the goal of rebalancing the fiscal burden across locations. This was denounced by supporters of the centralized cadaster as "abandoning the work to experts chosen locally, more often ignorant than skilled". [10] As Schnerb (1938, p.122) puts it: "the law of July 31,

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[10]*Archives Parlementaires*, second serie, Volume 36, p.354).

1821 buried the ambitious project of 1807". Surveying continued under this decentralized organization, and by 1846, all communes were cadastered.

Figure 1: Progress of the Napoleonic cadaster (1807-1850)
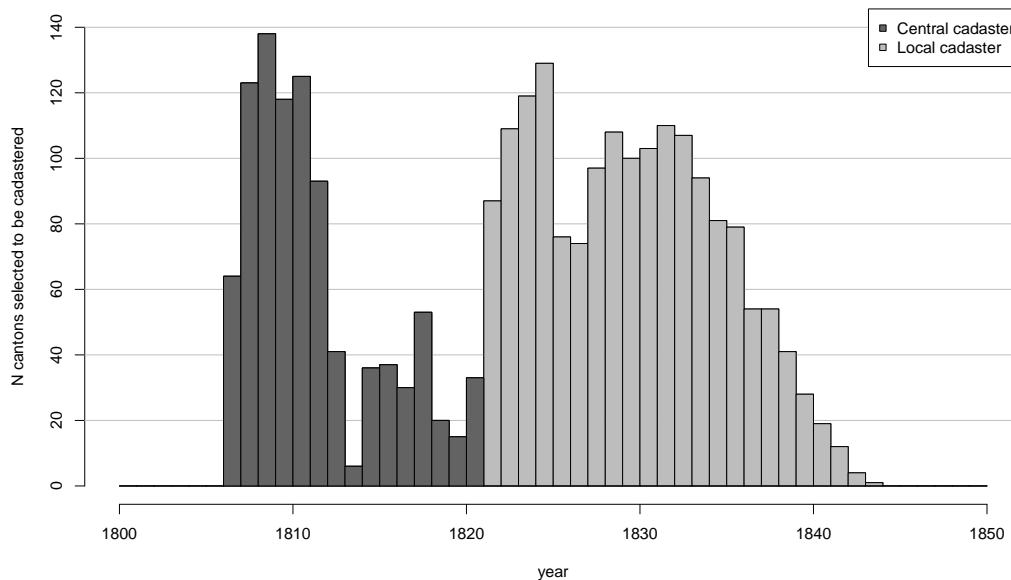


Another evolution mechanically reduced the impact of the cadaster on fiscal capacity. Direct taxation, among which the land tax, diminished significantly after 1821. After the Revolution, the budget had mainly been based on four direct taxes, the largest of which was the land tax. While this was viewed at the time as the fairest possible fiscal system, priorities soon shifted due to the need for more funds and the will to preserve landowners' interests. In 1804, Bonaparte re-established several indirect taxes, starting a trend that continued with the following regimes. As shown in Figure 2, indirect taxation rose from 20% of ordinary revenue to around 60% from the 1820s, while the share of direct taxes gradually decreased from 40% before 1820 to less than 30% in the 1850s. A fixed land tax was defended as a protection for rural producers, which was equivalent to a "fiscal privilege for landowners" (Schnerb, 1938, p.126). A fixed or diminishing land tax was also a way to preserve the political status quo as voting rights were conditioned on the payment of a high land tax up to 1848.

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Figure 2: The decline of direct taxation
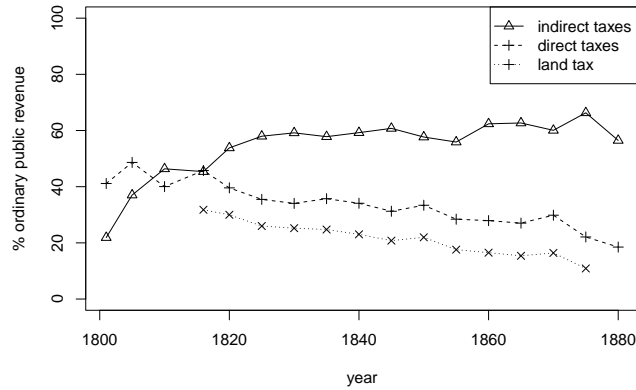


*Notes:* Data from Nicolas (1882).

In summary, both the decentralization of cadastral operations and the gradual reduction of the land tax as a source of public revenue plausibly diminished the impact of the cadaster on fiscal capacity.

## EMPIRICAL STRATEGY

This section outlines data sources and the identification strategy. The general approach is to test whether the cadaster - centralized or decentralized - promoted state power, in particular fiscal capacity, and whether it impacted economic development. I investigate this question both in the short and long run. The relevant administrative levels are communes (39,458 in 1807), cantons (2,893), arrondissements (363) and departments (85).[11] Table 2 provides a summary of the outcomes of interests, which are at the department, canton or commune level.

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[11]I include only Napoleonic departments which are within the boundaries of contemporary France.

*Timing of the cadaster*

To measure the gradual progress of the cadaster at a granular level, I take advantage of the fact that the French departmental archives have digitized almost all Napoleonic cadastral maps, indexing them by year of completion and commune. From these raw data, I created a dataset of the timing the Napoleonic cadaster for every canton in 81 departments (out of 85). I rely on 1807 administrative geography (which is mostly stable over the period of interest), reconstructed using comprehensive administrative information provided by Motte and Vouloir (2007). As discussed earlier, in each department, one or two cantons were selected to be surveyed every year. I define a canton as treated from the time a map is completed in any of its communes.[12] Figure 3 shows the spatial and temporal distribution of the obtained sample, showing a relatively even progress of cadastral operations within each department, over the French territory.

*Short and medium run analyses*

I first analyze the impact of the cadaster over the course of its implementation, between 1807 and 1845. For outcomes at the department level, the following two-way fixed effects model is estimated:

(1) $$Y_{d,t} = \beta \times \%areacadastered_{d,t} + \gamma X_{d,t} + \alpha_d + \lambda_t + \epsilon_{d,t}$$

The treatment $\%areacadastered_{d,t}$ is the share of cadastered area in a given department and year. $\alpha_d$ and $\lambda_t$ are department and year fixed effects. $X_{d,t}$ is a battery of demographic, geographic and historical variables, including department population as the only available time-varying control, and the interaction of cross-sectional geographic and administrative variables with year fixed effects (distance to administrative capitals and Paris, roads, forests, wheat suitability and terrain ruggedness). These variables are

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[12]Reassuringly, cadastral dates of communes of the same canton are clustered together, spanning one or two years. I manually checked the few deviations from this rule, which allowed to spot mistakes or approximations in the archival indexing. See Appendix 8 for more detail on the construction of the dataset.

Figure 3: Progress of the cadaster (1807-1845)
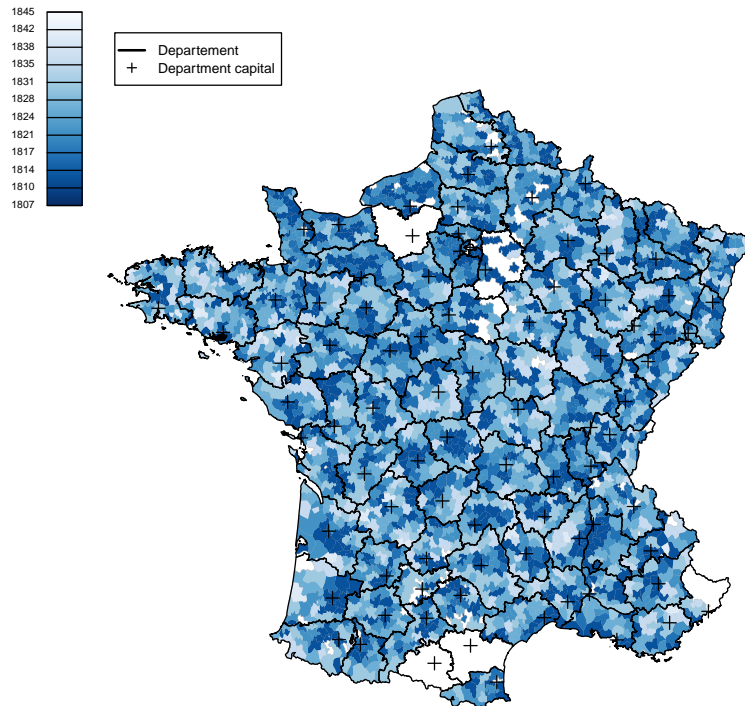


*Notes:* Departments and cantons borders shown on the map are based on current administrative boundaries. White areas corresponds to departments with missing data: Aude, Ariège, Eure, and some cantons of Seine-et-Marne. Savoie, Haute-Savoie, and Alpes Maritimes are excluded as they are not consistently part of the French territory over the period of interest.

described in Table A.1 in the appendix.

For outcomes at the canton level, I use difference-in-differences approaches that are robust to treatment heterogeneity, as implemented by De Chaisemartin and d'Haultfoeuille (2020). The treatment is a binary variable equal to one when a canton starts to be cadastered and zero otherwise.

For both department and canton level analyses, the common trend assumption must hold to interpret the results as causal effects of cadastral operations. For department level analyses, I assume that state power in departments with different trajectories of cadastral

progress would have evolved similarly under slower or faster progress, a strong version of the parallel trend assumption, as discussed by Callaway, Goodman-Bacon and Sant'Anna (2024). I am unable to formally test this assumption, but comparing outcomes - mainly fiscal capacity - between departments with a high and low "dose" of cadastral progress show similar trends in the pre-treatment period (see Figure A.7 in the appendix). For canton level analyses, the common trend assumption means that in the absence of cadastral surveying, outcomes would have had a similar path as untreated cantons. As we will see in the next section, event studies robust to treatment heterogeneity provide support for this assumption by showing no pre-trends (De Chaisemartin and d'Haultfoeuille, 2020).

**State power** I use three time-varying measures of fiscal capacity at the department level. First, I use the amount of land tax, collected approximately every five years between 1800 and 1870. Second, I use information on the birth origin and career of the departmental tax collectors, the *receveurs généraux*, from Pinaud (1990). To proxy for these agents' local knowledge, I create a variable equal to one when a tax collector' department corresponds to his birthplace. I also create a variable capturing their experience over time in the same department. Both approaches are inverse measures of the professionalization of the tax collection system.

Third, I use an inverse measure of the efficiency of tax collection, using novel data on *tax coercion expenditures* at the department level between 1802 and 1811, and later in 1828, 1834 and 1841. These corresponds to spendings on paying soldiers to garrison with late taxpayers to insure payment (Bloch, 1915, p. 620-622). Such coercive mechanisms dated back to the Ancien Régime and were very unpopular, including among tax administrators who were reluctant to use it unless under absolute necessity (Schnerb, 1933).[13] Figure 4 shows the spatial distribution of the three indicators of fiscal capacity in 1800. In the appendix, see Figures A.2, A.3 and A.4 for the evolution of this distribution over time.

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[13]Note that the expenditures data I use were associated with the collection of all direct taxation, but the land

Table 2: Outcome variables

| Outcomes | Level | Timeframe |
|---|---|---|
| *State power:* | | |
| Land tax amounts | dept. | 1791-7-8, 1802-6-11-17-20-25, decennial from 1840. |
| Tax collectors' identity/career | dept. | 1789-1865 |
| Tax coercion | dept. | 1802-1811, 1828, 1834, 1841 |
| Direct tax receipts | com. | 1881, 1911 |
| Attacks against gendarmes | cant. | 1800-1859 |
| *Land use:* | | |
| Public works | cant. | 1806-1820; 1821-1840 |
| Communal land activity | cant. | 1800-1860 |
| *Economic development:* | | |
| Canton population | cant. | 1800, 1806, 1821, quinquennial from 1831 |
| Bank presence | cant. | 1800-1910 |

*Notes:* Land tax amounts from *Comptes de l'Administration des Finances* (CAF). Information on tax collectors from Pinaud (1990). Tax coercion information from National Archives AF/IV*/232-240 and CAF. 1881 and 1911 tax receipts from Piketty and Cagé (2023). Approved public works data from Krause (2019). Attacks against gendarmes from Lignereux (2008). Communal land data from 2O inventories in departmental archives. Bank data from Hoffman, Postel-Vinay and Rosenthal (2019). Census population from Motte and Vouloir (2007). Tax coercion and attacks against gendarmes are inverse measures of state power.

Figure 4: Spatial distribution of fiscal capacity in the early 1800s
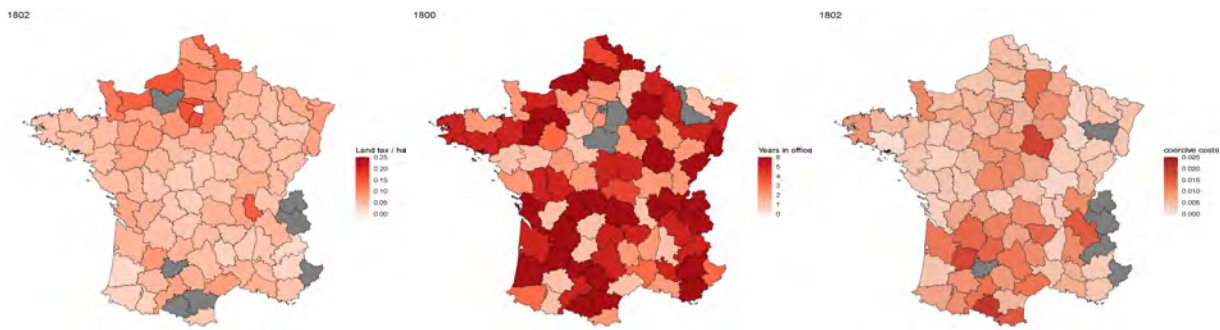


tax amounted to more than 75% of the total in 1808.

As an inverse measure of the state's coercive capacity, I use data on the yearly number of attacks against gendarmes, who were the main repressive authority in 19th century France. Gendarmes were often met with hostility by local populations (Emsley, 1999; Forrest, 1989; Lignereux, 2008). These communal "rebellions", where dozens to hundreds of villagers protested gendarme intervention and attacked them, reflect local mistrust of central state agents.[14]

**Public works** I use information on the yearly number of approved public work projects in communes. Every public good project costing more than a certain threshold had to be reviewed by a central consultative panel of architects, the Council of Civil Buildings. The *Conbavil* database inventories all projects submitted to this council (Krause, 2019). An important caveat is that the cost threshold increased from 5,000 F in 1806 to 20,000 F after 1822 (Château-Dutier, 2016, p. 256). As the provision of public works is more precisely measured before 1822, I can only test the effect of the centralized cadaster on this outcome.

**Communal land** A large literature associates cadasters with the end of communal land tenure. By clarifying land boundaries, the valuation of land, and discouraging costly litigation, it facilitates the transition from a collective to individual property rights regime (Scott, 1998; Libecap and Lueck, 2011; D'Arcy, Nistotskaya and Olsson, 2021). Moreover, when the cadaster gives a valuation to land, it makes more precise how much revenue a commune would get from leasing (or selling) communal land rather than leaving it for common use. Under the Ancien Regime and in the beginnings of the Revolution, the privatization of communal land had been encouraged but unevenly implemented. During the 19th century, the state encouraged the rental of communal land rather than its outright sale (Vivier, 1998), which meant partial privatization and simplification of tenure.

I create novel data on the status of communal land, combining information from 28

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[14]Forrest (1989, p. 76) writes: "often the attitude to military obligations was paralleled by that to taxation and to the extension of the role of the state in general.". See also Weber (1976, chapter 5).

departmental archives providing detailed indexes on changes in the status of communal land.[15] The obtained variable of interest is at the canton level, measuring the share of communes with recorded changes in communal land status in a given year. The obtained spatial and temporal variation in communal land status is shown on Figure A.14. Note that in the sample, 51% of communes have at least one case involving the commons between 1800 and 1848, indicating that most communes had some communal land.

**Population and financial development**   I measure two aspects of local economic development. First, I create a measure of urbanization, defined as the share of the cantonal population living in a commune with more than 2,000 inhabitants. Since censuses were conducted in 1800, 1806, 1821, and every five years from 1831, I use linear interpolation to obtain a yearly balanced panel. Using urban population as a proxy of economic growth is in line with the economic history literature (Bosker, Buringh and Van Zanden, 2013).

Second, to measure financial development, I create a variable equal to the number of banks by canton between 1801 and 1910, using data from Hoffman, Postel-Vinay and Rosenthal (2019). As the original data is available every three to six years, I again use linear interpolation to impute the missing years.

*Long run analyses*

In a second set of analyses, I investigate the long run effect of the centralized cadastral operations on fiscal capacity and economic development.

Cantons with a centralized cadasters tend to be more fertile and closer to administrative capitals, making it difficult to disentangle the impact of these factors from the impact

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[15]This amounts to approximately a third of departments for which I have cadastral data. Table A.3 in the appendix describes how departments with available data differ from others on a number of geographic and administrative characteristics. None of the covariates predicts data availability at conventional levels of statistical significance, suggesting that the obtained sample can be viewed as reasonably representative of the rest of the country.

of the central cadaster on fiscal capacity.[16] To address this challenge, I use a spatial re-gression discontinuity approach, comparing communes close to each other in different cantons, one treated (centralized cadaster) and one control (decentralized cadaster). I use the 1807 administrative geography to build the boundary between treated and control.[17]

Formally, I estimate the following equation:

$$(2) \qquad Y_{c,T} = \alpha + \beta \times centralizedcadaster_c + f(x_c, y_c) + cantonpair_c + \epsilon_c$$

$centralizedcadaster_c$ is a variable equal to one when commune $c$ is located in a can-ton with a centralized cadaster. $f(x_c, y_c)$ is a smooth function of commune $c$'s geographic location. $cantonpair_c$ are fixed effects for a treated/control canton pair, insuring that we compare communes which are geographically close to each other. Standard errors are clustered at the department level.

Outcome variables $Y_{c,T}$ include local direct fiscal receipts in 1881, i.e. more than 35 years after the completion of the cadaster, from Piketty and Cagé (2023). To the best of my knowledge, 1881 is the earliest year for which this information is available at the com-munal level (see Figure 5 for the spatial distribution of direct fiscal receipts, standardized by population or by communal area). In the appendix, I also conduct analyses using 1911 and 1920 data. The other long run outcome variables are proxies of various dimensions of economic development: communal population after 1846, the number of banks as a mea-sure of financial development, and the share of farms larger than 50 ha in 1962, measuring agricultural productivity.

The estimates yielded by this model are interpretable as a causal effect of the central-ized cadaster if and only if all other potential drivers of fiscal capacity vary continuously as we get closer to the boundary. Figure 6 shows that this assumption is not satisfied for several variables. Communes in cantons with a centralized cadaster are systematically closer to administrative capitals, have less forests or rugged terrain, and have a higher

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[16]Figure A.1 in the appendix shows the administrative, political, geographic predictors of canton selection to be cadastered prior to 1821.

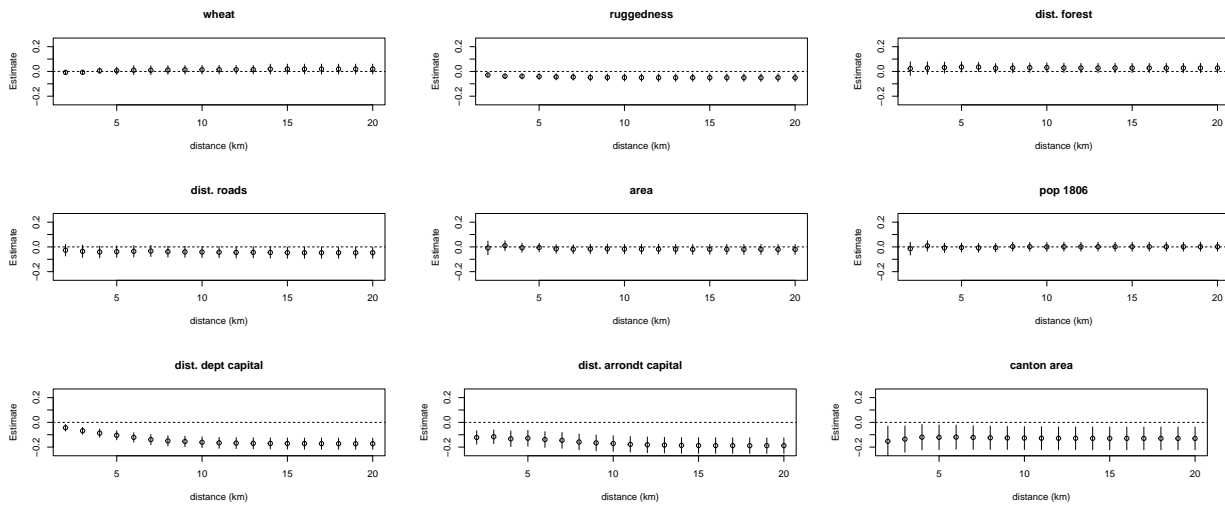[17]See Appendix 7 for more detail.

Figure 5: Fiscal capacity at the commune level in 1881
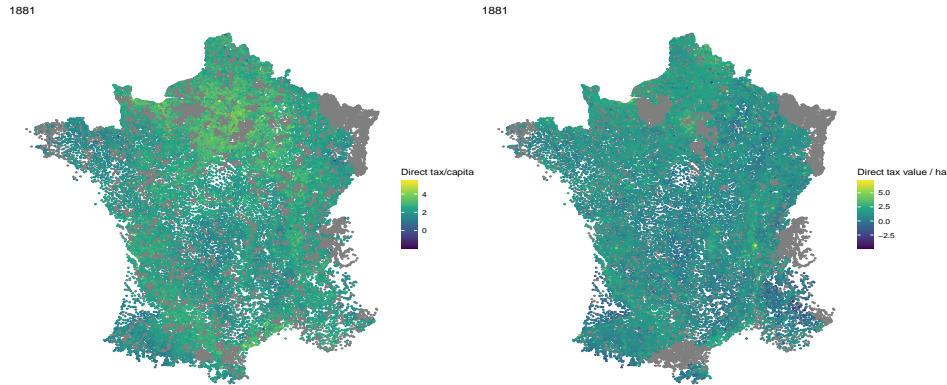


*Note:* Direct taxation information from Piketty and Cagé (2023).

Figure 6: Balance: communes with centralized vs. decentralized cadaster



*Notes:* Estimates of the effect of the central cadaster on various geographic and administrative covariates for 2 to 20 km bandwidths around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects. Cantons with administrative capitals are excluded from the sample.

population. As a way to partially address this issue, I will control for these imbalanced variables in the RD models.

This section presents the results of empirical analyses of the impact of the cadaster on state power, land use, and economic development. I first examine the impact of the cadaster over the course of implementation, i.e. comparing surveyed areas to non surveyed areas. I then consider the long run impact of the centralized cadaster as compared to the decentralized cadaster.

*No impact on state power*

Over the course of its long implementation, did the cadaster strengthen state power ?

Figure 7 shows the results of two-way fixed effects models estimating the impact of the share of cadastered area on our three measures of fiscal capacity. They do not support the common argument of a positive impact of the cadaster on fiscal capacity. First, there is no evidence that either the centralized or decentralized cadaster led the state to collect more land tax (left panel). If anything, amounts collected decrease in cadastered areas, which points toward weaker fiscal capacity.[18] Second, the cadaster does not promote the professionalization of tax collectors: those in cadastered areas have similar experience as well as likelihood of being born in their department of activity. Finally, there is no difference in the use of coercion in tax collection, suggesting that the cadaster did not improve the efficiency of the fiscal system.[19]

A caveat is that measures of fiscal capacity are unavailable below the department level. I cannot rule out that a positive impact on fiscal capacity was obtained locally *within* departments. Still, the results, in particular the decrease in land tax amounts associated

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[18]A similar evolution can be observed when we analyze land tax per capita instead of total land tax amounts. See Figure A.6 in the appendix.

[19]As a visual complement, Figure A.7 in the appendix plots the raw data for all three measures of fiscal capacity, splitting the sample at the median area cadastered by the end of the central cadaster period. For all three measures, no clear divergence between the most and the least cadastered department in 1821 is observed.

with the cadaster, suggests that the benefits, if any, were modest. This is also supported by the historical record of limitations of the scope of the cadaster after 1821 which was discussed in the Background section. Overall, both quantitative and qualitative evidence indicate that the cadaster was tolerated under the condition that taxation remained low and fixed in the future, rather than leading to greater extractive capacity.

Similarly, I find no evidence of a positive effect of the cadaster on coercive capacity, inversely measured by the number of attacks against gendarmes (Figure 8). Attacks slightly decrease following the centralized cadaster (middle graph), but the effect is not statistically significant at conventional levels. Results are similar when we restrict the sample to cantons with no administrative capitals, administrative capitals, or add department specific trends.

Figure 7: The cadaster and fiscal capacity (1800-1845)
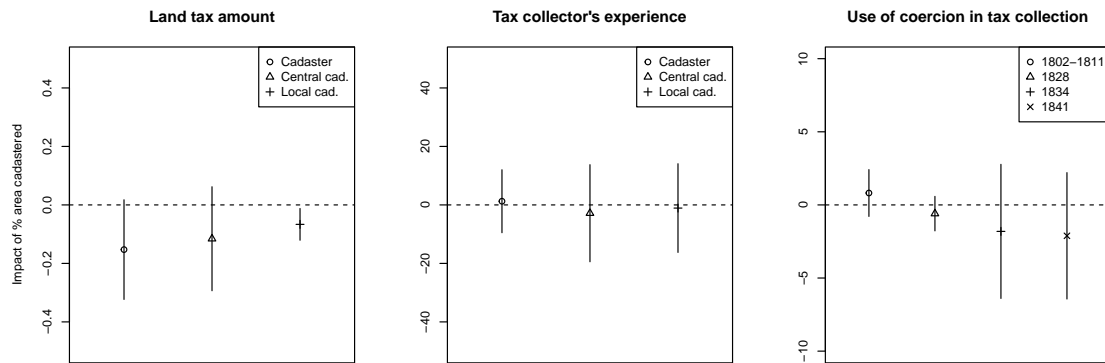


*Notes:* All models estimate the effect of the share of area cadastered in a department and include department and year fixed effects. "Cadaster": full 1800-1845 period; "Central cad.": 1800-1821 period; "Local cad.": 1822-1845 period.

*Public works and communal land*

Did cadastral surveys impact local land use? First, Figure 9 shows event studies of the impact of the centralized cadaster on public works. Five years after the centralized cadastral surveys (Panel A), cantons are 3.6% more likely to have any public work projects

Figure 8: The cadaster and attacks against gendarmes
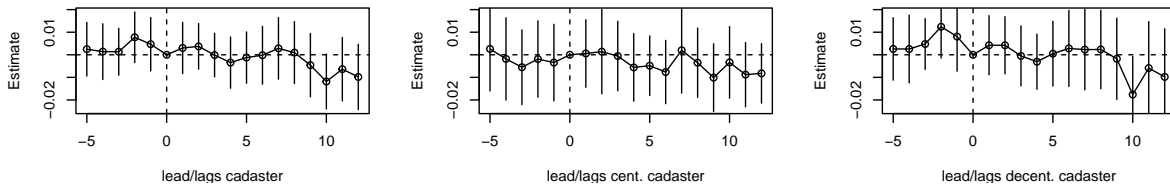


*Notes:* Middle and right event studies respectively estimate the effect of the centralized (pre 1821) and decentralized cadaster (post 1821). The left event study combines both types of cadaster.

adopted. In the appendix, Figure A.8 shows that this patterns hold if we exclude administrative capitals, include only administrative capitals, or add department-specific time trends. In the appendix, I show that there is no effect of the decentralized cadaster on the post 1820 sample including only large projects (Figure A.9). When including only large projects in the pre-1820 period, we find no effect of the centralized cadaster either, which shows that the post 1820 measurement change does not allow to meaningfully compare or combine the effects of the decentralized and centralized cadaster (Figure A.10).

Second, the cadaster is associated with the privatization of communal land (Panel B of Figure 9). The effect appears clearer for the centralized cadaster, but additional analyses in the appendix show substantial heterogeneity depending on whether a canton has an administrative capital: cantons with administrative capitals are *less* likely to privatize commons following the decentralized cadaster (Figure A.16, Panel B). As discussed earlier, the results are based on a partial sample of French departments and an imprecise dependent variable, and should therefore be interpreted with caution, but they are suggestive of the cadaster contributing to the simplification of land tenure discussed by Scott (1998). This was plausibly consequential for local level power relations.

Both results indicate that the cadaster led to some shifts in local land use. These are unrelated to the cadaster's fiscal dimension. Rather, the cadaster likely facilitated public works or the rationalization of the use of commons in a technical sense, by providing an authoritative map of local areas.

Figure 9: Impact of the cadaster on land use

Panel (A): Any public works (impact of the centralized cadaster)
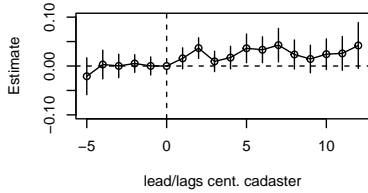


Panel (B): Privatization of communal land
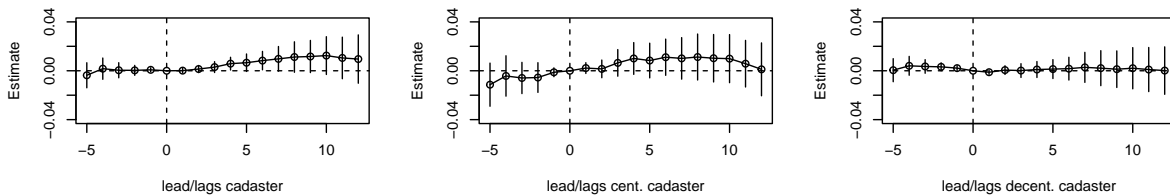


*Notes:* Panel A: Dependent variable is whether any public work project was adopted in a given year according to the *Conbavil* database. Panel B: Event studies in the second and third column respectively estimate the effect of the centralized (pre 1821) and decentralized (post 1821) cadaster. The first column combines both types of cadaster.

*Urban population and financial development*

Did the cadaster impact broader aspects of local economic development? Figure 10 shows the effect of the cadaster on urban population and financial development.

The effect of the cadaster on urban population shown on panel (A) is positive but not statistically significant at conventional levels. It is driven by the decentralized cadaster, although the lack of effect of the centralized cadaster may be due to the lack of variation in the first years of the panel, with censuses only in 1800, 1806 and 1820. There is no clear effect either on the number of banks, it is even slightly negative though imprecisely estimated (Panel B).

It must be noted that additional analyses in the appendix show that the effects on both urbanization and financial development are characterized by strong heterogeneity

depending on whether a canton has an administrative capital. For these variables, the decentralized cadaster has a strongly negative effect in cantons with administrative capitals, but a positive one on other cantons (Figure A.19). This suggests that the cadaster promoted an economic convergence between areas close to administrative capitals and the rest of the territory.

Figure 10: Impact of the cadaster on urban population and financial development

Panel (A): % Population in urban communes



Panel (B): Number of banks
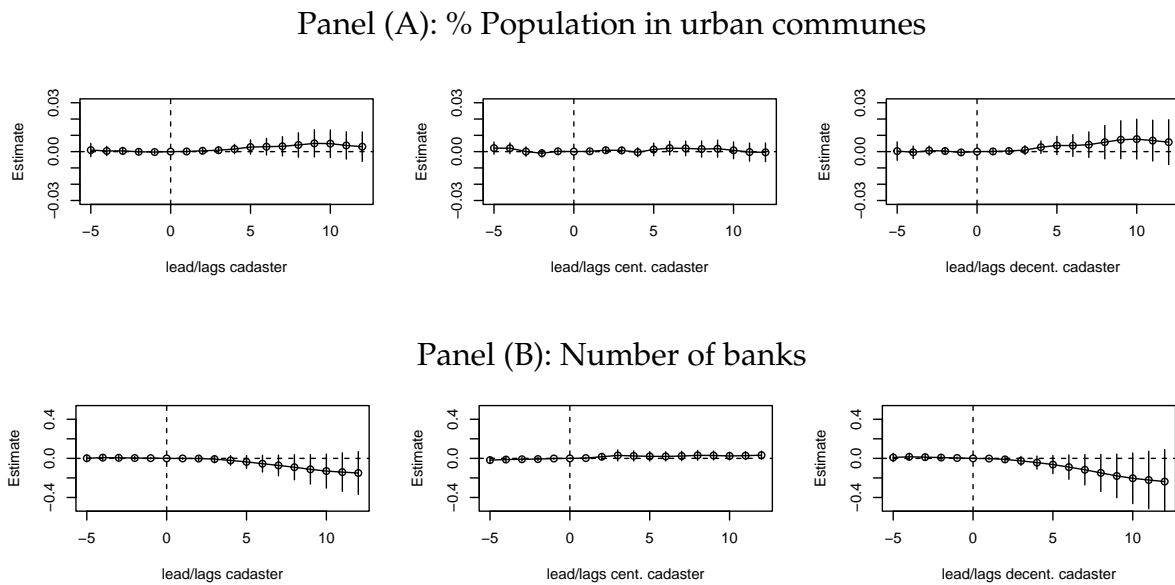


*Notes:* Urban communes: more than 2,000 inhabitants. Event studies in the second and third column respectively estimate the effect of the centralized (pre 1821) and decentralized cadaster (post 1821). The first column combines both types of cadaster.

*The long run impact of the centralized cadaster*

What were the consequences of the centralized cadaster in the long run? I compare communes that were cadastered during the centralized period with communes in a close bandwidth that were not, using a spatial RD approach. Figure 11 shows the long run impact of the centralized cadaster on 1881 fiscal capacity, commune population, financial development, and 1962 agricultural productivity. All specifications include controls for

the imbalanced variable previously discussed.[20]

First of all, communes with a centralized cadaster have higher tax receipts per capita in 1881 (top right panel).[21] This indicates a positive impact on communal fiscal capacity relative to areas that received a decentralized cadaster, amounting to approximately 3.5%. In the appendix, I complement these local results by estimating regressions of the impact of the centralized cadaster on receipts controlling for a battery of geographic and administrative controls and including departments or arrondissement fixed effects (Figure A.20). They show a stable positive effect of the centralized cadaster of similar magnitude as the local RD analysis (+ 2.5%). While I cannot rule out unobserved confounders explaining both cadastral implementation and local fiscal capacity, this provides support to the hypothesis that the centralized approach was more beneficial to fiscal capacity than the decentralized one. A potential mechanism would be that external third parties were better suited at reaching a "fair" and acceptable valuation of land, leading to greater willingness to pay in the long run. This result also confirms the appreciation of historians and contemporaries of the negative consequences of decentralizing the cadaster, as discussed in the Background section.

The analysis does not detect a long run impact of the cadaster on any of variables proxying for economic development: population, number of banks, or agricultural productivity. In the appendix, Figures A.24, A.25 and A.26 show similar results when using data posterior to 1881. There is no evidence that the cadaster impacted broader economic development.

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[20]See Figure A.23 in the appendix for results without controls.

[21]See Figure A.28 for similar results using alternative measures of the dependent variable: normalizing tax receipts by commune area instead of population, or total tax receipts.

Figure 11: Long run impact of the centralized cadaster: spatial regression discontinuity results
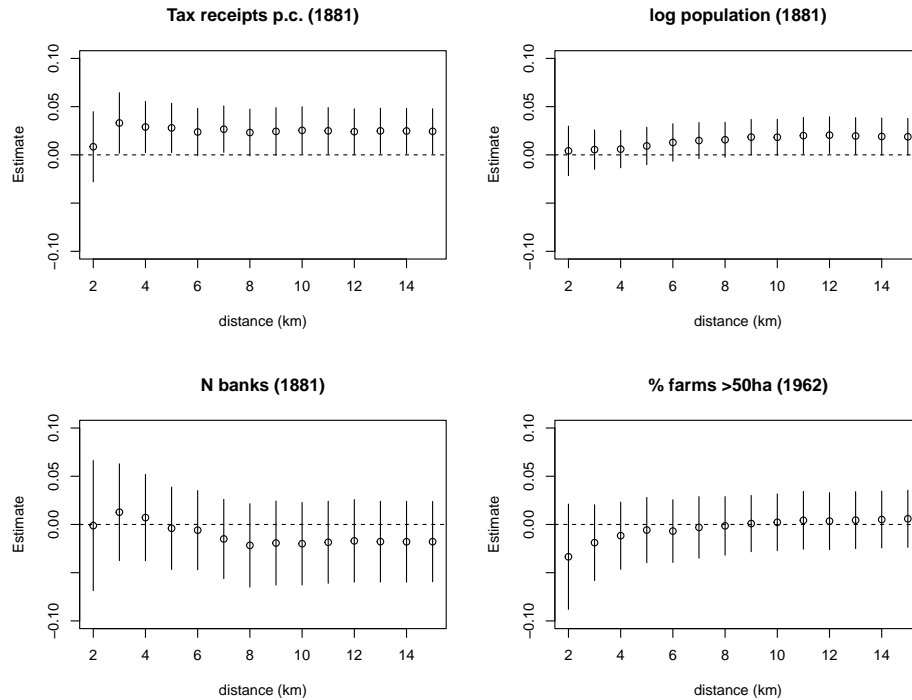


*Note:* Estimates of the effect of the centralized cadaster for various bandwidths around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects, distance to department and arrondissement capitals, canton area, commune area and population in 1806, distance to forests and terrain ruggedness. All dependent variables are standardized.

## CONCLUSION

I investigated the impact of the Napoleonic cadaster on state power and economic development.

In contrast to conventional wisdom, I found little evidence that informational capacity played a major role in strengthening the state. Still, the way informational capacity was built mattered in the long run. Areas which received a centralized cadaster collect more taxes relative to the ones with a decentralized cadaster, suggesting that the posi-

tive impact on fiscal capacity is conditional on top down implementation. I also find that the cadaster facilitated the privatization of commons and the building of public works, which are both areas closely linked to the mapping of land and not directly related to state power. Finally, while cadastral infrastructure has been linked to long term development in cross country analyses, in this case they are no clear medium or long run effects.

The empirical results confirm the lukewarm assessment of the cadaster by historians and contemporaries (Schnerb, 1938; Vivier, 2008; Delalande, 2011). As Vivier (2008) puts it: "From a model in 1807, the French cadaster became a "bastard project" because of disagreements on its goal, whereas the German, Dutch and Italian states made an effective instrument out of it". The limitations of the Napoleonic cadaster also echo findings from the literature on developing countries showing the difficulties of building informational capacity (Sánchez-Talanquer, 2020; Garfias, 2019; Bowles, 2020). This is interesting as France is usually viewed as a precursor of successful centralized state-building in other areas such as administration, conscription or linguistic standardization. Although the initial motivations of the cadaster reflected the simplifying logic of modern state-building described by Scott (1998), in practice it fell short of uniformizing land taxation on the French territory. Future research should explore further the differences between theory and practice in such state-building efforts.

The results also suggest that ambitious and costly legibility projects with long implementation periods are vulnerable to shifts in political conditions, particularly when the project might threaten the interests of elites. Such historical precedents may explain why developing countries often have low incentives to build them in the first place. More comparative research is needed to understand when the building of informational capacity does strengthen state power and when it does not.

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# ONLINE APPENDIX

## 1  CANTON CHARACTERISTICS

Figure A.1: Selection of cantons during the centralized cadaster period (1800-1821)
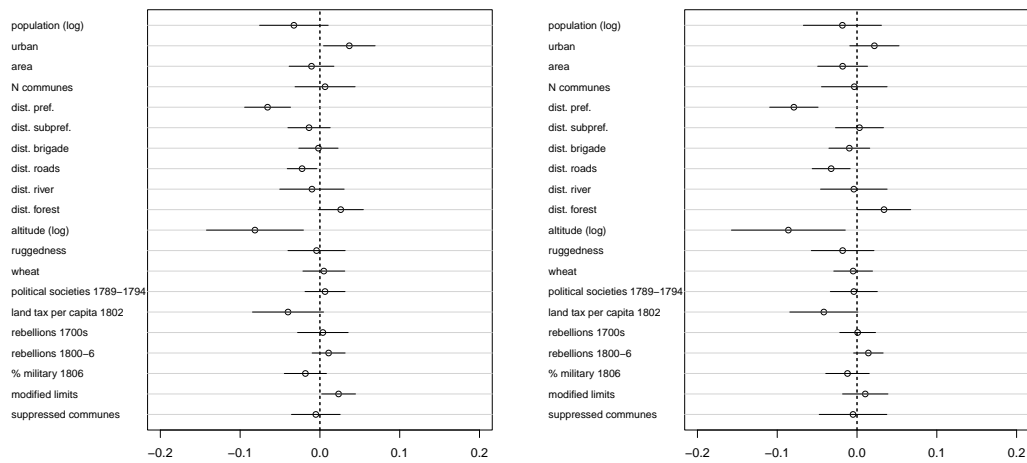


*Notes:* Cross-sectional analysis on 2,369 cantons. The dependent variable equals one when a canton is cadastered by 1821, zero otherwise. Department fixed effects. Standard errors clustered at the department level. Left panel: full sample. Right panel: sample excluding administrative capitals.

## Table A.1: Summary statistics: cantons

| | N | mean | median | sd | min | max |
|---|---|---|---|---|---|---|
| canton population | 162,067 | 11,385.59 | 10,336.67 | 17,987.45 | 406 | 1,487,423 |
| urban | 163,620 | 0.22 | 0 | 0.28 | 0 | 1 |
| canton area | 163,260 | 1,097.06 | 1,062.12 | 500.41 | 13.56 | 5,738.94 |
| N communes | 163,680 | 13.98 | 12 | 8.08 | 1 | 49 |
| dist. pref. | 163,560 | 35.58 | 34.39 | 19.01 | 0 | 124.85 |
| dist. subpref. | 163,680 | 17.39 | 16.22 | 9.85 | 0 | 83.46 |
| dist. brigade | 163,680 | 7.38 | 6.64 | 3.57 | 0 | 35.27 |
| dist. roads | 163,680 | 2.01 | 1.49 | 2.05 | 0.001 | 33.00 |
| dist. river | 163,680 | 22.85 | 15.40 | 26.37 | 0.001 | 221.77 |
| dist. forest | 163,680 | 1.79 | 1.36 | 1.75 | 0.07 | 29.59 |
| altitude (log) | 163,260 | 284.14 | 178.58 | 306.01 | 2.25 | 2,628.25 |
| ruggedness | 163,620 | 85.95 | 54.11 | 100.00 | 0 | 850.49 |
| wheat | 163,560 | 5,695.01 | 5,843.89 | 681.37 | 0 | 6,910.16 |
| political societies 1789-1794 | 163,680 | 1.82 | 1 | 2.03 | 0 | 21 |
| land tax per capita 1802 | 143,400 | 1.63 | 1.44 | 0.89 | 0.28 | 13.71 |
| rebellions 1700s | 163,680 | 2.40 | 1 | 10.47 | 0 | 472 |
| rebellions 1800-6 | 163,680 | 0.18 | 0 | 0.48 | 0 | 4 |
| % military 1806 | 133,920 | 0.02 | 0.02 | 0.01 | 0 | 0.12 |
| modified limits | 163,680 | 0.52 | 1 | 0.50 | 0 | 1 |
| suppressed communes | 163,620 | 0.05 | 0 | 0.15 | 0 | 1 |

## 2 FISCAL CAPACITY

Table A.2: Summary statistics: fiscal capacity

|                              | N     | mean       | median     | sd         | min     | max          |
|------------------------------|-------|------------|------------|------------|---------|--------------|
| tax coercion/amount collected | 1,118 | 0.004      | 0.003      | 0.004      | 0       | 0.06         |
| local tax collector          | 5,734 | 0.22       | 0          | 0.42       | 0       | 1            |
| tax collector experience     | 6,630 | 13.79      | 9          | 13.23      | 1       | 72           |
| % area cadastered (central)  | 4,808 | 0.26       | 0.28       | 0.14       | 0       | 0.55         |
| % area cadastered (local)    | 4,808 | 0.31       | 0.25       | 0.30       | 0       | 0.78         |
| department population        | 4,326 | 380,628.60 | 343,128.30 | 164,823.70 | 110,732 | 1,850,914.00 |

Figure A.2: Spatial distribution of land tax amounts over time, 1800-1880
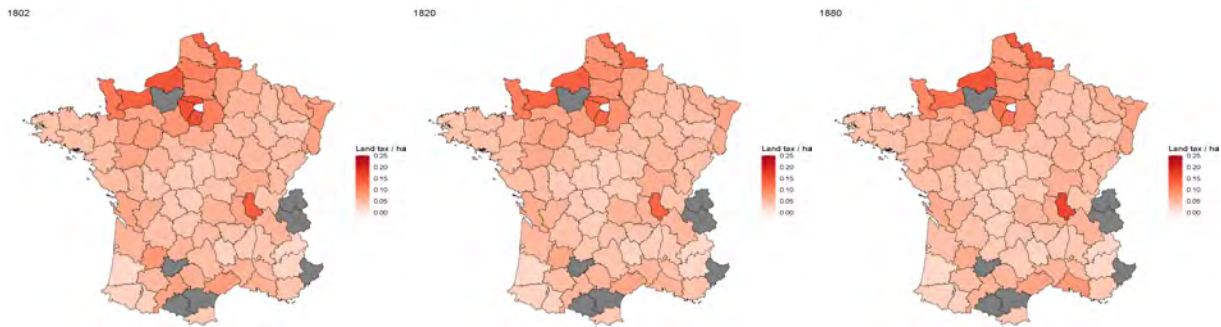


*Notes:* Information on land tax amounts from *Comptes de l'Administration des Finances*.

Figure A.3: Spatial distribution of tax collectors' experience over time, 1800-1880
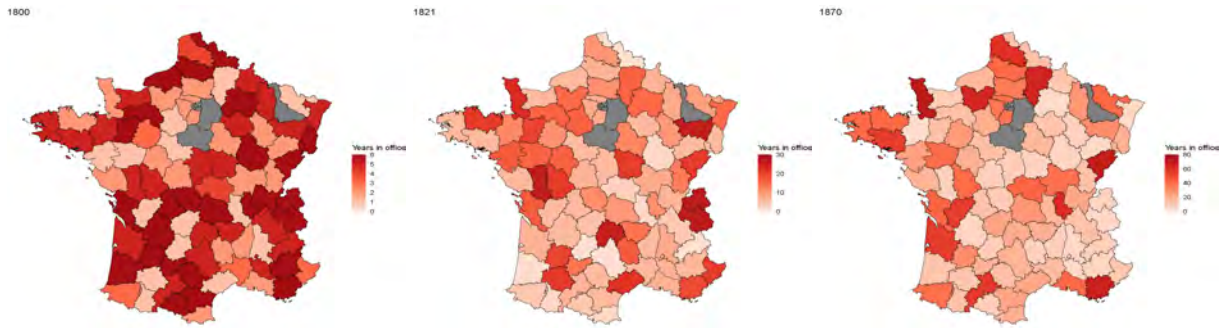


*Notes:* Information on tax collectors' identity and career from Pinaud (1990).

Figure A.4: Spatial distribution of tax coercion over time, 1802-1841 (expenditures/amount tax collected)
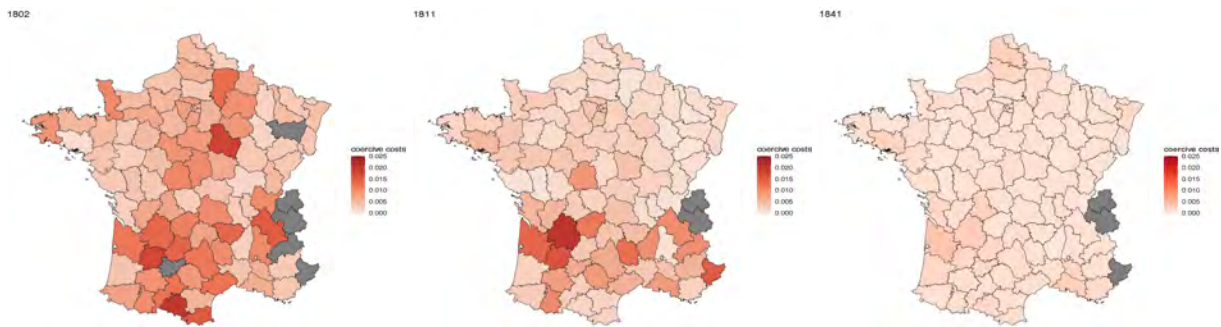


*Notes:* Expenditure data comes from yearly financial accounts, *Archives parlementaires* (1802, 1803 and 1804), and *Archives Nationales* AF/IV*/244-249.

Figure A.5: Fiscal capacity by commune, 1881 and 1911
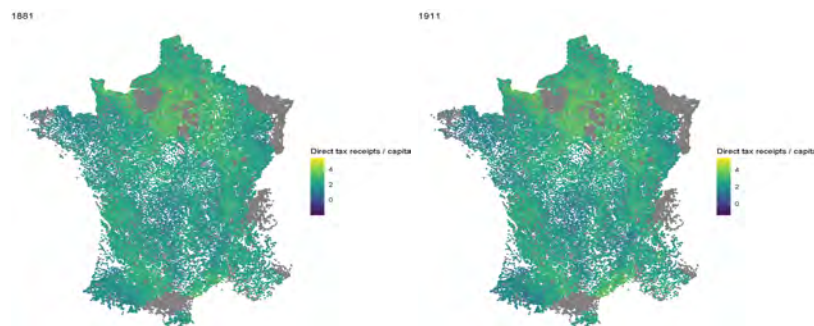


*Notes:* Data from Piketty and Cagé (2023).

## Figure A.6: Cadaster and the evolution of the land tax
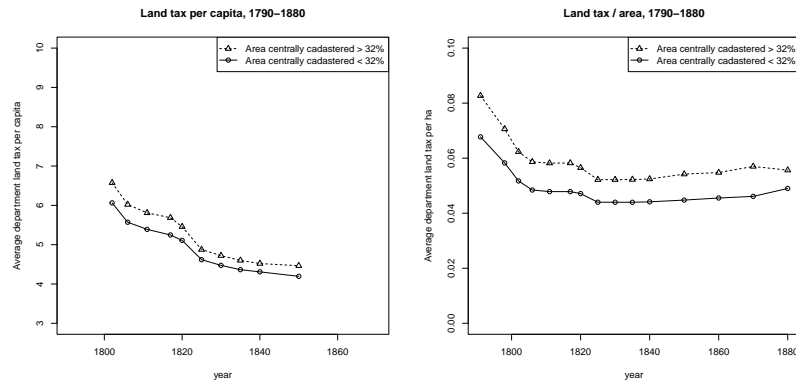


## Figure A.7: The cadaster and fiscal capacity (1800-1845)
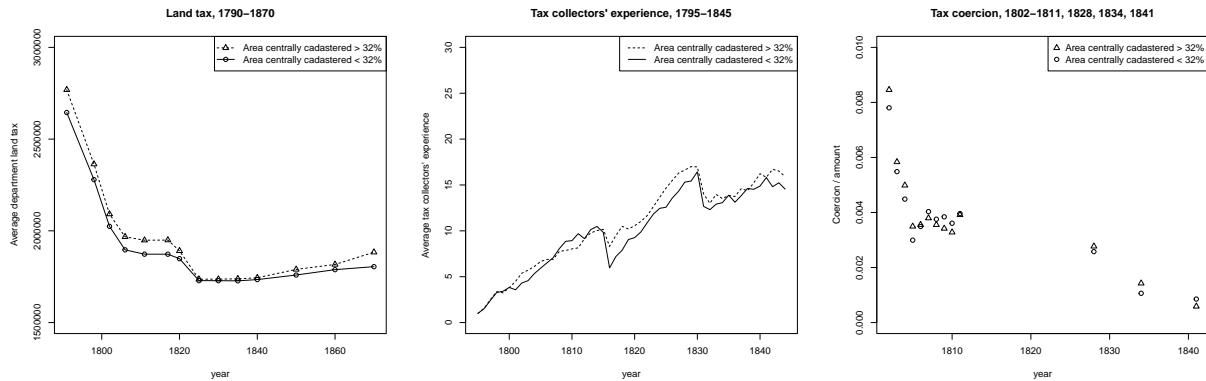


*Notes:* "Cadaster": full 1800-1845 period; "Central cad.": 1800-1821 period; "Local cad.": 1822-1845 period.

Panel B: 32% is the median of the share of departmental territory that is centrally cadastered in 1821.

# 3   PUBLIC WORKS

Figure A.8: Impact of the centralized cadaster on public works: alternative samples and specifications
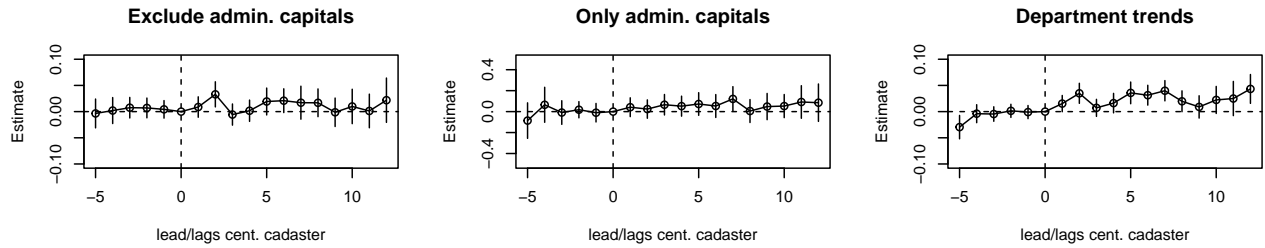


*Notes:* Dependent variable is whether any public work project was adopted in a given year according to the *Conbavil* database. Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level.

Figure A.9: Impact of the decentralized cadaster on large public works (1821-1840)
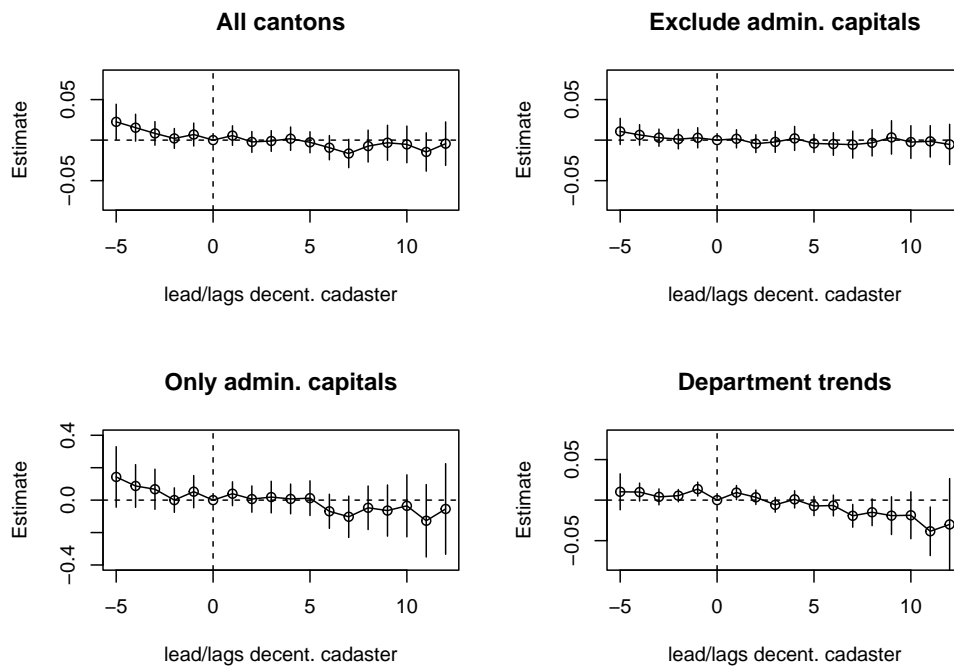
**All cantons**

**Exclude admin. capitals**

**Only admin. capitals**

**Department trends**



*Notes:* Dependent variable is whether any public work project was adopted in a given year according to the *Conbavil* database. Only large projects (above 20,000 F) are included in the database. Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level.

Figure A.10: Impact of the centralized cadaster on large public works (1806-1820)
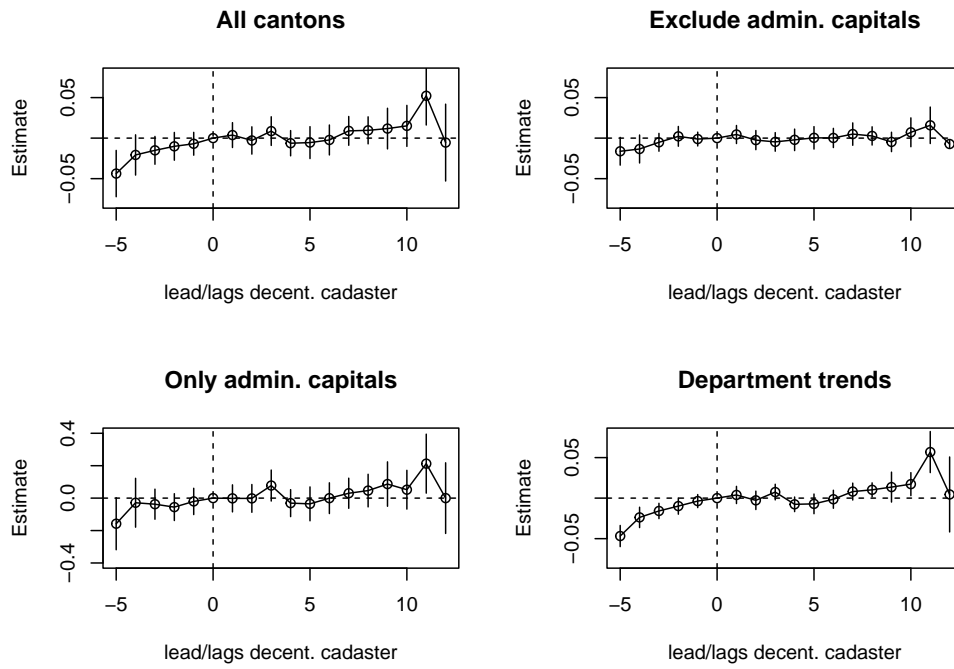


*Notes:* Dependent variable is whether any public work project was adopted in a given year according to the *Conbavil* database. Only large projects (above 20,000 F) are included in the database. Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level.

Figure A.11: Impact of the cadaster on attacks against gendarmes: exclude administrative capitals
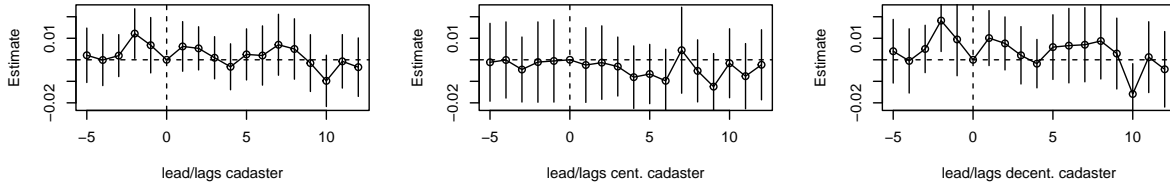


*Notes:* Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Middle and right event studies respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The left event study combines both types of cadaster. Cantons with a department or arrondissement capital are excluded from the sample.

Figure A.12: Impact of the cadaster on attacks against gendarmes: only administrative capitals
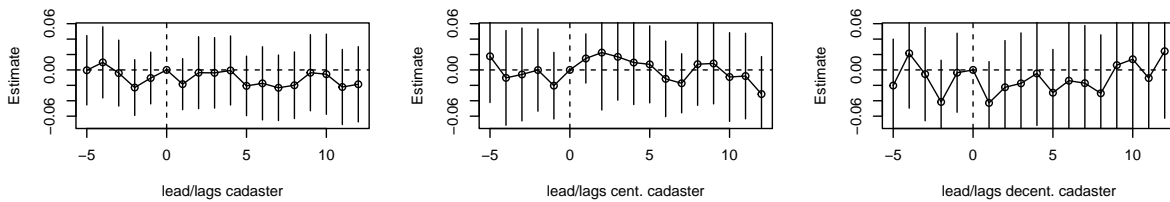


*Notes:* Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Middle and right event studies respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The left event study combines both types of cadaster. Only cantons with a department or arrondissement capital included in the sample.

Figure A.13: Impact of the cadaster on attacks against gendarmes: department trends
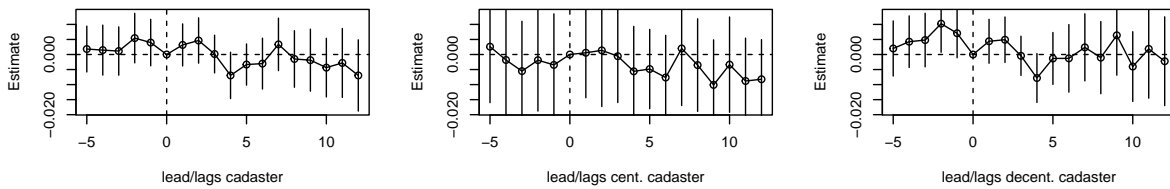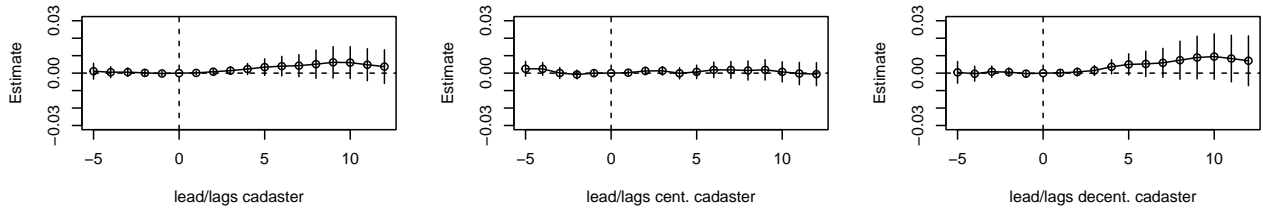


*Notes:* Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Middle and right event studies respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The left event study combines both types of cadaster.

# 5 COMMUNAL LAND

Figure A.14: Timing of communal land activities (1800-1848)
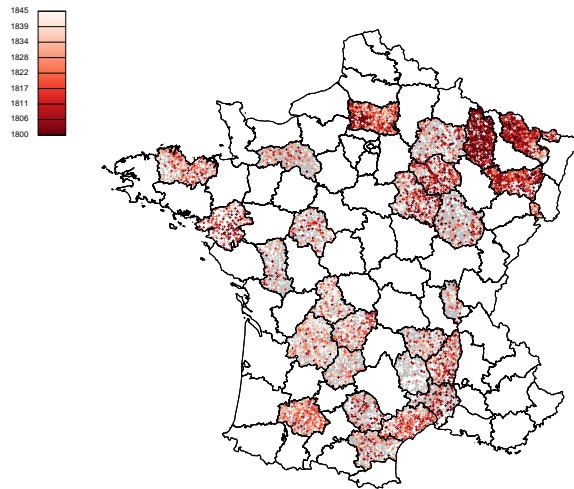
Figure A.15: Central cadaster and communal land administration
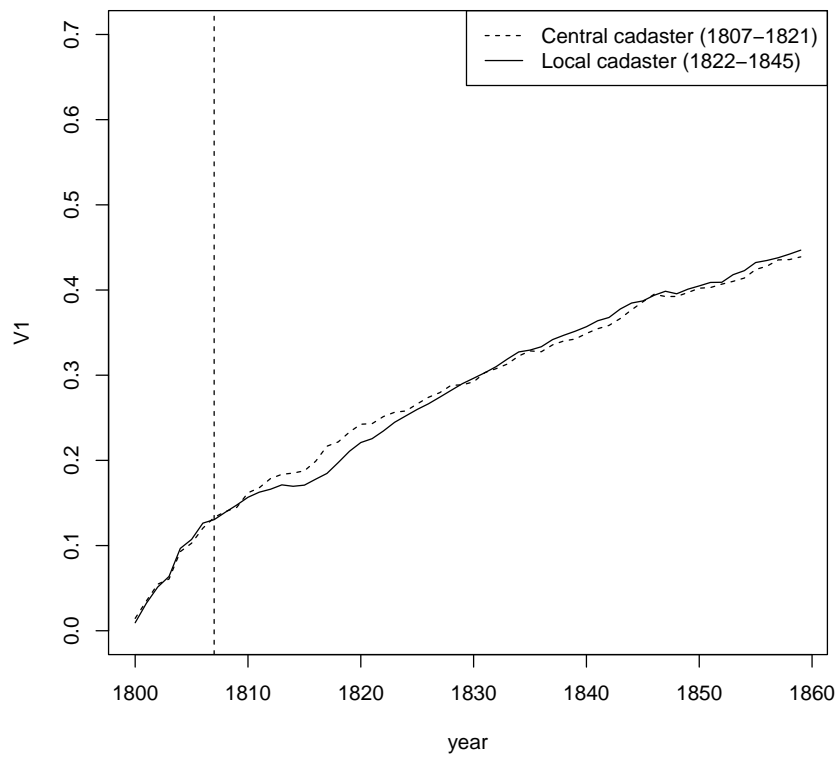
Table A.3: Predictors of data availability for communal land activities

| | *Dependent variable:* |
|---|---|
| | Data on communal land activities |
| wheat suitability | 0.042 (0.043) |
| ruggedness | 0.067 (0.049) |
| dist. forest | 0.065 (0.055) |
| dist. roads | −0.010 (0.035) |
| dist. Paris | 0.068 (0.123) |
| dist. prefecture | −0.007 (0.011) |
| dist. sous-prefecture | 0.007 (0.015) |
| dist. gendarmes | −0.011 (0.018) |
| dist. coast | 0.028 (0.040) |
| canton population | 0.001 (0.005) |
| N communes in canton | −0.081 (0.051) |
| gini dept. land tax 1835 | 1.603 (1.320) |
| cadaster date | 0.001 (0.001) |
| dept. fiscal burden | −0.087 (2.211) |
| Constant | −4.887 (3.129) |
| Mean dep. var | 0.3231 |
| Observations | 2,538 |
| $R^2$ | 0.037 |
| Adjusted $R^2$ | 0.032 |
| Residual Std. Error | 0.469 (df = 2523) |

*Notes:* *p<0.1; **p<0.05; ***p<0.01. Standard errors clustered at the department level in parentheses. All covariates except the last three are logged.

Figure A.16: Impact of the cadaster on the privatization of communal land: alternative sample and specifications
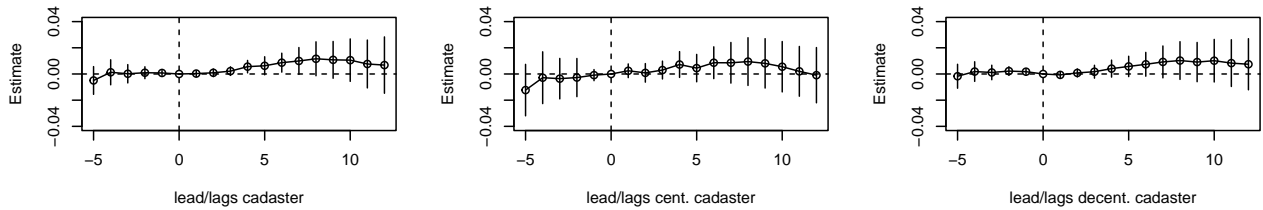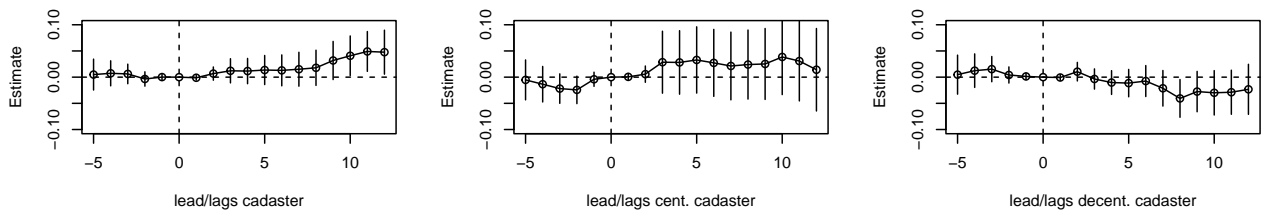
## Panel (A): Exclude admin. capitals



## Panel (B): Only admin. capitals



## Panel (C): Department trends



*Notes:* Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Event studies in the second and third column respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The first column combines both types of cadaster.

Figure A.17: Impact of the cadaster on canton share of urban population: alternative samples and specifications

### Panel (A): Exclude admin. capitals



### Panel (B): Only admin. capitals
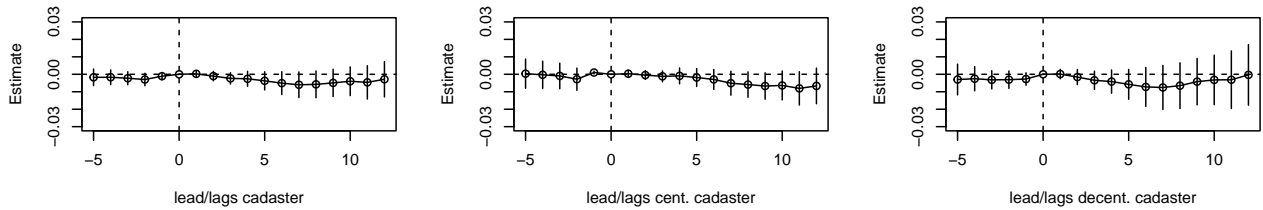


### Panel (C): Department trends
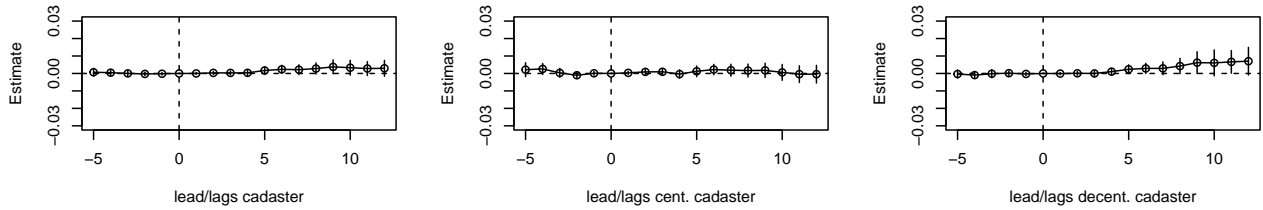


*Notes:* The dependent variable is the cantonal share of population in communes of more than 2,000 inhabitants. Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Event studies in the second and third column respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The first column combines both types of cadaster.

## Figure A.18: Impact of the cadaster on urban population

### Panel (A): Population in cities above 5,000 - all cantons
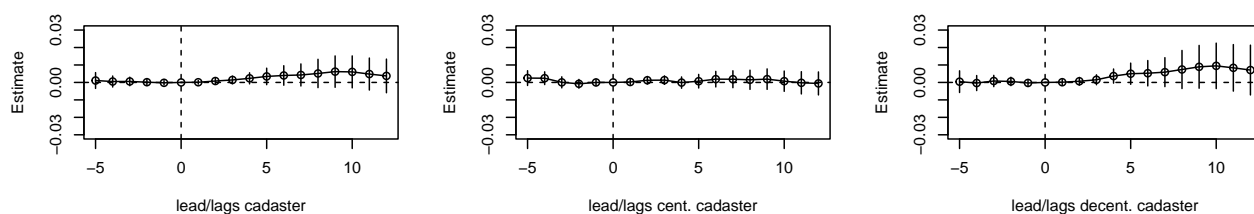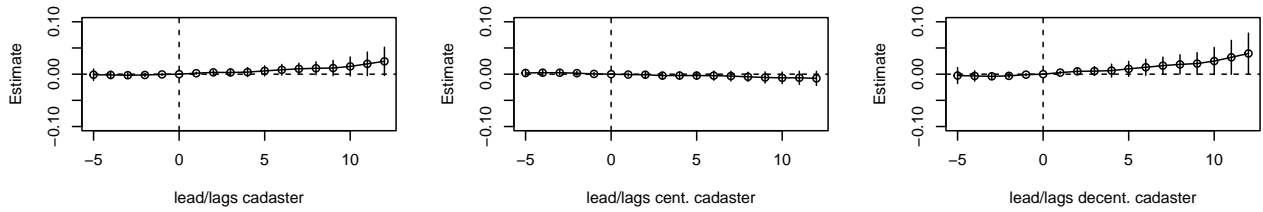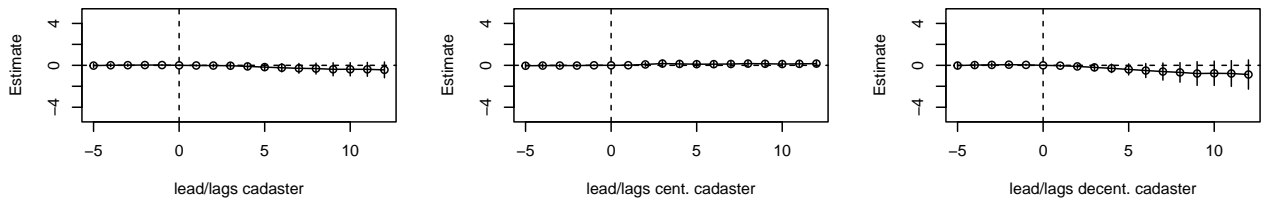


### Panel (B): Population in cities above 5,000 - exclude administrative capitals
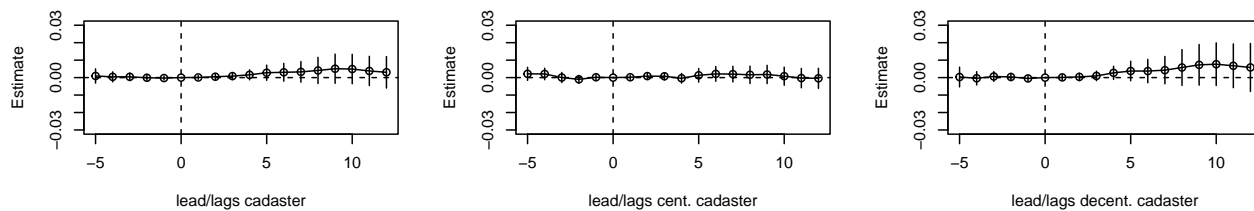


*Notes:* Event studies robust to heterogeneous treatment effects De Chaisemartin and d'Haultfoeuille (2020). Standard errors clustered at the department level. Event studies in the second and third column respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The first column combines both types of cadaster.

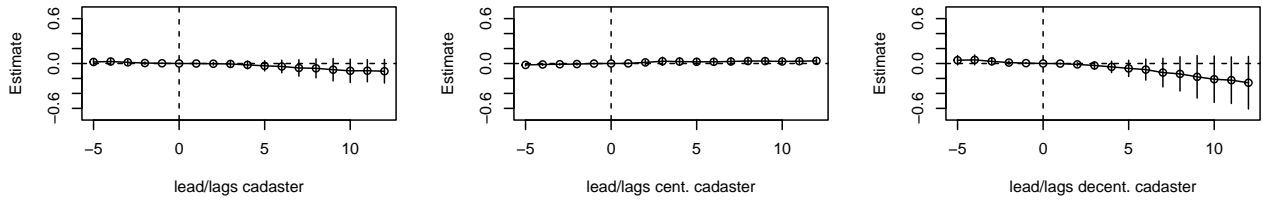Figure A.19: Impact of the cadaster on financial development: alternative samples and specifications

## Panel (A): Exclude admin. capitals



## Panel (B): Only admin. capitals



## Panel (C): Department trends



*Notes:* Event studies robust to heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille, 2020). Standard errors clustered at the department level. Event studies in the second and third column respectively estimate the effect of the centralized cadaster (1807-1821) and decentralized cadaster (1822-1845). The first column combines both types of cadaster.
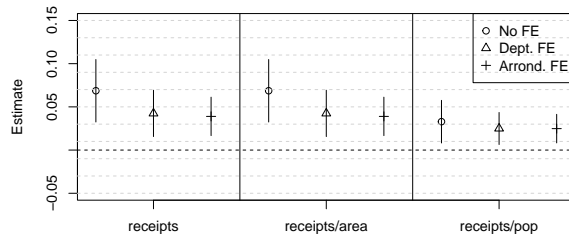
Figure A.20: Long run impact of the centralized cadaster on fiscal receipts: regression analyses
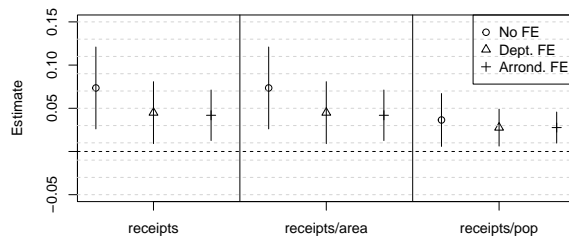
### Panel (A) 1881 Tax receipts
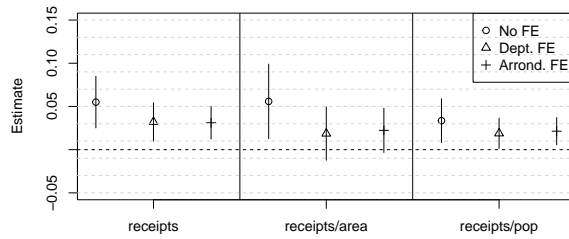


### Panel (B) 1911 Tax receipts



### Panel (C) 1920 Tax receipts



*Notes:* Estimates of the long run impact of the centralized cadaster on logged communal tax receipts in 1881, 1911 and 1920. All models include controls for 1806 commune population and area, 1806 population of the largest commune in the canton, indicators for administrative capitals, distance to administrative capitals, forests, roads, Paris, agricultural wheat suitability and terrain ruggedness.

Figure A.21: Spatial Regression Discontinuity comparing centralized and decentralized cadaster
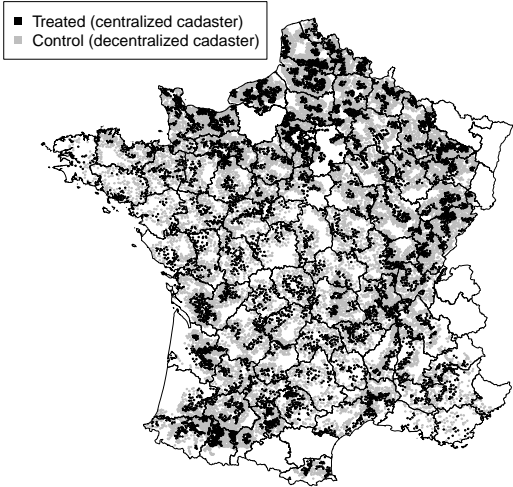


*Note:* The communes shown on the map are within a 10 km bandwidth from areas from communes with a different treatment status. Treatment: centralized cadaster. Control: decentralized cadaster.

Figure A.22: Spatial Regression Discontinuity comparing centralized and decentralized cadaster: effective sample.



1881

Direct tax/capita
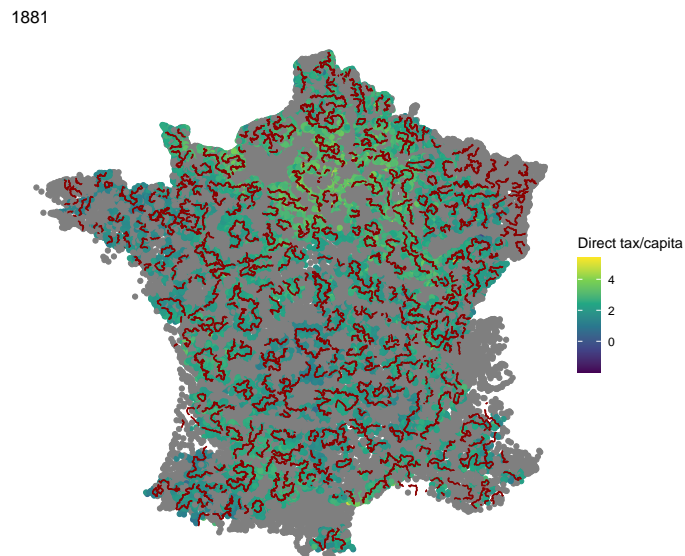
*Note:* The red line shows the boundary between cantons centrally cadastered and the others, excluding segments were the border changed between 1807 and 1881. The sample only includes communes within a 10km bandwidth of the boundary for which there is treatment variation within a canton pair.

Figure A.23: Long run impact of the centralized cadaster: spatial regression discontinuity results (no controls)
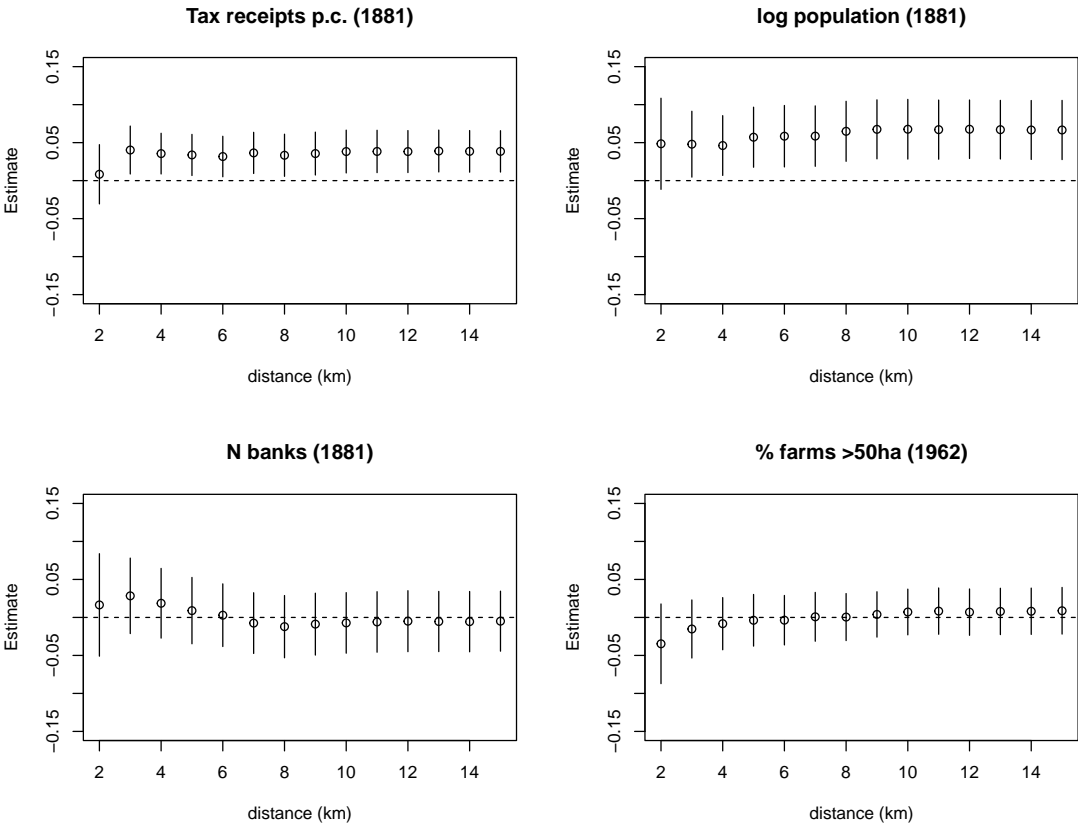


*Note:* Estimates of the effect of the centralized cadaster for various bandwidths around the boundary between treated and control cantons (centralized vs decentralized cadaster). All models control for latitude/longitude interactions and canton pair fixed effects.

Figure A.24: Centralized cadaster and fiscal capacity in 1911: spatial regression discontinuity results.
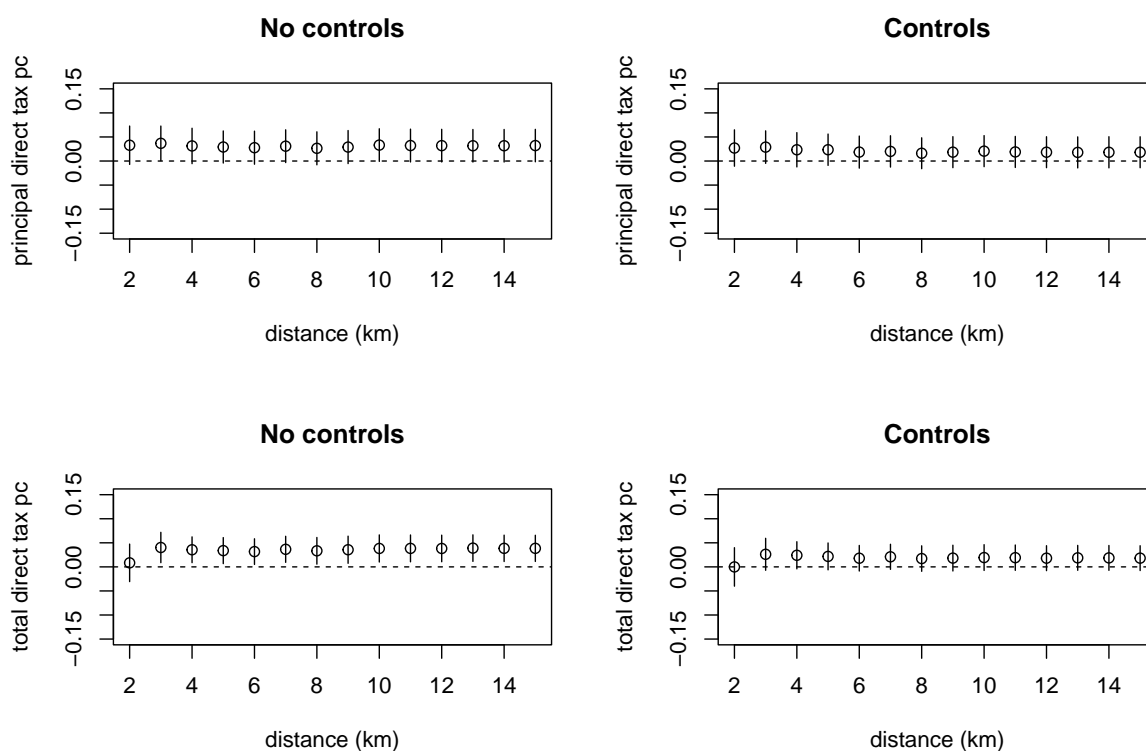


*Note:* Estimates of the effect of the central cadaster on logged communal tax receipts for various bandwidth around the boundary between treated and control cantons (central vs local cadaster). Both models control for latitude/longitude interactions and canton pair fixed effects. The model in the bottom panel controls for distance to department and arrondissement capitals, canton area, commune 1911 population and area, distance to forests and terrain ruggedness.

# Figure A.25: Centralized cadaster and population in the long run

**log population 1851**



**log population 1861**



**log population 1872**



**log population 1881**
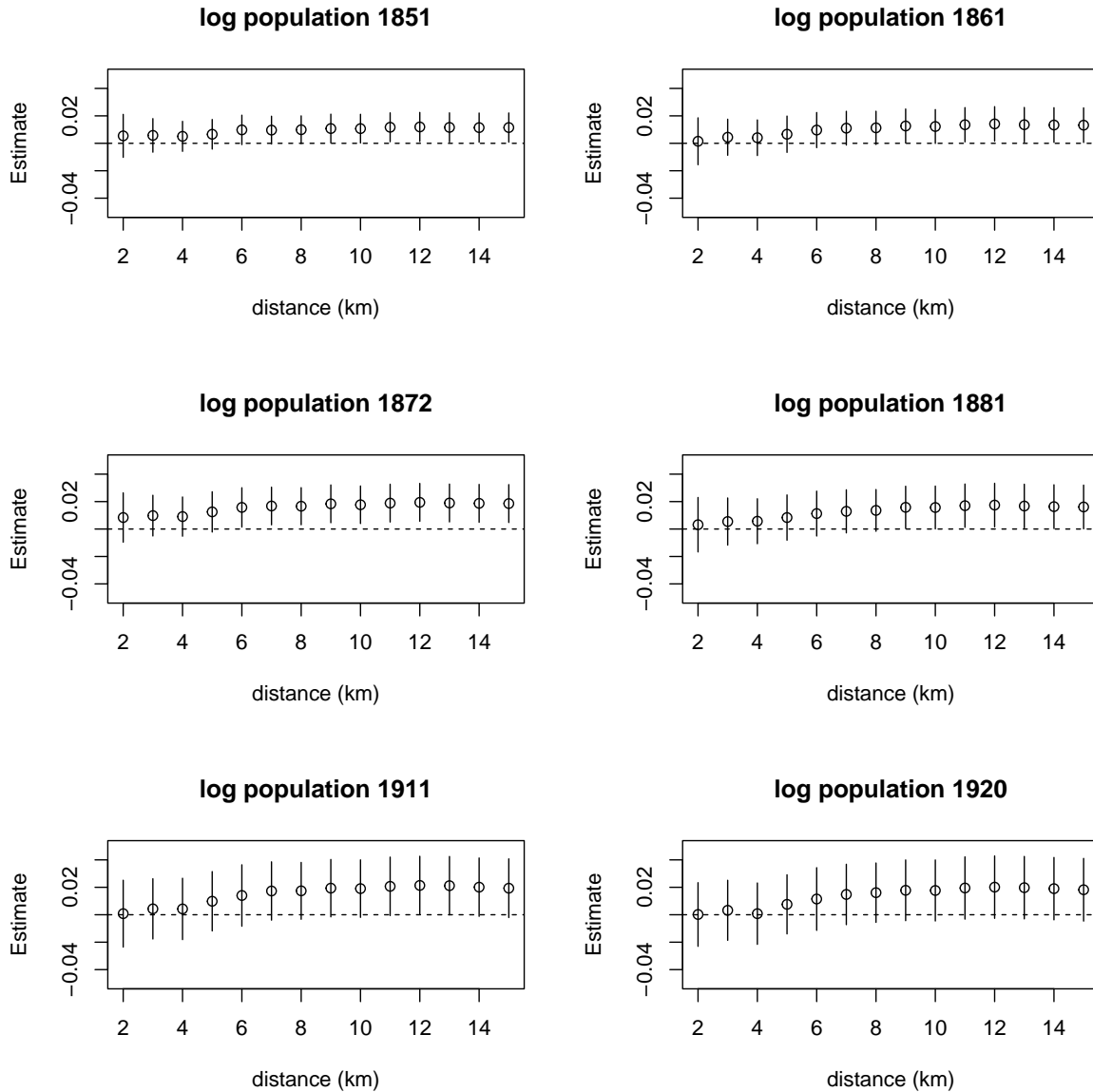


**log population 1911**



**log population 1920**



*Notes:* Estimates of the effect of the central cadaster for various bandwidths around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects. All models controls for distance to department and arrondissement capitals, canton area, commune area, distance to forests and terrain ruggedness.

Figure A.26: Centralized cadaster and financial development in the long run (1892 and 1910)



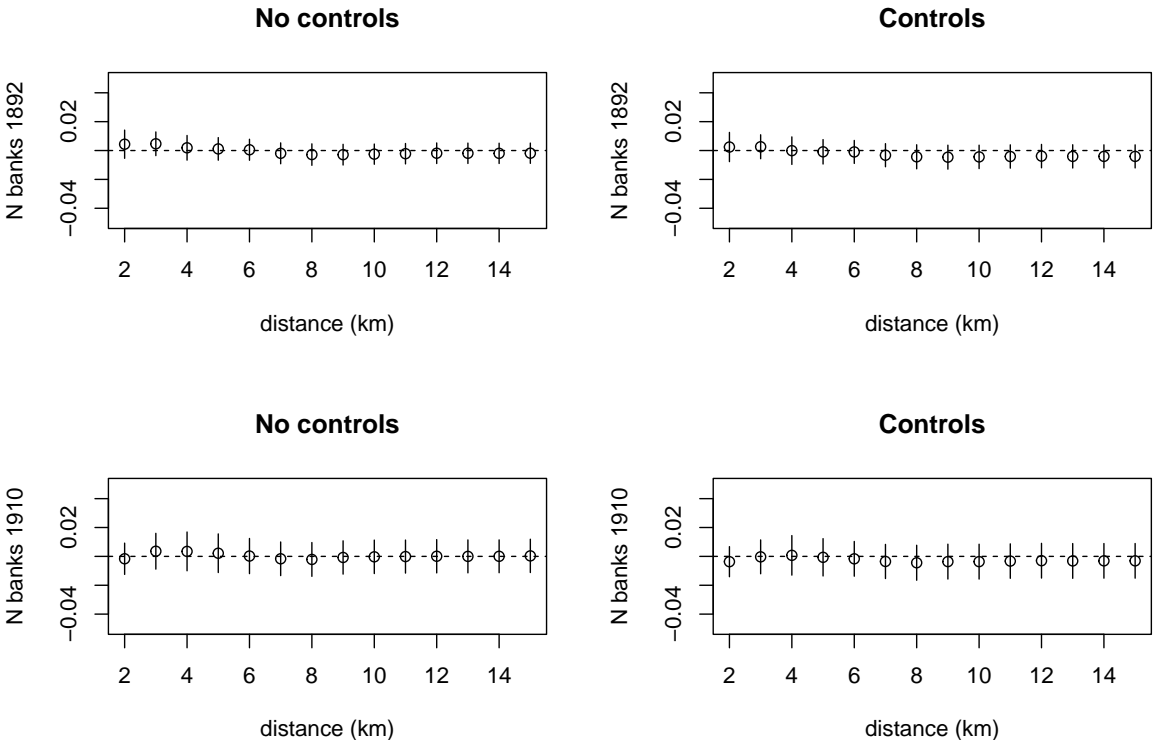*Notes:* Estimates of the effect of the central cadaster for various bandwidtsh around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects. All models controls for distance to department and arrondissement capitals, canton area, commune area, distance to forests and terrain ruggedness.

Figure A.27: Centralized cadaster and agricultural productivity in the long run



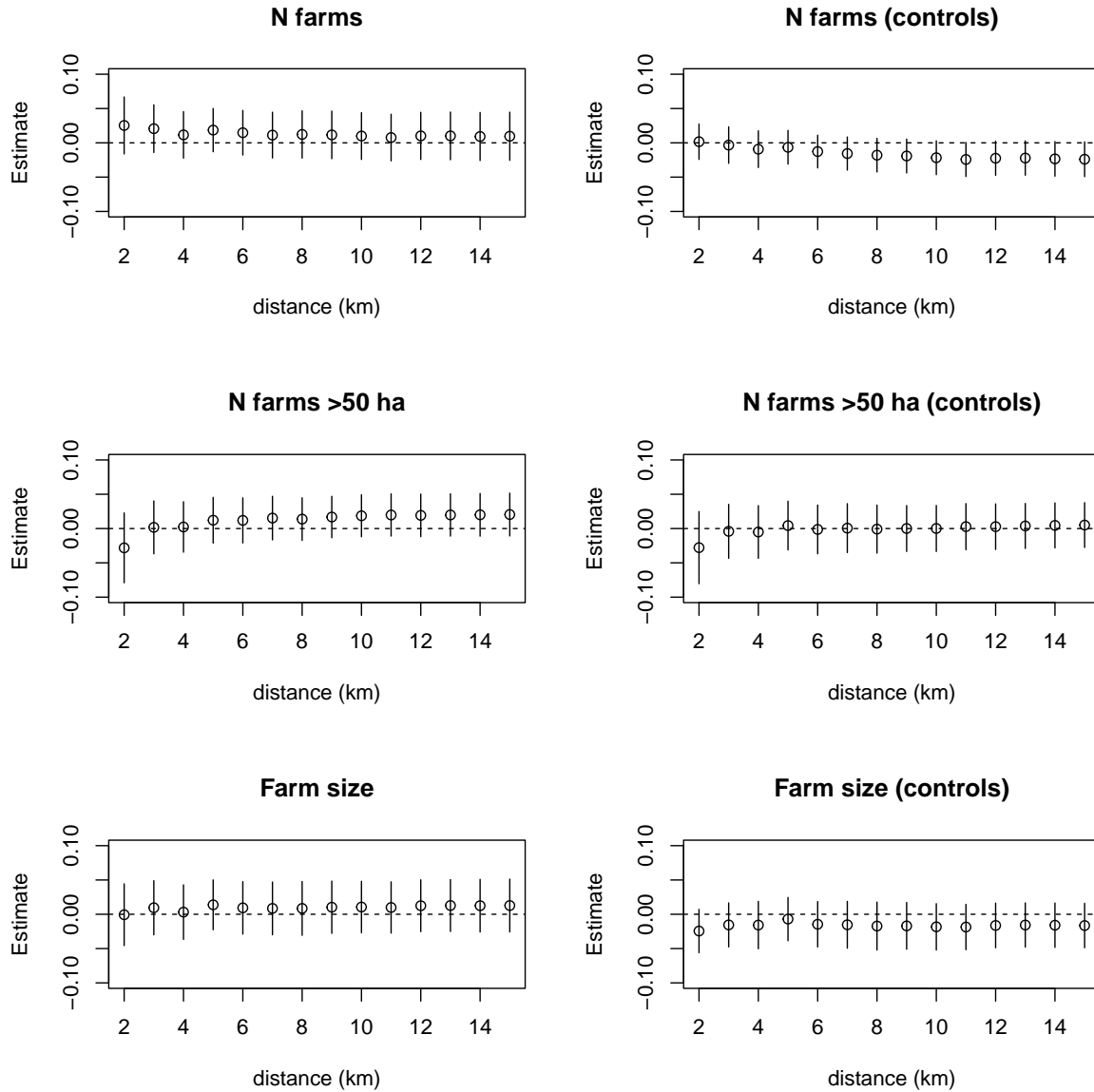*Notes:* Data from the 1962 agricultural census (from Piketty and Cagé (2023)). Estimates of the effect of the central cadaster for various bandwidths around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects. Models on the right also control for distance to department and arrondissement capitals, canton area, commune population and area, distance to forests and terrain ruggedness.

Figure A.28: Centralized cadaster and local fiscal capacity in 1881: alternative measures



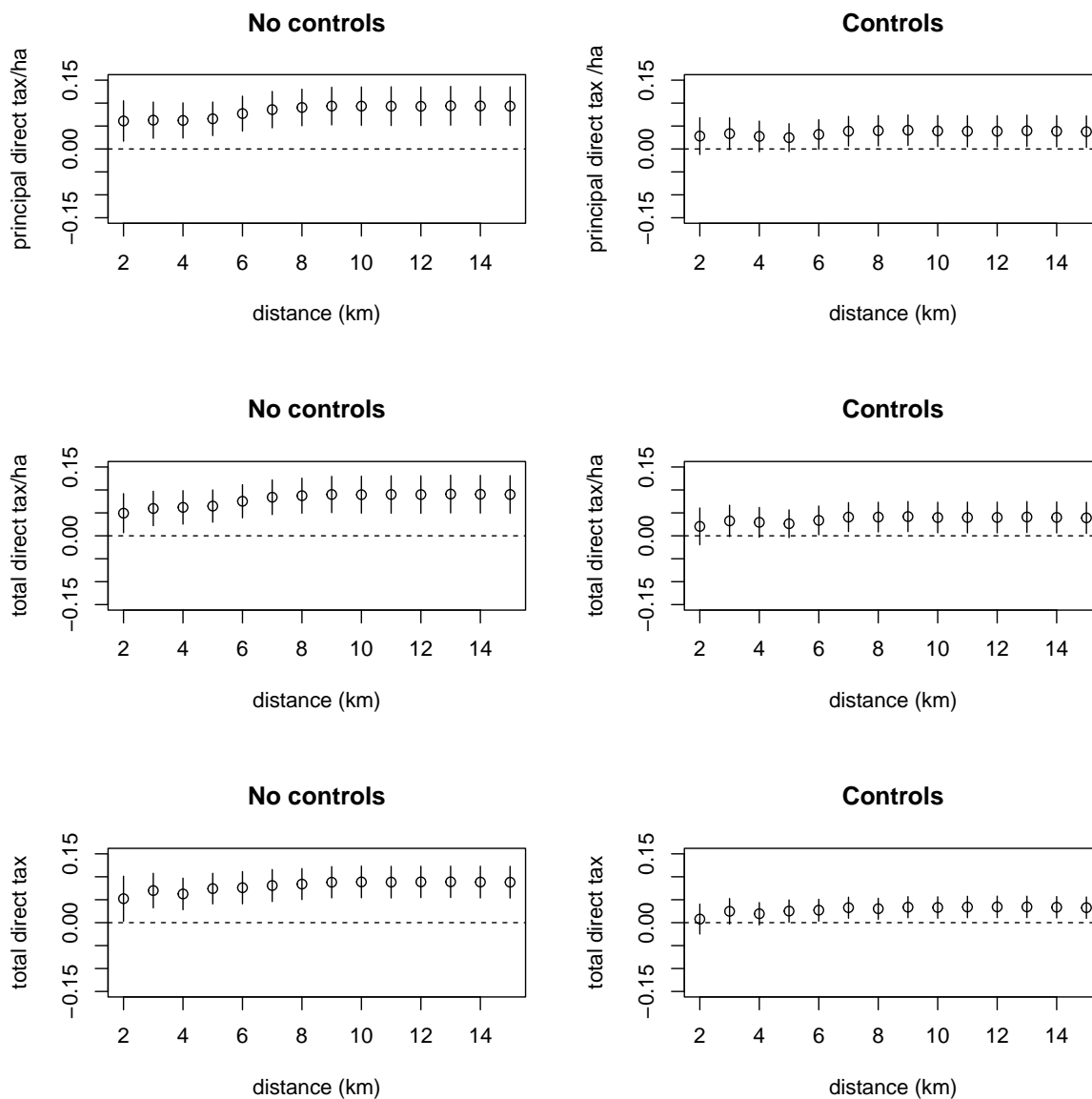*Notes:* Data from the 1962 agricultural census (from Piketty and Cagé (2023)). Estimates of the effect of the central cadaster for various bandwidths around the boundary between treated and control cantons (central vs local cadaster). All models control for latitude/longitude interactions and canton pair fixed effects. Models on the right also control for distance to department and arrondissement capitals, canton area, commune population and area, distance to forests and terrain ruggedness.

# 8 BUILDING THE CADASTER TIMING DATASET

The almost entirety of the Napoleonic cadaster was digitized during the mid-2000s and is available on the websites of departmental archives.[22]. Websites typically allows to search for a commune and visualize its cadaster. Data collection was done through web-scraping, copying or manual entry, depending on the structure of the websites.[23].

To build the canton-level dataset, I matched each commune to its 1807 canton using administrative and geographic data on communes from Motte and Vouloir (2007).[24] I verified that communes of the same canton are cadastered at close dates, as indicated by official sources as well as secondary literature. I manually checked all cantons whose communes appeared to be cadastered at very distant points in time. This allowed to identify some errors in the indexation of maps by the departmental archives. I also cross-checked the obtained dates with a 1817 cantonal map showing the progress of the cadaster.[25] The obtained commune-level data is then aggregated at the canton level, mainly because around 10% of the outcome data is only available at the canton level, but also to minimize measurement error (individual commune dates are often unreliable) and missing data problems.

In general, I infer the selection year by taking the minimum of all commune-level dates of completion of surveying in a given canton and substracting two years (see Table A.4).

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[22]See https://francearchives.fr/fr/article/26287472 for the list of departments and links to their respective digitized cadaster.

[23]The missing contemporary departments have either not digitized the maps (Aude and Ariège), not digitized the pre-1821 cadaster (Eure), or were not part of France during the whole period (Savoie and Haute Savoie, Alpes Maritimes).

[24]Motte and Vouloir (2007) provide exact information on canton composition, but not on canton spatial boundaries, which are only available for the years 2000s. Canton-level measures of spatial variables are therefore averages of commune-level data.

[25]Map by Alexis Donnet: https://gallica.bnf.fr/ark:/12148/btv1b53100219p.

Table A.4: Treatment definition for a canton treated in year $t$

| Year | Steps | Data availability | Treated |
|------|-------|-------------------|---------|
| $t-1$ | Canton is designated to be cadastered | No | No |
| $t$ | Demarcation of commune boundaries | Partial | Yes |
| $t+1$ to $t+k, k \geqslant 0$ | **Surveying within communes** | Yes | Yes |
| $t+k+1$ | Expertise and valuation | No | Yes |
| After $t+k+1$ | Cadaster is completed and used for taxation | No | Yes |

## 9    INFORMATION ON CADASTRAL OPERATIONS

A detailed set of instructions guided the implementation of the central cadaster. They were gathered in the *Recueil Méthodique*, published in 1811 by the Finance ministry (Clergeot, 2007). There are two main steps:

- **Surveying:** In October, the prefect designates one or two cantons to be cadastered. In the following year, commune limits are surveyed and any conflict over boundaries is addressed. The next year, the individual surveying process begins within communes. The unit of analysis is the plot, corresponding to each landowner/land use combination (cultivated lands of various crops are distinguished, as well as private or public buildings, gardens, forests, wasteland, marshes, etc).

- **Valuation:** Once surveyors have finished mapping the communes, an expert is tasked with the classification of each individual plot on a scale of one to five on the basis of agricultural suitability for the given type of culture. A price is then set for each class of land quality, on the basis of preliminary research on local land rental prices

and food prices. Each commune-level price is then harmonized if necessary by the inspector of contributions, another department level fiscal bureaucrat. See Figure A.29 for illustrations of the obtained documents.

Figure A.29: Example of Napoleonic cadaster: surveying and valuation
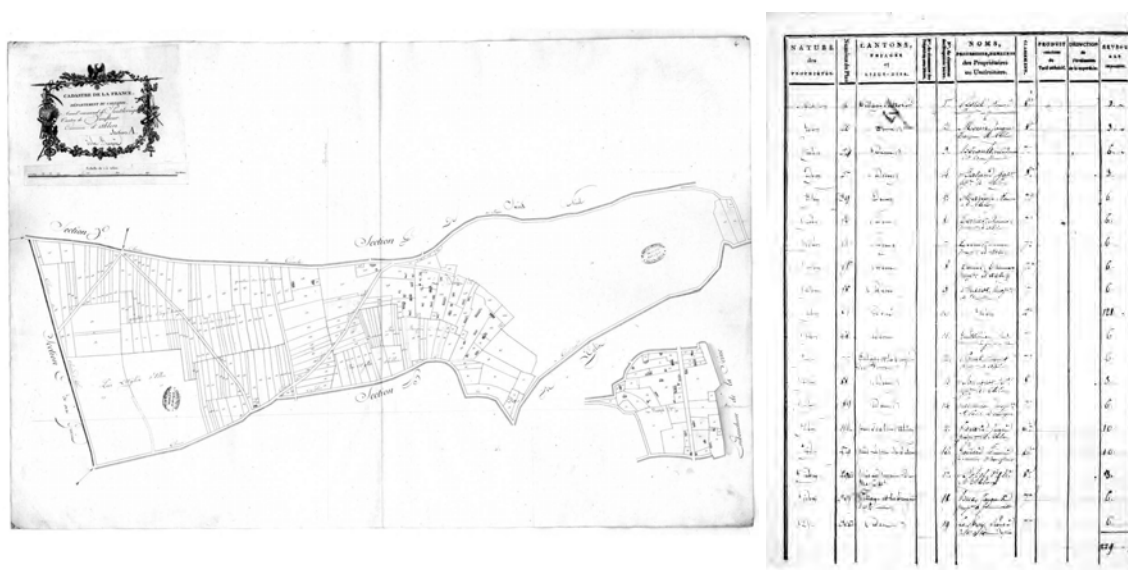


*Notes:* Extracts of the cadaster of Ablon (Calvados department), established in 1808. Left: section A of Ablon, with individual plots of land. Right: name of landowner, land classification, taxable income (*état de section*). Source: Archives Départementales du Calvados.

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There are two crucial features of this process. First, it is fully controlled by the central state: all the main responsible actors are directly appointed by either the Finance ministry (director of contributions, head surveyor, inspector) or the government (prefect). They are also all based in the department capital. The experts in charge of valuation are appointed by the prefect, must not have properties in the cadastered canton and their work is ultimately reviewed by the central bureaucrats. Local mayors only have a consultative role.[26]

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[26]Local mayors were appointed by prefects or the government for towns of more than 5,000 inhabitants, but at least they had to be living in the locality and thus had greater local knowledge

Second, this was not a fully objective measurement of income from land: the valuation of land, arguably the most important step, was left to the appreciation of external actors with limited information. For instance, the appointed expert was instructed to rely on local land rental prices as well as food prices (the *mercuriales*) but those were not systematically collected everywhere. In the event of contradictory or incomplete information the expert was instructed to use approximation to obtain a unique commune-level price[27] (Hennet, 1811, §586).

Even if the within-commune valuation was accurate, the final harmonization across communes of the same canton could raise serious problems in the presence of substantial variation in land quality. This task was left to a department-level official: in his final report, he was tasked to "present all the views which seems suitable to establishing the most perfect proportional equality between communes" (Hennet, 1811, §759). It is rather unclear how such an harmonization could be objectively determined in the absence of local knowledge.

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[27]In the handbook of instructions, there are more than a hundred pages devoted to the valuation of land. Instructions distinguish more than thirty particular cases (for instance, vine was particularly difficult to value due to the large initial investement).

## 10  STATUS QUO LAND TAXATION

There is no systematic data on French land inequality during the period of interest, but scholars agree that small landownership was widespread in France, notably in comparison of England. Béaur (2005) estimates that peasants owned between 40 and 45% of the land at the end of the Ancien Régime. These figures constitute a lower bound for the 19th century given the confiscation and redistribution of noble and clergy land (Bodinier and Teyssier, 2000). According to census data, there were about 10 millions land plots in 1815 (property owned by the same individual in one commune) and about 6 millions adult men. Given that some owned property in many localities, this indicates that most households owned at least some property, even if it was often too small to make a living.

Due to low information on land value, the land tax was therefore not collected as a proportional tax, but as a fixed tax amount that was distributed every year between administrative levels.[28] At the lowest level, within communes, local authorities allocated the tax burden among citizens. Such a system mechanically created heterogeneous effective tax rates.

Administrators and politicians argued that the status quo system raised many complaints and made tax collection difficult. For instance, a legislator complained that "instead of tightening the bonds of fraternity between individuals, [the land tax] threw among them a new seed of discord and division" (cited in Marion (1919)). In September 1797, all departments still had tax arrears of at least 10%, reaching almost 60% in some of them.[29]

This status quo system created geographic and individual inequality. On the geographic side, under-valuation of land in some localities led mechanically to a greater burden in others. Quantifying pre-cadaster geographic inequality is difficult given that low information was precisely the problem, but aggregated data from the cadaster in

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[28]This mode of tax collection was inherited from the Ancien Régime. See Slivinski and Sussman (2019) for an analysis of the advantages of such a system when the state has low information on taxpayers.

[29]"Tableau général de la Situation des Contributions Directes", National Archives AF/III/120.

1817 provides an idea of the magnitude of the discrepancies in effective tax rates: among cadastered cantons, tax rates ranged between 8.3% and 20%, with minimal and maximal individual tax rates[30] respectively 0.2% and 91% (Hennet, 1817). Partial canton-level data from Schnerb (1933) and Delestang (1803) on the Puy-de-Dôme and Orne departments also illustrates that the authorities were not even attempting to maintain the fiction of a fixed tax rate, as the rate of tax amount on estimated revenue varied considerably.[31] See Figure A.30 for an illustration of how the commune pre-cadaster fiscal burden maps to agricultural suitability. Table A.5 shows the correlates of effective tax rates in a sample of 106 communes: fertility is negatively correlated with the maximum tax rate, indicating that more fertile places are less taxed, at the expense of less fertile places.

I was unable to find direct evidence on individual inequality within communes, but it was an important motivation for the creation of the cadaster. Minister of Finances Gaudin writes that it was at this final level of tax distribution that "were prevalent particular interests, family connections, friendships, animosity, partiality against the nobles, the rich, the non-resident." (Gaudin, 1826).

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[30]Unfortunately only the lowest and highest tax rates are reported in Hennet (1817), so we do not have information on how many citizens are at the upper and lower tail of the distribution. By using this data source I also assume that the cadaster was overall correct in its assessment of the actual fiscal burden.

[31]Schnerb (1933) interprets these discrepancies as reflecting a biased allocation of the fiscal burden by departmental authorities, but it could be the authorities compensating for revenue undervaluation.

Table A.5: Determinants of status quo individual tax rates in 108 communes (1806)

| | *Dependent variable:* | | |
|---|---|---|---|
| | min. tax rate | max tax rate | max-min tax rate |
| | (1) | (2) | (3) |
| log pop. | −0.013*** (0.005) | 0.011 (0.022) | 0.024 (0.023) |
| area | 0.002 (0.003) | −0.0001 (0.014) | −0.003 (0.015) |
| caloric suitability | −0.003 (0.003) | −0.042*** (0.015) | −0.039*** (0.014) |
| admin. capital | 0.004 (0.003) | −0.026* (0.014) | −0.031** (0.014) |
| dist. pref. | −0.003 (0.004) | 0.005 (0.021) | 0.008 (0.022) |
| dist. sub-pref. | −0.008*** (0.003) | −0.003 (0.021) | 0.005 (0.021) |
| dist. brig. | 0.011** (0.005) | 0.039 (0.024) | 0.028 (0.026) |
| dist. roads | −0.002 (0.003) | −0.021 (0.029) | −0.019 (0.029) |
| average tax | 0.026*** (0.005) | 0.013 (0.012) | −0.013 (0.012) |
| Mean dep. var. | 0.06 | 0.33 | 0.27 |
| N dept. | 47 | 47 | 47 |
| N cant. | 89 | 89 | 89 |
| Observations | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.334 | 0.044 | 0.051 |

*Notes:* *p<0.1; **p<0.05; ***p<0.01. Data on the range of effective land tax rates from preliminary cadaster conducted in 108 communes. Source: (Oyon, 1804).

Figure A.30: Pre-cadaster taxation and agricultural suitability at the commune level in three departments
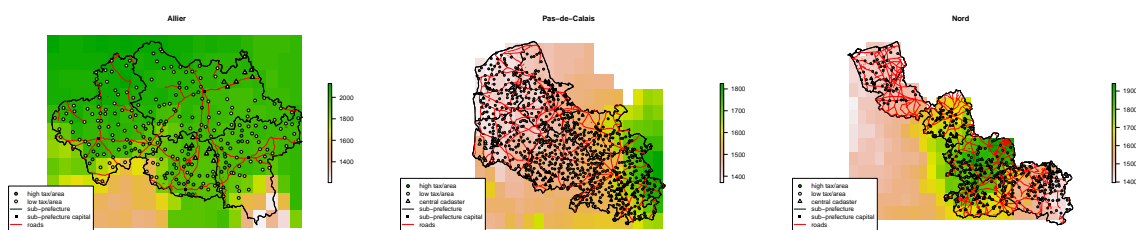


*Notes:* Pre-cadaster commune-level data on taxation is available for three departments. I include only rural communes with population below 1,000, so that commune area is a good proxy of agricultural land. Allier: 1793 land tax, 266 observations. Pas-de-Calais: 1807 direct taxation. Nord: 1807 land tax, 386 observations. Caloric suitability index from Galor and Özak (2016).

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