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

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**Abstract**

This study exploits the confiscation and auctioning off of Catholic 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, more investment in irrigation, and more efficient land use. We trace these increases in productivity to an increase in land inequality associated with the Revolution-era 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 19th century as other districts gradually overcame the transaction costs associated with reallocating feudal system property rights.

## 1. Introduction

The literature dealing with the long-run impact of institutions on economic growth shows the importance of property rights in land (Acemoglu, Johnson, and Robinson 2001; Rodrik, Subramanian, and Trebbi 2004; Doepke and Zilibotti 2005; Banerjee and Iyer 2005; Ramcharan 2010; Fenske 2011; Heldring, Robinson, and Vollmer 2015). For instance, research on England around the time of the Glorious Revolution suggests that lowering the transaction costs of reallocat-

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ing property rights increased investment in road projects (Bogart 2005; Bogart and Richardson 2009, 2011). However, there is a growing recognition in the literature that simply adopting a set of de jure institutions that better define rights will not necessarily lead to a superior allocation of property in the short run. Reallocation may be blocked by incumbents (Acemoglu et al. 2008), 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]

A historical case of land reallocation whose consequences can be traced over time occurred during the French Revolution. On November 2, 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 Catholic Church property and to redistribute it by auction. Over the next 5 years, more than 700,000 ecclesiastical properties—about 6.5 percent of French territory—were sold in what one historian termed the "most important event of the Revolution" (Lecarpentier 1908, p. 4; Bodinier and Teyssier 2000, p. 11, authors' translation). 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 [1792] 1929; Rosenthal 1992). The institutions adopted by the Revolution, by contrast, are often credited for much of the economic success both in France and abroad in the 19th century (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 on 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 such as, for example, Besley and Burgess (2000), Binswanger, Deininger, and Feder (1995), Goldstein and Udry (2008), and Fenske (2011) argue 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

[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).

[2] Building on this research, Oto-Peralías and Romero-Ávila (2016) argue that the unequal concentration of political and economic power that arose from the *Reconquista* across Spanish provinces had negative consequences on gross domestic product per capita in 2005. Galán (2018) finds that individuals receiving redistributed land in Colombia between 1968 and 1970 made greater investments in human capital subsequently.

countries and historical settings, for example, 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 that 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 in which all regions were subject to the same improvement in property rights but only a subset of regions had the transaction costs of reallocating property rights lowered. Second, unlike many other instances of land reform in which equality of holdings was the goal, the church lands confiscated during the Revolution were auctioned off to the highest bidder, which gives 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 19th century was a huge shift that should have, in theory, led to significant efficiency gains in agriculture. Research surveyed by Grantham (1997, p. 389) indeed finds 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. Our main focus is the impact of these confiscations on wheat cultivation during the 19th century because wheat was the main crop in France in the 18th and 19th centuries and the basis for bread, the main staple of the French population until the mid-19th century (Kaplan 1984; Toutain 1993). We conduct our study at the level of the district, of which there were 534 in 1789. We possess detailed data

[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 between 1815 and 1848 excluded peasants from the political system. In fact, during that period several legal reforms were passed (for example, the *Code Forestier* in 1827, which limited the use of forest areas, or the *Permis de Chasse* in 1844, which established a license for hunting) that reneged on some of the rights that peasants had acquired during the Revolution (see, for example, Barral 1968).

on confiscations and 19th-century agricultural outcomes and inputs for 194 of these districts. The endowment of the districts with ecclesiastical property varied between 0 percent and 40 percent (mean of 6 percent; standard deviation of 5.9 percent).

One potential source of concern for us is that the initial distribution of church land might be correlated with some other factor that also influenced 19th-century agricultural outcomes. For example, the church might have acquired superior land or have been more likely to maintain the land during the Old Regime.[4] 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 a district's soil and climate for wheat agriculture using data from the Food and Agriculture Organization of the United Nations (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 2018). Third, in our preferred specifications we include 12 region fixed effects and therefore identify on the variation within each region. Fourth, we implement an instrumental variables (IV) 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 a bishopric, all of which were mostly established before the 12th 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. Wheat yields, investments in irrigation and drainage, and intensity of exploitation (as proxied by percentage of 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 after the Revolution in regions where there was more redistribution and investment (Galor and Moav 2004). Finally, we show that the beneficial effects of Revolution-era land redistribution on agricultural productivity gradually declined over the course of the 19th century. This is consistent with other districts gradually overcoming the transaction costs associated with reallocating the feudal system's property rights. As a result, this study provides a complementary perspective to Franck and Michalopoulos (2017) on the consequences of the French Revolution. That study suggests that emigration, which occurred mainly in 1793–94 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

[4] Unfortunately, no systematic agricultural survey was carried out in France before 1841. There is therefore no detailed information about agriculture, much less data on church and nonchurch property, in France in 1789. However, it is unclear why a priori church (or nonchurch) property would be systematically associated with high or low wheat yields.

human capital in the long run. In our study, the focus on 194 districts 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 that overcame transaction costs but maintained the relatively unequal distribution of land before 1789.[5]

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 and how the Revolution-era 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 Revolution-Era Confiscations

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 the church's wealth was redistributed during the Revolution.

### *2.1. Property Rights in Land before and after the Revolution*

Pre-Revolution France was characterized by overlapping feudal property rights. This significantly raised the transaction costs of reallocating land or making investments in drainage and irrigation or reorganizing production more generally (for instance, by enclosing fields and adopting more efficient crop rotation systems).[6] Rosenthal (1992) explores in detail how pre-Revolution France was characterized by a complicated and overlapping system of feudal property rights that, combined with the convoluted judicial process, further raised the transac-

[5] 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 .47 percent (with a standard deviation of .64). The average share of émigrés (who left France during the Revolution) in the 62 departments in our sample is .44 percent (with a standard deviation of .63), while the average share of émigrés in the 24 departments that are excluded from our sample is .53 percent (with a standard deviation of .68).

[6] On the legacy of feudalism in France and overlapping property rights, see Mousnier (1979) and Bloch (1961, chaps. 32 and 33).

tion costs of investment. For example, Rosenthal (1992) describes how rights over the commons were often uncertain and contested between landowners (such as 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 18th-century France. What also prevented investment and land sales was the sheer number of privileges that would have 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, pp. 106–8) explains, patterns of landholding were "fantastically complicated. . . . [M]ost 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, pp. 106–8) 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.[7]

Like the nobility, the church took the preservation and assessment of its feudal rights very seriously. McManners (1999, p. 109) notes that, "[s]ince 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-Revolution France that were slow to be adjudicated. Consequently, French agricultural institutions experienced only marginal changes during this period.[8] This situation changed dramatically during the early days of the Revolution when, on August 4, 1789, the Constituent Assembly voted to abolish the feudal system. This included the elimination of all seigneurial rights and tithes and, eventually, the dismantling of the judicial system. Rosenthal (1992, p. 95) identifies two key institutional changes that made investments in agricultural projects—such as drainage or irrigation—

[7] 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.

[8] 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), and Jones (1988). Some changes, for example an enclosure movement supported by the monarchy and progressively implemented by the local parliaments, seem to have triggered some gains in productivity (Vivier 1998). The first enclosure law was adopted in Trois-Evéchés province on June 12, 1769, while the last one was passed on March 30, 1781, in Cambrésis province.

more likely to succeed after the Revolution: the massively increased power of the executive to override local objections to projects and 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 and Napoleon's establishment in 1804 of the Civil Code resulted in formal institutions more conducive to 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 are keen to emphasize that the privatization of common land enabled peasants to obtain well-defined plots of land where they could develop their own small but profitable vineyards. Nonetheless, McPhee (1999, p. 197) also acknowledges that in Corbières in the southwest, the revolutionary auctions of church property were dominated by wealthy individuals who also benefited from well-defined property rights. This explains how by 1830 the region was populated by wealthy wine growers and merchants from families that had acquired land during the Revolution. McPhee (1999, p. 194) notably mentions the successful Lignères brothers, who grew wine on over 25 hectares and built a distillery in the borough of Ferrals-les-Corbières.

However, the enforcement of the Civil Code after 1804 was not complete, and there remained significant transaction costs associated with land redistribution.[9] There is also substantial evidence that in early 19th-century France the laws delineated by the Civil Code were not applied across all regions and that pre-Revolution legal traditions often prevailed (see 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 northern France for much of the 19th century (Grantham 1980). In line with the analysis of Tocqueville ([1856] 1998), these inefficiencies can be partly explained by the existence of an overarching, and often inefficient, state bureaucracy.[10] Consistent

[9] Our argument concerning the implementation of the Civil Code is different from the well-known arguments that it is less flexible and therefore less conducive to economic growth than common law (for a survey, see, for instance, La Porta et al. 1998). There is little evidence that, at least in the early years of its implementation, the Civil Code was inferior to common law. For example, Le Bris (2017) finds that during the 1801–21 period the adoption of the Civil Code had little economic impact in regions where common law was used before the Revolution, notably in matters of property inheritance.

[10] Thinkers of a different persuasion than Tocqueville also have noted the existence of an inefficient bureaucracy in mid-19th-century France. For instance, Marx (2008, p. 121) writes that the administration in France was a "parasitic body which enmeshes the body of French society like a net and chokes all its pores."

with the evidence that we describe below, it was only in the second half of the 19th century, with the completion of the cadastre to delineate plots of land in each department (Bloch 1929), that property rights became sufficiently easy to define and enforce that many land transactions took place.

Overall, the 1789 Revolution brought about an undeniable simplification of the de jure legal system in France that resulted in a clearer delineation of property rights. However, consistent with Bleakley and Ferrie (2014) on 19th-century Georgia and Libecap and Lueck (2011) on 19th-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 toward a distribution more conducive to investment in modern agricultural practices.

### *2.2. Ecclesiastical Wealth and Revolution-Era Confiscations*

Estimates of the amount of land owned by the church before 1789 range between 6 percent (Sée 1968) and 10 percent (Lefebvre 1967). There was also a tremendous amount of variation across regions. For example, the fraction of land owned by the church in towns could vary from as large as one-third in Toulouse to 3 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 to rural laity and in some cases to entrepreneurs, who would then sublet it. This often resulted in the fractionalization of landholdings into small and separated plots, which was not conducive to incentivizing investment. For example, in Caudebec, where the church owned about 5 percent of the land, there was at least one church plot in 132 of the 136 parishes.

In addition to the transaction costs 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 requiring the king's eventual agreement.[11] The sale and purchase of property owned by ecclesiastics was thus possible, but at a sizable cost, which 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 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 18th

[11] As discussed by McManners (1999, p. 115), the transfer of church property required 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.

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 that took first prize at the Royal Agricultural Society of Limoges in 1770 and the Society of Lyon in 1787 (McManners 1999, p. 104).[12]

The Revolution-era 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 the properties. Auctions were largely conducted by local governments (namely, districts, cantons, and municipalities) but were regulated by guidelines established by the National Constituent Assembly. In addition to outlining procedures for the auction, the guidelines called for a survey of the property that was to be sold to establish an initial bidding price. We exploit these surveys in some of our robustness regressions in Section 5.3.

In an extensive accounting of the characteristics of the sale of the properties during the Revolution, Bodinier and Teyssier (2000) divide the properties into two groups by origin. The properties of first origin refer to those owned by the church, while the properties of second origin refer to the those owned by émigrés, namely, individuals who left France during the Revolution out of fear, ideology, or both (Greer 1951; 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-origin properties. 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 6 months (until May 20, 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 had been sold at this point.[13] 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 émigrés were allowed options to avoid foreclosure, which prevented some confiscated property from going to auction (Bodinier and Teyssier 2000, pp. 111, 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 (municipalities or departments) or of the central state (see, for example, Lefebvre 1924; Vivier 1998). Conversely, most

[12] In his 1763 treatise *Essai d'éducation nationale,* French jurist and education reformer Louis-René de Caradeuc de La Chalotais 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).

[13] Bodinier and Teyssier (2000, pp. 151–52) provide copious anecdotal and quantifiable evidence to support this timing.

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 5.3 that our main results are robust to including a variable measuring the percentage of land confiscated in a district from the émigrés.

Bodinier and Teyssier (2000, p. 153) estimate that more than 1.1 million properties were sold during the Revolution. The sales began in 1790 when 700,000 first-origin properties (about 6.5 percent of the French territory) changed hands; the sale of the 400,000 second-origin properties (about 3.5 percent of the French territory) started in 1793. According to Bodinier and Teyssier (2000, p. 153), the "most important lots" from both origins were sold early. For first-origin land, 40 percent of all properties were sold by the end of 1791, and for second-origin land, 53.9 percent of properties were sold by the end of 1794. From the revolutionaries' viewpoint, the purpose of selling church land was to raise revenue to solve the financial crisis of the French state. When they realized that the auctions could take several years to complete, they issued bonds known as assignats that could be redeemed for confiscated property at a later date. However, the revolutionaries began to print more assignats than there was property to back them, so they became, in effect, a fiat currency that was worthless because of inflation. 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 became richer in the long run. In the Online Appendix, we show that, indeed, 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 the 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, 2:96, authors' translation). Bodinier and Teyssier (2000, pp. 363–79) 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 land to result in the dismemberment of previously massive estates owned by the nobility and clergy and in 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 with places without auctions. There is no information about 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 provide explicit evidence that by the time of the 1862 agricultural survey—the first survey containing explicit information about the scale of agricultural plots—districts where a larger share of church land was auctioned had significantly larger farms—especially in the right tail of the distribution.

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

## 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 19th-century France. A district is the first level of administrative subdivision of French departments 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 districts in 1790, of which 194 are in our sample. The average size of a district is 1,129 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 62 have data on confiscations.

### *3.1. Redistribution of Church Land*

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

The data for Figure 1 are from Bodinier and Teyssier (2000) and cover 194 of the 534 districts created in 1789. However, Bodinier and Teyssier estimate that those 194 districts contain about two-thirds of church land prior to the Revolution because church property was not spread evenly throughout France. In the Online Appendix, we address concerns regarding the generalizability of our main results by showing that the observable characteristics of the 194 districts are largely similar to the other 340 districts for which there are no data in Bodinier and Teyssier (2000).

### *3.2. Agricultural Productivity, Investments, and Farms' Structure*

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

*Wheat Yields and Crop Rotation.* Our first measure of the impact of Revolution-era confiscations on economic activity is wheat yields in 1841. We collect the yields from the *Statistique agricole* (Ministère de l'agriculture 1842), which contains wheat yields at the arrondissement level that we match with the geographic location of the Revolution-era districts. Figure 2 shows hectoliters of wheat produced per hectare for all of France in 1841.

As an additional measure of agricultural productivity, we take advantage of the agricultural survey carried out in 1852 by the French government (Ministère de l'agriculture 1860), which provides data on the share of arable land in a district devoted to fallow and the share devoted to artificial prairies.[15] On the one hand, fallow land is a measure of agricultural backwardness: it is a feature of the three-

[15] Fallow is the variable Jachères in the source and is reported as the total amount in the district in hectares. Artificial Prairies is the variable Prairies Artificielles, which is described as "étendue totale (luzerne [alfalfa], sainfoin, trèfle [clover], mélanges divers)" (Ministère de l'agriculture 1860, pp. 158–69). It is also given as total hectares in a district.

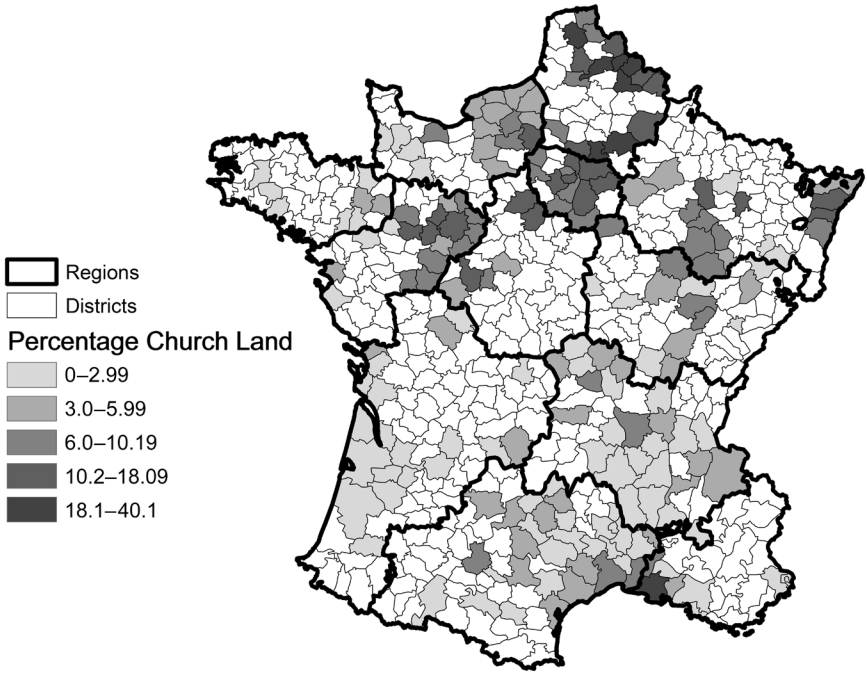


**Figure 1.** Land confiscations

field system that originated in the Middle Ages in which two fields are planted with crops and one field is left to fallow to recover its nutrients.[16] The 19th century was marked by the gradual adoption of more efficient, four-field rotation systems across France. At the end of the 18th century, about 30 percent of arable land was fallow. This amount dropped to 16.8 percent in 1852, and by 1882 it was just 10.8 percent (Caron 1979, 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.

*Pipe Manufacturers.* Two of the most active areas of investment to increase agricultural productivity during the 19th century were drainage and irrigation projects. While we do not observe drainage and irrigation investments directly, we observe their primary input, namely, pipe manufacturers. Figure 3 shows the geocoded location and number of pipe manufacturers in 1862 from Barral (1862). Much like concrete today, because of low economies of scale and high

[16] 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.

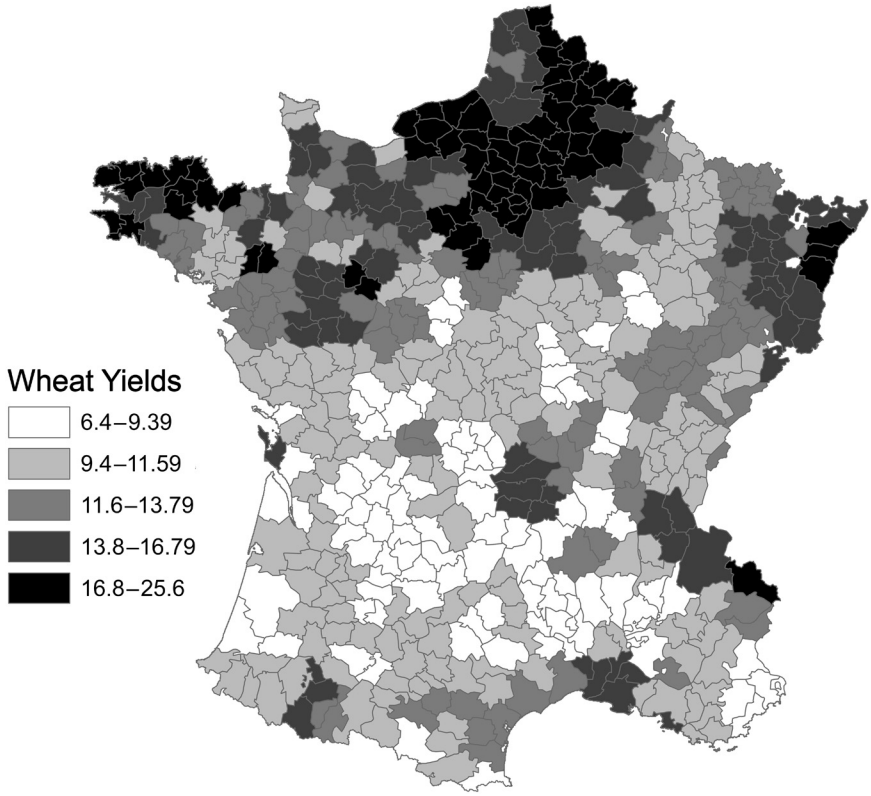


**Figure 2.** Wheat productivity

transport costs, pipes were usually produced close to their point of consumption in the 19th century (Maurel and Sédillot 1999). As a result, we can exploit the very disaggregated data on the locations of pipe manufacturers, which we indicate in Figure 3, to proxy for local investments in irrigation and drainage.

One issue we must deal with is the correct way to assign a pipe plant to a district. Using just the manufacturers inside the district would be suboptimal given that 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 a result, we draw a buffer of 25 kilometers around each district and assign the manufacturer to the district if it falls within either the district or the buffer (see Figure OA1 in the Online Appendix). Given the average size of districts, this solution tends to assign plants from all neighboring districts to the central one, more or less assuming that farmers did not go more than 50 kilometers to buy pipe.[17]

*Land Ownership.* To assess whether agricultural plots were larger in regions

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

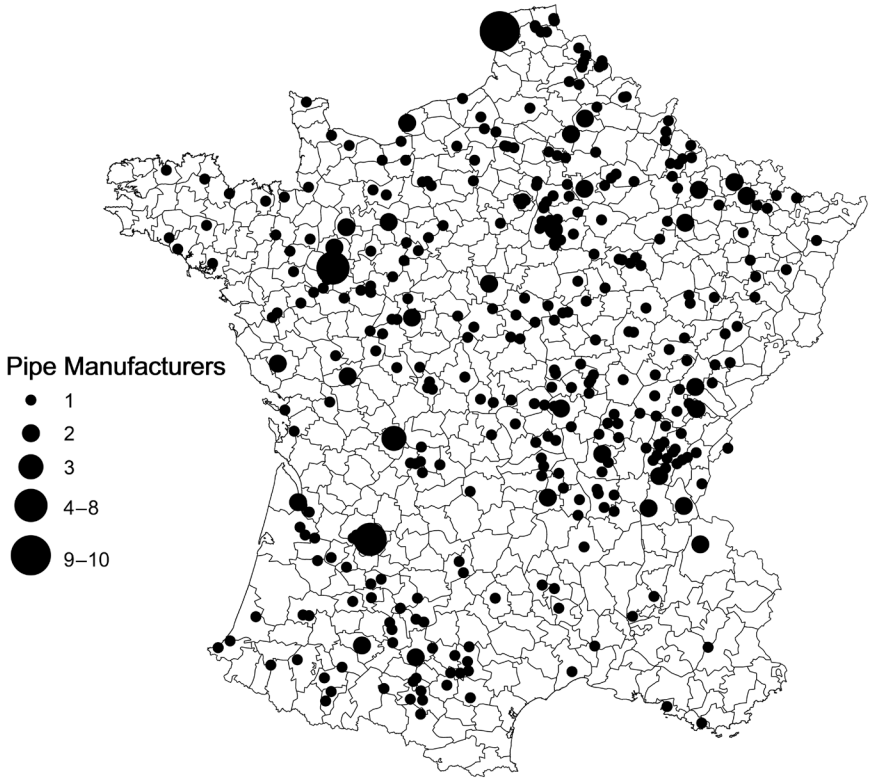


**Figure 3.** Drainage pipe manufacturers, 1862

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 is not available at the district level in 1862.

We supplement these data with a district-level measure of the percentage of farms that were cultivated by sharecroppers in 1852. Sharecropping is a means of contracting between an owner and a farmer whereby the owner provides the land and, very often, most of the nonlabor inputs to production, while the farmer promises to share the output (see Allen and Lueck 1992, 2002). While sharecropping was historically usually associated with concentrated ownership, it was also (at least in France) associated with many tenants operating on a small scale. During the 19th century, contemporaries such as Sismondi (1827) and Guillaumin (1904) denounced sharecropping as a pernicious system of cultivation that impoverished small farmers. For instance, in the Allier and Landes departments, sharecropping in the 19th century still implied that the tenant would work on the landlord's property in addition to providing a share of the harvest from the piece of land he rented (Agulhon, Désert, and Specklin 2003). While Barzel

(1997) takes a more positive view of the practice since share contracts can, for example, provide a balance between incentivizing work and sharing risk, sharecropping remained in 19th-century France a feudal legacy and indicated inefficient agricultural practices.

*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 soil suitability for wheat agriculture using data 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 National Aeronautics and Space Administration 90-meter Shuttle Radar Topography Mission survey (Jarvis et al. 2008). This variable is a potentially important predictor of the likelihood of investing in drainage since regions with a large elevation gradient would be naturally drained.

We also control for the market access of a district using newly digitized maps of transportation networks in 1789 combined with information about the location and population of the capital of each district. Market access captures the embeddedness of a region in the urban network while controlling for transportation costs (see, for example, Donaldson 2018; Donaldson and Hornbeck 2016). A higher score for market access suggests that businesses in a region have more potential customers and more suppliers. Market access measures combine two types of data: populations and the travel cost between them. Our urban population data for the French districts in 1789 come from the *Dictionnaire universel* (Prudhomme 1804). Since districts could also trade with cities outside France, we also collect data on all cities with populations above 2,000 people in 1800 within 500 kilometers of the French border. To construct our measure of transport costs, we geocode maps of the road and canal networks in France (and within 500 kilometers of France) in 1789 from Bonin and Langlois (1989) and Arbellot and Lepetit (1987), which we then combine with time-invariant maps of the rivers and seas. Figure 4 shows the road network in 1789. We split the map into $5 \times 5$ kilometer grids and assign to each grid the lowest-cost travel technology associated with it, using the costs of travel by river, sea, road, or no technology (portage) computed by Bairoch (1988).[18] We then apply Djikstra's algorithm to the grid map to calculate the lowest-cost travel path and the cost of taking that path between each district centroid (van Etten 2012; Dell 2015). Our measure of market access is then calculated as

$$\mathrm{MA}_i = \sum_{j}^{d} N_j \tau_{ij}^{-\sigma}, \tag{1}$$

where, $\mathrm{MA}_i$ is market access for district $i$, the total number of districts (and non-French cities) is $d$, $N_j$ is the population of the district or city $j$, and $\tau_{ij}$ is the lowest

[18] We normalize the estimates from Bairoch (1988) such that the cost of travel with no technology (portage) equals 1, and the relative cost for roads is .81, for rivers .21, and for seas .21.

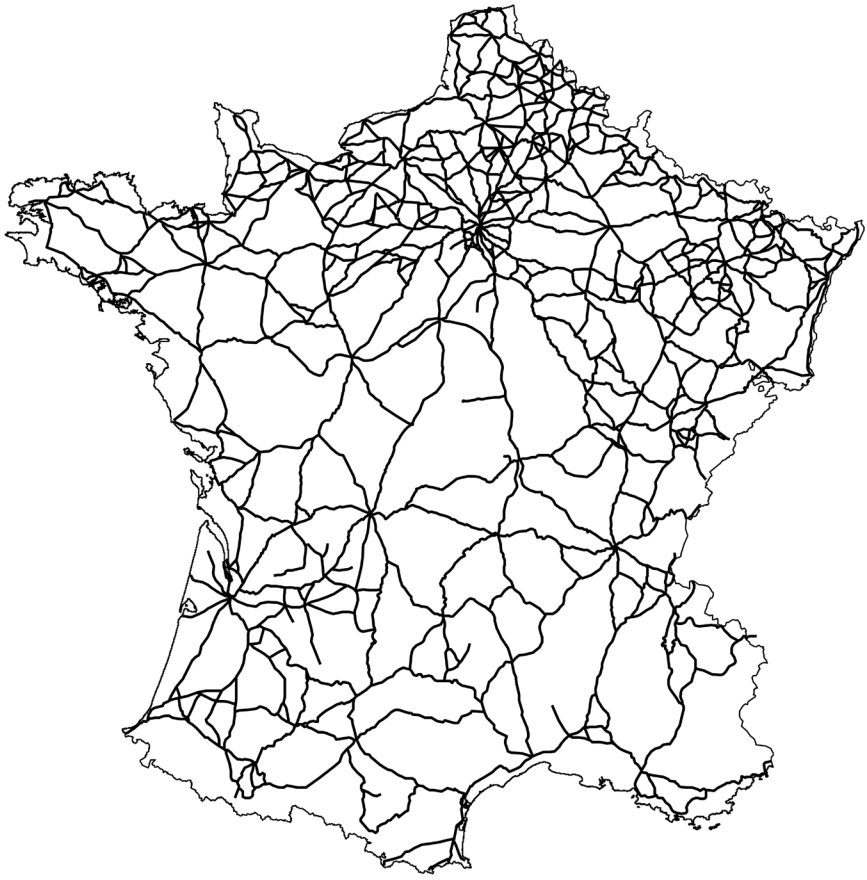

**Figure 4.** Road network, 1789

cost of traveling between districts and cities $i$ and $j$.[19] The term $\sigma$ is a trade elasticity measuring the responsiveness of trade to transport costs between locations; we set the value of $\sigma$ to 1.[20] In our regressions, we follow the current literature and

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

[20] The appropriate value for $\sigma$ 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 a city's economic activity with respect to transport costs across Africa and arrives at values consistently less than 1 (the preferred estimate is .28). Kopsidis and Wolf (2012) assume a value for $\sigma$ of 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 early 19th-century France, we follow Storeygard (2016) and Kopsidis and Wolf (2012) by setting $\sigma$ equal to 1: it is lower than what is preferred for studies of more developed economies but higher than what is estimated for underdeveloped regions in Africa today.

use the natural log of the expression in equation (1) (Donaldson 2018; Donaldson and Hornbeck 2016).

### 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 established by 1200 (Bartlett 1993, p. 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 18th century. The most important historical events that shaped the urban network occurred after 1200. The first of these events was the Black Death, which killed on average 40 percent of the European population and triggered an urban reset away from the Mediterranean Sea to northern Europe (Jedwab, Johnson, and Koyama 2016; Pamuk 2007). The second event was navigation to the Americas in 1492, which triggered a shift in growth toward the Atlantic coast (Acemoglu, Johnson, and Robinson 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 our IV regressions on the FAO's measures of a district's potential suitability for cultivating wheat and market access in 1789 (Fischer et al. 2002).

Between the 4th and 6th 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 to better acquire and manage this land, the papacy started appointing bishops throughout Christendom. Bishoprics were fundamentally territorial (Bartlett 1993), and much of this territoriality involved receiving and managing gifts of land.[21] Furthermore, between the 6th and 11th 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 Archbishop 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 11th century and the reforms of Gregory VII, enforcing clerical celibacy and prohibiting marriage, that the loss of property by the church was slowed.

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

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

**Table 1**
**Auction Plot Value per Hectare in 1790 and Distance from Nearest Bishopric**

| | Bivariate | Full Controls | Trim Top 1% | Trim Top 5% |
|---|---|---|---|---|
| Distance to Bishopric | −.00487 | −.00291 | −.00251 | .000514 |
| | (.00432) | (.00435) | (.00395) | (.00303) |
| Wheat Suitability | No | Yes | Yes | Yes |
| Market Access 1789 | No | Yes | Yes | Yes |
| *N* | 812 | 812 | 804 | 771 |
| Adjusted $R^2$ | .01 | .04 | .05 | .05 |

**Note.** The dependent variable is the log of Assessed Value per Hectare. Robust standard errors, in parentheses, are clustered at the department level; SD of Assessed Value per Hectare = .81; SD of Distance to Bishopric = 13.86.

In the Online Appendix we show the distribution of bishoprics in France in 1600 and the nonparametric 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 OA4, our instrument is highly relevant. No district is more than 55 kilometers from a bishopric; nonetheless, there is a very strong negative correlation between the amount of land owned by the church in a region and proximity to a bishopric.

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 subsample of districts using plot-level data on church properties in 1790 that we collected from archival sources (Bureau des biens à vendre 1791–92). Before the auctions took place, the revolutionaries had assessors visit the properties to provide estimates of their value.[23] We collect these data for 812 farms and vineyards. The distribution of the auction plots is shown in the Online Appendix. In Table 1 we estimate four regressions in which we investigate the relationship between an auction plot's distance from the nearest bishopric and its assessed value per hectare. We estimate a bivariate specification, include market access and wheat suitability controls, and trim the top 1 percent and the top 5 percent of observations by value per hectare.[24] There is no correlation between a plot's distance from a bishopric and its value in any of the specifications. The largest coefficient is −.0049, which indicates that a 1-standard-deviation increase in distance to a bishopric (13.86 kilometers) results in a decrease in value per hectare of less than a tenth of a standard deviation. Furthermore, the coefficient is statistically indistinguishable from 0. Figure 5 shows the lack of a correlation between plot value and distance to a bishopric.

[23] This was particularly important when assignats were 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 since several properties exceed the value of all others by an order of magnitude. It is likely that these values are driven by nonagricultural characteristics, such as a mansion being on the property.

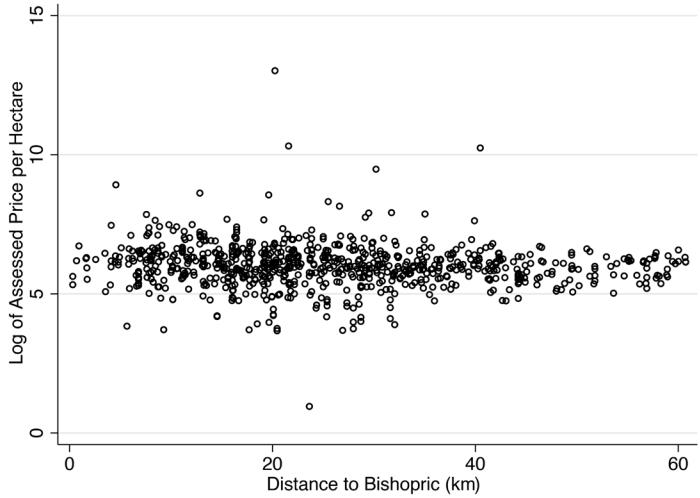


**Figure 5.** Correlation between distance to bishopric and auction property value in 1790

## 4. Empirical Strategy

Our empirical analysis is based on regressions of the form

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

where $Y_i$ is an outcome for district $i$, Percentage Confiscated$_i$ is the percentage 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 12 region dummy variables ($\theta_j$). We report robust standard errors for regression coefficients.[25] Our main coefficient of interest, which we report in the tables, is $\beta$. We express Percentage Confiscated as a number between 0 and 100.

## 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 and wheat acreage. In columns 1–3, we gradually add our main control variables for potential crop suitability and market access in 1789. In columns 4–6, we add the same control variables and include region fixed effects

[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 data set.

**Table 2**
**Land Confiscated and Wheat Production, 1841**

| | Without Region Fixed Effects | | | With Region Fixed Effects | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log Wheat Yields: | | | | | | |
| Percentage Confiscated | .0276** | .0245** | .0199** | .00983** | .00945** | .00941** |
| | (.00376) | (.00387) | (.00341) | (.00345) | (.00339) | (.00341) |
| Wheat Suitability | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Adjusted $R^2$ | .294 | .337 | .452 | .588 | .590 | .591 |
| Log Wheat Hectares: | | | | | | |
| Percentage Confiscated | .0386** | .0215* | .0216* | .0311* | .0246* | .0245* |
| | (.00937) | (.00884) | (.00898) | (.0120) | (.0105) | (.0103) |
| Wheat Suitability | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Adjusted $R^2$ | .054 | .191 | .187 | .176 | .277 | .278 |

**Note.** Results are from ordinary least squares regressions.Wheat yield is in hectoliters per hectare. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 194$.

* $p < .05$.

** $p < .01$.

so that the coefficient on Percentage Confiscated is based only on the within-region variation.

The regressions without region fixed effects show a robust relationship between Percentage Confiscated and Wheat Yields in 1841. When we include all control variables, the coefficient associated with Percentage Confiscated is .0199; this suggests that an increase in district-level confiscations by 10 percent is associated with an increase in wheat yields of close to 20 percent. When all control variables and region fixed effects are included, this estimate shrinks to about .009, which suggests that a 10 percent increase in confiscations led to a 9-percentage-point 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.

Table 2 also shows that there is also a robust, though statistically less precise, relationship between acreage of land in a district dedicated to wheat cultivation and Revolution-era confiscations. When we include all controls, the point estimate suggests that a 10 percent increase in confiscations is associated with 22 percent more land being dedicated to wheat production. Under the full specification with all controls and region fixed effects, this estimate retains statistical significance and suggests that a 10 percent increase in confiscations led to about a 25 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.

**Table 3**
**Land Confiscated and Land Usage**

| | Without Region Fixed Effects | | | With Region Fixed Effects | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Percentage Land Fallow: | | | | | | |
| Percentage Confiscated | −.00639** | −.00529** | −.00400** | −.00387** | −.00385** | −.00384** |
| | (.00106) | (.00115) | (.00108) | (.00134) | (.00134) | (.00134) |
| Wheat Suitability | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Adjusted $R^2$ | .135 | .181 | .259 | .424 | .421 | .421 |
| Percentage Land Artificial Prairie: | | | | | | |
| Percentage Confiscated | .00404* | .00324** | .00267** | .00183* | .00160* | .00160* |
| | (.000777) | (.000750) | (.000725) | (.000731) | (.000720) | (.000723) |
| Wheat Suitability | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Adjusted $R^2$ | .154 | .227 | .269 | .450 | .480 | .477 |

**Note.** Results are from ordinary least squares regressions. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 194$.

* $p < .05$.

** $p < .01$.

### 5.1.2. Land Use

In Table 3 we examine the relationship between revolutionary confiscations and land use in 1852, including the share left to fallow and the share converted into artificial prairies. As discussed above, percentage fallow is a measure of agricultural backwardness, while artificial prairies are a sign of agricultural modernization.

The results, which are robust across all specifications, show that the redistribution of church land led to its more efficient use: there is a lower share of fallow land and a higher share of artificial prairies in areas that experienced greater land redistribution. The specification in which we include all control variables and fixed effects suggests that a 10 percent increase in confiscations leads to a 3.8 percent decrease in fallow land ($\frac{1}{3}$ of a standard deviation) and a 1.6 percent increase in the share of artificial prairies ($\frac{1}{4}$ of a standard deviation).

## *5.2. Pipe Manufacturers*

In Table 4 we report regressions of the percentage of Revolution-era confiscations on the number of pipe plants near the district. The bivariate regression suggests that a 10 percent 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. We then 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 Per-

**Table 4**
**Percentage of Land Confiscated by District and Pipe Manufacturers**

| | Without Region Fixed Effects | | | With Region Fixed Effects | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Percentage Confiscated | .242** | .202** | .208** | .189** | .167* | .164* |
| | (.0633) | (.0634) | (.0645) | (.0656) | (.0669) | (.0674) |
| Elevation Range | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Adjusted $R^2$ | .100 | .124 | .122 | .347 | .379 | .383 |

**Note.** Results are from ordinary least squares regressions. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 194$.

* $p < .05$.

** $p < .01$.

centage Confiscated remains stable at about .2, the coefficient on elevation range (not reported) is, as expected, negative and suggests that a 1-standard-deviation increase in elevation range is associated with about .75 fewer pipe manufacturers. When we add our control for initial market access in 1789, the estimate on Percentage Confiscated is unaffected, while the coefficient on market access in 1789 (not reported) is not significant.

We then run the regressions with the 12 region fixed effects. The regression in column 6 suggests that a 10 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 Revolution-era confiscations is through investments in drainage and irrigation.

### *5.3. Robustness*

In this section we report the results of various robustness tests on our main results for wheat yields, pipe manufacturers, percentage prairie, and percentage fallow. For each test in Table 5, we report the coefficient on confiscations using eight specifications. The specifications for Wheat Yields are based on those with all controls in Table 2. The specifications for Pipe Manufacturing is based on the specifications with the full set of controls in Table 4. The remaining specifications follow the same pattern but use Percentage Fallow and Percentage Prairie as the dependent variables.

Table 5 reports the second-stage coefficient from our IV regressions using distance to nearest bishopric as the instrument. When fixed effects are excluded in the regressions for Wheat Yields, the first-stage *F*-statistic is large at 10.63. The second-stage coefficient suggests that a 10 percent increase in confiscations leads to a 50 percent increase in wheat yields. When region fixed effects are included, the first-stage *F*-statistic falls to 8.5, while the coefficient remains stable. Similarly, the results for the four dependent variables we consider are consistent with our OLS analysis, though in all cases the estimated coefficient on confiscations in-

**Table 5**
**Instrumental Variable Regressions and Robustness Checks**

| | | | | | | Market Access | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | IV Regressions | Conley Standard Errors | Clustered by Department | Émigré Confiscations | Trimmed Sample | Boerner and Severgnini (2011) | Campbell et al. (1993) | Credit | Average Auction Price | Average Auction Size |
| Wheat Yields | .0513** | .0199** | .0199** | .0200** | .0311** | .0162** | .0231** | .0190** | .00635* | .00644* |
| | (.0153) | (.0048) | (.004) | (.00337) | (.00474) | (.00316) | (.00380) | (.00339) | (.00240) | (.00246) |
| | [10.63] | | | | | | | | | |
| Wheat Yields (fixed effects) | .0578** | .0094* | .00941* | .00890* | .0172** | .00916** | .00991* | .00877** | | |
| | (.0192) | (.0042) | (.0046) | (.00342) | (.00612) | (.00340) | (.00340) | (.00332) | | |
| | [8.54] | | | | | | | | | |
| Pipe Manufacturers | .447* | .2076* | .208* | .208** | .207* | .192** | .203** | .196** | .252* | .202* |
| | (.199) | (.0913) | (.0795) | (.0640) | (.103) | (.0621) | (.0633) | (.0673) | (.100) | (.0900) |
| | [11.09] | | | | | | | | | |
| Pipe Manufacturers (fixed effects) | .731* | .1642* | .164* | .152* | .182+ | .166* | .153* | .147* | | |
| | (.298) | (.0737) | (.0668) | (.0651) | (.0941) | (.0668) | (.0654) | (.0631) | | |
| | [7.89] | | | | | | | | | |
| Percentage Land Fallow | −.0107+ | −.0040** | −.00400** | −.00392** | −.00553** | −.00312** | −.00490** | −.00322** | −.00320* | −.00438** |
| | (.00570) | (.0015) | (.0015) | (.00106) | (.00178) | (.00112) | (.00115) | (.00106) | (.00123) | (.000779) |
| | [10.63] | | | | | | | | | |
| Percentage Land Fallow (fixed effects) | −.0203** | −.0038** | −.00384* | −.00390** | −.00703** | −.00375** | −.00403** | −.00333* | | |
| | (.00785) | (.0013) | (.0015) | (.00137) | (.00191) | (.00135) | (.00137) | (.00129) | | |
| | [8.54] | | | | | | | | | |
| Percentage Land Artificial Prairie | .00616* | .0027* | .00267** | .00273** | .00462** | .00200** | .00307** | .00267** | −.00122 | −.00163+ |
| | (.00295) | (.0012) | (.00099) | (.000698) | (.000978) | (.000687) | (.000767) | (.000739) | (.000755) | (.000822) |
| | [10.63] | | | | | | | | | |
| Percentage Land Artificial Prairie (fixed effects) | .00780* | .0016** | .00160* | .00145* | .00343** | .00154* | .00166* | .00159* | | |
| | (.00391) | (.0006) | (.00064) | (.000689) | (.00122) | (.000722) | (.000734) | (.000729) | | |
| | [8.54] | | | | | | | | | |
| *N* | 194 | 194 | 194 | 194 | 176 | 194 | 194 | 194 | 40 | 40 |

**Note.** Results are from robustness tests. All regressions include baseline controls. Heteroskedasticity-robust standard errors are in parentheses; first-stage *F*-statistics are in square brackets. Significance is based on two-sided hypothesis tests. IV = instrumental variables.

+ $p < .1$.
* $p < .05$.
** $p < .01$.

creases in magnitude. One possible explanation for this increase is that our OLS estimates underestimate the effect of the Revolution-era confiscations. Another possibility is that our instrument picks up heterogeneity in the response of the outcomes to the treatment. This might be the case, for example, if the gains to redistribution of church land were greater for properties located close to seats of church administration (for example, bishopric cities).

In regressions not reported but available on request, we also adopted a version of our instrument that is even more stringent—distance to bishoprics only in places with populations in the smallest quartile of all cities. This instrument is more likely to be valid, as such bishoprics are less likely to be located in important locations that may be correlated with confiscations or the outcomes. When we did this, the results largely remained the same, though we lost precision on the estimates when the 12 region fixed effects were included.

We then control for potential spatial correlation across districts by adjusting the standard errors according to the method described by Conley (1999).[26] As expected, several of the coefficients are less precisely estimated after this adjustment, but in no case do the coefficients drop below the 5 percent significance level.[27]

During the Revolution, it was not only church land that was confiscated. There was also a significant amount of land redistributed from émigrés, mostly aristocrats who fled their estates to escape potential persecution at the hands of the revolutionaries (Greer 1951; Castries 1966). In Table 5 we control for these additional confiscations by including a variable equal to the amount of émigré confiscations in each department.[28] Our coefficient estimates are unaffected.

We also trim the top and bottom 5 percent 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 retains its economic significance but is statistically significant only at the 10 percent level, while the other results remain economically large and statistically significant.

To construct our market access measures in Table 5, we use different parameterizations drawn from the literature for the cost of travel over roads, canals, rivers, and seas. We first include the cost specifications from Boerner and Severgnini (2011), and then use Campbell et al. (1993). These specifications differ from those of Bairoch (1988), which we use in our main regressions for the rela-

[26] We choose a cutoff distance of 100 kilometers for the spatial weighting matrix in the reported regressions. We also investigated a cutoff of 250 kilometers and using no cutoff. The degree of spatial autocorrelation as measured using Moran's I for almost all specifications was greatest for shorter distances. As a result, using 100 kilometers is a conservative strategy. To estimate the Conley (1999) errors, we use the code provided by Hsiang (2010).

[27] We also ran regressions in which we clustered the standard errors at the department level. There are, on average, seven districts in each department. When we do this, the coefficients retain their statistical significance. Regressions are available from the authors on request.

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

tive weights placed on costs for sea, river, and road travel compared with portage (no technology).[29] All the results are unaffected.

We also use the availability of credit to account for the possibility that our results are driven by financial development, namely, 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 (Ministère de l'agriculture et du commerce 1843). The regression results however suggest that accounting for these 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 church properties. These data were compiled by the revolutionary assessors to make public the information concerning the plots before the auctions took place (Bureau des biens à vendre 1791–92). We compile the information about the estimated value and plot size for over 4,000 entries in these auction books. Figure OA2 in the Online Appendix shows the spatial distribution of the auction plots and the subset from which we draw our sample. From these data, we create district-level measures of the estimated auction value of the church properties and their surveyed sizes. In Table 5 we report the coefficients on confiscations while including these two variables as controls. While the coefficient on wheat yields shrinks by about a third in the regressions, it retains its statistical significance. The regressions on pipe manufacturers and percentage fallow are relatively unaffected; however, the results for percentage prairie lose statistical significance.[30]

## 6. The Impact of Revolution-Era Confiscations on Agricultural Investment in the Long Run

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 yet 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 Revolution 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 Revolution-era land auc-

[29] As with the cost specifications from Bairoch (1988), we normalize all estimates such that the cost of travel with no technology (portage) carries a value of 1. The relative costs for Boerner and Severgnini (2011) in Table 5 are thus portage 1, roads .50, rivers .50, and seas .13. The relative costs from Campbell et al. (1993) are portage 1, roads .81, rivers .59, and seas .06.

[30] We do not run these regressions at the auction plot level using region fixed effects because of the severe reduction in variation across regions.

tions may have jump-started the process of consolidating landholdings in some areas. Then, consistent with 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 19th century. If this interpretation is true, then we would expect to see greater inequality in landholdings in districts with more Revolution-era redistribution and the treatment effect of the confiscations to diminish over time as untreated regions gradually unwound the feudal distribution of property.

### *6.1. Land Inequality and Ownership*

Bodinier (2010, p. 29, authors' translation) supports the possibility that the Revolution-era auctions allowed for the consolidation of landholdings, asserting 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 percent of all first-origin land auctioned, while 350 peasants purchased 33.2 percent (Bodinier and Teyssier 2000, pp. 219–29). In a similar case, for the district of Limoux, 41 individuals of the grand bourgeoisie purchased 52.6 percent of first-origin land, while 170 peasants accounted for only 15.4 percent. Only a limited number of districts presented by Bodinier and Teyssier (2000) attribute larger gains to the peasants than the bourgeoisie. Even so, in one such district, Coiron, peasants account for only 56.2 percent of all first-origin auctioned land, while the entire bourgeois class accounts for 46.9 percent.

Inequality of land ownership likely did not occur through the number of buyers; in the district of Les Andelys, for example, the numbers of bourgeois and peasant buyers were similar (221 peasants and 223 bourgeoisie). Rather, land auctions most likely preserved existing inequality, as bourgeois buyers purchased larger plots of land; in Les Andelys, peasants purchased 21.1 percent of the land, while the bourgeoisie purchased 49.4 percent (Bodinier and Teyssier 2000, p. 229). This pattern is supported by other case studies outlined in Bodinier and Teyssier (2000, pp. 215–41).

Bodinier and Teyssier (2000) further support the likelihood of the consolidation of landholdings by examining the small number of studies of the resale of confiscated lands in the decade or so after the first-origin auctions. In the district of Tours, for example, 26 percent of the confiscated properties were resold between 1791 and 1814, while in the district of Coiron 20 percent of the confiscated land was resold by 1796.

There are no consistent data on land inequality after the Revolution until 1862, and they are at the department level rather than the district level. Nonetheless, analyzing these data can give some idea of whether there was a persistent difference in landholdings in districts where more land was redistributed in the 1790s. We estimate quantile regressions using average farm size as the dependent vari-

**Table 6**
**Land Confiscated and Average Farm Size**

| | Quantile | | | | | Ordinary Least Squares |
|---|---|---|---|---|---|---|
| | .10 | .25 | .50 | .75 | .90 | |
| Percentage Confiscated | .053 | .065 | .359 | .615** | .547** | .213 |
| | (.059) | (.108) | (.224) | (.210) | (.216) | (.133) |
| Adjusted $R^2$ | .10 | .08 | .15 | .14 | .06 | .15 |

**Note.** Results are from quantile and ordinary least squares regressions. All regressions include controls for wheat suitability and market access in 1789 and region fixed effects. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 194$.
** $p < .01$.

able. Our control variables include measures of soil suitability for wheat and market access in 1789. Because of the higher level of aggregation in the dependent variable (there were 84 departments and 534 districts in 1790), we do not include region fixed effects, and we cluster the standard errors at the department level.

Table 6 reports the coefficient on Percentage Confiscated by quantiles of average farm size. The results suggest that districts with more confiscations had, on average, larger farms. In the 75th percentile, for example, our estimate suggests that a district with 10 percent more confiscations had farms that were 6 hectares larger on average. Given that the standard deviation of average farm size is 5 hectares, this is an economically significant effect.[31] Overall, our empirical analysis of average farm size suggests that one of the main effects of the Revolution-era redistribution of church land was to increase land inequality in districts where there were more confiscations.

Furthermore, in Table 7, we look at what percentage of a district's farmers were sharecroppers. As explained in Section 3.2, sharecropping is consistently associated with small-scale farming. For this purpose, we run district-level regressions based on equation (2) using percentage of sharecropping as the dependent variable. The results suggest that there is a robust negative relationship between Revolution-era confiscations and the percentage of farmers engaged in sharecropping in a district. For example, in our preferred specification with all controls and region fixed effects included, the estimated effect of a 10 percent increase in confiscations is a reduction in sharecropping by about 10 percent.

### *6.2. The Effect of Revolution-Era Confiscations in the Long Run*

According to our hypothesis, the sale of 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. To investigate this possibility, we collect data on wheat yields in

[31] In Figure OA5 of the Online Appendix, we plot the overall distributions of farm size for districts above and below the mean in Revolution-era confiscations as an alternative way to visualize these results.

**Table 7**
**Percentage of Land Confiscated and Sharecropping**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Percentage Confiscated | −.0234** | −.0211** | −.0170** | −.00941* | −.00976* | −.00977* |
| | (.00370) | (.00374) | (.00363) | (.00380) | (.00379) | (.00380) |
| Wheat Suitability | No | Yes | Yes | No | Yes | Yes |
| Market Access 1789 | No | No | Yes | No | No | Yes |
| Region fixed effects | No | No | No | Yes | Yes | Yes |
| Adjusted $R^2$ | .176 | .195 | .268 | .473 | .473 | .470 |

**Note.** Results are from ordinary least squares regressions. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 194$.

* $p < .05$.

** $p < .01$.

1841, 1852, 1875, 1892, 1912, and 1929 (Direction de la statistique générale 1878; Ministère de l'agriculture 1842, 1860, 1897, 1913, 1936).[32] Unfortunately, only the data for 1841 and 1852 are reported at the district level; for the other years the data 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

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

where $d$ indexes districts or departments, $j$ indexes our 12 region fixed effects, and $t$ indexes year.

In Table 8 we report the estimated coefficient $\beta_t$ for each year. In 1841 the estimated effect indicates that a 10 percent increase in confiscations in a district led to a 9.4 percent increase in wheat productivity. This estimate declines to 7.8 percent in 1852 and becomes statistically indistinguishable from 0 in 1875 and 1892. In 1912 the coefficient again becomes statistically significant at the 10 percent level and reaches about half the magnitude as in 1841. In 1929 it shrinks slightly but retains statistical significance.

When we investigate the robustness of the results in Table 8, 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 percent of the district. Arles also had a great deal

[32] We chose 1875 because of its historical significance, since it is the year when the Third French Republic was proclaimed, 1912 is the last year prior to World War I for which we have data, and 1892 was chosen because it is the year when a national agricultural survey was undertaken that is equidistant from 1875 and 1912. Finally, 1929 is the year of publication of the only agricultural survey of the interwar period.

**Table 8**
**Percentage of Land Confiscated and Wheat Yields**

| | (1) | (2) |
|---|---|---|
| Percentage Confiscated × 1841 | .0094* | .0050+ |
| | (.0046) | (.0027) |
| Percentage Confiscated × 1852 | .0078+ | .0048+ |
| | (.0043) | (.0025) |
| Percentage Confiscated × 1875 | −.0002 | −.0015 |
| | (.0024) | (.0028) |
| Percentage Confiscated × 1892 | .0021 | .0009 |
| | (.0020) | (.0027) |
| Percentage Confiscated × 1912 | .0045+ | .0034 |
| | (.0024) | (.0027) |
| Percentage Confiscated × 1929 | .0036+ | .0030 |
| | (.0021) | (.0027) |
| Robust estimator | No | Yes |
| Adjusted $R^2$ | .71 | .77 |

**Note.** Results are from ordinary least squares regressions. Wheat yields are in hectoliters per hectare. All regressions include dummies for year, wheat suitability by year, market access in 1789 by year, and region-year fixed effects. Heteroskedasticity-robust standard errors are in parentheses. Significance is based on two-sided hypothesis tests. $N = 1{,}152$.

+ $p < .1$.

* $p < .05$.

of church land confiscated—25 percent of its area. One possibility is that the beneficial effects of land reallocation persisted longer in the districts that received a larger treatment than the average location. Another possibility is that there were long-term, persistent effects of the land reallocation that reemerged in the 20th century. Regardless, the positive coefficients for 1912 and 1929 disappear under the robust estimation technique reported in column 2.[33] The coefficients from specification (2) are plotted over time in Figure OA6 in the Online Appendix.

Overall, the results in Table 8 offer mixed support for our hypothesis that the Revolution-era 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 100 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 1 persisted and facilitated investments in mechanization during the 20th century. Such an interpretation would be in line with the analysis of Franck and Michalopoulos (2017): they find that areas with less redistribution of émigrés' property, namely, the properties of second origin, preserved their pre-1789 unequal land structure and benefited from more agricultural investments in the 19th century.

[33] 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.

## 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 19th century in areas that 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 likely sustained the inequality inherited from the Old Regime that turned out to be conducive to productivity in the agricultural sector in the 19th century when growth was primarily driven by the accumulation of physical capital. Although it is beyond the scope of this study to assess whether the legal institutions of the Old Regime inhibited growth in the 18th 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 19th century. This effect, however, waned 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 19th century (for a discussion, see, for example, Asselain 1984; Toutain 1993). A potential avenue for future research would be to focus on the other economic policies of the revolutionary era that explain the evolution of investments in the agricultural sector in the 19th century.

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