The Effects of Land Redistribution: Evidence from the French Revolution *

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Abstract: This study exploits the confiscation and auctioning off of Church property that occurred during the French Revolution to assess the role played by transaction costs in delaying the reallocation of property rights in the aftermath of fundamental institutional reform. French districts with a greater proportion of land redistributed during the Revolution experienced higher levels of agricultural productivity in 1841 and 1852 as well as more investment in irrigation and more efficient land use. We trace these increases in productivity to an increase in land inequality associated with the Revolutionary auction process. We also show how the benefits associated with the head-start given to districts with more Church land initially, and thus greater land redistribution by auction during the Revolution, dissipated over the course of the nineteenth century as other districts gradually overcame the transaction costs associated with reallocating the property rights associated with the feudal system.

Keywords: Institutions, Property Rights, French Revolution, Coase Theorem

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1 Introduction

The literature dealing with the long-run impact of institutions on economic growth has shown the importance of property rights in land (Acemoglu et al., 2001; Rodrik et al., 2004; Doepke and Zilibotti, 2005; Banerjee and Iyer, 2005; Ramcharan, 2010; Fenske, 2011; Heldring et al., 2015). For instance, research on England around the time of the Glorious Revolution suggests that lowering the transaction costs of reallocating property rights increased investment in road projects (Bogart and Richardson, 2009; Bogart, 2005). However, there is a growing recognition in the literature that simply adopting a set of *de jure* institutions which better define rights, will not necessarily lead to a superior allocation of property in the short-run. Reallocation may either be blocked by incumbents (Acemoglu et al., 2009) or transaction costs may be large enough to prevent the Coase Theorem from leading to the optimal allocation of land (Libecap and Lueck, 2011; Bleakley and Ferrie, 2014).[1]

An historical case of land reallocation whose consequences can be traced over time occurred during the French Revolution. On the 2nd of November 1789, in the midst of the early enthusiasm for Revolution and to solve the fiscal crisis of the Monarchy, the French Constituent Assembly passed a law to confiscate all Church property and to redistribute it by auction. Over the next five years more than 700,000 ecclesiastical properties—about 6.5% of French territory—were sold in what one historian termed the 'most important event of the Revolution' (Lecarpentier, 1908; Bodinier and Teyssier, 2000). In selling the extensive property holdings of the Catholic Church, the Revolutionaries were doing much more than raising funds—they were dismantling one of the fundamental institutions of the feudal era. The destruction of the Church went part and parcel with the abolition of other feudal institutions, such as noble privileges, which were blamed by both contemporaries and subsequent observers for the stagnation of the Old Regime economy (Young, 1929; Rosenthal, 1992). The institutions adopted by the Revolution, by contrast, are often credited for much of the economic success both within France and abroad in the nineteenth century

[1] On the interpretation of the Coase Theorem and the importance of the initial allocation of property rights when transaction costs are large see McCloskey (1998).

(Grantham, 1997; Acemoglu et al., 2011).

This study is closely related to two strands of the literature on the roots of long-run comparative development (Spolaore and Wacziarg, 2013; Nunn, 2014). First, it builds upon research dealing with the impact of equality on subsequent economic growth: Galor and Zeira (1993) and Galor and Moav (2004) argue that equality is not conducive to economic development when growth is driven by physical capital accumulation but fosters it when growth is driven by human capital accumulation.[2] Second, this study is related to the literature that focuses on the economic impact of land reform. On the one hand, studies by, e.g., Besley and Burgess (2000), Binswanger et al. (1995), Goldstein and Udry (2008) and Fenske (2011), have argued that land reform schemes can be beneficial to agricultural productivity. For instance, Besley and Burgess (2000) analyze the effect of land reforms in India from 1958 to 1992 and find that states with a greater share of land redistribution experienced a decline in poverty and a rise in agricultural wages. On the other hand, several studies show that land reforms in various countries and historical settings, i.e., in 19th century Sicily (Bandiera, 2003), in Mexico in the 1910s (Dell, 2012) or in Spain in the 1930s (Domenech and Herreros, 2017), can have detrimental effects on economic growth by increasing internal conflict and corruption.

In this paper we exploit the extensive spatial variation in confiscations of Church property during the Revolution to investigate the importance of the initial allocation of property rights for the success of institutional reform. The redistribution of Church land during the French Revolution offers a valuable case study in institutional change for several reasons. First, all regions experienced the *de jure* institutional reforms of the Revolution at the same time but not all regions were endowed with the same amount of Church property in 1789. They thus experienced different amounts of redistribution. Given the importance of Church property holdings in agriculture, we focus on outcomes in this sector in the years following the Revolution. In so doing, we contribute to the growing literature on the long-run impact of land reforms by investigating a clear-cut case where

[2]Building on this research, Oto-Peralias and Romero-Avila (2016) argue that the unequal concentration of political and economic power that arose from the Reconquista across Spanish provinces had negative consequences on GDP per capita in 2005.

all regions were subject to the same improvement in property rights but where only a subset of regions had the transaction costs of reallocating property rights lowered. Second, unlike many other instances of land reform where equality of holdings was the goal, the Church lands confiscated during the Revolution were auctioned off to the highest bidder, thus giving us the opportunity to test the importance of a market mechanism in allocating rights. Third, the transition from the overlapping set of property rights associated with French land markets during the Old Regime to the better defined property rights of the nineteenth century was a huge shift which should have, in theory, led to significant efficiency gains in agriculture. Research surveyed by Grantham (1997, p. 389) indeed found that productivity in agriculture did increase a great deal in France between 1789 and 1870. However, Grantham (1997) also notes that productivity gains were about twice as great after 1840 as during the years immediately following the Revolution. Our study explains this gradual increase in agricultural productivity by showing how districts with a better initial allocation of land benefited more from the institutional reforms of the Revolution.[3]

Our empirical analysis builds on the highly disaggregated data collected by Bodinier and Teyssier (2000) on Revolutionary confiscations of Church lands which we combine with data from detailed agricultural surveys in 1841 and 1852. We conduct our study at the district level, of which there were 534 in 1789. We possess detailed data on confiscations and nineteenth century agricultural outcomes and inputs for 194 of these districts. The endowment of these districts with ecclesiastical property varied between 0% and 40% (mean= 6% with sd = 5.9%).

One potential source of concern for us is that the initial distribution of Church land might be correlated with some other factor which also influenced nineteenth century agricultural outcomes. For example, the Church might have acquired superior land or was more likely to maintain the land during the Old Regime. We adopt several strategies to minimize the impact of such, potentially confounding, effects. First, we condition our regressions on measures of the potential suitability of

[3]It is unclear whether the political strength of the French peasantry can provide a convincing explanation for our results. This is because the censitary suffrage that existed in France between 1815 and 1848 excluded peasants from the political system. In fact, during this period, several legal reforms were passed (e.g., the *Code Forestier* in 1827 that limited the use of forest areas or the *Permis de Chasse* in 1844 that established a license for hunting) that reneged on some of the rights that peasants had acquired during the Revolution (see, e.g., Barral (1968)).

a district's soil and climate for wheat agriculture using data from the FAO (Fischer et al., 2002). Second, we control for the initial embeddedness of each district in the Old Regime market system, and thus the potential returns to investing in agriculture, by constructing measures of market access for each of the districts in 1789 (Donaldson, 2016). Third, in our preferred specifications we include twelve region fixed effects and, therefore, identify on the within variation in each of these regions. Fourth, we undertake a placebo analysis using potato yields as the historical evidence suggests that potato production should have been less affected by the investments in agriculture which we identify for wheat production. Fifth, we implement an instrumental variables strategy based on the premise that centers of Church administration, proxied by seats of bishoprics, were more likely to prevent Church lands from falling into the hands of secular landowners during the medieval period. We show that proximity to one of these bishoprics, mainly established before the twelfth century, is a highly relevant instrument for the amount of Church land in a district in 1789.

In both our fixed effects and IV regression results we find significant effects on agricultural productivity and agricultural investment in 1841 and 1852 in regions where more Church land was redistributed. Specifically, wheat yields, investments in irrigation and drainage, and intensity of exploitation (as proxied by percent land left fallow), were all higher in regions with more Church land initially. To explain these outcomes, we provide evidence that there was more land inequality post-Revolution in the regions where there was more redistribution and investment (Galor and Moav, 2004). Lastly, we show that the beneficial effects of Revolutionary land redistribution on agricultural productivity gradually declined over the course of the nineteenth century. This is consistent with other districts gradually overcoming the transaction costs associated with reallocating the property rights associated with the feudal system. As such, this study provides a complementary perspective to the paper of Franck and Michalopoulos (2017) on the consequences of the French Revolution. Their study suggests that emigration, which mainly occurred in 1793-1794 during a radical turn of the Revolution and after the Church land had been auctioned, led to a more egalitarian distribution of land and had detrimental consequences on agricultural productivity in the short-run but enabled more investments in human capital in the long-run. In this study, the focus on 194 districts located

in 62 departments (the administrative subdivisions of French territory) where emigration was lower than the national average enables us to analyze the impact of Church land redistribution which overcame transaction costs but maintained the relative unequal distribution of land which existed before 1789.[4]

Overall, our results suggest that the benefits of institutional reform depend a great deal on the transaction costs faced by economic agents. Furthermore, as the Coase Theorem implies, when transaction costs are high, the initial allocation of property rights matters a great deal for whether efficient outcomes will be achieved. The auctioning-off of Church land during the Revolutionary period gave some regions a head-start in reallocating feudal property rights and adopting more efficient agricultural practices.

The remainder of the paper proceeds as follows. In Section 2 we review the historical background of property rights in land before and after the revolution as well as review how the Revolutionary land redistributions took place. In Section 3 we describe our data. In Section 4 we discuss our empirical strategy. We present and discuss our results on agricultural outcomes in Section 5 and in Section 6 we provide evidence on the mechanism that drives our results—increased concentration of landholdings in places with more land redistribution. In Section 7 we conclude.

2 Historical Background: The Church's Property and Revolutionary Consfications

The French Revolution generated tremendous change in both *de jure* political institutions and *de facto* economic relations. In this section, we provide some background on the institutions associated with agricultural property rights and Church wealth before and after the Revolution. We also discuss how Church wealth was redistributed during the Revolution.

[4]The data on emigration during the Revolution collected by Greer (1951) suggest that the average share of *émigrés* in the population of the 84 departments was equal to 0.47% (with a standard deviation of 0.64). The average share of *émigrés* in the 62 departments in our sample is equal to 0.44% (with a standard deviation of 0.63) while the average share of *émigrés* in the 24 departments which are excluded from our sample is equal to 0.53% (with a standard deviation of 0.68).

2.1 Property Rights in Land Before and After the Revolution

Pre-Revolutionary France was characterized by feudal property rights which were overlapping. Consequently, this significantly raised the transaction costs of reallocating land or making investments in drainage, irrigation, or re-organizing production more generally (e.g. by enclosing fields and adopting more efficient crop rotation systems).[5] Rosenthal (1992) explores in detail how pre-revolutionary France was characterized by a complicated and overlapping system of feudal property rights which, combined with the convoluted judicial process further raised the transaction costs of investment. For example, Rosenthal (1992) describes how rights over the commons was often uncertain and contested between landowners (e.g. nobles or the Church) and peasants. Furthermore, he shows how the Crown often conspired to maintain this equilibrium in an attempt to stave off the growing power of the nobility.

It was not simply that property rights were overlapping in eighteenth century France. What also prevented investment and land sales was the sheer number of privileges that would have had to be renegotiated with any transaction. Furthermore, the Church did not even need to own the land for it to have a stake in any potential sale. As McManners (1999, 106-108) explains, patterns of land-holding were "fantastically complicated... most property was in some way subject to feudal obligations, and part of the vast inheritance of the Gallican Church was its feudal dues from lands it did not own, but were within its fiefs and seigneuries." These rights could include the *cens* (a quit-rent), a tax on crops known as the *champart*, taxes to use the mill or stud a bull called *banalités*, or a toll on a road or river. McManners (1999, 106-108) gives the example of the Bishop of Lodève who possessed a *droit de pulvérage* on flocks of birds transiting his lands, the right to impart a fine on those who made doors or windows in the old city walls, and a *droit de coupe* on foreigners who wished to sell grain inside the city walls.[6]

There is no doubt that, like the nobility, the Church took the preservation and assessment of their

[5] On the legacy of feudalism in France and overlapping property rights see Mousnier (1979) and Bloch (1964, vol. 2, chapters 32 and 33).

[6] As evidence that these rights could be transferred, the city of Lodève purchased the Bishop's *droit de coupe* for 600 livres a year. However, there is no doubt that the transaction costs of consolidating all rights were formidable.

feudal rights very seriously. McManners (1999, 109) notes that, "Since the late seventeenth century, antiquarian studies had been flourishing; now, delving in the archives became an occasion of profit. Technical handbooks were published on the art of checking on the past history and present legality of feudal incidents, and *feudistes* arose, professional researchers who were paid by results. One such was appointed by the chapter of Sainte-Radegonde of Poitiers in 1785: a *feudiste-géographe*, to be paid 2,000 livres a year for six years, and half of all sums he recovered."

There were substantial conflicts over property rights in pre-revolutionary France which were slow to be adjudicated. Consequently, French agricultural institutions experienced only marginal changes during this period.[7] This situation changed dramatically during the early days of the Revolution when, on 4 August, 1789, the Constituent Assembly voted to abolish the feudal system. This included the elimination of all seigneurial rights, tithes and, eventually, the dismantling of the judicial system. Rosenthal (1992, p. 95) identifies two of the key institutional changes which made investments in agricultural—such as drainage or irrigation projects—more likely to succeed after the Revolution. First, the massively increased power of the executive to override local objections to projects and second, the loss of jurisdiction of the judiciary over many economic issues. Taken together, these two changes drastically reduced the likelihood that a judicial appeal against a transaction or investment project would succeed. Rosenthal (1992, p. 96) also emphasizes the role of the confiscation and subsequent redistribution of Church land in lowering the transaction costs of making agricultural improvements.

Hence, the abolition by the Revolutionaries of the Old Regime's feudal institutions as well as Napoleon's establishment in 1804 of the *Code Civil* resulted in formal institutions more conducive for investment and economic growth (Crouzet, 2003; Acemoglu et al., 2011). In this respect, McPhee (1999) and Plack (2006) document that the agrarian reforms after 1789 fostered the growth of viticulture. Both McpPhee (1999) and Plack (2006) are keen to emphasize that the privatization of

[7]It is beyond the scope of this study to analyze the evolution of French agriculture during the 18th century and the Revolution. Seminal studies on this issue include Lefebvre (1924); Labrousse (1933); Ado (2012); Jones (1988). There were some changes, for example an enclosure movement supported by the Monarchy and progressively implemented by the local Parliaments which seems to have triggered some gains in productivity (Vivier, 1998).The first enclosure law was adopted in the *Trois-Evéchés* province on 12 June 1769 while the last one was passed on 30 March 1781 in the *Cambrésis* province.

common land enabled peasants to obtain well-defined plots of land on which they could develop their own small but profitable vineyards. Nonetheless, McPhee (1999, p.197) also acknowledges that in the region of Corbières in the South-West of France, the revolutionary auctions of Church property were dominated by wealthy individuals who also benefited from well-defined property rights. This explains that by 1830, the region was characterized by the presence of wealthy wine growers and merchants from the families that had acquired land during the Revolution. McPhee (1999, p. 194) notably mentions the successful Lignères brothers who grew wine over 25 hectares and had built a distillery in the borough of Ferrals-les-Corbières.

However, the enforcement of the *Code Civil* after 1804 was not complete and there remained significant transaction costs associated with land redistribution.[8] There is also substantial evidence that in early nineteenth century France the laws delineated by the *Code Civil* were not applied across all regions and that pre-revolutionary legal traditions often prevailed (e.g., Soboul (1968)). The adjudication of property rights immediately following the Revolutionary period remained a complicated process, whether it involved the lease of commons held by French municipalities (Vivier, 1998) or water management and land irrigation (Ingold, 2011). Selling land was still costly and this led to the creation of a large market in land rents that enabled the continued existence of open-field farming in the North of France for much of the nineteenth century (Grantham, 1980). In line with the analysis of Tocqueville (1856), these inefficiencies can partly be explained by the existence of an overarching, and often inefficient, state bureaucracy.[9] Consistent with the evidence that we will find below, it was only in the second half of the nineteenth century, with the completion of the cadastre which delineated plots of land in each department (Bloch, 1929), that property rights became sufficiently easy to define and enforce that many land transactions took place.

[8]Our argument concerning the *implementation* of the *Code Civil* is different from the well-known arguments that it is less flexible and, therefore, less conducive to economic growth than common law (see, e.g., La Porta et al. (1998), for a survey). There is actually little evidence that, at least in the early years of its implementation, the *Code Civil* was inferior to common law. For example, Le Bris (2017) finds that during the 1801-1821 period the adoption of the *Code Civil* had little economic impact in the French regions where common law was used before the Revolution, notably in matters of property inheritance.

[9]Thinkers of a different persuasion than Tocqueville also noted the existence of an inefficient bureaucracy in mid-nineteenth century France. For instance, Marx (2008) wrote that the administration in France was a "parasitic body which enmeshes the body of French society and chokes all its pores".

Overall, the 1789 Revolution brought about an undeniable simplification of the *de jure* legal system in France which resulted in a clearer delineation of property rights. However, consistent with work by Bleakley and Ferrie (2014) on nineteenth century Georgia and Libecap and Lueck (2011) on nineteenth century Ohio, the existence of high transaction costs may have prevented an immediate reallocation of land away from the inefficient usages associated with the feudal system towards a distribution more conducive to investment in modern agricultural practices.

2.2 Ecclesiastic Wealth and Revolutionary Confiscations

Estimates of the amount of land owned by the Church before 1789 range between 6 percent (Sée (1968)) and 10 percent (Lefebvre (1947)). There was also a tremendous amount of variation across regions. For example, the fraction of land owned by the Church within towns could vary from as large as one third in Toulouse to three percent in Limoges.

Agricultural property served as a major income stream for ecclesiastical institutions. It was common for sizable plots of Church land to be leased out to rural laity, and in some cases to entrepreneurs, who would then sublet the land. This often resulted in the fractionalization of landholdings into small, separated, plots which were not conducive to incentivizing investment. For example, in Caudebec, where the Church owned about 5% of the land, there was at least one Church plot in 132 of the 136 parishes.

In addition to the transaction costs discussed above due to feudal privileges, the Church also faced some unique challenges when it came to property transactions. One of the most important of these was a policy known as *mortmain*, under which Church property could not be alienated before a lengthy legal procedure which required the King's agreement.[10] The sale and purchase of property owned by ecclesiastics was thus possible, but at a sizable cost which likely hindered entrepreneurs wishing to partake in investment projects. Thus, when the archbishop of Aix sought to sell half his properties in 1782, he required special permission from the courts to do so. Likewise, Church

[10] As discussed by McManners (1999, p. 115), the transfer of Church property required an an enquiry *de commodo et incommodo* which entailed the authorization of the local judges of the Crown. Furthermore, for the largest sales, letters patent had to be registered from the relevant Parliament.

property owners were forbidden from clearing land or acquiring new lands without an explicit enquiry, and eventual act of permission, from the court.

Nonetheless, there is ample evidence that the Church did often act as a rational, profit-maximizing, property owner. Clergymen were not incompetent but the institutions of the Old Regime prevented them from making sound investments. When agricultural societies were being founded in the second half of the eighteenth century, members of the Church were prominent in their organization and membership. For example, the abbé François Rozier published a textbook on botany for the Royal Veterinary School in 1766 which took first prize at the Royal Agricultural Society of Limoges in 1770 and the Society of Lyon in 1787 (McManners, 1999, 104).[11]

The Revolutionary auctions quickly redistributed Church property into the hands of those willing to pay. In November 1789, the National Constituent Assembly passed legislation that declared all ecclesiastical property to be at the disposal of the Nation and, beginning in December 1790, local governments began to auction off these properties. Auctions were largely conducted by local governments (i.e., districts, cantons and municipalities) but were regulated by guidelines established by the National Constituent Assembly. In addition to outlining procedures for the actual auction itself, the guidelines called for a survey of the property that was to be sold in order to establish an initial bidding price at auction. We exploit these surveys in some of our robustness regressions in Section 7.

In an extensive accounting of the characteristics of the sale of these properties during the Revolution, Bodinier and Teyssier (2000) divide the properties into two groups of different "origins". The properties of first origin refer to properties owned by the Church while the properties of second origin refer to the properties owned by the *émigrés*, i.e., those individuals who left France during the Revolution, either out of fear or ideology (or both) (Greer, 1951; Duc de Castries, 1966).

We focus primarily on the first origin confiscations collected by Bodinier and Teyssier (2000) for two reasons. First, the sale of first origin properties was more straightforward than that of second

[11] In his 1763 treatise *Essai d'éducation nationale* French jurist and education reformer La Cholotais described what sorts of expertise a clergyman should possess, including being 'well informed on methods of improving cultivation and on the art of surveying" (McManners, 1999, p. 104).

origin. This is because second origin confiscations occurred at a later stage of the Revolution and were subject to more interruptions, such as the decision on November 21, 1795 (30 Brumaire, Year IV) to suspend the sales of properties for approximately six months (until May 20th or 1 Prairial of the following year). Bodinier and Teyssier (2000) provide evidence to suggest that this interruption affected second origin sales but not first origin sales given that most first origin properties were sold off at this point.[12] Second, sales of second origin included more complicated procedures that potentially would make empirical results more difficult to interpret. In particular, the families of the *emigrés* were allowed options to avoid foreclosure, which in turn prevented some confiscated *emigré* property from going to auction (Bodinier and Teyssier, 2000, p. 111,p. 140). The fraction of land confiscated during the second origin as collected by Bodinier and Teyssier may not be reflective of the fraction of land redistributed. In particular, some of the second origin land eventually became the property of the local governments (the municipalities or the department) or of the central state (see, e.g., Lefebvre (1924) and Vivier (1998)). Conversely, most of the Church properties of first origin were sold in auctions to private individuals (Bodinier and Teyssier, 2000, p. 111). In any case, we show in Section 7 that our main results are robust to including a variable measuring the percent of land confiscated in a district from the *emigrés*.

Bodinier and Teyssier (2000, p. 153) estimate that more than 1.1 million properties were sold during the Revolution with 700,000 from the first origin (i.e., about 6.5% of the French territory) (which began in 1790) and 400,000 from the second origin (i.e., about 3.5% of the French territory). The sale of the properties of first origin began in 1790 and that of second origin began in 1793. According to Bodinier and Teyssier (2000), the "most important lots" for both origins were sold early. For the first origin, 40% of all properties were sold by the end of 1791 and for the second origin, 53.9% were sold by the end of 1794.[13]

[12]Bodinier and Teyssier (2000) provide numerous anecdotal evidence to support this timing as well as quantifiable evidence in the tables on pp. 151-152.

[13]From the Revolutionaries' viewpoint, the purpose of selling Church land was to raise revenue in order to solve the financial crisis of the French state. When they realized that the auctions may take several years to complete, they issued bonds known as Assignats which could be redeemed for consfiscated property at a later date. However, they began to print more Assignats than there was property to back them and they became, in effect, a fiat currency. There is therefore no evidence that the central government recovered much for the sales of Church land, or that local governments where more Church land was sold up became richer in the long-run. In regressions available upon request, we indeed find that towns with more church land did not have more revenues in 1880 and 1900.

There is ample evidence that, initially, the Church lands were often purchased by speculators less interested in farming than in benefiting from the "frothy" land market generated by the underlying political instability of the Revolutionary enterprise.[14] Georges Duval, a contemporary Parisian notary observed these auctions and noted that, "...the contracts of sale, above all, multiplied in plain sight, and at no other time, I think, was there made an exchange so rapid of property (Duval, 1844, 96)." Bodinier and Teyssier (2000, 363-379) review the numerous regional monographs on the redistribution of land during the Revolution and conclude that the general tendency was for the resale of the auctioned-off land to result in the dismemberment of previously massive estates owned by the nobility and clergy as well as increased ownership by the peasantry. They do not, however, present data on exactly what happened to the size of plots in places with auctions compared to places without. There is no information on how many properties were bought by which individuals and to what extent land transactions after 1815 mitigated the extent of revolutionary redistribution. In Section 6 we will provide explicit evidence that, in fact, by the time of the 1862 agricultural survey—the first which contains explicit information on the scale of agricultural plots—districts that experienced more auctions of Church land had significantly larger farms—especially in the right tail of the distribution.

3 Data

In our empirical analysis, we combine district-level data on confiscations from Bodinier and Teyssier (2000) with newly collected data on agricultural productivity and investment in nineteenth century France. The term "district" refers to the first level of administrative subdivision of French departments that were established in 1790 and replaced by arrondissements in 1800. We consistently use the 1790 districts for this project and match to arrondissements when appropriate. There were 534 of these districts in 1790, of which 194 are in our sample. The average size of a district is 1129 square kilometers with a standard deviation of 478. For some of our robustness checks, we carry out our analysis at the level of the department, of which there were 62 for which we have data on

[14]The auctioned lands were originally intended to be used to back the issuance of bonds known as *assignats* used by the Revolutionary government to retire the national debt and, in part, buy-out stakeholder from the Old Regime. Eventually, the *assignats* were transformed into a fiat currency as the fiscal needs of the government increased.

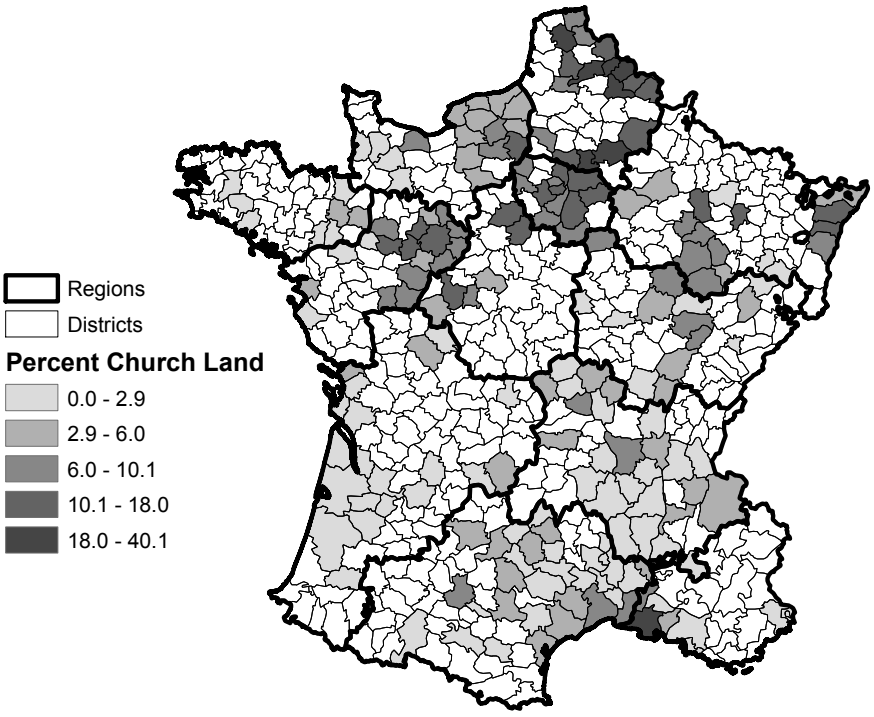

Figure 1: Land Confiscations

confiscations.

3.1 Redistribution of Church Land

Our main explanatory variable is the percent of Church land redistributed through the French Revolution in each district. Figure 1 shows the spatial distribution of these confiscations and where data are missing.

These data were collected by Bodinier and Teyssier (2000) and cover 194 out of the 534 districts created in 1789. However, Bodinier and Teyssier (2000) estimates that these 194 districts contain about two-thirds of Church land prior to the Revolution because the Church property was not spread evenly throughout France. In Appendix Section 8.2, we address concerns regarding the generalizability of our main results by showing that the characteristics of these 194 districts are largely similar on observables to the other 340 districts for which there are no data in Bodinier and Teyssier (2000).

3.2 Agricultural Productivity, Investments, and Farm Structure

In this section, we present our variables of economic activity which revolutionary confiscations might have affected in the long-run. These measures pertain to agricultural productivity, investments and farm structure.

3.2.1 Wheat Yields and Crop Rotation

Our first measure of the impact of Revolutionary confiscations on economic activity is wheat yields in 1841. We collect the yields from the *Statistique Agricole* that was published in 1842 and contains wheat yields at the arrondissement level that we then match with the geographic location of the Revolutionary districts. Figure 2 shows hectoliters of wheat produced per hectare for all of France in 1841.

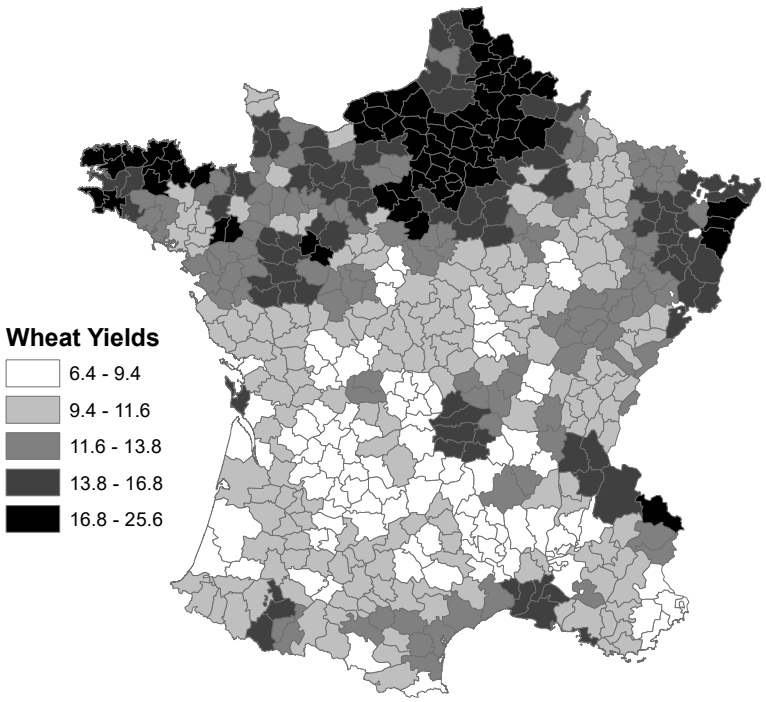

Figure 2: Wheat Productivity

As an additional measure of agricultural productivity, we take advantage of the Agricultural Survey carried out in 1852 by the French government that provides data on the share of arable land in a district devoted to fallow and the share devoted to artificial prairies. On the one hand, fallow land

is a measure of agricultural backwardness since they are a feature of the three-field system which originated in the Middle Ages with two fields planted with crops while one field was left to fallow to recover its nutrients.[15] The nineteenth century was marked by the gradual adoption of more efficient, four-field rotation systems across France. At the end of eighteenth century about 30% of arable was fallow. This dropped to 16.8% in 1852 and by 1882 was just 10.8% (Caron, 2014, p. 126).

On the other hand, artificial prairies are nitrogen fixing crops planted on arable land where wheat is usually grown (Rozier, 1809, p. 432). Unlike the share of fallow land, which indicates agricultural backwardness, the share of artificial prairies is a measure of technological innovation. By planting a nitrogen fixing crop, productivity increased on both the intensive and extensive margins.

3.2.2 19th century Investment – Pipe Manufacturers

Two of the most active areas of investment to increase agricultural productivity during the nineteenth century were drainage and irrigation projects. While we do not observe drainage and irrigation investments directly, we observe their primary input, i.e., pipe manufacturers. Figure 3 shows the geo-coded location and number of pipe manufacturers in 1862 from this dataset Barral (1862). Much like concrete today, because of low economies of scale and high transport costs, pipes were usually produced close to their point of consumption in the nineteenth century (Maurel and Sédillot, 1999). As such, we can exploit the very disaggregated data on the locations of pipe manufacturers to proxy for local investments in irrigation and drainage (see Figure 3).

One issue we must deal with is determining the correct way to assign a pipe plant to a district. Using just the manufacturers inside the district would be sub-optimal given there is no reason a farmer on the border of a district would not purchase pipe from a nearby plant just over the border. As such, we draw a buffer of twenty-five kilometers around each district and assign the manufacturer to the district if it falls within either the district itself or the buffer (see Figure 7 in the Appendix). Given the average size of districts, this solution tends to assign plants from all

[15] Usually, one field was planted in fall with cereals, such as rye or wheat, while the other field was planted with seeds such as beans or lentils.

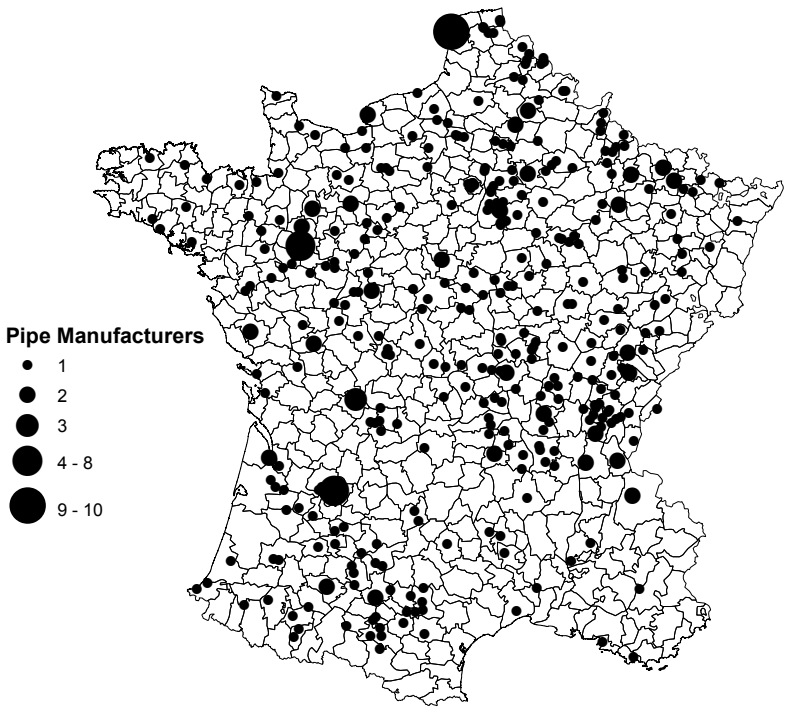

Figure 3: Drainage Pipe Manufacturers in 1862

neighboring districts to the central one, more or less assuming farmers did not go more than fifty kilometers to buy pipe.[16]

3.2.3 Nineteenth Century Land Ownership

To assess whether agricultural plots were larger in regions with more confiscations, we use data on average farm size from the 1862 agricultural survey at the department level, since such information is not available in either 1841 or 1852, and not available at the district level in 1862.

We supplement these data with a district-level measure of the percent of farms that were cultivated by sharecroppers in 1852. Sharecropping is a means of contracting between an owner and farmer whereby the owner provides the land and, very often, most of the non-labor inputs to production while the farmer promises to share the output. According to contemporaries such as Sismondi (1827), sharecropping was a pernicious system of cultivation which impoverished small farmers. While subsequent research (e.g., Barzel (1989)) has taken a more positive view of the practice since

[16]We experiment with buffers of 0km, 15km, 50km, and 100km as well. Statistical and economic significance increases with buffer size up to 50km and then declines.

Figure 4: Road Network in 1789

Figure 5: Road Network in 1841

share contracts can, for example, provide a balance between incentivizing work and sharing risk, there is general agreement that they are associated with small-scale farming.

3.2.4 Geographic controls and measures of market access

In addition to our main outcome variables, we also incorporate a host of controls in our analysis. To capture differences in geographic suitability across districts, we control for wheat and potato soil suitability from the FAO (Fischer et al., 2002). We also account for the difference between the maximum and minimum elevation in a district across samples using data from the NASA 90 meter SRTM survey (Jarvis et al., 2008). This variable is a potentially important predictor of likelihood to invest in drainage since regions with a high elevation gradient would be naturally drained.

We also control for the market access of a district using newly digitized maps of transportation networks from 1789 and 1841 and the location and population of the capital of each district for each time period. Market access captures the "embededness" of a region within the urban network while controlling for transportation costs (see, for example, Donaldson (2016) and Donaldson and Hornbeck (2016)). A higher score for market access suggests that businesses in a region have both more potential customers and suppliers. Market access measures combine two types of data,

populations and the travel cost between these populations. Our urban population data for the French districts in 1789 and 1841 come from the *Dictionnaire universel* (1804) and from Motte et al. (2003). Since districts could also trade with cities outside of France, we also collect data on the all cities with populations above 2,000 people in 1800 within 500km of the French border. To construct our measure of transport costs we geocode maps of the road and canal networks in France (and within 500kms of France) in both 1789 and 1841 from Bonin and Langlois (1989) and Grangez (1845) which we then combine with time invariant maps of the rivers and seas. Figures 4 and 5 show the evolution of the road network between these two dates. We then split the map into 5x5 kilometer grids and assign to each grid the least cost travel technology associated with it, using the costs of travel by river, sea, road, or no technology (portage) computed by Bairoch and Braider (1991).[17] We then apply Djikstra's algorithm to the grid map to calculate the least cost travel path and total cost of taking this path between each district centroid (van Etten, 2012; Dell, 2015). Our measure of market access is then calculated as,

$$MA_i = \sum_{j}^{d} N_j \tau_{ij}^{-\sigma} \tag{1}$$

where, MA_i is market access for district i, the total number of districts (and non-French cities) is d, N_j is the population of district or city j, and τ_{ij} is the lowest cost for traveling between districts and cities i and j.[18] The term σ in equation 1 is a trade elasticity which measures the responsiveness of trade to transport costs between locations. We set the value of σ to one.[19] In our regressions, we follow the current literature and use the natural log of the expression in equation 1 (Donaldson,

[17]We normalize the estimates from Bairoch and Braider such that the cost of travel with no technology (portage) carries a value of 1 and the relative cost for roads is 0.81, for rivers 0.21, and for seas 0.21.

[18]We calculate the cost of traveling within the "own" district assuming the radius of the district is 15kms and the cost of traveling is negligible. The results are robust to excluding the own district from the calculation of the variable.

[19]The appropriate value for σ depends on context. For modern and developed economies, researchers tend to estimate higher values (Eaton and Kortum, 2002; Donaldson and Hornbeck, 2016). Storeygard (2016) estimates the elasticity of city economic activity with respect to transport costs across Africa and arrives at values consistently less than 1 (their preferred estimate is 0.28). Kopsidis and Wolf (2012) assume $\sigma = 1$ for their study of Prussian trade during the Industrial Revolution. This is also the value assumed by many earlier studies of 'market potential' or 'market access' (Harris, 1954). Since our study covers developing markets in France between 1789 and 1841, we follow Storeygard (2016) and Kopsidis and Wolf (2012) by setting $\sigma = 1$ which is lower than what is preferred for studies of more developed economies, but higher than what it is estimated for underdeveloped regions in Africa today.

2016; Donaldson and Hornbeck, 2016).

3.2.5 The Potato as a Placebo

A potential empirical concern is that our baseline regressions may only capture the initial suitability of land for wheat production. This is all the more possible as the Church may have been more likely to acquire higher quality land and, therefore, more Revolutionary confiscations may have also occurred in these districts. One of our main strategies to deal with this potential endogeneity is to perform a placebo analysis using potato yields. There are several reasons why the potato may be a suitable placebo. First, the potential yields, as defined by the FAO, of both potatoes and wheat in France are highly spatially correlated. The correlation between the yields of the two crops across districts is 0.92 and statistically significant at the 1% level. Figure 8 in the Appendix shows the scatter plot of the two yields. As such, if our regressions on Church land confiscations are driven by the suitability of wheat, we should obtain the same erroneous results with similar regression coefficients on percent land confiscated when using potato yields or acreage.

Second, there is ample historical and scientific evidence that potatoes were extremely robust and could be grown virtually anywhere, regardless of irrigation or drainage. Indeed, the potato first found its foothold in France during the eighteenth century in the most rugged and difficult locations to grow food, including the Pyrénées and Dauphiné (Zuckerman, 1999, 78). This trend was reinforced by the early-modern reputation of the potato of causing disease and depleting soil fertility. By the end of the eighteenth century, however, the potato's reputation was changing to that of an extremely robust and nutritious complement to more traditional fare.[20] Furthermore, recent research by Nunn and Qian (2011) established that regions in the world that were more likely to adopt the potato also experienced faster population growth during the eighteenth and nineteenth centuries.

[20]This change was encouraged by the government. For example, Antoine-Augustin Parmentier was associated with Louis XVI's court and a dedicated advocate for the adoption of the potato. In order to counter claims that the potato ruined the soil, in 1786 he ran a public experiment outside just outside of Paris in which planted potatoes on 50 acres of sandy soil. He did not post a guard at field at night and, as he expected, peasants stole potatoes from his successful crop, a fact which Parmentier then used this often in his writings defending the potato (Zuckerman, 1999, 83). Parmentier's claims are backed up by in district wheat and potato yields in 1841 as illustrated in Appendix Figure 9.

Third, potatoes were typically not grown on as a large a scale as wheat and, as such, large scale investments in irrigation or drainage would have been less likely to be undertaken by potato producers. While we do not have data on individual farm sizes by crop, data show that in 1840, the potato only occupied 3.6% of French arable (Zuckerman, 1999, p. 185). Furthermore, at the district level, potato acreage was much smaller than wheat, as illustrated by Figure 10 in the Appendix: the average district in our sample had about 2,440 hectares of land under potato cultivation. This was about ten times less than the average of 22,000 hectares of wheat under cultivation. The relatively small scale of potato cultivation is also consistent with the perception of the late eighteenth century that the potato, while not necessarily suitable for respectable tables, was a perfect crop to plant as a hedge against famine—something for farmers of other crops to plant on the margins of their land as a sort of insurance policy.

3.3 Bishoprics as an Instrumental Variable

We use the distance of a district from the nearest Bishopric as an instrument for the amount of Church land confiscated and auctioned off in 1789. Since almost all Bishoprics in the region of modern-day France were already established by 1200 (Bartlett, 2003, 6), it is unlikely that our instrument will be correlated with investments by the Monarchy or secular lords in the early-modern period. Furthermore, one of the most important determinants of the value of agricultural land is its proximity to markets to sell its product. In this sense the "optimal" locations to engage in agriculture evolved greatly between 1200 and the end of the eighteenth century. The most important historical events which shaped the urban network occurred after 1200. The first of these events was the Black Death which killed on average 40% of the European population and triggered an 'urban reset' away from the Mediterranean Sea to Northern Europe (Jedwab et al., 2016; Pamuk, 2007). The second event was the discovery of the Americas in 1492 which triggered a shift in growth towards the Atlantic coast (Acemoglu et al., 2005). In addition to these shifts, the gradual development of roads and canals during the Old Regime worked to lower transport costs and reduce the importance of location across many regions. To further reduce the possibility that our instrument is picking up a spurious correlation with soil suitability or urban density (since

Paris was important in 1200 just as it was in 1789) we condition all of our IV regressions on the FAO measures of potential wheat suitability of a district as well as market access in 1789.

Between the fourth and sixth centuries, the Catholic Church acquired vast amounts of land. These gains were so great that one Merovingian ruler of Gaul, Chilperic, declared "... that all the wealth of the kingdom had been transferred to the churches" (Goody, 1983, p. 112). Partly in order to better acquire and manage this land, the Papacy started appointing Bishops throughout Christendom. Bishoprics were fundamentally territorial (Bartlett, 2003) and much of this territoriality involved receiving and managing gifts of land (Wood, 2006).[21] Furthermore, between the sixth and eleventh centuries, one of the chief roles of a Bishop was to protect the lands that had been acquired by the Church from the depredations of the laity. Goody (1983, p. 112) gives the example of the famous scholar-monk Bede complaining of the rapid acquisition of "... the Church in the hands of laymen" in a letter to the Arcbishop of York in 734. He was requesting the appointment of more bishops to the territory to prevent the Church's patrimony from being gradually lost.[22] It was only by the eleventh century and the reforms of Gregory VII, enforcing clerical celibacy and prohibiting marriage, that the loss of property by the Church was slowed.

In Figure 12 in the Appendix, we show the distribution of bishoprics in France in 1600 and in Appendix Figure 13 we show the non-parametric relationship between a district's distance to the nearest bishopric and the percentage of Church land auctioned off during the Revolution. As suggested by Figure 13, our instrument is highly relevant. No district is more than 55 kilometers away from a Bishopric; nonetheless, there is a very strong negative correlation between the amount of land owned by the Church in a region and bishopric proximity.

A potential threat to the validity of the instrument is the possibility that Bishops managed properties closer to them better or invested more in these places. We can test whether this was the case for a sub-sample of districts using plot-level data on church properties in 1790 which we collected from archival sources. Before the auctions took place, the Revolutionaries had assessors visit the

[21] See chapter 20 in Wood (2006), for example on the role played by Bishops in preventing secular authority from taking ecclesiastical property.

[22] See also Goody (1983, 117) for more examples of Bishops playing the role of protector of Church property.

Dependent. Variable: Log Assessed Value per hectare in 1790				
	(1) Bivariate	(2) Full Controls	(3) Trim Top 1%	(4) Trim Top 5%
Distance to Bishopric	-0.00487	-0.00291	-0.00251	0.000514
	(0.00432)	(0.00435)	(0.00395)	(0.00303)
Wheat Suitability	No	Yes	Yes	Yes
Market Access 1789	No	Yes	Yes	Yes
N	812	812	804	771
adj. R-sq	0.01	0.04	0.05	0.05

Table 1: Auction plot value per hectare in 1790 and distance from nearest Bishopric. Robust standard errors clustered at the department level. SD in Assessed Value per hectare = 0.81. SD in Distance to Bishopric = 13.86.

properties to provide estimates of their value.[23] We collect these data for 812 farms and vineyards from the *Tableau des biens à vendre* which the Revolutionaries published (Tableau, (1791)). The distribution of these auction plots is shown in Appendix Figure 11. In Table 1 we estimate a series of regressions where we investigate the degree to which an auction plot's distance from the nearest bishopric explains its assessed value per hectare. We estimate a bivariate specification (column 1), include the market access and wheat suitability controls (column 2), trim the top 1% of observations (column 3), and trim the top 5% of observations (column 4).[24] In all specifications there is no correlation between a plot's distance from a bishopric and its value. The largest coefficient is estimated in column 1 as -0.0049. Its interpretation is that a one standard deviation increase in distance to bishopric (13.86 kilometers) results in less than a tenth of a standard deviation decrease in value per hectare. Furthermore, the coefficient is statistically indistinguishable from zero. Appendix Figure 6 illustrates the lack of a correlation between plot value and distance to bishopric.

[23]This was particularly important when assignats were being directly backed by the church lands—the Revolutionaries attempted to issue an amount of assignats equal to the assessed value of church property.

[24]We trim the top observations by value per hectare since several properties exceed the value of all others by an order of magnitude. It is likely these values are driven by non-agricultural characteristics, such as a mansion being on the property.

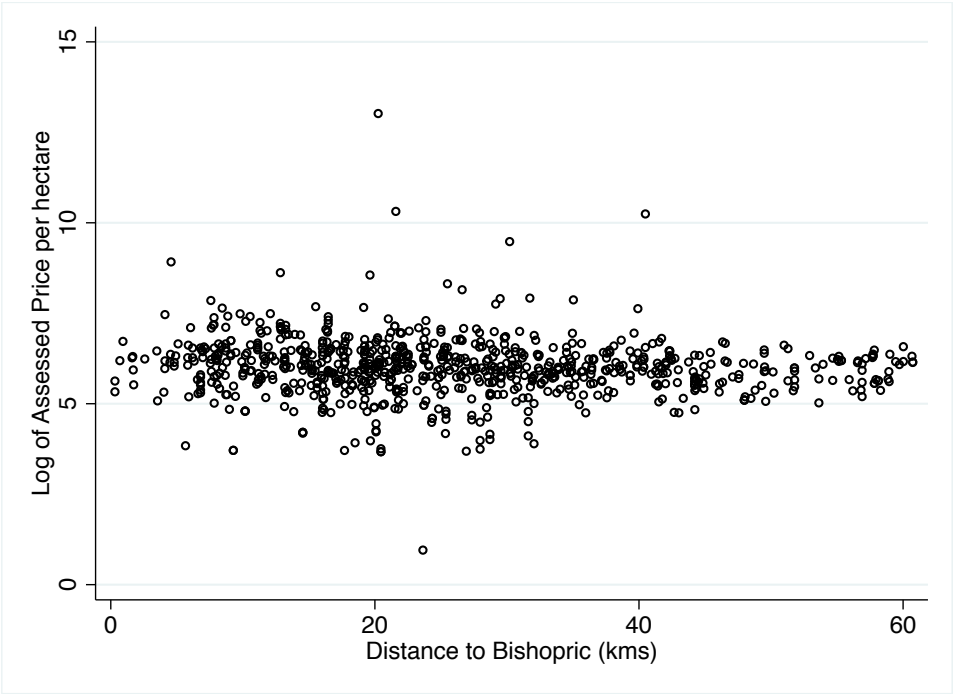

Figure 6: Correlation between distance to bishopric and auction property value in 1790.

4 Empirical Strategy

4.1 Empirical Model

Our empirical analysis is based on regressions of the form:

$$\mathrm{Y}_i = \alpha + \beta \text{Percent Confiscated}_i + \gamma \text{Soil Suitability}_i + \delta \text{Market Access 1789}_i + \theta_j + \varepsilon_i \quad (2)$$

where Y_i is an outcome for district i, Percent Confiscated$_i$ is the percent of Church land confiscated in district i during the Revolution, Soil Suitability$_i$ is the measure of either wheat or potato production potential from the FAO, and Market Access 1789$_i$ is our measure of market access in 1789. In many regressions we also include twelve region dummy variables (θ_j). We report robust standard errors for regression coefficients.[25] Our main coefficient of interest, which we report in the tables, is β. We express Percent Confiscated as a number between 0 and 100.

[25]When the outcome is at the department level (a higher level of aggregation) we cluster at the department level or collapse our district-level data into a department level dataset.

5 Main Results

5.1 Church Land Redistribution and Agricultural Productivity

5.1.1 Wheat Production

In Table 2 we report the results of estimating Specification 2 using the outcomes of wheat yields in Panel A and wheat acreage in Panel B. In regressions (1)-(3) in both panels, we gradually add our main control variables for potential crop suitability and market access in 1789. In regressions (4)-(6), we add the same control variables as well as include region fixed effects so that the coefficient on Percent Confiscated is based only on the within region variation.

	Panel A: Dependent Variable: Log Wheat Yield in 1841					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.0276***	0.0245***	0.0199***	0.00983***	0.00945***	0.00941***
	(0.00376)	(0.00387)	(0.00341)	(0.00345)	(0.00339)	(0.00341)
Wheat Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.294	0.337	0.452	0.588	0.590	0.591
	Panel B: Dependent Variable: Log Wheat Hectares in 1841					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.0386***	0.0215**	0.0216**	0.0311**	0.0246**	0.0245**
	(0.00937)	(0.00884)	(0.00898)	(0.0120)	(0.0105)	(0.0103)
Wheat Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.054	0.191	0.187	0.176	0.277	0.278

Table 2: Percent Land Confiscated in District and Wheat Production

In Panel A, regressions (1)-(3) show that a robust relationship between Percent Confiscated

and Wheat Yields in 1841. In column (3) where we include all control variables, the coefficient associated with Percent Confiscated is equal to 0.0199: this suggests that an increase in district level confiscations by ten percent is associated with an increase in wheat yields of close to twenty percent. When all control variables and district fixed effects are included in column (6), this estimate shrinks to about 0.009, suggesting a ten percent increase in confiscations led to a nine percentage increase in yields. These estimates are consistent with confiscations lowering the transaction costs of making investments in irrigation or of draining more fertile land and, thus, increasing the productivity of wheat production.

In Panel B, we show that there is also a robust, though statistically less precise, relationship between acreage of land in a district dedicated to wheat cultivation and Revolutionary confiscations. The point estimate in column (3) suggests a ten percent increase in confiscations is associated with twenty-two percent more land being dedicated to wheat production. Under the full specification with all controls and region dummies in column (6), this estimate retains statistical significance and suggests that a ten percent increase in confiscations leads to about a twenty-five percent increase in acreage dedicated to wheat cultivation. Taken together, these results are consistent with an increase in wheat cultivation due to improved drainage and reclaimed land.

5.1.2 Land Use

In Table 3, we examine the relationship between revolutionary confiscations and land use in 1852. In Panel A we focus on the share of land which is left to fallow and in Panel B on the share of land which has been converted into artificial prairies. As we discussed above, fallow percentage is a measure of agricultural backwardness while artificial prairies are a measure of agricultural modernization.

The results, which are robust across all specifications, show that the redistribution of Church land led to a more efficient use of land: we find that there is a lower share of land fallow and a higher share of artificial prairies in areas which experienced greater land redistribution. Specifically, the specifications in column (6) of Panels A and B, where we include all the control variables and the

fixed effects, suggests that a ten percent increase in confiscations leads to a 3.8 percent decrease in land fallow (1/3 of a std. deviation in land fallow) and to a 1.6 percent increase in the share of artificial prairies (1/4 of a std. deviation in artificial prairies).

	Panel A: Dep. Variable: Percent Land Fallow					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	-0.00639***	-0.00529***	-0.00400***	-0.00387***	-0.00385***	-0.00384***
	(0.00106)	(0.00115)	(0.00108)	(0.00134)	(0.00134)	(0.00134)
Wheat Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.135	0.181	0.259	0.424	0.421	0.421
	Panel B: Dep. Variable: Percent Land Artificial Prairie					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.00404**	0.00324***	0.00267***	0.00183**	0.00160**	0.00160**
	(0.000777)	(0.000750)	(0.000725)	(0.000731)	(0.000720)	(0.000723)
Wheat Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.154	0.227	0.269	0.450	0.480	0.477

Table 3: Percent Land Confiscated in District and Land Usage

5.2 Pipe Manufacturers

In Table 4 we report our regressions of percent of Revolutionary confiscations on number of pipe plants near the district. The bivariate regression in column (1) suggests a 10% increase in confiscations is associated with 2.4 more pipe plants near the district. Relative to the mean number of pipe plants of 5.4 and the standard deviation of 4.4, this is an economically large effect. In column (2) we control for the elevation range in the district, under the assumption that regions with more geographic relief will tend to naturally drain and will, potentially, benefit more from natural, gravity assisted, irrigation. While the coefficient on percent confiscated remains stable at about 0.2, the

coefficient on elevation range (not reported) is, as expected, negative and suggests a one standard deviation increase in elevation range is associated with about 0.75 fewer pipe manufacturers. In column (3) we add our control for initial market access in 1789. The estimate on Percent Confiscated is unaffected while the coefficient on market access in 1789 (not reported) is not significant.

	Dependent Variable: Number of Pipe Manufacturers in 1856					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.242***	0.202***	0.208***	0.189***	0.167**	0.164**
	(0.0633)	(0.0634)	(0.0645)	(0.0656)	(0.0669)	(0.0674)
Elevation Range	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.100	0.124	0.122	0.347	0.379	0.383

Table 4: Percent Land Confiscated in District and Number of Pipe Manufacturers

In columns (4)-(6) we run the same regressions as (1)-(3) but include our twelve region fixed effects. The regression in column (6) including all the controls and region fixed effects suggests that a ten percent increase in confiscations leads to an increase of about 1.6 pipe manufacturers near the district. We interpret these results as strong evidence that one of the mechanisms through which agricultural productivity is correlated with Revolutionary confiscations is through investments in drainage and irrigation.

5.3 Market Access after the Revolution

In this section we investigate whether Revolutionary confiscations were associated with an increase in investment in transportation infrastructure during the 19th century. For this purpose, we take advantage of the change in the network of roads between 1789 and 1841 (see Figures 4 and 5) using the information from Bonin and Langlois (1989) and Grangez (1845). We construct measures of market access for both 1789 and 1841(see above in Section 3.2.4) and then calculate

the district-level change over these periods.[26] We then investigate whether there is a correlation between Revolutionary land confiscations in a district and the change in market access.

	Panel A: Dep. Variable: Change in Market Access 1789-1841					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.00344	0.00786**	0.0102**	0.00768	0.00763	0.00925
	(0.00394)	(0.00398)	(0.00392)	(0.00672)	(0.00669)	(0.00652)
Market Access 1789	No	Yes	Yes	No	Yes	Yes
Elevation Range	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	-0.003	0.047	0.066	0.033	0.029	0.045
	Panel B: Dep. Variable: Change in Market Access with 1789 Population					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.00322*	0.00593***	0.00575***	0.00412**	0.00407**	0.00443**
	(0.00184)	(0.00185)	(0.00178)	(0.00199)	(0.00192)	(0.00185)
Market Access 1789	No	Yes	Yes	No	Yes	Yes
Elevation Range	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.010	0.141	0.137	0.344	0.350	0.354
	Panel C: Dep. Variable: Change in Market Access with 1789 Transport Network					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.00233	0.00391	0.00584*	0.00538	0.00539	0.00644
	(0.00327)	(0.00336)	(0.00318)	(0.00586)	(0.00591)	(0.00580)
Market Access 1789	No	Yes	Yes	No	Yes	Yes
Elevation Range	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	-0.004	-0.001	0.014	-0.008	-0.014	-0.008

Table 5: Percent Land Confiscated in District and Market Access

[26] Our calculation of the change in market access differs slightly from the level of market access in 1789 which we use as a control variable in all regressions. First, we exclude non-French cities and transport networks in the calculation as there is no reason to believe that an improved allocation of property rights in France would lead to infrastructure changes outside of France. Second, we exclude the "own" district from the calculations. We do this because the size of the population of a district is probably endogenous to the change in that district's population and investment in infrastructure over time. See Donaldson and Hornbeck (2016, p. 831) for a discussion of this potential source of bias.

In Panel A of Table 5 we investigate the overall percentage change in market access of a district and land confiscations. In columns (1)-(6) we progressively add initial market access, elevation range (as a proxy for ruggedness) and region fixed effects. While all the coefficients are positive in these regressions, the only statistically significant coefficients are when we exclude district fixed effects. In column (6) where we include all controls and region fixed effects, the coefficient on confiscations suggests a ten percentage point increase in confiscations is associated with a nine percentage point increase in market access.[27]

The lack of robustness in the results of Panel A may be explained by the fact that market access combines two types of information: the size of surrounding markets, as proxied by urban populations, and the cost of getting to these markets, as proxied by the least cost travel cost through the transport network to the cities. If Revolutionary confiscations lowered the transaction costs of building roads or canals, at least initially, we would expect market access to increase because the transport network improves near a district, not because cities become more populous.[28] To test this proposition, we construct two additional measures of change in market access. First, we construct the percentage change holding constant urban populations at their 1789 levels while allowing the transport network to change between 1789 and 1841. Second, we construct a measure which holds the transport network constant at 1789 levels and allows urban populations to change.

We report the results of using change in market access holding constant population in Panel B. Across all the regressions, the coefficients on confiscations are positive and statistically significant. Furthermore, the coefficients are also relatively large, suggesting a ten percent increase in confiscations is associated with about a 4.5% increase in market access due to transportation infrastructure improvements between 1789 and 1841. These estimates may be compared to the mean change in market access over the period of 16%.

In Panel C, we investigate the impact of confiscations on the change in market access, holding

[27] We calculate the percentage difference in market access as the log difference between 1789 and 1841.

[28] In the general equilibrium, of course, city populations are endogenous to the transport network (and vice versa). However, in the relatively short run, we would expect confiscations to lower the costs of making investments in transport which, over time, would translate into greater urban populations.

constant the transportation infrastructure at its 1789 value. The coefficients, while positive, are statistically very imprecise. Overall, we interpret the results of decomposing market access in Panel B as suggesting a robust and economically large effect of Revolutionary confiscations on improvements in the transportation network.

5.4 Robustness

5.4.1 Potato Yields: A Placebo Analysis

In this subsection, we run our baseline regressions using potato yields and acreage as our outcomes. As we discussed above, there are several reasons which suggest that potatoes were less likely to be affected by investments in irrigation and drainage than wheat. As such, we consider the regressions in this section to be placebo regressions.

	Panel A: Dependent Variable: Log Potato Yield in 1841					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	0.0267***	0.0232***	0.0186***	0.00388	0.00370	0.00370
	(0.00652)	(0.00675)	(0.00674)	(0.00579)	(0.00586)	(0.00588)
Potato Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.095	0.121	0.162	0.466	0.463	0.460
	Panel B: Dependent Variable: Log Potato Hectares in 1841					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	-0.00484	-0.00538	0.00987	0.00739	0.00633	0.00647
	(0.00904)	(0.00931)	(0.00947)	(0.0110)	(0.0108)	(0.0107)
Potato Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	-0.004	-0.009	0.163	0.234	0.236	0.255

Table 6: Percent Land Confiscated in District and Potato Production

In Table 6 we run the same regressions as in Table 2, but use the potato as the outcome. Instead of controlling for potential wheat suitability, we now control for potential potato suitability. In Panel A columns (1)-(3) there is a positive relationship between potato yields in 1841 and percent land confiscated, however, when we add our twelve region fixed effects in columns (4)-(6) this relationship completely disappears. We find this pattern in the coefficients reassuring since it suggests that there was a systematic spatial relationship between crop suitability and Church landholdings in France. However, given the insignificance of our placebo regressions, our empirical strategy of focusing on the variation within each of our twelve regions, seems to be effective.

In Panel B, we examine that there is any systematic relationship between overall potato cultivation in a district and Percent Confiscated. None of these regressions are economically or statistically significant. This is consistent with potato cultivation being on a relatively small scale and unaffected by potential investments in reclaiming drained or newly irrigated land.

5.4.2 Robustness and IV Estimates

In this section we report the results of running various robustness tests on our main results for wheat yields, pipe manufacturers, percent prairie, and percent fallow. Each column in Table 7 represents a different test. For each test we report the coefficient on confiscations using eight different specifications. The first row reports specifications based on column (3) of Table 2. The second row adds region fixed effects and, as such, is based on column (6) of Table 2. The third row is based on the controls and specification used in column (3) of Table 4 and the fourth row adds region fixed effects in a similar fashion to column (6) of Table 4. The remaining four rows follow the same pattern but using Percent Fallow and Percent Prairie as the dependent variables.

In column (1) we report the second stage coefficient from our IV regressions using distance to nearest bishopric as the instrument. We report in parentheses the first stage F-stat for each regression. In the first two rows, we regress Revolutionary confiscations on wheat yields while excluding FE's (row 1) and then adding them (row 2). When FE's are excluded, the first stage F-stat is large at 10.63. The second stage coefficient suggests a ten percent increase in confiscations leads to a 50% increase

in wheat yields. When region FE's are included (row 2) the first stage F-stat falls to 8.5 while the coefficient remains stable. Similarly, the results for all four dependent variables we consider in rows 1-8 are consistent with our OLS analysis, though in all cases the estimated coefficient on confiscations increases in magnitude. One possible explanation of this increase is that our OLS estimates are underestimating the effect of the Revolutionary confiscations. Another possibility is that our instrument is picking up heterogeneity in the response of the outcomes to the treatment. This might be the case, for example, if the gains to redistribution Church land were greater for properties located close to seats of Church administration (i.e. bishopric cities).

In column (2) we add a control for potato suitability from the FAO to the specifications and find the coefficients are robust to this. In column (3) we control for potential spatial correlation across districts by clustering standard errors on the department. There are, on average, seven districts in each department. When we do this, the coefficients retain their statistical significance.

During the Revolution it was not only Church land that was confiscated. There was also a significant amount of land redistributed from *emigrés*, mostly aristocrats who fled their estates to escape potential persecution at the hands of the revolutionaries (Greer, 1951; Duc de Castries, 1966). In column (4) we control for these additional confiscations by including a variable equal to the amount of *emigré* confiscations in each department.[29] Our coefficient estimates are unaffected.

In column (5) we trim the top and bottom 5% of confiscation observations from the sample to assess whether our results are being driven by extreme observations. We find that the fixed effects estimate using pipe manufacturers as the outcome becomes statistically insignificant (p-value = 0.123), although it retains its economic significance, while the other results remain economically large and statistically significant.

[29]The data on *emigrés* are only available at the department level, which is a higher level of aggregation than the districts used in most of our regressions.

	(1)	(2)	(3)	(4)	(5)
	IV (Distance Bishopric)	*Potato*	*Cluster Dept*	*Emigré Confiscations*	*Trim Top and Bottom 5%*
Wheat Yields	0.0513*** (F=10.63)	0.0200***	0.0199***	0.0200***	0.0311***
	(0.0153)	(0.00346)	(0.00401)	(0.00337)	(0.00474)
Wheat Yields (FE)	0.0578*** (F=8.54)	0.00939***	0.00941**	0.00890**	0.0172***
	(0.0192)	(0.00341)	(0.00463)	(0.00342)	(0.00612)
Pipe Mnfg.	0.447** (F=11.09)	0.221***	0.208**	0.208***	0.207**
	(0.199)	(0.0693)	(0.0795)	(0.0640)	(0.103)
Pipe Mnfg. (FE)	0.731** (F=7.89)	0.159**	0.164**	0.152**	0.182*
	(0.298)	(0.0665)	(0.0668)	(0.0651)	(0.0941)
Fallow	-0.0107* (F=10.63)	-0.00399***	-0.00400***	-0.00392***	-0.00553***
	(0.00570)	(0.00109)	(0.00146)	(0.00106)	(0.00178)
Fallow (FE)	-0.0203*** (F=8.54)	-0.00382***	-0.00384**	-0.00390***	-0.00703***
	(0.00785)	(0.00135)	(0.00146)	(0.00137)	(0.00191)
Prairies	0.00616** (F=10.63)	0.00244***	0.00267***	0.00273***	0.00462***
	(0.00295)	(0.000667)	(0.000987)	(0.000698)	(0.000978)
Prairies (FE)	0.00780** (F=8.54)	0.00155**	0.00160**	0.00145**	0.00343***
	(0.00391)	(0.000612)	(0.000643)	(0.000689)	(0.00122)
Baseline Controls	Yes	Yes	Yes	Yes	Yes
N	194	194	194	194	176

	(6)	(7)	(8)	(9)	(10)
	Market Access Alt BO	*Market Access Alt CA*	*Credit*	*Average Auction Price*	*Average Auction Size*
Wheat Yields	0.0162***	0.0231***	0.0190***	0.00635**	0.00644**
	(0.00316)	(0.00380)	(0.00339)	(0.00240)	(0.00246)
Wheat Yields (FE)	0.00916***	0.00991**	0.00877***	---	---
	(0.00340)	(0.00340)	(0.00332)		
Pipe Mnfg.	0.192***	0.203***	0.196***	0.252**	0.202**
	(0.0621)	(0.0633)	(0.0673)	(0.100)	(0.0900)
Pipe Mnfg. (FE)	0.166**	0.153**	0.147**	---	---
	(0.0668)	(0.0654)	(0.0631)		
Fallow	-0.00312***	-0.00490***	-0.00322***	-0.00320**	-0.00438***
	(0.00112)	(0.00115)	(0.00106)	(0.00123)	(0.000779)
Fallow (FE)	-0.00375***	-0.00403***	-0.00333**	---	---
	(0.00135)	(0.00137)	(0.00129)		
Prairies	0.00200***	0.00307***	0.00267***	-0.00122	-0.00163*
	(0.000687)	(0.000767)	(0.000739)	(0.000755)	(0.000822)
Prairies (FE)	0.00154**	0.00166**	0.00159**	---	---
	(0.000722)	(0.000734)	(0.000729)		
Baseline Controls	Yes	Yes	Yes	Yes	Yes
N	194	194	194	40	40

Table 7: Robustness

In columns (6) and (7) we use different parameterizations drawn from the literature for the cost of travel over roads, canals, rivers, and seas when we construct our market access measures. In column (6) we include the cost specifications from Boerner and Severgnini (2011), while in column (7) we use Campbell et al. (1993). These specifications differ from those of Bairoch and Braider (1991), which we use in our main regressions for the relative weights placed on sea, river and road travel cost compared to portage (no technology).[30] All the results remain unaffected.

In column (8) we account for the possibility that our results are driven by financial development, i.e., greater wheat yields could have resulted from the presence of lending institutions that financed agricultural projects. To test for this hypothesis, we collect data on the number of individual bank accounts and the amount of deposits in local savings banks in 1840 (France, 1843). The regression results in column (8) however suggest that accounting for both variables does not modify the sign or significance of the coefficients associated with our variables of interest, and barely affects their size.

In addition to the aggregate district data on confiscations, there are incomplete data at the auction plot level on the characteristics of the Church properties. These data were compiled by the revolutionary assessors in order to make public the information concerning the plots before the auctions took place (Tableau, (1791)). We compile the information on the estimated value and plot size for over 4000 entries in these auction books. Figure 11 in the Appendix shows the spatial distribution of these auction plots as well as the subset from which we draw our sample. From these data, we create district level measures of the estimated value of the Church properties as well as the surveyed size of the properties. In columns (9) and (10) we report the coefficients on confiscations while including these two additional variables as controls. While the coefficient on wheat yields shrinks by about a third in the regressions, it retains its statistical significance. The pipe manufacturers and fallow percentage regressions are relatively unaffected; however the results for percentage prairie lose statistical significance.[31]

[30] As with the cost specifications from Bairoch and Braider, we normalize all estimates such that the cost of travel with no technology (portage) carries a value of 1. The relative costs for Boarder and Severgnini from Column (6) are thus: portage (1), roads(0.50), rivers (0.50) and seas (0.13). The relative costs from Campbell et al are: portage (1), roads (0.81), rivers (0.59) and seas (0.06).

[31] We do not run these auction plot level regressions using the region fixed effects due to the severe reduction in variation across regions.

6 Mechanisms

In this section, we investigate a mechanism that may explain why districts where more Church land was redistributed experienced greater agricultural investment. The fact that all regions of France were subject to the institutional changes triggered by the Revolution, and there was still a large amount of variation in economic performance after the Revolution, presents a puzzle. One way of resolving this puzzle is to acknowledge that the reforms of the Revolutions may have generated incentives to reallocate land away from the inefficient feudal distribution but these transactions were burdened with very large transaction costs. To phrase the Coase Theorem in a slightly different way than usual—in the presence of large transaction costs the initial allocation of land mattered a great deal for achieving efficiency in agriculture. In other words, the Revolutionary land auctions may have jump-started the process of consolidating land holdings in some areas. Then, consistent with the work of Galor and Zeira (1993) and Galor and Moav (2004) who argue that land inequality is conducive to economic development when economic growth depends on physical capital accumulation, those areas would have also experienced greater investment during the nineteenth century.

If this interpretation is true, then we would expect to see: (i) greater inequality in land-holdings in districts with more Revolutionary redistribution and (ii) the treatment effect of the Revolutionary confiscations to diminish over time as un-treated regions gradually unwound the feudal distribution of property.

6.1 Land Inequality and Ownership

Bodinier (2010) supports the possibility that the revolutionary auctions allowed for the consolidation of land holdings. He asserts that "in most districts, a few dozen buyers recovered the major part of the land and the most important buildings". In the district of Bernay, for example, 27 individuals of the "Grand Bourgeois" class purchased 39% of all land auctioned during the first origin while 350 peasants purchased 33.2% (Bodinier and Teyssier, 2000, 229). Inequality of land ownership

likely did not occur through the number of buyers; in the district of Les Andelys, for example, the number of bourgeois and peasants buyers were similar (221 peasants compared to 223 bourgeois). Rather, land auctions most likely preserved existing inequality as bourgeois buyers purchased larger plots of land; in Les Andelys, peasants purchased 21.1% of the land while the bourgeois purchased 49.4% (Bodinier and Teyssier, 2000, 229). This pattern is supported by other case studies outlined in (Bodinier and Teyssier, 2000, 215-241).

Still, there are no consistent data on land inequality after the Revolution until 1862 and those data are at the department level rather than the district level. Nonetheless, analyzing these data can give us some idea of whether there was a persistent difference in land holdings in regions where more land was redistributed in the 1790's. We estimate quantile regressions using average farm size as the dependent variable. Our control variables include measures of soil suitability for wheat as well as market access in 1789. Because of the higher level of aggregation in the dependent variable (there were 84 departments in 1790 as opposed to 534 districts) we do not include region fixed effects and we cluster the standard errors at the department level.

Dependent. Variable: Average Farm Size in 1862						
	Quantile Regression Estimates					OLS
	0.10	0.25	0.50	0.75	0.90	Coeff.
Percent Confiscated	0.053	0.065	0.359	0.615***	0.547***	0.213
	(0.059)	(0.108)	(0.224)	(0.210)	(0.0.216)	(0.133)
Wheat Suitability	Yes	Yes	Yes	Yes	Yes	Yes
Market Access 1789	Yes	Yes	Yes	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.10	0.08	0.15	0.14	0.06	0.15

Table 8: Percent Land Confiscated in District and Average Farm Size

Table 8 reports the coefficient on percent confiscated at the 10%, 25%, 50%, 75%, 90% percent quantiles of average farm size. The results strongly suggest that, while there were about the same percentage of small farms in districts with confiscations, there were significantly more large farms in the right hand tail of the distribution. In the 75th percentile, for example, our estimate suggests

that a region with 10% more confiscations had farms that were six hectares larger on average. Given that the standard deviation of average farm size is five hectares, this is an economically significant effect.[32] Overall, our empirical analysis on average farm size suggests that one of the main effects of the Revolutionary redistribution of the Church land was to increase land inequality in regions where there were more confiscations.

	Dependent. Variable: Percent Sharecroppers, 1852					
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Confiscated	-0.0234***	-0.0211***	-0.0170***	-0.00941**	-0.00976**	-0.00977**
	(0.00370)	(0.00374)	(0.00363)	(0.00380)	(0.00379)	(0.00380)
Wheat Suitability	No	Yes	Yes	No	Yes	Yes
Market Access 1789	No	No	Yes	No	No	Yes
Region FE's	No	No	No	Yes	Yes	Yes
N	194	194	194	194	194	194
adj. R-sq	0.176	0.195	0.268	0.473	0.473	0.470

Table 9: Percent Land Confiscated in District and Share Cropping

We next look at what percent of a district's farmers were sharecroppers. As we explained in Section 3.2.3, sharecropping is consistently associated with small-scale farming. We run district-level regressions based on equation 2 using percent sharecropping as the dependent variable. These results are reported in Table 9. There is a robust negative relationship between Revolutionary confiscations and the percentage of farmers practicing sharecropping in a district. For example, in our preferred specification with all controls and region fixed effects included the estimated effect of a 10% increase in confiscations is a reduction by about ten percent in sharecropping.

6.2 The Effect of Revolutionary Confiscations Over Time

According to our hypothesis, the sale of the Church land gave some districts a "head start" in reallocating land away from the feudal distribution of property. If this is so, then we would expect that, eventually, the regions without confiscations would catch-up. In order to investigate

[32] In Appendix Figure 14 we plot the overall distributions of farm size for districts above and below the mean in Revolutionary confiscations as an alternative way to visualize these results.

this possibility, we collect data on wheat yields in 1841, 1852, 1875, 1892, 1912, and 1929.[33] Unfortunately, only the data for 1841 and 1852 are reported at the district level; the other years are at the department level. To account for this fact in our regressions below, we cluster standard errors at the department level.

We adopt the following empirical approach to investigate the evolution of wheat yields over time. We estimate:

$$\begin{aligned}\text{Log Yield}_{dt} = &\sum_{t=1841}^{1929} \beta_t \text{Percent Confiscated}_d + \sum_{t=1841}^{1929} \gamma_t \text{Soil Suitability}_d \\ &+ \sum_{t=1841}^{1929} \delta_t \text{Market Access 1789}_d + \sum_{t=1841}^{1929} \phi_t \theta_j + \varepsilon_{dt}\end{aligned} \tag{3}$$

where d indexes districts or departments, j indexes our twelve regional fixed effects, and t indexes year. In Table 10 we report the estimated β_t for each year. In 1841 the estimated effect is 0.0094 which is interpreted as a 10% increase in confiscations in a district led to a 9.4% increase in wheat productivity. This estimate declines to 7.8% in 1852 and becomes statistically indistinguishable from zero in 1875 and 1892. In 1912, the coefficient again becomes statistically significant at the 10% level and reaches about half the magnitude as in 1841. In 1929 it shrinks slightly but retains statistical significance.

[33] We choose 1875 because of its historical significance since it is the year when the Third French Republic is proclaimed; 1912 is the last year prior to WWI when we have data; 1892 is chosen because it is the year when a national agricultural survey is undertaken that is equidistant fom 1875 and 1912; finally, 1929 is the year of publication for the only agricultural survey of the interwar period

	Dep. Variable: Log Wheat Yields	
	(1)	(2)
Percent Confiscated X 1841	0.0094**	0.0050*
	(0.0046)	(0.0027)
Percent Confiscated X 1852	0.0078*	0.0048*
	(0.0043)	(0.0025)
Percent Confiscated X 1875	-0.0002	-0.0015
	(0.0024)	(0.0028)
Percent Confiscated X 1892	0.0021	0.0009
	(0.0020)	(0.0027)
Percent Confiscated X 1912	0.0045*	0.0034
	(0.0024)	(0.0027)
Percent Confiscated X 1929	0.0036*	0.0030
	(0.0021)	(0.0027)
Wheat Suitability X Year	Yes	Yes
Market Access 1789 X Year	Yes	Yes
Region FE's X Year	Yes	Yes
Year Dummies	Yes	Yes
Robust Estimator	No	Yes
N	1,152	1,152
adj. R-sq	0.71	0.77

Table 10: Percent Land Confiscated in District and Wheat Yields Over Time

When we investigate the robustness of the results in Table 10 we find that the statistically significant coefficients in 1912 and 1929 reported in Column 1 are completely driven by two districts centered around the towns of Cambrai and Arles. Cambrai happens to have had more Church land confiscated and auctioned off than any other district—40% of the area of the district. Arles also had a great deal of Church land confiscated—25% of its area. One possibility is that in these districts which received a larger treatment than the average location the beneficial effects of land reallocation persisted for longer. Another possibility is that there were long-term, persistent, effects of the land reallocation that reemerged in the twentieth century. Regardless, the positive coefficients for 1912 and 1929 disappear under a robust estimation technique which is reported in Column 2.[34] The

[34]We implement the rreg command in Stata to perform the robust regression based on the procedure of Huber (1964) along with an initial step in which high leverage outliers are removed.

coefficients from specification (2) are plotted over time in Figure 15 in the Appendix.

Overall, the results in Table 10 offer mixed support for our hypothesis that the Revolutionary auctions gave a head start to regions with more Church land. There definitely seems to have been, on average, a decline in the size of the treatment effect of the auctions in the hundred years following the Revolution. However, we do not have a solid explanation for why there is a positive and significant effect again in 1912 and 1929 (based on two districts). It could be that the unequal land holdings that we identified in Section 6.1 persisted and facilitated investments in mechanization during the twentieth century. Such an interpretation would be in line with the analysis of Franck and Michalopoulos (2017): they find that areas with less redistribution of the *emigrés*' property, i.e., the properties of second origin, preserved their pre-1789 unequal land structure and benefited from more agricultural investments in the nineteenth century.

7 Conclusion

This study analyzes the impact of land redistribution on agricultural productivity by focusing on the impact of the confiscation of Church property during the French Revolution. The results suggest that agricultural investment and crop yields were higher in the middle of the nineteenth century in areas which experienced more land redistribution. The agricultural modernization enabled by the redistribution of Church land did not stem from a more equal land ownership structure. Rather, the redistribution of Church land likely sustained the inequality inherited from the Old Regimewhich turned out to be conducive to productivity in the agricultural sector in the 19th century when growth was primarily driven by physical capital accumulation. Although it is beyond the scope of this study to assess whether the legal institutions of the Old Regime inhibited growth in the eighteenth century, it appears that the redistribution of Church land enabled the consolidation of large landholdings and reduced the transaction costs of making agricultural investments more profitable in the first half of the nineteenth century. This effect, however, progressively wanted over time.

Finally, our results provide additional perspective on the long-standing debate regarding the

relationship between the French Revolution and the (either actual or alleged) backwardness of French agriculture during the nineteenth century (see, e.g., Asselain (1984) and Toutain (1993), for a discussion). A potential avenue for future research, therefore, would be to focus on the other economic policies of the Revolutionary era that explain the evolution of investments in the agricultural sector in nineteenth century.

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8 Appendix

8.1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Percent Confiscated	194	5.90	5.87	0.00	40.1
Log Wheat Yield	194	2.54	0.30	1.90	3.24
Log Wheat Hectares	194	9.43	0.93	3.67	10.68
Log Potato Yield	194	4.57	0.50	3.33	6.01
Log Potato Hectares	194	7.62	0.83	5.65	9.32
Pipe Manufacturers	194	5.40	4.38	0.00	24.00
Elevation Range	194	473.94	503.88	54.00	3536.00
Wheat Suitability	194	3.78	1.21	1.33	8.00
Potato Suitability	194	4.93	1.05	2.75	8.00
Log Market Access 1789	194	13.52	0.26	13.00	14.52
Change in MA 1789-1841	194	0.33	0.40	-1.47	1.54
Artifical Prairie 1852	194	0.10	0.06	0.00	0.22
Fallow 1852	194	0.20	0.10	0.00	0.43
Sharecroppers 1852	194	0.34	0.32	0.00	0.99
Avg. Farm Size 1862	194	9.48	5.25	2.86	23.15
Distance to Bishopric	194	15694.10	15156.26	0.00	61592.25

Table 11: Descriptive Statistics

8.2 Sample Selection

An empirical challenge we face is that our data on land confiscations cover only about a third of the districts in France. As all of the results we report in the main text of the paper use only districts for which we have data, this does challenge the validity of our analysis. However, to the extent one would wish to generalize our findings to the rest of France, there could be concerns with the comparability of the districts for which we have data and those we do not. This prompts us to compare the observable characteristics of the districts with data on land confiscations and those in which the data are missing in Table 12.

	Dependent Variable: Districts in Sample =1, Out of Sample = 0			
	(1)	(2)	(3)	(4)
	Bivariate	*Bivariate, FE's*	*Multivariate*	*Multivariate, FE's*
Wheat Suitability	0.0206	0.00796	0.00952	-0.00829
	(0.0184)	(0.0205)	(0.0433)	(0.0466)
Potato Suitability	0.0266	0.0228	0.0365	0.0477
	(0.0222)	(0.0252)	(0.0511)	(0.0555)
Elevation Range	-0.0190	-0.0843*	-0.276	-0.986*
	(0.0348)	(0.0441)	(0.450)	(0.520)
Market Access 1789	0.183**	0.190	0.199**	0.0987
	(0.0806)	(0.138)	(0.0863)	(0.146)
Region FE's	No	Yes	No	Yes
Include All Covariates	No	No	Yes	Yes
N	534	534	534	534

Table 12: Balance of Samples With vs. Without Data on Confiscations

In Table 12, we investigate the correlation between each variable and a dummy variable equal to one if the district is in our sample. In Column (1), we explore the bivariate correlations (in separate regressions for each variable) and in Column (2), we repeat the regressions from Column (1) while controlling for the twelve district fixed effects. For Columns (1) and (2), each coefficient represents a separate regression. In Column (3), we present the coefficients of a multivariate regression while Column (4) contains the coefficients of a multivariate regressions with regional dummy variables. We first show that there is no correlation between a district's suitability for wheat cultivation and whether it is in our sample. The second regression (in Row 2) shows there is also no correlation between districts in our sample and potato cultivation suitability. We also examine whether the difference between the maximum and minimum elevation in a district differs across samples since, as we discussed above, elevation is a potentially important predictor of likelihood to invest in drainage. Under the bivariate regression, elevation range is not a significant predictor of sample; however it is correlated with sample once the twelve region fixed effects are included. In the multivariate FE regression in column (4), the coefficient on the elevation barely statistically significant at conventional levels.

We are particularly concerned that locations which are more economically viable may either be more likely to be in our sample, or that within our sample, the Church may have owned more land in more economically viable places. This could potentially reduce our ability to generalize our results out of sample. In Table 12 our measure of market access in 1789 is strongly correlated with being in sample in the bivariate regression (Column 1) and the multivariate regression (Column 3). This makes sense given that our confiscations data were compiled, in part, from separate regional studies which were biased towards well-known or economically central locations (Bodinier and Teyssier, 2000). However, once we include region fixed effects (Columns 2 and 4) the correlation between market access and sample disappears. Nonetheless, we will be careful to condition on market access in all of our main regressions below.

Despite the generally supportive results in Table 12, it is important to keep in mind that all of our regressions in the main text of the paper use only the sample for which we have information on Revolutionary confiscations (sample=1). Our identifying assumption for these regressions is that, conditional on being in sample, there is no systematic relationship between Revolutionary confiscations and the various outcomes we investigate. Conditional on our controls, region dummies, and IV strategy described below, the possibility of such selection is minimized.

8.3 Additional Maps

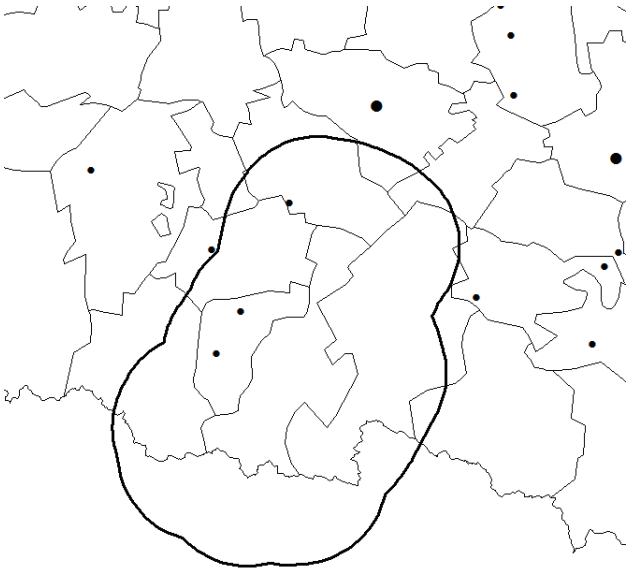

Figure 7: Construction of 25km buffer around the districts. Circles represent pipe manufacturers.

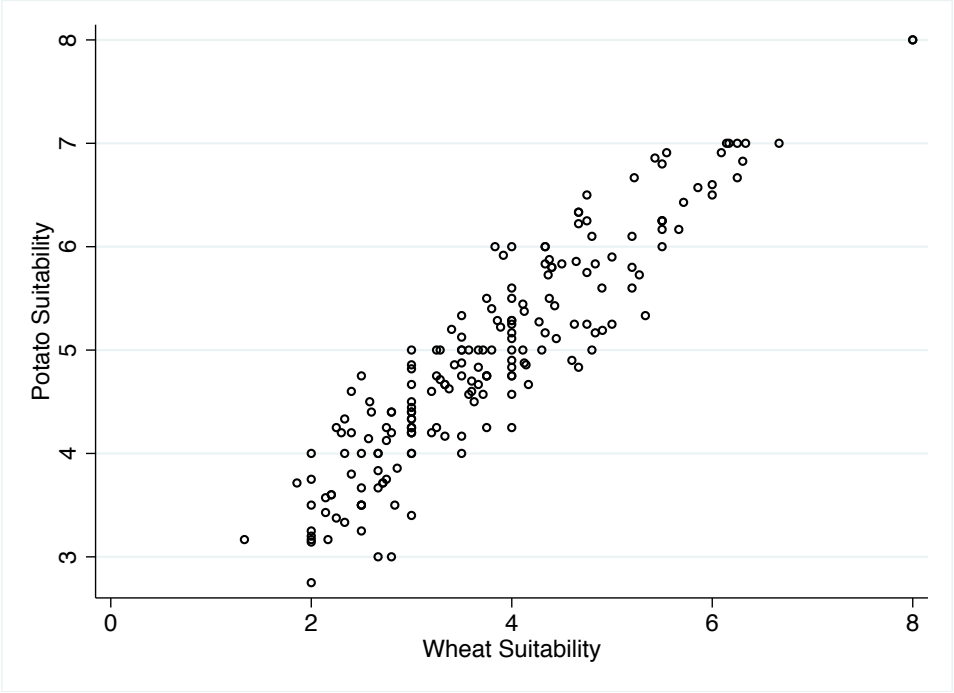

Figure 8: Wheat versus Potato Potential Suitability (Source: FAO)

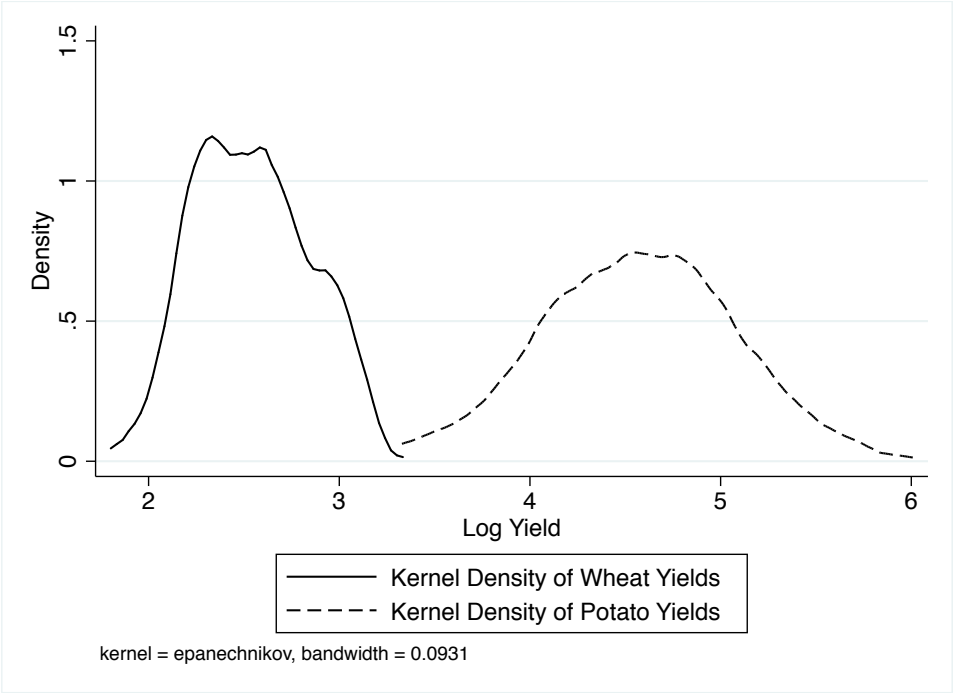

Figure 9: Distribution of Wheat and Potato Yields, 1841

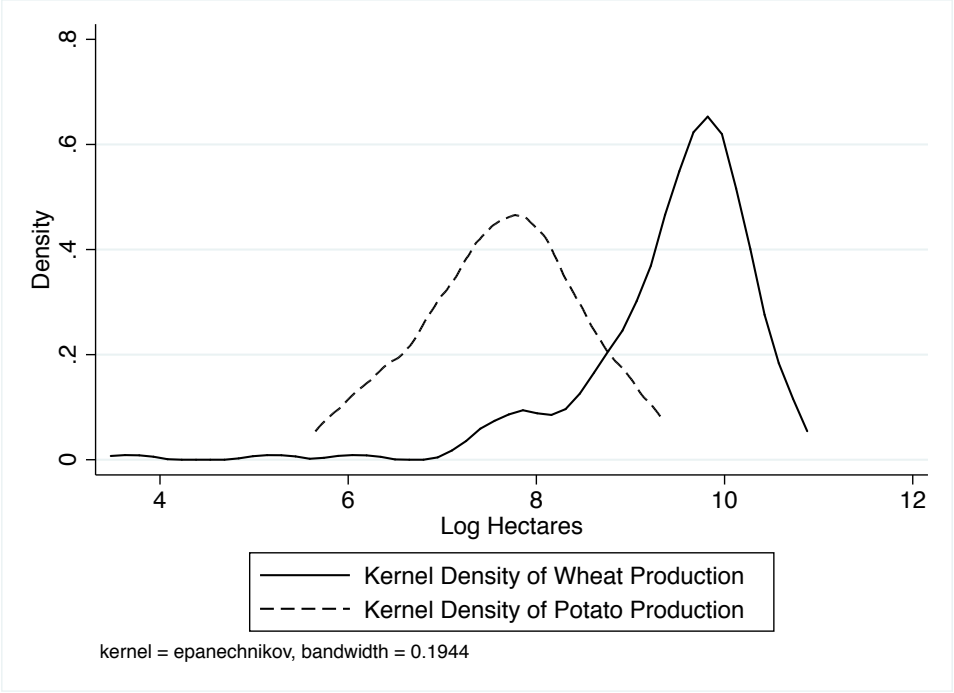

Figure 10: Distribution of Wheat and Potato Acreage

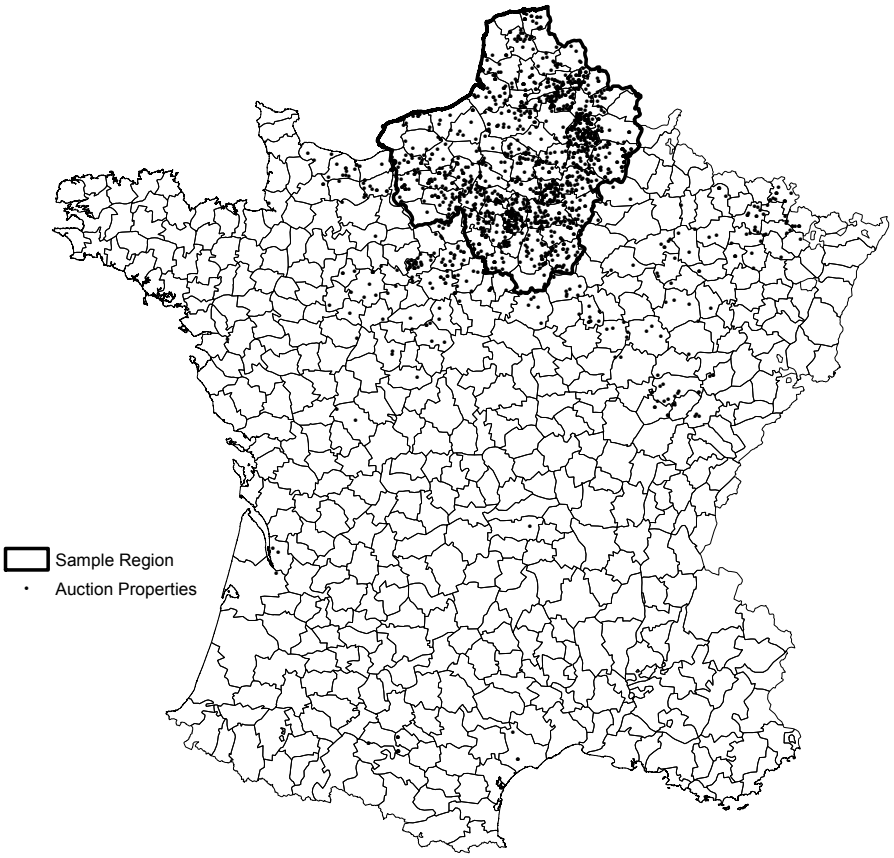

Figure 11: Auction Plot Locations. Sample used in regressions includes districts with bold border.

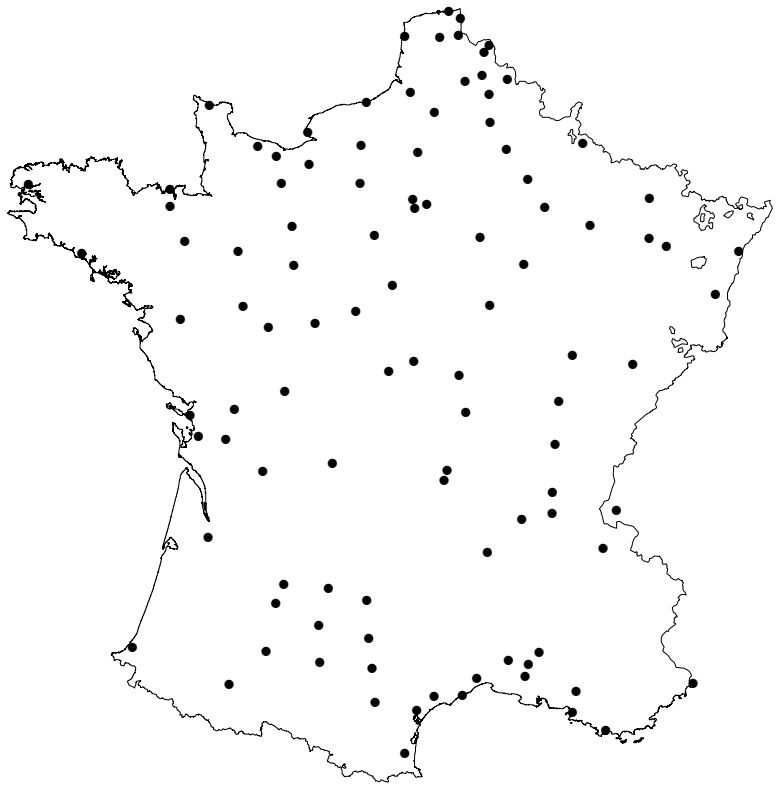

Figure 12: Bishoprics in 1600

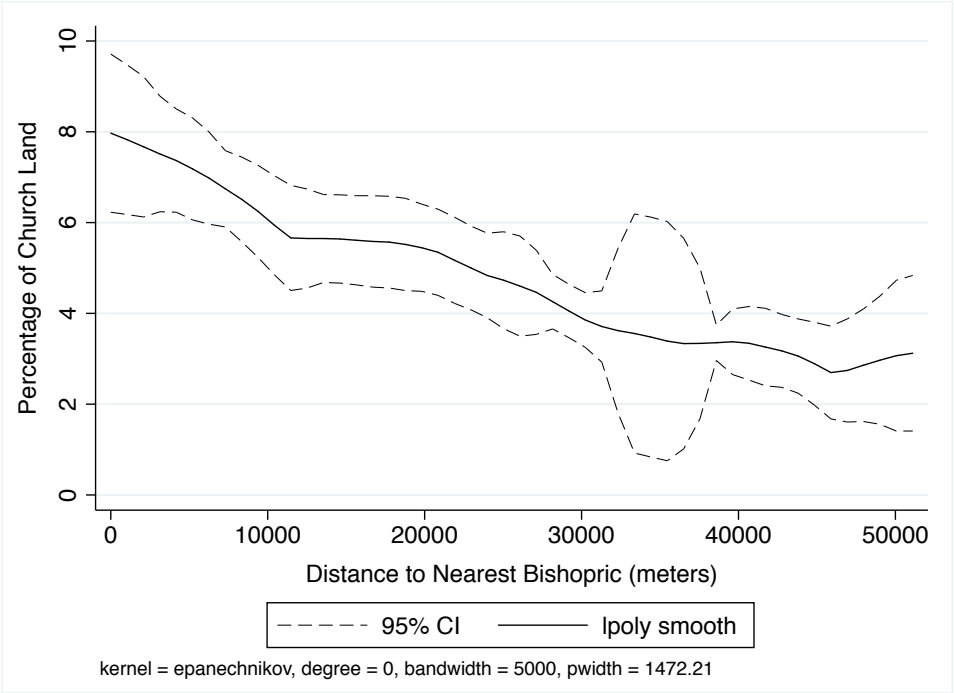

Figure 13: Correlation between distance to 1600 bishopric and Revolutionary confiscations.

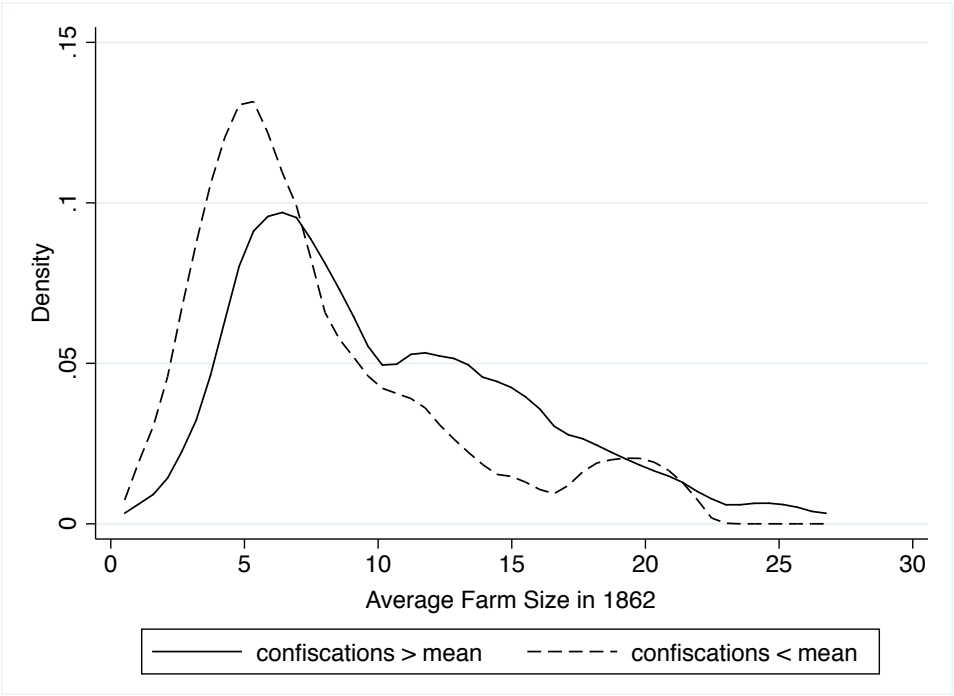

Figure 14: Distribution of average farm sizes above and below mean confiscations in 1862.

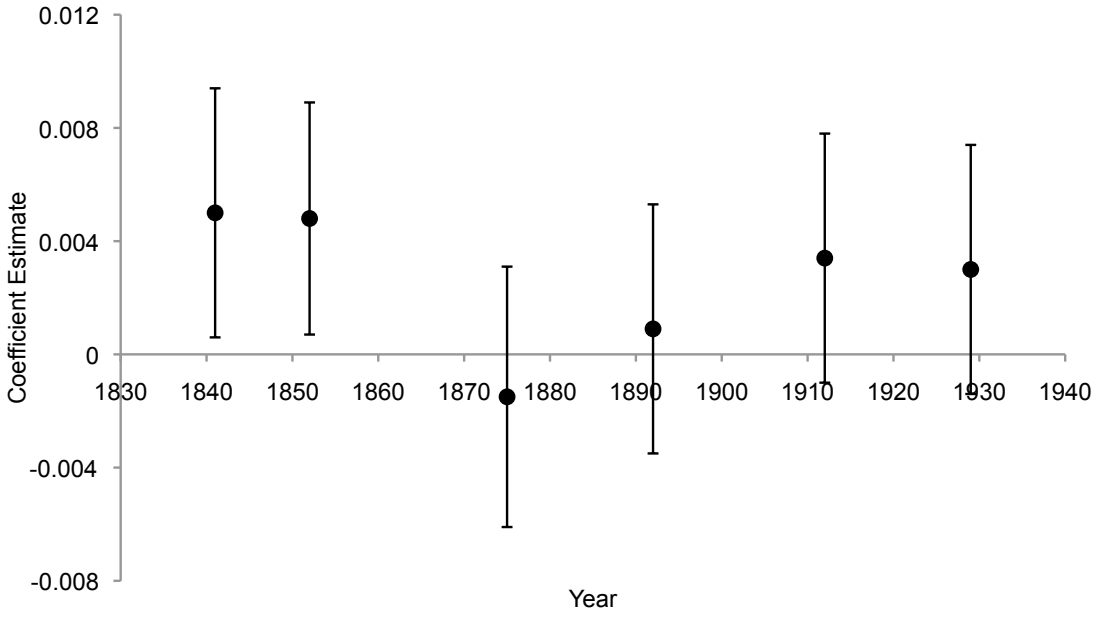

Figure 15: The effect of Revolutionary confiscations on agricultural productivity over time.