Land reforms in developing financial markets: lessons from England's land enclosures 1750-1830*

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Abstract

Land privatization or titling reforms are regarded as a central pillar of development policy. It is well known that titling improves allocational efficiency; however, less is known about its ability to enhance financial market access. This paper studies a gradual reform process in 1750–1830 England, privatizing land with common use rights. We provide a theory of the nexus between titling reforms and market access and derive testable empirical predictions. Using a novel database of personal defaults and leveraging county-level variation, we document empirical evidence supporting our theory. We find that titling land with common use rights lead to a rise in local bankruptcies indicating an effect on market access. This effect is stronger in industrialized regions and during downturns.

Keywords: Land Privatization, Land Titling, Enclosures, Collateral Constraints, Credit Markets, Financial Development, Bankruptcy, Industrial Revolution, Economic History, Misallocation, Financial Frictions, Business Cycles.

JEL Codes: E44, G21, G33, K11, N13, N23, O11, O16, O43, Q15.

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1 Introduction

Land privatization (also known as land titling) is often regarded as a critical reform for developing economies due to its potential to improve resource allocation and stimulate economic growth. The key mechanism underlying these policy prescriptions is that formalizing land rights increases landowners' incentives to invest in their land, both by ensuring the returns from their investments and by enabling them to access credit by using the land as collateral (e.g., Feder et al. (1988); de Soto (2000); Deininger (2003)). Several empirical studies that examined this question found that titling indeed has a positive and significant effect on landowners' investment in land and on land value. The evidence regarding the mechanisms in place, however, remain inconclusive and highly dependent on local institutional features, including the security of property rights and underdevelopment of financial markets (e.g., Feder and Feeny (1991); Besley (1995); Deininger and Chamorro (2004); Besley and Ghatak (2010);Galiani and Schargrodsky (2010); Manysheva (2022)).

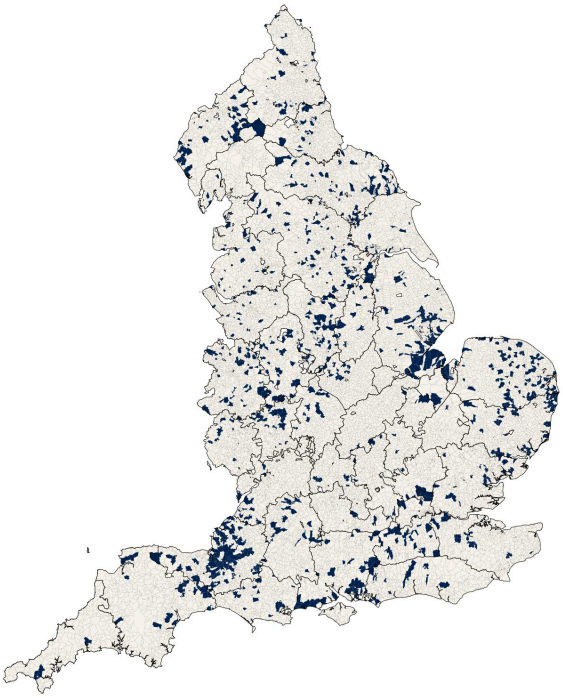
In this paper we study a unique case of titling reforms: the enclosure of land in eighteenth- and nineteenth-century England. We find that titling in this context affected financial markets and argue that enclosures improved access to credit. To give context, between 1750 and 1830, approximately 5.9 million acres of land (around 23,876.5 km^2), or roughly 18 percent of England's total land area, were subject to *enclosure* (Turner (1984)), a legal process that altered property rights over land. Importantly, property rights in England were generally secure in this period (Clark (1996)); however, enclosures changed the feudal nature of landholding and facilitated the broader use of land as collateral (Hodgson (2017), p.6).

There are three important advantages to this case study that allow us to identify the financial channel. First, enclosures involved abolishing all forms of common usage rights over large plots of land that was not agricultural, including, meadows and woodlands, as well as land also known as *waste* (*i.e.*, areas of either stony or rocky, moors, mountains, steep hillsides, etc.). This point matters because in many studies, titling is observed in a rural context, where the land serves both as a factor of production and as collateral for loans, a duality that makes it challenging to disentangle the effect on agricultural productivity from financial inclusion.[1] The second key element is that the rights to the titled land were transferred to relatively wealthy landowners, who were more likely to borrow, as opposed to poor individuals typically examined in most of the existing literature. Lastly, these reforms were sizable, encompassing 4 percent of all England and spread throughout the country, see Figure 1.

We begin our analysis by formalizing the financial effect of land titling in a stylized dynamic endogenous default model in which entitlement can increase credit availability. Heterogeneous entrepreneurs hire factors of production given a cash-in-advance constraint. Borrowing is costly and requires intermediation, and due to the prevailing institutions, the

[1] In fact, studies that concentrate on urban rather than agricultural land find a more significant effect of titling on access to credit (e.g., Piza and de Moura (2016)).

Figure 1: Enclosure of waste by perish



Note: This map reports parishes in which enclosure of waste took place between the years 1750–1830. Lines indicate ancient county borders. Source: see text.

interest rate is capped at the usury rate. Instead, financial intermediaries compete with each other over lending volume by requiring borrowers to post collateral as a function of the loan amount. Commitment in this economy is limited, and default by the entrepreneur entails forfeiture of the collateral to the bank. Crucially, the posting of collateral is also costly for the entrepreneurs. Because intermediaries cannot perfectly observe borrower characteristics, the required collateral is not sufficient to fully prevent the endogenous default of some entrepreneurs. Thus, in equilibrium some entrepreneurs continuously borrow and produce, while others endogenously default.

Introducing land enclosure in this environment implies that some entrepreneurs now face a lower collateral posting cost, increasing their overall desire to borrow. This raises their continuation value and makes overall default risk per-pound-loaned lower. Thus, land titling induces the financial sector to compete over a larger volume of lending and reduce the equilibrium collateral requirements. However, by raising market access overall, this ultimately increases the incentives to default for entrepreneurs who did not see a decline in their collateral posting costs. We show that under general conditions, this equilibrium effect implies a rise in the total number of defaults.

We proceed to empirically evaluate our theory, focusing on waste land privatization through Parliamentary enclosure acts in 1750-1830 England. This enclosure process was gradual, consisting of 1,600 separate enclosure acts of waste during our sample period, each

establishing rights over specific plots. From an economic history perspective, this period is of particular interest due to the rapid industrialization, known as the Industrial Revolution, and the emergence of modern growth patterns of accelerated growth, making it a valuable case study. The role of land enclosures was previously studied mainly in relation to its effect on agricultural productivity and its role in the England's industrialization. However, their financial effects remain understudied (Pressnell (1956), p. 349; Hodgson (2017)).

To conduct our empirical analysis, we construct a unique panel database of ancient English counties for the relevant years, which includes data on the population of Parliamentary enclosure acts and bankruptcy events. Given the scarcity of local banking data ((Pressnell, 1956), p.322), the bankruptcy information is particularly valuable for understanding financial conditions during this period. Our bankruptcy dataset also provides details on the location and occupation of the bankrupt individuals. It includes over sixty thousand cases, sourced from a newly digitized collection created by the authors, based on notices published in the *London Gazette* as mandated by the 1705 Bankruptcy Act.

We use a Poisson local projections model to assess the effect of land enclosures on bankruptcies. Our results admit a causal interpretation under the historically likely assumption that enclosure approval and approval timing are exogenous to the particular county's financial condition. Our baseline specification employs a local-projections-based (Jorda, 2005) identification strategy. Our headline result demonstrates that the enclosure of 1k acres of land is associated with a local rise in bankruptcies in the county of 1.1% within the first year and 2.0% in the second year following the enclosure. We show that this result is robust to various specifications and find no evidence of pre-trends.

Our theory posits that enclosures increased market access. We use bankruptcies as a testable implication of our framework. To support our interpretation of the rise in bankruptcies as evidence of increased market access, we test several corollaries of our theory and show that they are borne out by the data.

Theoretically speaking, our market access interpretation of the rise in defaults implies that we should observe stronger effects of enclosures on bankruptcies when risk and competition are higher. Both the rise in risk (both geopolitical and industrial) and the increase in regional banking competition are secular trends during our sample; consistent with our model predictions, we show that the effect of enclosures on bankruptcies is indeed more pronounced during the latter half of our sample, from 1793 onward, years including a rise in geopolitical tensions with the coming of the Napoleonic wars and higher degrees of industrialization. Furthermore, we augment our dataset with county-level measures of industrialization and document how the effect is mainly driven by the more industrial counties, and periods in which access to finance is more critical and projects are riskier.

Additionally, we leverage regional weather variation captured by the width of tree rings in England during our sample period to construct a shock series to agricultural yields. We then interact our measure of enclosures with dummies indicating degrees of exposure to this

shock and demonstrate that the financial effect of land enclosures is stronger during bad times. When adverse economic conditions arising from bad weather in a mostly agrarian society are combined with the approval of land enclosures, we see a more substantial rise in bankruptcies, consistent with our theory.

While this paper is primarily concerned with the financial role of land enclosures, privatized land is also a factor of production that is likely to generate real economic effects in addition to the financial ones. To explore this real effect and validate our financial interpretation of the effects resulting from waste enclosures, we repeat our baseline local projections model using open field enclosures instead of waste area enclosures and see the opposite effect. Open field enclosures were acts in which the organization of land plots within an estate was altered to allow farmers to work contiguous or adjacent plots instead of disjointed ones. Open field enclosures yield an immediate real effect generating a decline in bankruptcies following an enclosure act, further substantiating the financial nature of the effect observed for waste area enclosures.

The contribution of our results is threefold. Primarily, we illuminate an understudied financial aspect of land enclosure during England's industrial revolution. Secondly, we establish a financial equilibrium effect by which land reforms can affect access to financial markets. Last, our results offer valuable lessons as to the implementation of future land reforms in developing countries in the present day. Namely, we show how the exact timing of the reform relative to the local business cycle, the phase of industrialization, and the stage of financial development can alter its effects on the developing economy.

Our study offers valuable insights into several strands of existing literature. Historically, we provide a new interpretation of the economic role of land enclosures in England's industrialization. While land enclosures have been extensively studied, the focus has largely been on their impact on agricultural productivity (*e.g.*, McCloskey (1989); Allen (1992); Heldring et al. (2022)), rather than their financial implications. Additionally, much of the research has centered on the shift from traditional and corporate systems of cultivation to modern, individualistic ones, therefore, examining the enclosure of arable open fields. In contrast, we focus on the enclosure of commons and waste land, which were often considered to have little economic value. On the financial side of enclosures, studies such as those by Pressnell (1956), Habakkuk (1965), and, Hodgson (2017), suggest that enclosures enabled the use of privatized land as collateral for loans. However, to our knowledge, we are the first to fully explore and empirically test this idea, providing new insights into the economic consequences of enclosures.

We also contribute to the literature that examines the effect of titling reforms on access to credit, particularly in the presence of inefficient enforcement of debt contracts. A number of studies have provided evidence supporting the existence of a positive effect of land titling on credit supply. For instance, Feder et al. (1988) found that land titling in Thailand influenced investment primarily through its impact on credit access. The conclusions of many of these

studies are limited for several reasons. One key issue is the type of market failures being addressed. In many low-income countries, formal land titling and registration do not necessarily translate into secure tenure in practice, which is crucial for generating a meaningful impact on credit markets (Manysheva (2022)). Another limitation is the failure to account for selection bias and other potential confounders that could bias the estimated effects and lead to an overestimation of the impact of titling programs (Deininger and Chamorro (2004)). A number of studies, such as those by Feder and Feeny (1991); Besley (1995); Deininger and Chamorro (2004); Besley and Ghatak (2010); Galiani and Schargrodsky (2010); Manysheva (2022), have addressed many of these concerns, but they often focus on agricultural environments, where it is difficult to isolate the financial effects of titling from productivity gains resulting from better resource allocation. Additionally, most of these studies are set in low-income contexts, which introduces further complexities.

Our study builds on these existing works but offers several significant contributions. Our setting and analysis are advantageous in allowing us to isolate the access to credit channel by focusing solely on the privatization of non-agricultural land with common use rights. Thus, we can study the financial effects separately from potential productivity improvements associated with agricultural reforms. Moreover, our analysis is conducted in a context where property rights are already secured, it investigates the effects of changes to property rights among a relatively wealthier population, thus avoiding the confounding factors that typically arise in more impoverished or agricultural-focused environments. Theoretically, we contribute by explicitly modeling a monopolistic competition leading towards an endogamous collateral requirement. Empirically, we leverage the surprising timing in which land titles were granted to examine their effects on the local credit market. This work finds supporting evidence of titling's effect on financial market access, and shows how these effects are stronger during downturns and in more industrial settings, pointing towards the underlying mechanisms.

Our work is also related to a rich tradition in the macroeconomic literature considers the role of factor misallocation á la Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) in accounting for cross country differences in economic development. In particular, there is a body of works that studies the role of collateral requirements for entrepreneurs in generating such a misallocation of resources, e.g., Buera and Shin (2013); Moll (2014); Manysheva (2022); Morazzoni and Sy (2022); Goraya (2023); Albuquerque and Ifergane (2024). All these works conceptualize collateral requirements using an exogenous collateral constraint as in the seminal works of Evans and Jovanovic (1989) and Kiyotaki and Moore (1997). In comparison, our model and institutional setting jointly present a context where the collateral requirements, and the constraint faced by the entrepreneur itself, are an equilibrium outcome. This is a likely case when financial intermediaries compete over the collateral itself instead of interest rates due to usury laws, or other institutional frictions.

This paper proceeds as follows. Section 2 presents the institutional context of our study.

Section 3 develops our theoretical framework and derive the main testable predictions from it. Section 4 describes our database used in the empirical analysis. Section 5 details the method of our empirical analysis and presents the results. The final section concludes.

2 Institutional setting: England 1750-1830

2.1 Land enclosure in England 1750-1830

One of the most important changes to landed rights in England during the years 1750-1830 was parliamentary enclosures (i.e., land enclosures carried out under the authority of the private Acts of enclosure), which accounted for the major part of land enclosures in this period. They transformed the legal status of approximately 5.9 million acres of land (23,876.5 km2), about 18 percent of the land in England (according to Turner (1984), pp. 179-181).[2]

Literally, the term enclosure (or *inclosure*) refers to fencing or hedging off areas of land for private use. Fencing, however, followed a legal process that abolished all forms of customary usage rights over the land, known as *common rights*, which were old-established and included mainly the right of the occupiers of farmlands and cottages of the parish to graze livestock on arable lands of the *open fields* after the crops had been harvested, as well as on areas of meadow and of open land.[3] Thus, land enclosures did not change the quality of enforcement of property rights, which were already secure in England before the 1688 Revolution (Clark (1996)), but rather, the “feudal nature of landed rights”, enabling more extensive use of land "as collateral to finance business ventures.” (Hodgson (2017), p.6).

There were two main types of land enclosures. One was the enclosure of open fields, which was in fact a re-organization of existing rights over the scattered and unfenced strips of land, with the aim of consolidating it into one large and contiguous plot. The second type was the enclosure of commons, which privatized land to which villagers previously had customary usage rights. Areas with usage rights included woods, meadows, as well as land that was referred to by contemporaries as *waste*, "included areas of stony or rocky ground together with more extensive stretches of heathland, moors and bogs, as well as barren mountains and steep hillsides. Parts of the waste might be useful for some very sparse grazing, for gathering wild berries and digging turves or peat for fuel, and perhaps for getting supplies of

[2]There was another important form of enclosure that was carried out by the common consent of the owners of the land ("enclosures by agreement"). In this form of enclosure landowners agreed unanimously to enclose a part or all of the land. Private enclosure of this sort took place throughout the Middle Ages and the Early Modern period. The crucial change Parliament enacted around 1700. By about 1900, virtually all of England was under private consolidated ownership (Mingay (1997), p.14).

[3]In the open fields system farmers’ strips of land were scattered and unfenced and decisions over the use of land had to be reached in common. The use of land required much cooperation in cultivation and animal husbandry, as well as in decisions of the choice of crops in the crop-rotation system, in which one field would lie fallow to prevent soil exhaustion while the other one or two were cultivated, growing different seasonal crops, such as corn, wheat, rye, barley, peas, beans and oats. The lord’s demesne strips would often be scattered among those of the tenants.

clay, gravel and stone for repairing houses and maintaining the roads." (Mingay (1997), pp.8-9). A very high proportion of Parliamentary enclosures consisted of commons and waste (three fifth according to Chapman (1987)), thus, most of the open fields were already enclosed before the eighteenth century.

The relevant difference between the two types of enclosures is that the latter was newly privatized land and therefore increased the stock of privately owned land, while the former type of enclosure only changed the land's productivity and consequently, its value, but not its legal status.[4] In this study we focus on the effect of the enclosure of waste and examine its effect on financial markets.

2.2 The value of enclosed waste

While waste was not used for intensive cultivation prior to its enclosure, it was usually essential for grazing as well as for materials used for fuel, building and fertilizing. In some cases, its use could be converted to agricultural cultivation. In contrast with Clark and Clark (2001) claim, which concludes from information on enclosures of charity land that the value of waste was marginal, local studies of enclosure show that waste was highly valued and in many cases was sold or leased after the enclosure award. Based on evidence from waste enclosure in the township of Croston in south-west Lancashire, which had the highest concentration of large landed estates in the county and was the location of considerable waste land, "the value of the waste land to people at every level is unmistakable" (Rogers (1993), p. 145).[5] The township consisted of about 1,200 acres of formerly enclosed manor and demesne lands (*i.e.*, land directly owned by a lord or a king), and a further 800 acres of open waste known as *Croston Finney*, which was enclosed in 1725. According to Rogers (1993), the value of enclosing this type of land was the potential of increasing the returns of the owners through leasing it out, thus, although some proprietary claims over the wasteland were acknowledged, it was also conditioned by an insistence on customary use rights by villagers (p. 146-8). The enclosed waste in Croston (Finney) was highly valued (estimated at £1.5 per acre of high quality land, 50 percent higher than the value of the waste that was enclosed before 1725). The land was not turned over to intensive cultivation but was highly valued for grazing and remained so until the turn of the nineteenth century (Rogers (1993), p.148). Based on evidence of estate leases, completed by 1735 at the latest, many small landholders sold their land following the enclosure (p. 151, Table 2).

Similarly, evidence from Somerset, where extensive areas of waste were enclosed during the eighteenth and nineteenth century (13.8 percent of the county) and land enclosure awards were well preserved, shows that waste was highly valued (Williams (1972); Buchanan

[4] (see Heldring et al. (2022)).

[5] While Lancashire was mainly studied in the context of its industrialization, it featured a rich and diverse agricultural landscape, stretching from the flat plains of West Lancashire and the rolling vales of the Kibble Valley, to the fertile fields of the Fylde and the serene, pastoral uplands in the far north.

(1982)). The value of the waste land can be inferred from the Parliamentary enclosure awards that survived (1770-1830) and documented sales of land for financing the enclosure.[6] It depended on the land's quality, land use suitability (*e.g.*, cultivation, grazing, construction, etc.), and expected enclosure costs (Buchanan (1982)). Thus, the landscape of the four major regions that were subject to waste enclosure in Somerset (the lowland Levels, and the upland areas of the Western Hills, Mendip Hills, and Southern Hills), varied much.

2.3 Access to credit

Despite the institutional changes brought about by the 1688 Glorious Revolution, the English financial system remained fragmented and restricted in 1750-1830.[7] It was shaped by institutional factors, including limited enforceability of contracts, legal constraints on private banking, and a usury law, that resulted in a "three-tiered structure" consisting of London banks, the Bank of England (BoE), and country banks, each playing a distinct role in the economy (Pressnell (1956), p. 75). Alongside this formal banking system, there existed an informal credit sector that played a crucial role, especially in the absence of sufficient formal banking services. This sector included respected traders, wealthy aristocrats, merchants, moneylenders, scriveners, and goldsmiths, all of whom provided credit and banking services, albeit outside the formal regulatory framework.

The origins of London's banking system can be traced back to the mid-seventeenth century, when goldsmiths began offering banking services. This development was catalyzed by the seizure of £130,000 of merchants' bullion by King Charles I in 1640, which led merchants to seek safer storage for their funds, previously held at the Tower of London. Goldsmiths emerged as trusted custodians of wealth, offering a more secure and profitable alternative for merchants and the aristocracy (Andreades (1909) p. 21). Over time, goldsmiths began to extend credit, creating the foundations for modern banking in London.

Despite the advantages of goldsmith banking, this model posed challenges for the government, which had to borrow at relatively high interest rates (Andreades (1909), pp. 34-35). This became particularly problematic after the 1672 crisis, when the government suspended all payments from the Exchequer for 12 months while owing £1,300,000 to the goldsmiths. The resulting atmosphere of distrust made it increasingly difficult for the government to secure funding, a problem that worsened after the 1688 Glorious Revolution when the need for financing grew due to costly wars.

When the Bank of England was established in 1694 it was primarily to facilitate govern-

[6] The land was sold in a public auction, after the commissioners inspected the land, assessed its quality and situation on the advice of a surveyor, and arranged a mortgage (Buchanan (1982), p.114)

[7] While there is an agreement as to the important role of Glorious Revolution in the development of the financial markets (Dickson (1967); North and Weingast (1989)) the question as to the extent to which it impacted private credit markets remains debated. Thus, while it strengthened the government's debt capacity, some scholars argue that the effects on private credit markets were either minimal or even negative (e.g., Clark (1996); Temin and Voth (2008))

ment debt issuance. Although it is known to have played a crucial role in the development of the financial sector (Hodgson (2017); O'Brien and Palma (2023)), it did not solve the broader credit shortages that plagued the economy (Pressnell (1956), Calomiris and Haber (2015)). In fact, Calomiris and Haber (2015) go as far as to argue that the creation of the Bank of England hindered industrialization and that England industrialized "in spite of the fact that the government had quite consciously constrained the growth of the banking system in order to favor itself and the Bank of England" (p. 85).

The Bank of England was established by Parliament as the first joint stock bank in England and its monopoly powers were granted in Acts passed in 1697, 1707 and 1708. The Act of 1708 restricted the issue of notes to the Bank of England and required all other banks to function as partnerships of six or fewer members. The result was that private banks in England remained small, limited in their ability to mobilize credit and in their geographical reach (Turner (2014), p.36). The number of these partnership banks grew steadily during the 18th century, with more than 300 banks by 1800 and 761 banks by 1813, after a growth phase during the Napoleonic Wars Pressnell (1956), p. 127).

On top of these legal constraints was the usury law, which capped the interest rates that private banks could charge on loans and which did not apply to government borrowing. Usury laws favored government debt over private lending and discouraged private banks from providing loans for long-term or higher-risk ventures (Calomiris and Haber (2015), p. 96). It created major barriers for entrepreneurs, particularly those seeking to fund innovative and high-risk projects that were essential for industrial development. A notable example of this is the Boulton and Watt enterprise, which struggled to secure the necessary capital for James Watt's pioneering work on the steam engine. Despite Matthew Boulton's social status and strong reputation as a successful entrepreneur, the firm faced severe financial constraints, threatening its survival and hindering its growth (Roll (1968), p.79).[8]

The favoring of government borrowing also had broader economic consequences, including rising interest rates and liquidity shortages. Studies by Quinn (2001) and Temin and Voth (2013) show that government borrowing crowded out private credit, exacerbating financial conditions during periods of war and economic recession. Hoppit (1987) found that bankruptcies tended to rise during these times, particularly as businesses faced tightening credit and disruptions in trade. Hudson (1986) similarly noted that textile firms experienced higher failure rates during recessions when credit became scarce, with firms unable to secure the capital needed to weather downturns (p. 203).

The result was that access to private credit was limited, and businesses struggled to secure external funding, especially as the economy expanded and industrialized in the mid-eighteenth century (Hoppit (1987); Casson (1993); Wilson (1995)). Many firms in the textile industry struggled due to liquidity problems rather than lacked assets (Hudson (1986), p.249) and only a small group of well-connected entrepreneurs, with access to London cap-

[8] see also Hodgson (2021), p.434

ital or merchant networks, was able to expand their businesses (Chapman (1979)). Most firms remained small and were the first to fail during economic downturns.[9]

The monopoly of the BoE on note issuing further constrained private banks outside London, where the BOE did not circulate notes nor establish branches. The result was the emergence of small local banks, known as *country banks*, that issued notes, offered overdrafts, and discounted bills (Pressnell (1956), pp. 136, 284; Calomiris and Haber (2015), pp. 95-97). However, their notes were less secure than those of the BoE and they were therefore more susceptible to bank runs in the instance of a financial crises (Joslin (1954), p.170).[10] Despite the attempt to mitigate these risks by employing agents in London that managed their investments and ensured the liquidity of their notes (Joslin (1954), p.183), they remained unstable and prone to failure, providing mostly short-term credit.

The number and size of country banks grew rapidly. While there were no more than a dozen in the 1750's, they reached about one hundred in the mid 1770's and nearly tripled to 276 in the early 1780's. Then, after 1797, their number reached an estimated peak of 740 in 1810, before beginning a decline to under 400 by 1850 (Gent (2016), p. 15).[11] By the early nineteenth century banks existed in all the English counties. For example, according to the Post Office London Directory, there was an average of 13 banks per county in 1808 (excluding London, which had 79 banks out of a total of around 620). Interestingly, no significant correlation was found between the number of country banks during this period and county specialization.

In conclusion, the English financial system expanded between 1750 and 1830, but remained fragmented and restricted by the legal frameworks. While institutional changes improved the government's debt capacity, they did little to alleviate the credit constraints faced by entrepreneurs and hindered the development of a dynamic banking system that could support industrialization. The existence of an informal credit sector, though increasingly declining over time, provided some relief to businesses but could not fully address the financial needs of a growing economy. The expansion of country banks during this period played an important role in industrialization, but their small size, dependence on London agents, and instability meant they were unable to fully address the financial needs of the growing economy.

[9] According to Chapman (1979), the funds required for working capital in industries like textile were much higher than those for fixed capital (about three times as much), which were relatively modest before 1815 and could be met through the conversion or adaptation of existing buildings.

[10] The average capital of a country bank was about £10,000 by the end of the eighteenth century according to Pressnell (1956) (pp. 226-227). Only a few of the largest Country banks reached half a million in balance sheet (Gent (2016)).

[11] "In the UK provinces there were about a dozen country banks in 1750, 119 in 1784 and 280 in 1793, reaching to a peak of 707 in 1812" (Hodgson (2017), p.436).

2.4 Loans by way of mortgage

Collateral has been theoretically shown to play a crucial role in environments with weak enforcement of debt contracts (Barro (1976); Hart and Moore (1994)). Reliance on collateral is a key feature in early financial markets and in developing economies, but also in more developed markets with stronger enforcement mechanisms. Empirical research has found for example, that collateral constraints restrict firm entry and post-entry growth (Schmalz et al. (2017)), and that collateral value influences firms' debt capacities and investments (Chaney et al. (2012); Gan (2007)). Furthermore, recent studies also find that collateral played a role in financial contracts, showing that U.S. firms using assets with low collateral value sign contracts characterized by higher costs, smaller size and shorter maturity than firms with high collateral values (see e.g., Benmelech and Bergman (2009); Benmelech et al. (2005), and more).

Indeed, within the institutional setting in the years 1750-1830, described in section 2.3, borrowing from banks or other individuals outside the trusted social circles, was challenging and required securities. In this paper, we assume that the land privatized through enclosure served as collateral for loans, helping to facilitate borrowing. This could have been done either by the original landowners or by the new owners, if the land was sold after its privatization.

While the scattered and partial documentation from this period does not allow us to provide direct evidence for such transactions, there is much indirect evidence to support this conjecture. First, land was widely used as collateral for borrowing from either, individuals or banks. Hodgson (2021), who studies this matter in depth, provides ample evidence from various studies for the use of land as collateral in this period, in which there was a remarkable rise in the volume of discounts and loans on mortgage according to Joslin (1954) (p.170). In his comprehensive examination of London and Country bank financial records, Gent (2016) finds that the business model of most of the established goldsmith banks "focused on the direct gathering of non-interest-bearing deposits from wealthy individuals and lending these out secured against collateral, mostly longer-dated mortgages on houses and landed estates." (p.158). FOr example, in the years 1778-1797, Hoares Bank's longer-term commitments in the form of "money lent on mortgage, bond, etc." accounted for the majority of the total secured lending (p.101). Similarly, on the eve of the Restriction in 1796, half of Goslings' assets were again devoted to secured lending on mortgage or bond or other collateral. (p. 106). In the same vain, Turner (1981) noted that large landowners were chronically encumbered by mortgages throughout the beginning of the eighteenth century, and concludes that "mortgage, apparently, had become a secure method of raising a loan" (pp.243-4).

As to the enclosed land, Hodgson (2021) argues that enclosed land played a significant role in providing collateral for mortgages. Yet, he finds that it was mainly in the agricultural

and landed sectors rather than in the industrial ones, which faced distinct financial challenges and often relied more on other forms of finance, such as equity or short-term credit. Hudson (2002), however, challenges this view. She notices that an unusual number of textile entrepreneurs, known as *clothiers*, were acquiring land in west Yorkshire before it was enclosed and concludes that it was probably to secure better terms on loans (p.97). In addition, evidence suggests that in many cases enclosed land served to raise funds to pay for the enclosure itself (e.g., the commissioners' rates and fencing) by mortgage on the land, of which the value was expected to rise (Mingay (1963), pp 97-98). In fact, many enclosure acts contained clauses permitting commissioners to mortgage land to cover the costs of enclosures, indicating that landowners were already using their newly privatized land as collateral (Pressnell (1956), p.350). Pressnell (1956) also finds evidence that country banks helped in the financing of enclosures and noted that their business' location was influenced by the proximity of large farms (pp. 349-355).

3 Theoretical framework

In order to understand how land enclosures affect market access, we develop a tractable model where entrepreneurs borrow from intermediaries in order to finance their activities. The model is tailored to capture salient institutional details of the historical context: in particular, lenders face a binding usury rate, and there exists a "many to many" relationship between lenders and borrowers.

Entrepreneurial activity is risky since projects may fail; but more importantly, entrepreneurs may choose to default on their debt obligations. Because financial intermediaries are constrained by usury laws, they cannot set the borrowing rate high enough to compensate for default risk. Instead, intermediaries require collateral to partially overcome the limited commitment problem on the part of borrowers.

However, from the entrepreneur's perspective, posting collateral is costly even in the event where they do not default. Land reforms interact with this environment in part by increasing the pool of available assets to entrepreneurs which can be used as less costly collateral. Ultimately, the model yields empirically testable predictions that will be evaluated in the next sections of the paper.

3.1 Setup

Time is discrete and goes from $t = 1, \ldots, \infty$. There are two types of agents in the model: entrepreneurs (or "firms") and financial intermediaries (or "banks"). All agents are risk-neutral and maximize discounted lifetime expected profits.

Firms. When in operation, a firm i has access to a productive technology which produces revenue

$$y_{i,t} = z_{i,t} f(v_{i,t}), \tag{1}$$

where $z_{i,t}$ is productivity and $f(\cdot)$ is a concave production function with $f(0) = 0, f'(v) > 0, f''(v) < 0$ (identical across firms). Production depends on variable inputs $v_{i,t}$, which firms must borrow in advance.[12] Firms borrow from differentiated banks $j \in [0,1]$, so that $v_{i,t} = \int_0^1 \ell_{i,t}(j)\,\mathrm{d}j$, where $\ell_{i,t}(j)$ is the loan amount of firm i from bank j (in measure $\mathrm{d}j$).

Each bank charges the same gross rate $1 + r$ (which is fixed and exogenous due to regulations). However, firms must post collateral $g_{i,t}(j)$ at each bank from which they borrow. Banks require each firm to post collateral equal to a fraction of the firm's loan amount: $g_{i,t}(j) = \eta_t(j)\ell_{i,t}(j)$. Firms take as given the required collateral fraction $\eta_t(j)$ across banks (the bank problem is described below).

Posting collateral is costly: firms must pay cost $c_{i,t}\gamma(g_{i,t})$ to post collateral, where $g_{i,t}$ is a CES function of all borrowing across banks:

$$g_{i,t} \equiv \left[\int_0^1 g_{i,t}(j)^\theta \,\mathrm{d}j\right]^{\frac{1}{\theta}}. \tag{2}$$

Note that $\theta > 1$; thus, collateral aggregation is a convex function. The cost function $\gamma(\cdot)$ satisfies $\gamma(0) = 0, \gamma'(g) > 0, \gamma''(g) > 0$ (identical across firms). The convexity of the cost function $\gamma(\cdot)$ captures the idea that, due to contracting frictions, posting larger amounts of collateral imply significant increases in costs. The cost parameter $c_{i,t}$ captures the fact that these costs differ across firms.[13]

The CES assumption reflects firm preferences or relationships across different banks, or reputation concerns. A higher value of θ implies that firms find it more difficult to substitute borrowing across banks. Thus, $\theta > 1$ can be interpreted narrowly as bank market power: higher θ implies more market power. More generally, θ can be interpreted as the overall sophistication or risk-bearing capacity of the financial intermediation sector (broadly defined).

CES aggregation implies

$$g_{i,t}(j) = \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} g_{i,t} \implies v_{i,t} = \int_0^1 \frac{1}{\eta_t(j)}\left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} \mathrm{d}j\, g_{i,t}, \tag{3}$$

[12] For simplicity, we normalize the price of output and inputs to 1. This is without loss of generality as we can define (1) in terms of revenue and normalize $z_{i,t}$.

[13] Another alternative approach is to instead assume some loss between the promised collateral and the delivered collateral (or a difference between the value of the collateral to the firm vs the bank). This would not meaningfully change the firm or bank problem, so long as the banks can require different amounts of collateral as a function of the expected collateral loss.

where $\eta_t \equiv \left[\int_0^1 \eta_t(j)^{\frac{\theta}{1-\theta}}\,\mathrm{d}j\right]^{\frac{1-\theta}{\theta}}$. Since $\theta > 1$, we have $-\infty < \frac{1}{1-\theta} < 0$. Thus we have that demand for bank j loans is lower whenever the collateral fraction $\eta(j)$ is higher.

If the firm repays bank j ($D_{i,t}(j) = 0$), its collateral $g_{i,t}(j)$ is returned and it pays the bank $(1+r)\ell_{i,t}(j)$. If the firm declares bankruptcy and defaults ($D_{i,t}(j) = 1$), then the firm does not pay the bank but loses its collateral $g_{i,t}(j)$. Thus at the end of period, the firm pays bank j

$$\psi_{i,t}(j) \equiv \left[\mathbf{1}(D_{i,t}(j) = 0)(1+r) + \mathbf{1}(D_{i,t}(j) = 1)\eta_t(j)\right]\ell_{i,t}(j).$$

The firm can always choose to default. Additionally, even if the firm wishes to repay, with probability $q_{i,t}$ the firm fails and is forced to default. If the firm has defaulted on any bank in any previous period, it enters autarky and earns A each period. The following Lemma characterizes the firm problem.

Lemma 1 (Firm Problem)**.** *Firm i chooses inputs $v_{i,t}$ and makes default decisions $D_{i,t}(j) = D_{i,t}(j') \equiv D_{i,t}$ in order to maximize lifetime discounted expected profits, given by*

$$\mathcal{W}_{i,t} \equiv \max_{\{v_{i,t+k}, D_{i,t+k}\}_{k=0}^{\infty}} \mathrm{E}_t \sum_{k=0}^{\infty} \beta^k \Pi_{i,t+k}(v_{i,t+k}). \tag{4}$$

If $D_{i,t} = 1$ for any t, then $\Pi_{i,t+k} = A\ \forall k > 0$. Otherwise,

$$\mathrm{E}_t \Pi_{i,t}(v_{i,t}) = z_{i,t} f(v_{i,t}) - c_{i,t}\gamma(g_{i,t}) - \begin{cases} (1-q_{i,t})(1+r)v_{i,t} + q_{i,t}\tilde{\eta}_t g_{i,t} & \text{if } D_{i,t} = 0 \\ \tilde{\eta}_t g_{i,t} & \text{if } D_{i,t} = 1 \end{cases}, \tag{5}$$

where $\tilde{\eta}_t \equiv \int_0^1 \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}}\mathrm{d}j$ is a function of the dispersion of collateral requirements, and $g_{i,t}$ is given by (3).

Banks. Banks $j \in [0,1]$ are risk-neutral and maximize expected per-period profits. The loan rate $1+r$ is exogenous, but firms compete monopolistically over collateral (as described above in the firm problem). Banks finance their lending at the risk-free rate $1 + r^{rf}$.

While banks are unable to change the rate at which they lend, each bank can require borrowers post collateral equal to a fraction of the loan amount. In particular, bank j chooses the collateral fraction $\eta_t(j)$ such that when lending to $\ell_{i,t}(j)$ to firm i, firm i posts collateral $g_{i,t}(j) = \eta_t(j)\ell_{i,t}(j)$. We assume that the collateral demanded is restricted to be a linear function of loan amount, and in particular cannot condition on firm type. If firm i repays bank j ($D_{i,t}(j) = 0$), then the bank earns $(1+r)\ell_{i,t}(j)$. If firm i defaults ($D_{i,t}(j) = 1$), the bank keeps the collateral $g_{i,t}(j)$. Thus, per-period profits of bank j are

$$\Pi_t(j) = \int_i \left[\mathbf{1}(D_{i,t}(j) = 0)(1+r)\ell_{i,t}(j) + \mathbf{1}(D_{i,t}(j) = 1)g_{i,t}(j)\,\mathrm{d}i - (1+r^{rf})\ell_{i,t}(j)\right]\mathrm{d}i\,. \tag{6}$$

Banks take the CES demand (3) as given. The following Lemma characterizes the bank problem.

Lemma 2 (Bank Problem.)**.** *Bank j solve the following per-period problem:*

$$\max_{\eta_t(j)} (1+r)\frac{1}{\eta_t(j)}\left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t^R + \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t^D - (1+r^{rf})\frac{1}{\eta_t(j)}\left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t, \tag{7}$$

taking as given the collateral index η_t and aggregate posted collateral by firm repayments:

$$G_t^R \equiv \int_i \mathbf{1}(D_{i,t}=0) g_{i,t}\,\mathrm{d}i\,, \tag{8}$$

$$G_t^D \equiv \int_i \mathbf{1}(D_{i,t}=1) g_{i,t}\,\mathrm{d}i\,, \tag{9}$$

and $G_t \equiv \int_i g_{i,t}\,\mathrm{d}i = G_t^R + G_t^D$.

3.2 Equilibrium

We focus on a symmetric equilibrium in which all banks choose $\eta_t(j) = \eta_t(j') \equiv \eta_t$. The following Proposition characterizes the equilibrium of the model.

Proposition 1 (Symmetric Equilibrium)**.** *The aggregate collateral index is given by*

$$\eta_t = \theta\left[(1+r^{rf}) - (r-r^{rf})\frac{G_t^R}{G_t^D}\right]. \tag{10}$$

Taking this as given, the firm problem can be written recursively as

$$\mathcal{W}_t = \max_{D_{i,t}} \quad \mathbf{1}(D_{i,t}=0)\mathcal{W}_t^R + \mathbf{1}(D_{i,t}=1)\mathcal{W}_t^D, \tag{11}$$

$$\begin{aligned}\mathcal{W}_t^R = \max_{v_{i,t}^R} \quad & z_{i,t} f(v_{i,t}^R) - c_{i,t}\gamma(\eta_t v_{i,t}^R) \\ & + (1-q_{i,t})\left[\beta \mathrm{E}_t[\mathcal{W}_t] - (1+r)v_{i,t}^R\right] + q_{i,t}\left[\frac{\beta}{1-\beta}A - \eta_t v_{i,t}^R\right],\end{aligned} \tag{12}$$

$$\mathcal{W}_t^D = \max_{v_{i,t}^D} \quad z_{i,t} f(v_{i,t}^D) - c_{i,t}\gamma(\eta_t v_{i,t}^D) + \left[\frac{\beta}{1-\beta}A - \eta_t v_{i,t}^D\right], \tag{13}$$

and the optimal production decisions when planning to repay or default satisfy

$$z_{i,t} f'(v_{i,t}^R) - c_{i,t}\eta_t\gamma'(\eta_t v_{i,t}^R) = (1-q_{i,t})(1+r) + q_{i,t}\eta_t, \tag{14}$$

$$z_{i,t} f'(v_{i,t}^D) - c_{i,t}\eta_t\gamma'(\eta_t v_{i,t}^D) = \eta_t. \tag{15}$$

The results from Prop. 1 allow for some general observations. First, from the bank optimality conditions (10), we see that that market power implies that banks can extract high

collateral even when default rates are small (recall $\theta > 1$). Thus, banks can operate even with a small spread between the (exogenous) loan rate r and the risk-free rate r^{rf}.

Further, from the concavity of the production function $f(\cdot)$ and the convexity of the cost function $\gamma(\cdot)$, we can immediately see from the firm optimality conditions (14) and (15) that, all else equal, firms will borrow (and produce) more if they are more productive (larger $z_{i,t}$); if they face lower collateral costs (smaller $c_{i,t}$); or if they are less risky (lower $q_{i,t}$). Additionally, we can also immediately see that firms who *ex-ante* plan on defaulting will borrow (and produce more).[14]

However, without further structure, Prop. 1 does not allow us to say much about characterizing the endogenous default decision of a given firm. In order to better understand the firm default decision, we make the following assumptions:

(1) *Persistent idiosyncratic firm characteristics:* $z_{i,t} \approx \mathrm{E}_t\, z_{i,t+1}$, $q_{i,t} \approx \mathrm{E}_t\, q_{i,t+1}$, and $c_{i,t} \approx \mathrm{E}_t\, c_{i,t+1}$.

(2) *Regularity conditions:* the support of the distribution of idiosyncratic firm characteristics $\{z_{i,t}, q_{i,t}, c_{i,t}\}$ are such that $(1-\beta(1-q_{i,t}))\gamma(\eta_t v^D_{i,t}) < \gamma(\eta_t v^R_{i,t})$; and for any $\{z_{i,t}, q_{i,t}\}$, firm i will always choose to repay if $c_{i,t} = 0$.

Assumption (1) is a strong assumption, but implies $\eta_t \approx \mathrm{E}_t\, \eta_{t+1}$ and $\mathcal{W}_{i,t} \approx E_t \mathcal{W}_{i,t+1}$. This transforms equations (11)-(13) into a repeated static problem, which greatly simplifies the analysis below. The regularity assumption (2) is weaker and not necessary, but guarantees that the firm default decision is well-behaved and rules out unnecessary cases to consider.

The following Proposition characterizes the firm default decision.

Proposition 2 (Endogenous Default)**.** *Under assumptions (1)-(2), there is a unique value* $\bar{c}_{i,t} \equiv \bar{c}\left(\eta_t, z_{i,t}, q_{i,t}\right)$ *such that*

$$\mathcal{W}^D_{i,t} > \mathcal{W}^R_{i,t} \iff c_{i,t} > \bar{c}_{i,t}.$$

There exist values $\check{q}, \check{c}, \check{\beta}$ *such that* $0 \le q_{i,t} < \check{q}, 0 \le c_{i,t} < \check{c}, \check{\beta} < \beta < 1$ *implies*

$$\frac{\partial \bar{c}}{\partial \eta} \propto v^D_{i,t} > 0, \tag{16}$$

$$\frac{\partial \bar{c}}{\partial z} \propto \frac{v^R_{i,t}}{\gamma(\eta_t v^R_{i,t})} > 0, \tag{17}$$

$$\frac{\partial \bar{c}}{\partial q} \propto A - z_{i,t}\left(f(v^R_{i,t}) - f'(v^R_{i,t})\, v^R_{i,t}\right) < 0, \tag{18}$$

[14] We assume the equilibrium collateral fraction $\eta_t < 1+r$ (i.e., the required collateral fraction does not exceed the gross repayment of the loan).

and

$$\frac{\partial^2 \bar{c}}{\partial \eta^2} \propto -\frac{2v_{i,t}^D v_{i,t}^R \gamma'(\eta_t v_{i,t}^R)}{\gamma(\eta_t v_{i,t}^R)} + \frac{1}{z_{i,t} f''(v_{i,t}^R)} < 0, \tag{19}$$

$$\frac{\partial^2 \bar{c}}{\partial \eta \partial z} \propto -\frac{v_{i,t}^R f(v_{i,t}^R) \gamma'(\eta_t v_{i,t}^R)}{\gamma(\eta_t v_{i,t}^R)^2} < 0, \tag{20}$$

$$\frac{\partial^2 \bar{c}}{\partial \eta \partial q} \propto v_{i,t}^R \left[z_{i,t} \left(f(v_{i,t}^R) - f'(v_{i,t}^R) v_{i,t}^R \right) - A \right] > 0. \tag{21}$$

Prop. 2 characterizes the cutoff value $\bar{c}_{i,t}$, which governs whether a firm will default or not as a function of the collateral costs $c_{i,t}$ which they face. If costs are above this threshold, the firm endogenously chooses to default; otherwise, the firm repays. The intuition is simple: all else equal, firms which face a higher cost of posting collateral will produce less, which implies a lower continuation value of repaying and producing.

The next set of results in Prop. 2 study how this cutoff value varies across firms. The result in (16) shows that when the required collateral fraction η_t is higher, this cutoff value increases. In other words, when firms are required to post more collateral, all else equal they find choosing to default less appealing. While it is obvious that the value of defaulting is lower when firms stand to lose more collateral, a higher required collateral fraction also implies that production is less appealing when $c_{i,t} \neq 0$. However, as long as $c_{i,t}$ is not too large, the former effect dominates and the threshold for defaulting increases when the required collateral η_t increases.

The next result in (17) shows that the default threshold also increases in firm productivity. It is clear that when a firm is more productive, the value of operating is higher, and thus the continuation value of repaying is higher. However, even defaulting firms will borrow and produce more when productivity is high. Prop. 2 shows that, so long as firms put a high effective weight on the future (that is, β is high enough and $q_{i,t}$ is low enough), the former effect dominates and the threshold for defaulting increases when productivity $z_{i,t}$ increases.

The result in (18) studies how the default threshold varies as a function of firm riskiness. Firm riskiness does not affect the value of defaulting. However, firm riskiness reduces the effective discount factor of the firm (since a risky firm is more likely to be forced into autarky), and thus reduces the continuation value of repaying for the firm. Thus, the default threshold is lower when firm riskiness $q_{i,t}$ is high.

The final set of results in Prop. 2 shows how the transmission of an increase in the required collateral to the default decision varies as a function of firm characteristics. Unlike the first-order effects, the second-order effects are not always intuitive and are more sensitive to the parameterization of the model. When the required collateral fraction η is already high, result (19) shows that the effect of further increases in required collateral on the default threshold is dampened. This is easy to understand when considering a hypothetical case where $\eta_t \approx 1 + r$ (i.e., the required collateral fraction is nearly as large as the gross repayment

of the loan). In this case, it is clear from (14) and (15) that firms will make nearly identical production decisions whether they plan on repaying or defaulting. Further increases in the required collateral fraction will thus have only minor effects on the *ex-ante* borrowing decision of defaulting firms. Thus, when required collateral η_t is high, further increases in η_t will only lead to modest increases in the default threshold.

Result (20) shows that for very productive firms, the default threshold is less responsive to increases in required collateral. Recall from the discussion of (17) that increased productivity increases both the value repaying (through the usual continuation channels) as well as the value of defaulting (as defaulting firms borrow and produce more); and that the former dominates when the effective weight on the future is large. However, increases in required collateral cause firms to borrow and produce less (even if the firm will repay, due to the costs of posting collateral). For repaying firms, this reduces the entire stream of future expected profits, and thus the reduction is larger for firms which do not heavily discount future production opportunities. Thus, for the same reason that increased productivity $z_{i,t}$ pushes out the default threshold, the effects of increased required collateral η_t on the default threshold is mitigated for productive firms.

Finally, result (21) shows that for riskier firms, the default threshold is more responsive to increases in required collateral. Recall from the discussion above that increases in required collateral reduce the continuation value of repaying firms (due to collateral posting costs). However, higher risk implies that firms effectively discount the future more aggressively; thus, this channel is dampened. Moreover, higher risk does not affect the decisions the firms makes when choosing to default. Thus, increased riskiness $q_{i,t}$ amplifies the effect that increased required collateral η_t has on the default threshold.

3.3 Land reform experiment

We consider what happens in the model when a subset of firms face an exogenous decline in the cost of posting collateral. In particular, we are not only interested in the reaction of firms who enjoy the reduction in collateral costs but also the firms which do not receive the reduction.

Formally, denote the (*ex-ante*) repayment and default sets as $\mathscr{R}_t \equiv \left\{i : \mathscr{W}_{i,t} = \mathscr{W}^R_{i,t}\right\}$ and $\mathscr{D}_t \equiv \left\{i : \mathscr{W}_{i,t} = \mathscr{W}^D_{i,t}\right\}$, respectively. The aggregate loan amounts by (*ex-ante*) repayment or default are given by $V^R_t \equiv \int_{i\in\mathscr{R}_t} v^R_{i,t}\,\mathrm{d}i$ and $V^D_t \equiv \int_{i\in\mathscr{D}_t} v^D_{i,t}\,\mathrm{d}i$. Finally, define the mass of firms in each of these groups as $\mu^R_t \equiv \int_{i\in\mathscr{R}_t}\mathrm{d}i$ and $\mu^D_t \equiv \int_{i\in\mathscr{D}_t}\mathrm{d}i$.

Our experiment consists of selecting a subset of incumbent firms $i \in \mathscr{R}_t$ and reducing their collateral costs to $\tilde{c}_{i,t} < c_{i,t}$, while leaving the collateral costs of other firms unchanged. It is easy to see from (14) that such firms increase their borrowing; and from Prop. 2, such firms will continue to endogenously choose to repay. Thus, keeping the aggregate collateral fraction η_t fixed, we have an increase in V^R_t, but no change in V_{t^D} or fractions μ^R_t, μ^D_t. Of

course, because aggregate repayments V_t^R have changed, the optimality conditions of the bank problem have changed as well. In particular, from (10), we see that this puts downward pressure on required collateral η_t.

Thus, the comparative statics in Prop. 2 lead to the following predictions:

(1) Following the land reform, the total number of defaulting firms will *increase*.

(2) The increase in defaults is *mitigated* for more productive firms.

(3) The increase in defaults is *mitigated* when required collateral is high; in particular, mitigation occurs when financial intermediary market power is large.

(4) The increase in defaults is *amplified* for riskier firms.

4 Data

The empirical analysis is based on a balanced panel data, containing historical information on 42 English counties between 1750 and 1830, in which an observation is a county i at year t, and the total number of observations is 3,321.[15] The main variables in the dataset are the number of bankruptcies, our main outcome variable, and land enclosure awards, our main explanatory variable.

As the data is at the county-year level, it allows us to handle the omission of unobserved county characteristics that are fixed over time, as well as annual changes that affected the whole country. In addition, to control for changes in bankruptcies that resulted from agglomeration, we use the annual county population, which proxies economic development at the time and varies between counties and over time. County population in 1750 varied between a minimum of about 117 thousand people and 5 million people (in London) and a minimum of about 190 thousand and 17 million in 1830.[16]

To estimate the impact of land privatization on the number of bankruptcies, we exploit the unanticipated nature of the timing in which the enclosure awards were granted as a source of exogenous variation. We show that enclosures were associated with a significantly higher number of bankruptcies, mainly in the industrializing counties.

Tables 1 presents summary statistics for the main variables used in our analysis.

[15]The county borders in the analysis are those known as England's "ancient counties", with Yorkshire subdivided into its North, East and West Ridings. Middlesex is included, however, We omit the observation from London, which was a major commercial center at the time and had one third of the bankruptcies in our data while it had no land enclosures

[16]County-level population figures for the years 1761-1801 come from Wrigley (2007), Table 5, p.54; for 1751 from Deane and Cole (1967), table 24; the 1811-1831 are uncorrected census figures from Mitchell (1988) (Dean and Cole made minor corrections to these figures to include members of the armed forces), table8 The data is available at a decennial frequency. Linear interpolation was used for conversion to annual figures.

Table 1: Descriptive Statistics by Period

	All (N=3,321)	Year < 1793 (N=1,763)	Year ≥ 1793 (N=1,558)
Number of bankruptcies	15.43	7.59	24.30
	(34.97)	(17.12)	(46.12)
Population (thousands)	202.22	164.80	243.59
	(183.44)	(115.13)	(230.12)
Number of waste enclosures	0.48	0.24	0.76
	(1.54)	(0.76)	(2.06)
Enclosed waste area (1k acres)	387.64	254.55	538.23
	(1658.86)	(1368.82)	(1924.74)
Share of workers in agriculture	46.86	47.02	46.59
	(13.66)	(13.11)	(14.54)
Share of workers in the secondary sector	38.74	39.00	38.30
	(11.73)	(11.46)	(12.16)

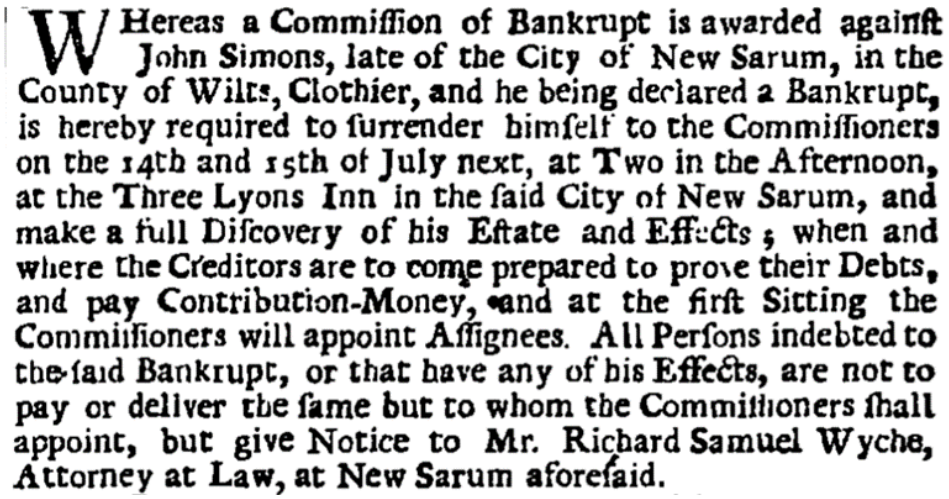
Note: This table reports the sample averages of each variable in by county and year. Standard deviations are reported in parenthesis.

4.1 Bankruptcy data

The first active intervention of the English government in disputes regarding bankruptcies was in its 1542 Statute of Bankrupts. The act, which was aimed at debtors who *"craftily obtaining into their hands great substance of other men's goods do suddenly flee to parts unknown, or keep their houses, not minding to pay or return to any their own creditors, their debts and duties."*, enabled creditors to initiate legal proceedings after one or more creditors had observed an "Act of Bankruptcy" by a petitioned to Lord Chancellor, who created a "Bankruptcy Commission", which was given the power to search, seize and sell all assets.[17] Amendments to the law took place under Elizabeth (1572) and James I (1603, 1624), which were mainly related to the occupation, gender, amount of debt, and nationality of the the debtor, as well as to the mechanics of the procedure. Until 1706, there was no exit from bankruptcy prior to repayment of all debts. The act 4-5 Anne, which allowed for the first time, for the possibility that bankruptcy was due to unavoidable misfortune, allowed bankrupts to exit the legal state of bankruptcy prior to full repayment of all debts. Thus, the bankrupt could be awarded a certificate of discharge and an allowance of 5 per cent of value of estate up to a maximum of £200 (the decision could be made by the Commissioners). The penalty for those found to behave fraudulently, however, increased (Carlos et al. (2019), p.

[17] Public Act 34:35 Henry VIII c.4: Statute of Bankrupts. The act can be viewed online at the website of the "The Statutes Project": https://statutes.org.uk/site/the-statutes/sixteenth-century/1542-34-35-henry-8-c-4-bankrupts-act/

Figure 2: Example of bankruptcy notice



WHereas a Commiſſion of Bankrupt is awarded againſt John Simons, late of the City of New Sarum, in the County of Wilts, Clothier, and he being declared a Bankrupt, is hereby required to ſurrender himſelf to the Commiſſioners on the 14th and 15th of July next, at Two in the Afternoon, at the Three Lyons Inn in the ſaid City of New Sarum, and make a full Diſcovery of his Eſtate and Effects; when and where the Creditors are to come prepared to prove their Debts, and pay Contribution-Money, and at the firſt Sitting the Commiſſioners will appoint Aſſignees. All Perſons indebted to the ſaid Bankrupt, or that have any of his Effects, are not to pay or deliver the ſame but to whom the Commiſſioners ſhall appoint, but give Notice to Mr. Richard Samuel Wyche, Attorney at Law, at New Sarum aforeſaid.

Note: According to the notice, John Simons, a Clothier from the City of New Sarum, Wiltshire was declared bankrupt on 06/06/1732. The notice specifies the time and place in which he will be making a full discovery of his assets in the presence of the commissioners and the creditors will prove their debts. Source: Recorded in The Gazette (London Gazette). Publication date: 6 June 1732, Issue:7098, Page:2. https://www.thegazette.co.uk/London/issue/7098/page/2

485). As mentioned above, the Bankruptcy Act of 1705 was the first to require a notice to published in the *London Gazette* on three separate occasions– specifying time and location of all bankruptcy-related meetings. It remained almost unchanged until the statute of 1830 abolished commissioners in bankruptcy, put the administration of estates into the hands of the court, and created the official assignee or receiver.

While the amount of debt that led to the bankruptcy is not mentioned in the announcement, we do know that threshold was set at £100 in the 1624 Act.[18] As to the number of creditors, Carlos et al. (2019) shows on the basis of ledger books from September 1710 to April 1714 documenting the names of the creditors as well as information on the bankrupt and the commissioners, that for the four years and 549 certificates, 8,424 creditors were represented, which is an average of sixteen creditors per bankrupt. There were more than 360 cases with 5-20 creditors, more than 100 with 20-60 creditors, and almost 20 cases with 60 or more creditors (p. 492, Table 2).

The county-year level number of bankruptcies in our analysis comes from a newly digitized dataset, created by the authors of this paper, which is based on information from notices that were published in the *London Gazette*, following the requirement the 1705 Bankruptcy Act.[19] It contains the main information that appears in the notice, including, the name of the bankrupt, his occupation (sometimes more than one occupation is mentioned), loca-

[18] Hoppit (1987) retrieved files of 152 bankrupts (most of them from the late eighteenth century, and from the London area) and found that about 20 percent of the bankrupts owed 100-1,000 pounds, and around 30 percent owed more than 30,000 pounds (of which 65 percent were London Merchants), and the rest owed mounts in between.

[19] Public Act 4 Anne c.17: An Act to Prevent Frauds Frequently Committed by Bankrupts.

tion, and the date in which he was declared bankrupt, as can be observed in the example in Figure 2.[20]

It is important to note that we observe a bankruptcy in our data only when the legal proceedings end and the debtor was eventually declared bankrupt. This implies that the actual bankruptcy took place sometime before it appears in our data. We estimate this lag to be about one year.

4.2 Land enclosure awards

The data used in the study includes the location, year of award, area and type of enclosure of the entire population of English Parliamentary enclosure acts between 1750 and 1830, which was compiled by Satchell et al. (2017).[21] Of the 4,691 acts that were awarded between 1750 and 1830, 1,600 were of waste (56 percent), these enclosures can be observed in Figure 3a. The enclosure of waste was more common in the North-West and its relative importance began to grow in 1810, as can be observed in Figure 1. About 20.6% of our county-year-level observations experienced an enclosure of waste.

As mentioned above, we perceive the timing in which the enclosure awards were granted as a source of exogenous variation. The timing of grant of an enclosure award was unanticipated due to the complexity of the legal process and to its dependence on many arbitrary variables (Tate (1978), 1944, p.392; Turner (1973), pp.185-186). The process began by a petition to parliament by the landowners after obtaining the consent of the owners of three quarters of the amount of land by value. The petition could then be refused or accepted, in which case Parliament appointed an enclosure commission to implement the act.[22] The process that followed included mapping of the land plots, ascertaining of the claims of the villagers to land, and reviewing the counterclaims. Finally, at the end of the process, the commission drew the permanent legal record of the enclosure award (Tate (1978), pp.14-23). In the words of Mingay (1997) *"The date of the passing of a private enclosure Act by Parliament is not necessarily indicative of the beginning or ending of the process of achieving an enclosure. The bringing of the Bill to Parliament was not the start, but a stage marking the*

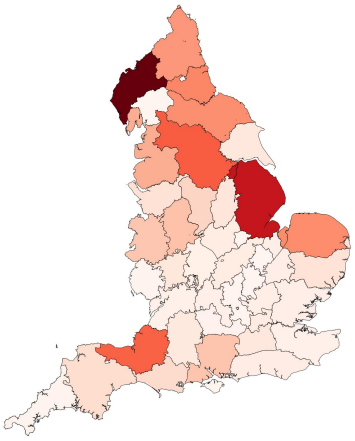
[20] Julian Hoppit has already collected and analyzed the information about bankruptcies in England and published his findings in a book entitled, "Risk and Failure in English Business 1700-1800" (Hoppit (1987)). However, the data he used ends in 1800 plus it has never been digitized. In addition, Hoppit used docket books for the years 1711-1764 (besides 17 months between 1723-1724), which provide an approximation of the true number of bankruptcies, thus, not all bankruptcy petitions were confirmed by the authorities as true bankruptcies (Hoppit (1987)), p. 44). The newly created dataset that is used in this study contains all bankruptcies in the years 1705-1830 based on the notices in *London Gazette*, and contains all the available information about the bankrupt (e.g., name, location, occupation).

[21] The evidence on enclosures that is used in this papers comes from Parliamentary acts, rather than a private agreement, which were less common in this period.

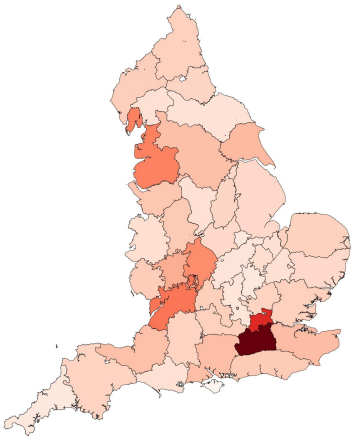
[22] According to Mingay (1997), 22 percent of all enclosure bills between 1750-1815 were withdrawn even before they reached any parliamentary opposition, and more must have been deliberated without agreement even to advance the bill. Moreover, Neeson (1993) mentions that 14 percent of private bills that did reach parliament failed between 1715-1774 (p.275).

Figure 3: Bankruptcies and enclosures in England 1750–1830

(a) Waste enclosures



(b) Bankruptcies per capita



Note: The figure presents on each panel a heat map indicating the level of the title variable by ancient counties of England.

end of a preliminary period of negotiations between the parties involved, a period that might be relatively brief, occupying a year or two, or quite protracted, where there were serious difficulties in reaching agreement…" (pp.20-21).

5 Empirical analysis

This section empirically evaluates our theory on the role of land enclosures in affecting market access. Our key theoretical prediction, given in Proposition 2, indicates a mapping from market access to defaults. We use our novel bankruptcy data, described in Section 4, to ascertain the effect of land enclosures on local financial markets by exploiting temporal and regional variation in the data. Section 5.1 establishes the basic fact that waste enclosures increase bankruptcies. In Section 5.2, we proceed to substantiate the predictions of our model by demonstrating that the data is also consistent with additional implications of our theory. Namely, we demonstrate how productivity-enhancing reforms do not generate the same effects as waste enclosures; we show that the effects are stronger in riskier and more competitive periods; and finally, we illustrate how exposure to risk, both industrial and geopolitical, and to the adverse business cycles amplifies our baseline effect. Appendix B studies the robustness of our analysis to several methodological choices and threats and will be referred to in this section.

5.1 The effect of land enclosures on local bankruptcies

We begin by estimating the effect of an enclosure of waste land at time t in county i on bankruptcies in the same county during the following years. To do so, we employ a local-projections-based (Jorda, 2005) identification strategy by estimating the following equation

$$BR_{i,t+h} = \exp\left(\delta_t^h + \alpha_i^h + \sum_{j=0}^{l} \beta_j^h ENC_{i,t-j} + \sum_{j=0}^{l} \eta_j^h (BR_{i,t-j}) + \pi_h pop_{i,t-1} + \epsilon_{i,t}^h\right), \forall h \in \{1,\dots,5\}, \tag{22}$$

where, BR is the number of bankruptcies, ENC is the enclosed area of waste (in thousand of acres), and pop is population size (in thousands). Our coefficient of interest is β_h, which corresponds to the expected change in the number of bankruptcies after h periods as a result of an increase of 1k acres in the enclosed land. δ_t^h and α_i^h are time and county fixed-effects, included to control for aggregate macroeconomic conditions and county-specific time-invariant characteristics. We add lagged enclosures of land to control for anticipation effects arising from recent approvals of land enclosures in the particular region. To control for local financial cycles and migration trends, we also add lagged bankruptcies and population size.[23] All inference is done using double clustered standard errors at the county and year level. Note that double clustering takes care of cross-sectional dependence in the error term as well as serial correlation within each county.

Because our dependent variable is an aggregate count variable at the county level, we employ Poisson regressions throughout this section and interpret β_h in percentage change terms. Poisson regressions are commonly used in the analysis of count processes and produce a consistent estimate of the mean effect even when the true data generating process is not Poisson.[24] We also leverage the insights of Montiel Olea and Plagborg-Møller (2021) and control for a large number of lags for the outcome variable, thus purging the error term from serial correlation.[25]

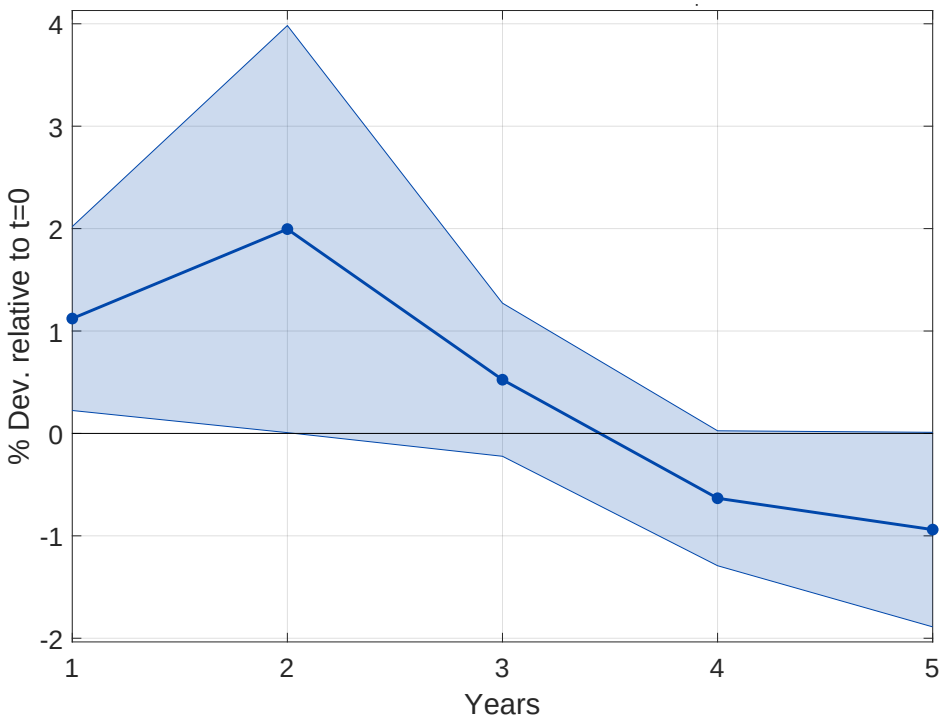
To empirically assess the financial impact of waste enclosures we estimate equation (22) using the total area of waste enclosures granted in county i at time t, expressed in thousands of acres, as our enclosure measure. Results from this exercise are presented in Figure 4, documenting that after an enclosure of 1k acres of waste, bankruptcies in the county increased by 1.1% within the first year and 2.0% in the second year following the enclosure. This increase is both statistically significant and economically meaningful. To put these numbers in perspective, the median area of enclosed waste area, conditional on experiencing any waste enclosure in county i at time t, is 863 acres, and the mean is 1,839 acres, with

[23] Only one population lag is included in all regressions since the county-level population is available at a decennial frequency. Linear interpolation is used for conversion.

[24] See Wooldridge (1999).

[25] Our baseline includes $l = 4$ lags, but all results in this section are not sensitive to this choice. Using different numbers of lags between $l = 1,\dots 6$ yields similar results; see Appendix B.1.

Figure 4: The Effect of Waste Enclosures on Bankruptcies



Note: This figure reports in the solid lines values of β_0^h from estimating equation (22) using the total area of waste area enclosures in county i at time t. Shaded areas indicate 90% confidence intervals where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to an enclosure of 1k acres.

some areas experiencing enclosures of over 20,000 acres of waste. Thus, a county experiencing an average-sized waste enclosure grant is expected to experience an increase of 2.0% in bankruptcies in the first year and a 3.7% rise in bankruptcies in the second year post enclosure.

Robustness checks. Figure 4 establishes that waste enclosures lead to a rise in local bankruptcies. Several choices we made in the analysis might affect this result. First, we used the total enclosed area to measure enclosure intensity. It is conceivable that non-linear valuations or agglomeration effects might lead a single enclosure of 1k acres to affect economic conditions differently than five enclosures with a total area of 1k acres in the same county. Figure 10 replicates the analysis in Figure 4 using the average area granted instead of the total area and finds consistent results. Second, our results might be affected by the number of lags we choose to include in estimating equation (22). Appendix B.1 demonstrates that our results are not sensitive to controlling for one year and up to six years of lagged values. Finally, to assess our interpretation of the enclosure timing as an exogenous event, we propose and implement a pre-trend test consistent with our baseline estimation using equation (22) and find no evidence of a statistically significant pre-trend, validating our assumption that enclosure grant timing was exogenous. These tests are formally introduced and presented in

Appendix B.1.

5.2 Mechanisms and potential drivers

The previous section establishes that waste area enclosures lead to a rise in local bankruptcies. We interpret these findings through the lens of our theory as arising from an increase in market access following the waste enclosures due to a reduction in the equilibrium collateral requirements. Given the presence of usury laws in that period, this rise in market access is, in practice, extremely difficult to observe. Furthermore, it requires observing data at the regional lender level that is, to the best of our knowledge, non-existent. However, our theory offers several testable predictions that can further support our claim and offer insights into the channels underpinning it. Proposition 2 suggests that the effect of waste enclosure on bankruptcies should be stronger when risk is higher and when competition is stronger. A natural first step in assessing this prediction is to examine the effect of several secular trends that occurred simultaneously through our sample period.

The years of 1750–1830 saw fast-paced industrial developments changing the menu of available investment opportunities and to a higher degree of innate risk involved with business ventures. In addition, following the 1793 crisis, and the emergence of the Napoleonic wars, geopolitical risk is on the rise for the latter half of our sample. These years also saw a rapid expansion in regional banking, implying a higher degree of financial competition within counties. Thus our theory predicts that the effects of waste enclosures are stronger during the years of 1793 onward, as these were characterized by more industrial risk, geopolitical risk, and banking competition.

To test this prediction Figure 5 repeats our baseline analysis presented in Figure 4 but splitting the sample to the years 1750–1792, and 1793–1830. Figure 5 supports our theory by demonstrating the indeed the years 1793–1830 account for most of the effect of waste area enclosures on bankruptcies, whereas the former part of the sample experiences smaller, statistically insignificant effects.

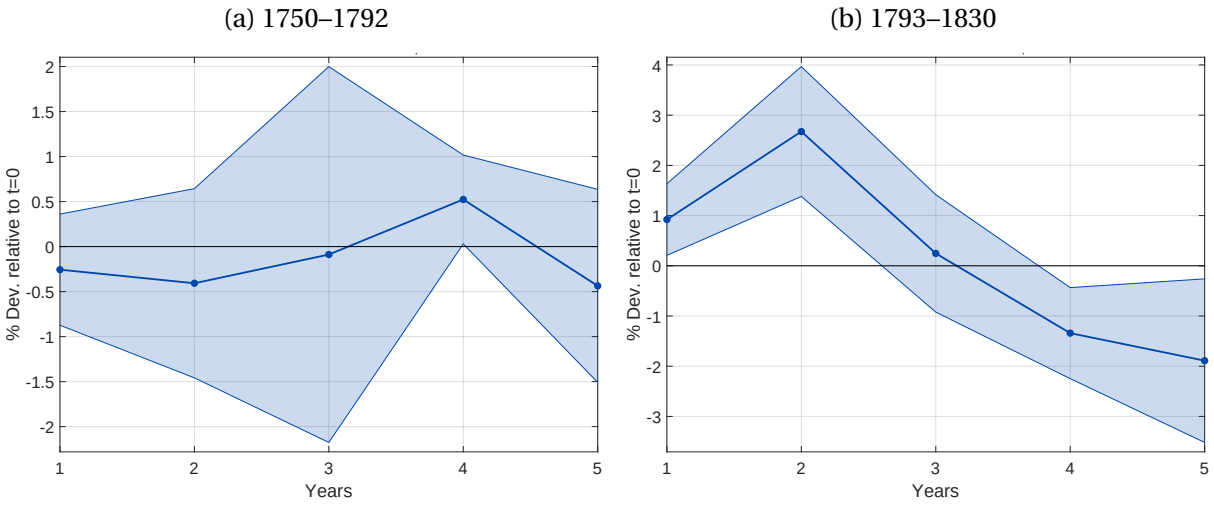
The role of industrialization. To dig deeper and more explicitly into the role of industrialization, we now leverage the panel element of our database and estimate the following specification:

$$BR_{i,t+h} = \exp\left(\delta_t^h + \alpha_i^h + \pi^h pop_{i,t-1} + \sum_{j=0}^{l}\left(\beta_j^h + \beta_j^{h,75+}\mathbb{I}_{i,t}^{75+} + \beta_j^{h,25-}\mathbb{I}_{i,t}^{25-}\right) ENC_{i,t-j} \right. \tag{23}$$

$$\left. + \sum_{j=0}^{l}\eta_j^h BR_{i,t-j} + \sum_{j=0}^{l}\left(\gamma_j^{h,75+}\mathbb{I}_{i,t}^{75+} + \gamma_j^{h,25-}\mathbb{I}_{i,t}^{25-}\right) + \epsilon_{i,t}^h\right), \quad \forall h \in \{1,\dots,5\}. \tag{24}$$

where $\mathbb{I}_{i,t}^{75+}$ and $\mathbb{I}_{i,t}^{25-}$ denote a county-time exposure dummy that takes the value of one if a certain exposure measure, x is above its 75$^{\text{th}}$ or below its 25$^{\text{th}}$ percentile correspondingly and

Figure 5: The Effect of Land Enclosures on Bankruptcies



Note: This figure reports in the solid lines values of β_0^h from estimating equation (22) using the total area of all waste area enclosures in county i at time t in two separate time periods: 1750–1792 in panel a, 1793–1830 in panel b. Shaded areas indicate 90% confidence intervals where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to an enclosure of 1k acres.

zero otherwise. This flexible and functional-form-free strategy allows us to pick up factors that amplify or dampen the response of bankruptcies to land enclosures.[26]

Figure 6 reports estimates of equation (23) using a set of exposure variables measuring, by shares of workers engaged in a sector, the economic specialization of a particular county-year observation.[27] Figure 6 presents a clear image. Counties and years that experienced a low exposure to agriculture and a high exposure to the secondary sector are precisely those in which waste enclosures had the strongest effects, peaking at around a 3% rise in bankruptcies two years after the enclosure of 1k acres of wasteland. To validate this finding, we also use the time-invariant county classifications from Wrigley (2007), dividing counties into industrial or commercial, agricultural, and mixed, to conduct a similar analysis. This analysis is presented in Figure 7, and its findings support the claim that exposure to industrialization drives the effect.[28]

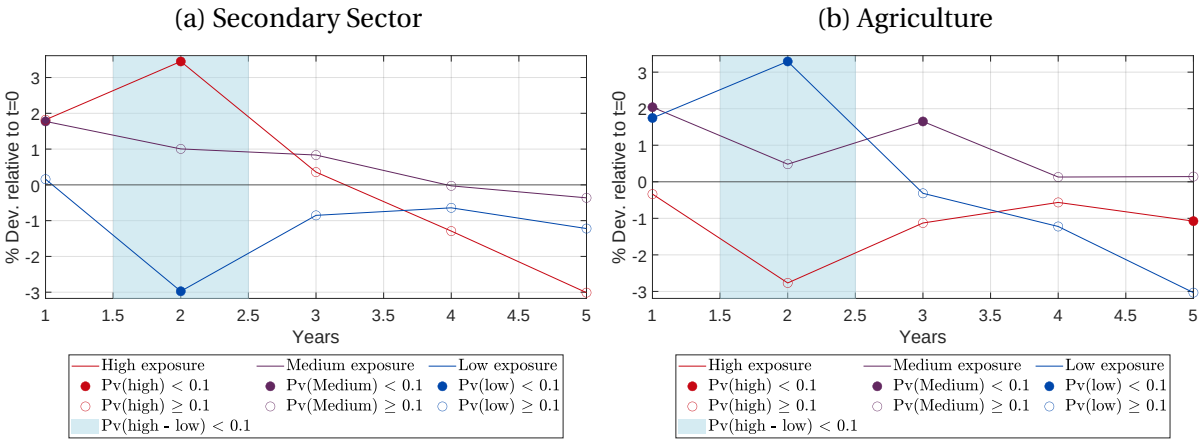
Business cycle risk. Another potential channel through which the effect of waste enclosures on market access might be mediated according to our theory is the state of the real

[26]There is nothing special about the 75^{th} or 25^{th} exposure cutoffs and they are chosen to create two groups that are sufficiently large to draw statistical inference. When this specification is used we report in Appendix B.2 a robustness check using the 15^{th},20^{th},25^{th},30^{th},35^{th}, and 40^{th} percentiles as the cutoff for the low exposure group and similarly the 85^{th},80^{th},75^{th},70^{th},65^{th}, and 60^{th} percentiles as the cutoff values above which and observation is classified as high exposure.

[27]The figures are from Keibek (2016), Appendix B and were interpolated into an annual frequency. West Yorkshire years: 1755, 1785 from Shaw-Taylor and Jones (2005).

[28]Technically speaking, the analysis is done by estimating equation (23) but with the exposure dummies given by the assignment into Wrigley's three categories.

Figure 6: Exposure to Industrialization and the Effect of Waste Enclosures



Note: This figure reports impulse responses estimated via equation (22) using the total area of waste area enclosures in the solid lines. Each panel reports a set of impulse responses estimated using a separate exposure variable indicated in the title. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the low exposure subsample and the high exposure coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.

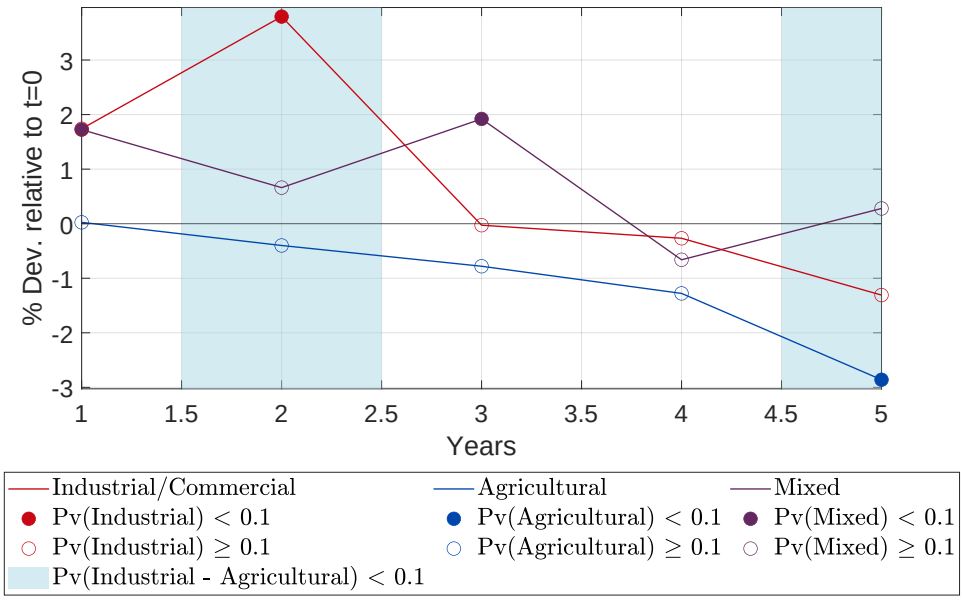
economy. We can think of business cycle fluctuations as a uniform decline in productivity for all productive units as is the standard real business cycle view. Our theory indicates that if firms are less productive, the effect of waste enclosures on bankruptcies should be amplified. To obtain a measure of exogenous fluctuations in real activity we leverage a measure of historical standardized tree ring growth series.[29] Because the width of tree rings is influenced by environmental factors like temperature, precipitation, soil moisture, and sunlight, its annual growth patterns can be used to trace changes in historical climate conditions and agricultural productivity. Years with wider rings indicate favorable growing conditions, such as abundant rainfall and moderate temperatures while narrow rings indicate drought, poor soil quality, or other stressors like extreme temperatures or pest infestations. The series used in our study come from different sample locations corresponding to four climate regions in England. The series were matched to counties based on their relevant climate region.[30]

We use this tree ring series to construct a new weather shock variable. Fitting an ARIMA model to each of the tree ring series in each locality allows us to flexibly capture the expectations for agricultural conditions in each locality. Extracting the residuals of the raw tree rings

[29]The tree ring growth index chronologies are constructed from samples taken from trees in various location. They are located in the International Tree-Ring Data Bank (ITRDB) and managed by the World Data Service for Paleoclimatology manages. The samples can be downloaded from the website of the National Centers for Environmental Information (NOAA):https://www.ncei.noaa.gov/products/paleoclimatology/tree-ring

[30]The samples are from the surroundings of Bath (information from 1754), Sheffield (from 1761), Norwich (from 1717) and Moffat in Scotland (from 1652). The climate regions are based on the Met Office: https://www.metoffice.gov.uk/research/climate/maps-and-data/about/districts-map

Figure 7: Exposure to Industrialization and the Effect of Waste Enclosures: Wrigley County Classification



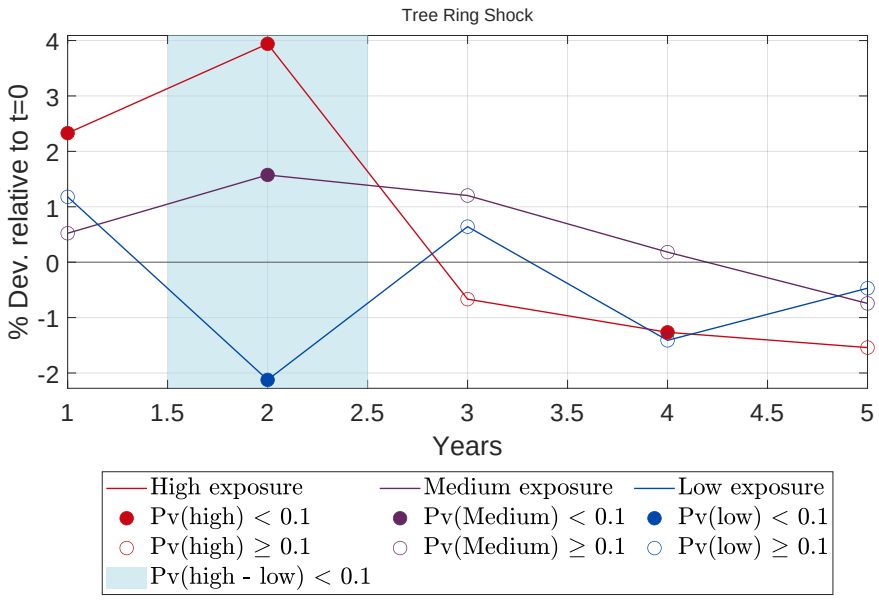
Note: This figure reports impulse responses estimated via equation (23) using the total area of waste area enclosures in the solid lines, and defining exposure using Wrigley's classification. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the industrial and agricultural counties' coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.

with the fitted ARIMA model yields a weather shock. The resulting shock variable has several desirable characteristics. First, it exhibits cross-sectional and temporal variation. Second, it is a way to reduce the dimensionality of multiple climate variables and indicate how favorable agricultural conditions were at that place and time in an unanticipated fashion, in the statistical sense. Last, it is a continuous measure indicating differences in intensities of growth conditions and not an indicator variable. This shock is essentially a supply shock in an agricultural society indicating surprisingly bad agricultural yields.

Using the specification in equation (23) to study how differential exposure to weather shocks affected how waste enclosures altered market access, we find that high exposure to waste enclosures, combined with adverse agricultural conditions (the red line in Figure 8) leads to an amplified response of bankruptcies to waste enclosures.

Financial effects vs real effects. Our theory predicts that the observed rise in bankruptcies following waste enclosures in Figure 4 is a consequence of the financial role of land in reducing collateral posting costs, thus altering the resulting equilibrium of credit markets. However, because land is also a factor of production, the observed effect could emerge as

Figure 8: Exposure to Weather Shocks and the Effect of Waste Enclosures

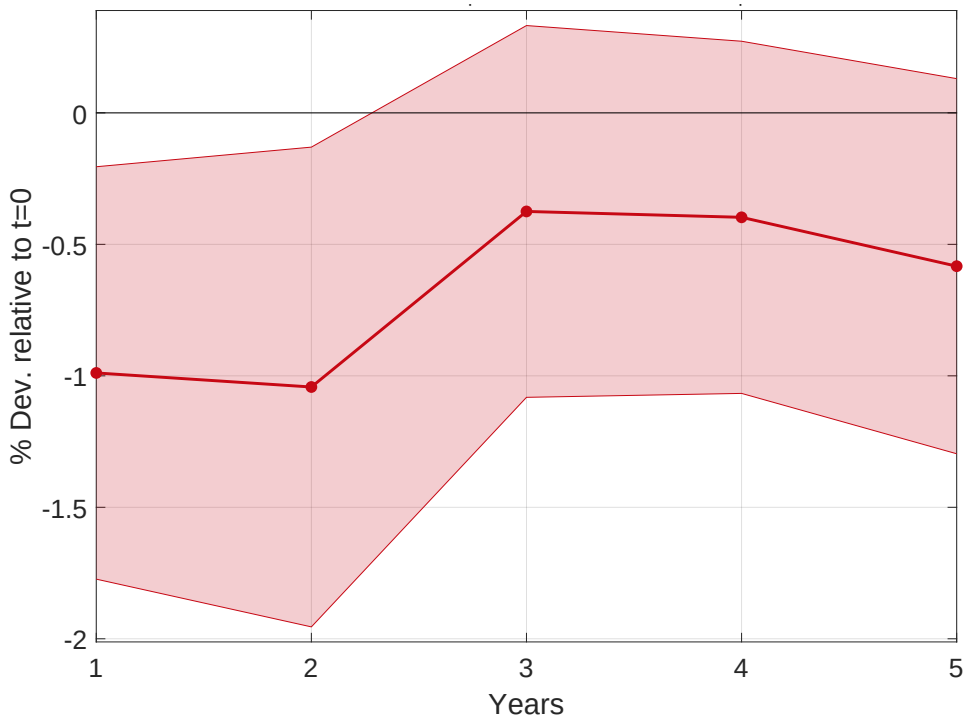


Note: This figure reports impulse responses estimated via equation (23) using the total area of waste area enclosures in the solid lines, and defining exposure dummies using our weather shock measure. The shock is constructed such that high exposure indicates that weather conditions were particularly unfavorable. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the high and low exposure interaction coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.

a consequence of changes in the local supply for goods. To address this concern, we also examine the effect of a different type of land enclosure: the enclosure of open fields. Unlike the enclosure of waste, which can be viewed as land privatization, enclosure of open fields changed the nature of production within a certain region by reorganizing plot allocations, making them contiguous, thus allowing the farmers to exploit economies of scale and raise productivity through agglomeration effects (Adamopoulos and Restuccia (2020); Adamopoulos and Restuccia (2014)). In the context of our model, this is akin to a rise in productivity for some firms.[31] Our theory tells us that the two type of enclosures should result in different effects on bankruptcies. Reforms that raise the productivity of some firms, like the open field enclosures should reduce bankruptcies while waste enclosures should increase them.

[31] In the open fields system, farmers' strips of land were scattered and unfenced and decisions over the use of land had to be reached in common. The use of land required much cooperation in cultivation and animal husbandry, as well as in decisions of the choice of crops in the crop-rotation system, in which one field would lie fallow to prevent soil exhaustion while the other one or two were cultivated, growing different seasonal crops, such as corn, wheat, rye, barley, peas, beans and oats. The lord's demesne strips would often be scattered among those of the tenants. See Heldring et al. (2022) for a recent empirical analysis of the effects of enclosure of open fields on land productivity.

Figure 9: The Effect of Open Field Enclosures on Bankruptcies



Note: This figure reports in the solid lines values of β_0^h from estimating equation (22) using the total area of open field enclosures in county i at time t. Shaded areas indicate 90% confidence intervals where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to an enclosure of 1k acres.

Figure 9 repeats the analysis in Figure 4 using open field enclosures. We find effects of the opposite sign: open-field enclosures are followed by a reduction in bankruptcies. This finding, which is consistent with our theoretical framework, lends further support our interpretation of the rise in bankruptcies resulting from waste enclosures as improving market access and more broadly to our financial interpretation of the waste enclosure shock.

6 Concluding Remarks

This paper proposes a theory and supporting evidence on the link between land reforms and market access. Our theory is tailored to study a historically significant case study at the height of the Industrial Revolution, a period of much change where land reforms were sizable and plentiful, allowing us to draw lessons from the past to our modern context. We demonstrate that when land is used as collateral and collateral is a margin of competition, an influx of good collateralizable assets improves market access as an equilibrium effect. We leverage a unique database on personal bankruptcies to collect evidence in support of our argument, demonstrating that granting waste enclosures was followed by a rise in bankruptcies. We provide additional validating evidence that supports our theory-based interpretation of the findings and sheds new light on this historical period.

Our results offer new insights both in their time and out of it. In the context of eighteenth and nineteenth-century England, we demonstrate how granting property rights and titles on local wasteland affected financial markets and contributed to the development process during the height of the Industrial Revolution. While some allude to this possibility, we are the first to offer evidence of this theory. These results are important since they provide a window into the workings of financial markets during a critical moment in the history of industrialization and contribute to our understanding of the economic history of the Industrial Revolution.

Examining our results with modern eyes and in the contemporary context allows our theory and results to provide several generalizable lessons on implementing land reforms. Reforms that improve land pledgeability and introduce more collateral into a frictional financial system are expected to improve market access. However, the degree of industrialization, state of the business cycle, exposure to geopolitical risk, and the degree of banking competition are all critical mediating factors that govern the effect size and underpin the reform's ultimate impact.

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Appendix A Theory Appendix

Proof of Lemma 1.

Proof. Since defaulting on any bank in period t causes the firm to enter autarky in period $t+1$, when defaulting (endogenously or exogenously) the firm will choose to default on all banks. Thus, $D_{i,t}(j) = D_{i,t}(j') \equiv D_{i,t}$. In this case, repayments aggregated across all banks are given by

$$\begin{aligned}\int_0^1 \psi_{i,t}(j)\,\mathrm{d}j &= \int_0^1 \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} \mathrm{d}j\, g_{i,t} \\ &\equiv \tilde{\eta}_t g_{i,t},\end{aligned}$$

which follows from (3). If the firm does not choose to default nor fails exogenously, then repayments are

$$\begin{aligned}\int_0^1 \psi_{i,t}(j)\,\mathrm{d}j &= (1+r)\int_0^1 \ell_{i,t}(j)\,\mathrm{d}j \\ &= (1+r)\,v_{i,t},\end{aligned}$$

where the second line follows from the cash-in-advance constraint. Thus, if *ex-ante* firm i does not actively choose to default (on any bank j), the expected repayments are

$$\mathrm{E}_t \int_0^1 \psi_{i,t}(j)\,\mathrm{d}j = (1-q_{it})(1+r)\,v_{i,t} + q_{it}\tilde{\eta}_t g_{i,t}.$$

Equation (5) follows.

□

Proof of Lemma 2.

Proof. Define the total *ex-ante* collateral posted to bank j as $G_t(j) = \int_i g_{i,t}(j)\,\mathrm{d}i$; and the *ex-post* posted collateral from repaying and defaulting firms as $G_t^R(j) = \int_i \mathbf{1}(D_{i,t}(j) = 0) g_{i,t}(j)\,\mathrm{d}i$ and $G_t^D(j) = \int_i \mathbf{1}(D_{i,t}(j) = 1) g_{i,t}(j)\,\mathrm{d}i$, respectively. Since default risk is idiosyncratic, the law of large numbers implies these objects are equal to beginning of period expectations for bank j. Then we have that the expected profits of bank j are

$$\mathrm{E}_t\left[\Pi_t(j)\right] = \frac{1+r}{\eta_t(j)} G_t^R(j) + G_t^D(j) - \frac{1+r^{rf}}{\eta(j)} G_t(j), \tag{A.1}$$

where we have used the fact that $\ell_{i,t}(j) = \eta_t(j) g_{i,t}(j)$. Then from (3),

$$G_t(j) = \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} \int_i g_{i,t}\,\mathrm{d}i \equiv \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t,$$
$$G_t^R(j) = \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} \int_i \mathbf{1}(D_{i,t}(j)=0) g_{i,t}\,\mathrm{d}i \equiv \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t^R,$$
$$G_t^D(j) = \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} \int_i \mathbf{1}(D_{i,t}(j)=1) g_{i,t}\,\mathrm{d}i \equiv \left(\frac{\eta_t(j)}{\eta_t}\right)^{\frac{1}{1-\theta}} G_t^D.$$

Since each bank is in measure $\mathrm{d}j$, we have that $\frac{\partial \eta_t}{\partial \eta_t(j)} = 0$ and $\frac{\partial g_{i,t}}{\partial \eta_t(j)} = 0$ (holding fixed $\eta_t(j')$ for all other banks $j' \neq j$). Moreover, if firm i defaults on any bank, it will also default on bank j. Thus,

$$\frac{\partial}{\partial \eta_t(j)} \Pr\left[D_{i,t}(j)=1\right] = 0.$$

Thus, bank j takes as given G_t, G_t^R, G_t^D. Hence, (A.1) is equal to (7).

□

Proof of Proposition 1.

Proof. The bank optimality conditions and a symmetric equilibrium imply

$$(1+r)G_t^R - (1+r^{rf})G_t = -\frac{1}{\theta}\eta G_t^D,$$

and (10) follows from $G_t = G_t^R + G_t^D$.

From the firm problem, a symmetric equilibrium implies $\tilde{\eta}_t = 1$ and $g_{i,t}(j) = g_{i,t} = \eta_t v_{i,t}$. Then the realized repayments of firm i are given by

$$\int_0^1 \psi_i(j)\,\mathrm{d}j = \mathbf{1}(D_{i,t}=0)(1+r)v_{i,t} + \mathbf{1}(D_{i,t}=1)\eta_t v_{i,t},$$

and the expected profits conditional on the endogenous choice of repayment is given by

$$\mathrm{E}_t \Pi_{i,t}(v_{i,t}) = z_{i,t} f(v_{i,t}) - c_{i,t}\gamma(\eta_t v_{i,t}) - \begin{cases} (1-q_{i,t})(1+r)v_{i,t} + q_{i,t}\eta_t v_{i,t} & \text{if } D_{i,t}=0 \\ \eta_t v_{i,t} & \text{if } D_{i,t}=1 \end{cases}.$$

Additionally, if the firm defaults (either exogenously or endogenously), then the firm earns A in all periods afterwards. Thus, conditional the choice of $v_{i,t}$ and on repaying, (4)

becomes

$$\begin{aligned}
&\mathrm{E}_t \sum_{k=0}^{\infty} \beta^k \Pi_{i,t+k}(v_{i,t+k}) = \Pi_{i,t}(v_{i,t}) + \mathrm{E}_{t+1} \sum_{k=1}^{\infty} \beta^k \Pi_{i,t+k}(v_{i,t+k}) \\
&\equiv \Pi_{i,t}(v_{i,t}) + \beta \mathcal{W}_{i,t+1}.
\end{aligned}$$

Conditional the choice of $v_{i,t}$ but in the case of default, we have

$$\begin{aligned}
&\mathrm{E}_t \sum_{k=0}^{\infty} \beta^k \Pi_{i,t+k}(v_{i,t+k}) = \Pi_{i,t}(v_{i,t}) + \mathrm{E}_{t+1} \sum_{k=1}^{\infty} \beta^k A \\
&\equiv \Pi_{i,t}(v_{i,t}) + \frac{\beta}{1-\beta} A.
\end{aligned}$$

Thus, the value of repaying is given by (12); the value of (endogenously) defaulting is given by (13); and the firm problem can be written as in (11). Differentiating with respect to $v_{i,t}$ and setting to zero gives the optimality conditions (14) and (15), which characterize the per-period input decisions in the case of endogenous repayment or default.

□

Proof of Proposition 2.

Proof. Assumption (1) implies that the time-invariant value functions satisfy

$$\begin{aligned}
\mathcal{W}_i^R &= \left(\frac{1}{1-(1-q_i)\beta}\right)\left(z_i f(v_i^R) - c_i \gamma(\eta v_i^R) - \left[(1-q_i)(1+r) + q_i \eta\right] v_i^R + q \frac{\beta}{1-\beta} A\right), \\
\mathcal{W}^D &= z_i f(v_i^D) - c_i \gamma(\eta v_i^D) - \eta v_i^D + \frac{\beta}{1-\beta} A.
\end{aligned}$$

Assumption (2) implies that for $c_i = 0$, $\mathcal{W}_i^R > \mathcal{W}_i^D$. The envelope theorem implies that differentiating the difference between the two value functions $F_i \equiv \mathcal{W}_i^R - \mathcal{W}_i^D$ with respect to collateral costs gives

$$\frac{\partial F_i}{\partial c_i} = \gamma(\eta v_i^D) - \left(\frac{1}{1-(1-q_i)\beta}\right)\gamma(\eta v_i^R),$$

which is strictly negative by Assumption (2). Finally, taking $c_i \to \infty$, from (14) and (15), we have that $v_i^R \to 0$, $v_i^D \to 0$, and thus

$$\begin{aligned}
\mathcal{W}_i^R &\to q \frac{\beta}{1-\beta} A, \\
\mathcal{W}_i^D &\to \frac{\beta}{1-\beta} A,
\end{aligned}$$

so in the limit, $\mathcal{W}_i^D > \mathcal{W}_i^R$. Thus there is some unique threshold $\bar{c}_i$ such that $\mathcal{W}_i^R = \mathcal{W}_i^D$ when $c_i = \bar{c}_i$, and $\mathcal{W}_i^R < \mathcal{W}_i^D$ iff $c_i > \bar{c}_i$.

Since $\frac{\partial F_i}{\partial c_i} \neq 0$ for all values of c_i, we can apply the implicit function theorem to find the gradient and hessian of $\bar{c}_i$ with respect to $\mathbf{x} \equiv \begin{bmatrix} \eta & z_i & q_i \end{bmatrix}^\top$.

$$
\begin{aligned}
D_{\mathbf{x}} \bar{c}_i &= -\left(\frac{\partial F_i}{\partial c_i}\right)^{-1} D_{\mathbf{x}} F_i, \\
H_{\mathbf{x}} \bar{c}_i &= -\left(\frac{\partial F_i}{\partial c_i}\right)^{-1} \left(H_{\mathbf{x}} F_i + D_{\mathbf{x}} F_i \left[D_{\mathbf{x}} \bar{c}_i\right]^\top + D_{\mathbf{x}} \bar{c}_i \left[D_{\mathbf{x}} F_i\right]^\top + \frac{\partial^2 F_i}{\partial c_i^2} D_{\mathbf{x}} \bar{c}_i \left[D_{\mathbf{x}} \bar{c}_i\right]^\top \right),
\end{aligned}
$$

which holds in an appropriately defined neighborhood around $\{\eta, z, q\}$. Imposing the envelope theorem and evaluating the first- and second-order derivatives above, and taking the limit as $c_i \to 0, q_i \to 0, \beta \to 1$ implies that $\frac{\partial \bar{c}}{\partial \eta}$ approaches 0 from above at the rate in (16); $\frac{\partial \bar{c}}{\partial z}$ approaches (17); $\frac{\partial \bar{c}}{\partial q}$ approaches $-\infty$ at the rate in (18); $\frac{\partial^2 \bar{c}}{\partial \eta^2}$ approaches 0 from below at the rate in (19); $\frac{\partial^2 \bar{c}}{\partial \eta \partial z}$ approaches (20); and $\frac{\partial^2 \bar{c}}{\partial \eta \partial q}$ approaches $+\infty$ at the rate in (21).

□

Appendix B Empirical Appendix

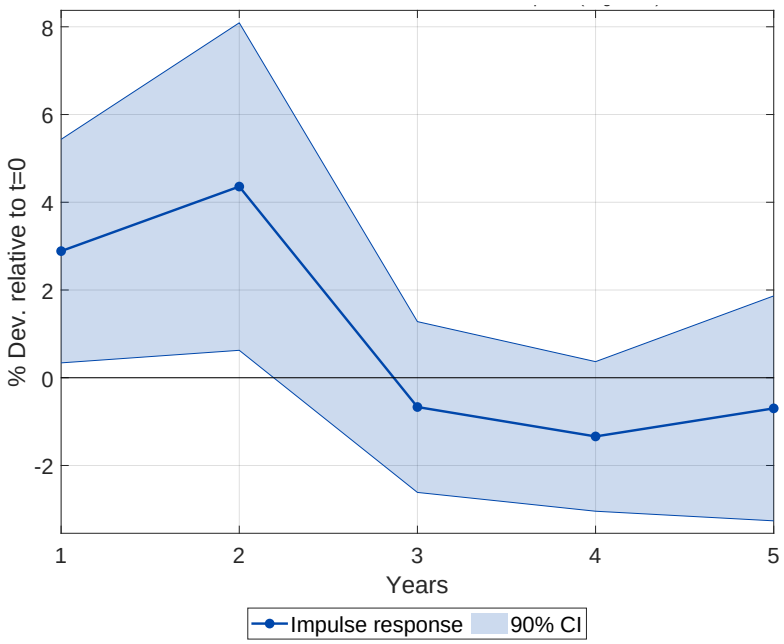
B.1 Robustness checks to Section 5.1

This appendix discusses several robustness checks to substantiate the finding presentative in Figure 4, indicating that waste area enclosures lead to a rise in bankruptcies.

Alternative enclosure intensity measurement One might conjecture that due to agglomeration effects or nonlinear valuations whereby a large plot of land that is twice the size of a small plot might be worth more than twice over the small plot as it allows for larger future projects to be initiated or due to the reduction in future transaction costs in ascertaining two separate contracts for two equivalently-sized plots instead of one. Figure 10 and demonstrates that our results are robust to that interpretation of the data and produce consistent estimates. Waste area enclosures are associated with an increase in bankruptcies.

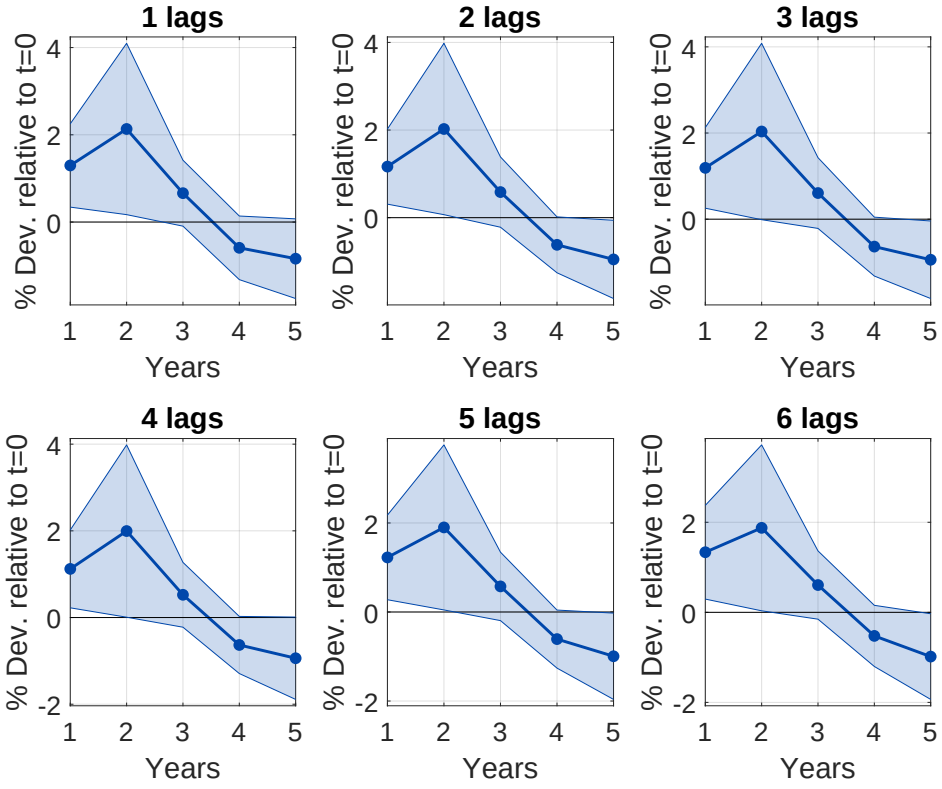
Lag order selection Estimating Equation (22) requires specifying l, the lag order of the control vector. Our baseline estimates are obtained using $l = 4$. To show that this choice does not critically effect our results we report in Figure 11 how our results change when we use values ranging from $l = 1$ to $l = 6$.

Figure 10: The Effect of Land Enclosures on Bankruptcies



Note: This figure reports in the solid lines values of β_0^h from estimating Equation (22) using the average area of a waste enclosure approved in county i at time t. Shaded areas indicate 90% confidence intervals where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to an enclosure of 1k acres.

Figure 11: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1750 - 1830: Robustness to Lag Order Selection.



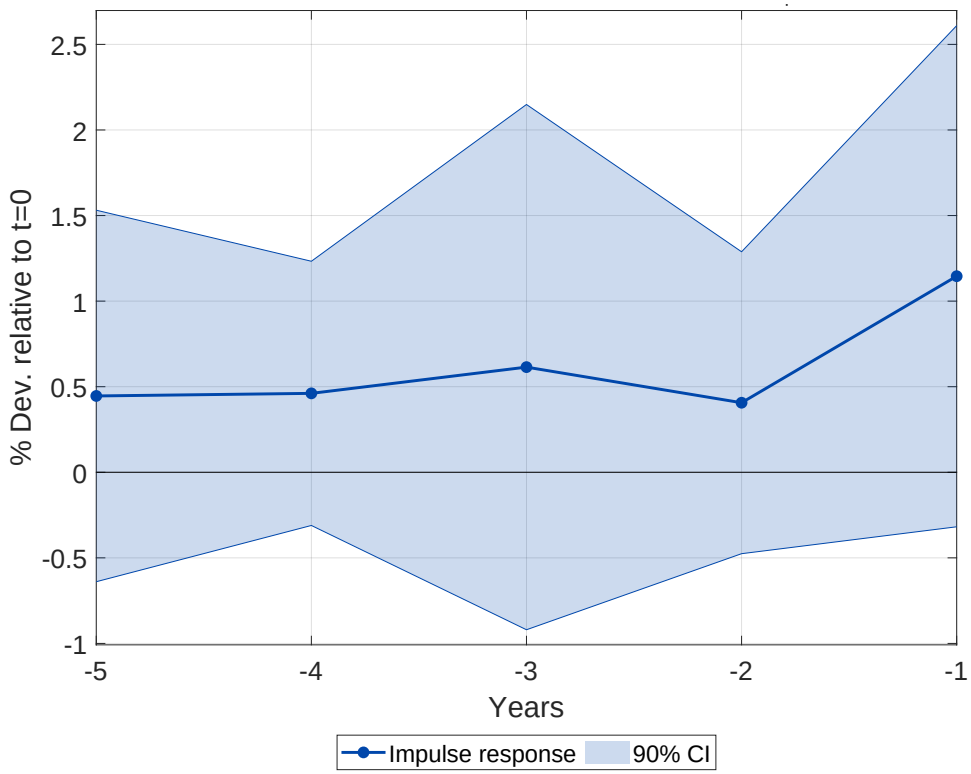
Note: The figure displays impulse response estimates of bankruptcies to land enclosure shocks, with confidence intervals at the 90% level. Each panel corresponds to values of β_0^h from estimating Equation (22) using data from 1750 - 1830 with a different number of lagged control $l = 1,\ldots,6$. The responses are scaled as percentage deviations from the pre-enclosure level.

Potential pre-trends Another concern for our interpretation of the result is the possibility that counties where waste enclosures were granted have seen different circumstances and financial conditions, leading to increased petitioning for enclosures or to an increased likelihood of their approval. To alleviate this concern, we estimate the following complementary specification:

$$BR_{i,t-h} = \tag{B.1}$$
$$\exp\left(\delta_t^h + \alpha_i^h + \beta_{pretrend}^h ENC_{i,t} + \sum_{j=1}^{l} \beta_j^h ENC_{i,t-h-j} + \sum_{j=1}^{l} \eta_j^h (BR_{i,t-h-j}) + \pi_h pop_{i,t-h-1} + \epsilon_{i,t}^h\right),$$

where $h \in \{-1,\ldots,-5\}$. $\beta_{pretrend}^h$, tells us to what extent is an enclosure at time t informative of the outcome at time $t-h$. Finding a significant coefficient might challenge any causal interpretation we attribute to our baseline estimates. Figure 12 reports the results of the estimation of Equation (B.1) finding no evidence of a statistically significant pretrend. To demonstrate that this result is also unaffected by the number of included lags we re-estimate Equation (B.1) using values of l ranging from 1 to 6 and finding consistently no statistically

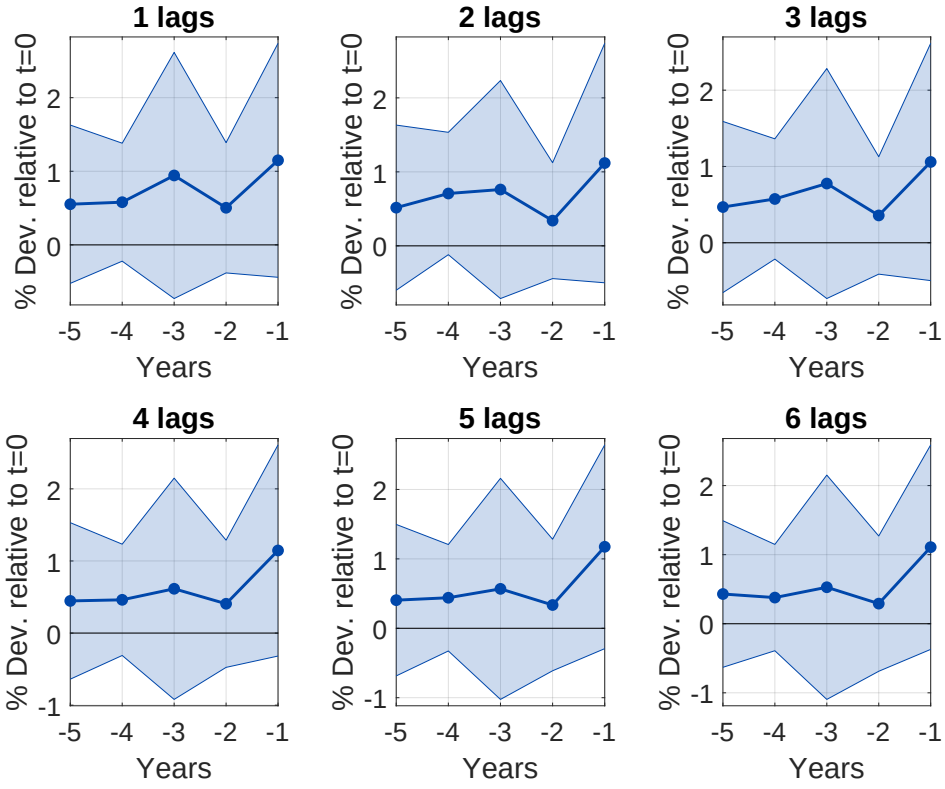
Figure 12: The Effect of Waste Enclosures on Bankruptcies: Pretrend Test



Note: This figure reports in the solid lines values of $\beta^h_{pretrend}$ from estimating Equation (22) using the total area of waste enclosures granted in county i at time t. Shaded areas indicate 90% confidence intervals where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to an enclosure of 1k acres.

significant pre-trend. This exercise is presented in Figure 13.

Figure 13: The Effect of Waste Enclosures on Bankruptcies: Pretrend Test: Robustness to Lag Order Selection.



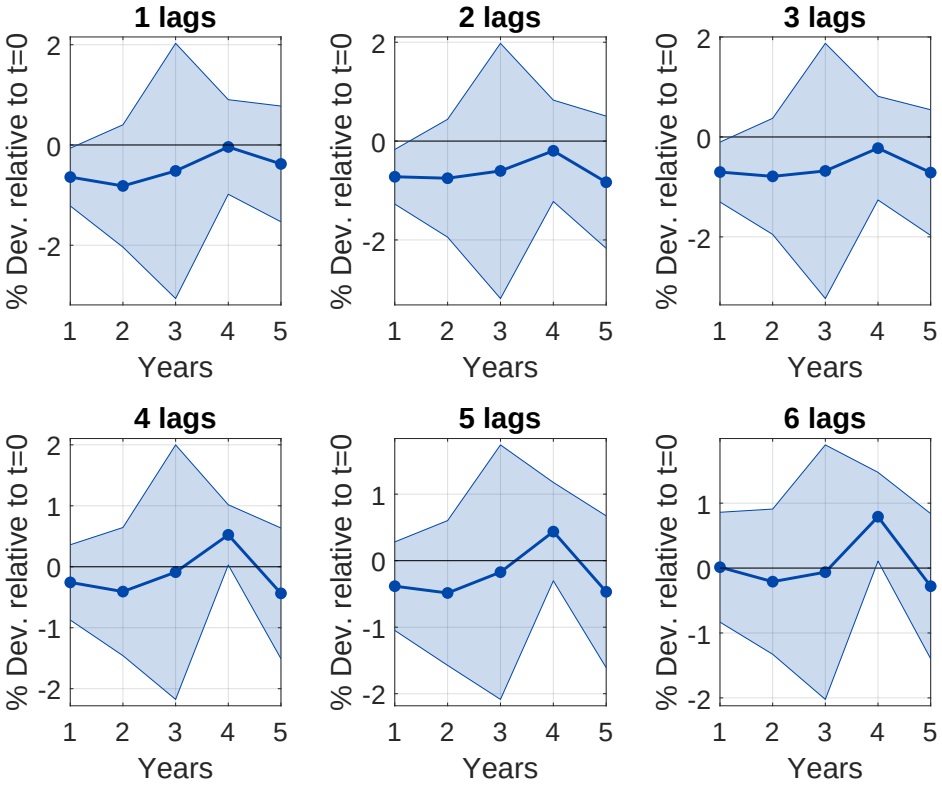
Note: The figure displays impulse response estimates of bankruptcies to land enclosure shocks, with confidence intervals at the 90% level. Each panel corresponds to values of β_0^h from estimating Equation (22) using data from 1793 - 1830, with a different number of lagged control $l = 1, \ldots, 6$. The responses are scaled as percentage deviations from the pre-enclosure level.

B.2 Robustness checks for section 5.2

Lag order selection and sample splitting Figures 14 and 15 demonstrate that the sample splitting exercise reported in Figure 5 is also unaffected by our choice of lag order in Equation (22).

Cutoff selection for Figures 6 and 8 The specification in Equation (23) requires specifying an exposure cutoff value expressed in percentile terms. The groups are defined such that low exposure denotes values below the $50 - p_x$ percentile and high exposure denote values above the $50 + p_x$ percentile of the exposure measure. Our baseline uses $p_x = 25$. We conduct robstness checks to all results hinging on this specificatio to see that they are not sensitive to this cutoff choice. We maintain symmetry in our robustness checks and re-estimate Equation (23) using $50 - p_x$ as the 15^{th},20^{th},25^{th},30^{th},35^{th}, and 40^{th} percentiles of the exposure measure. Figures 16 and 17 demonstrate that the result in Figure 6 is robust to our cutoff choice. The effect of waste enclosure on bankruptcies is stronger in counties and years that are most exposed to the secondary sector and the least exposed to agriculture.

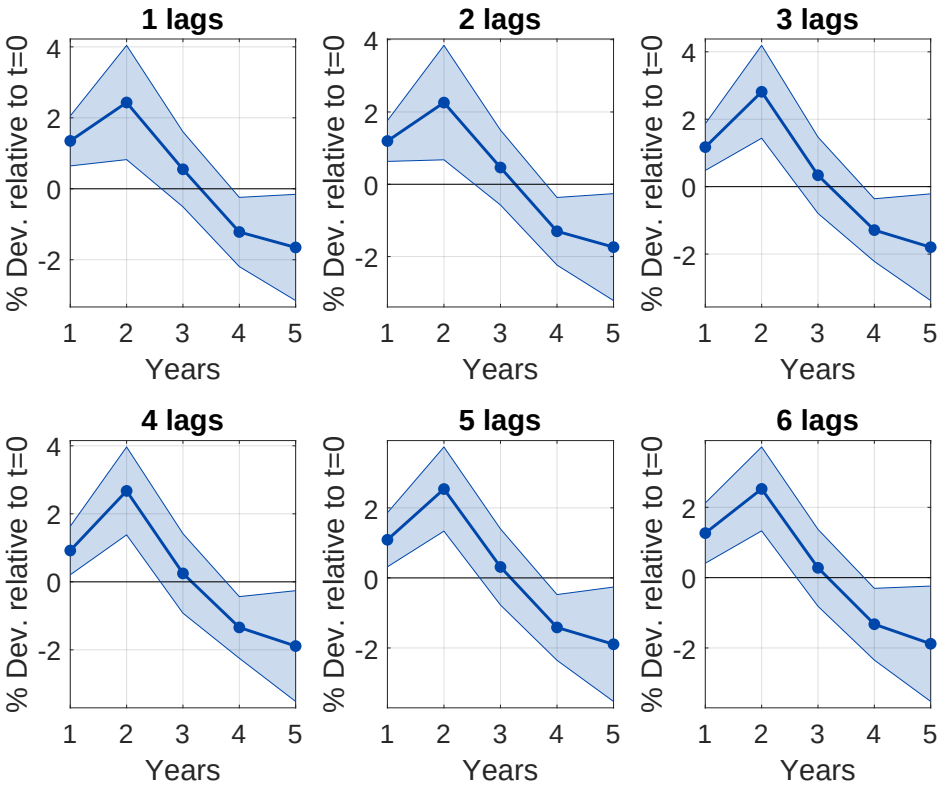
Figure 14: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1750 - 1792: Robustness to Lag Order Selection.



Note: The figure displays impulse response estimates of bankruptcies to land enclosure shocks, with confidence intervals at the 90% level. Each panel corresponds to values of β_0^h from estimating Equation (22) using data from 1750 - 1792, with a different number of lagged control $l = 1, \ldots, 6$. The responses are scaled as percentage deviations from the pre-enclosure level.

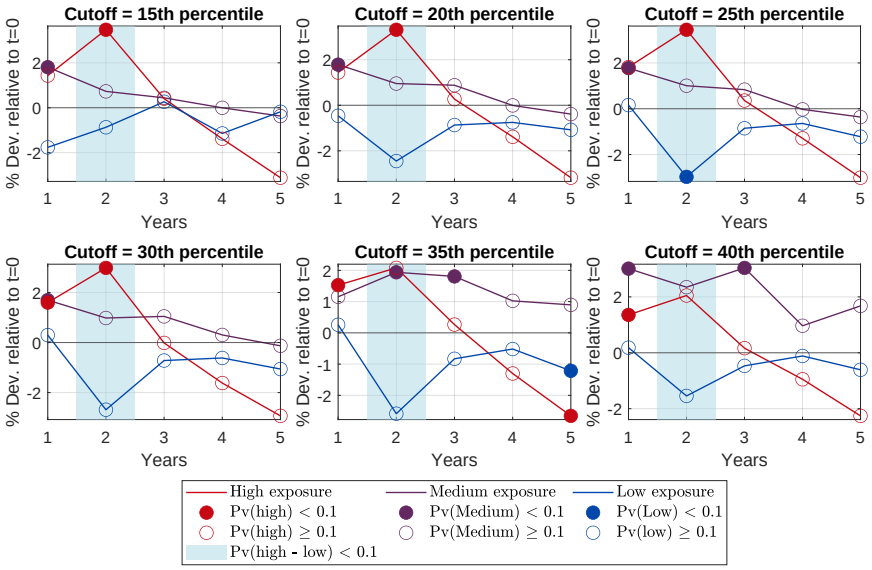
Figure 18 demonstrates that as in Figure 8 of the main text, high exposure to the weather shock amplifies the effect of waste enclosures on bankruptcies.

Figure 15: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1793 - 1830: Robustness to Lag Order Selection.



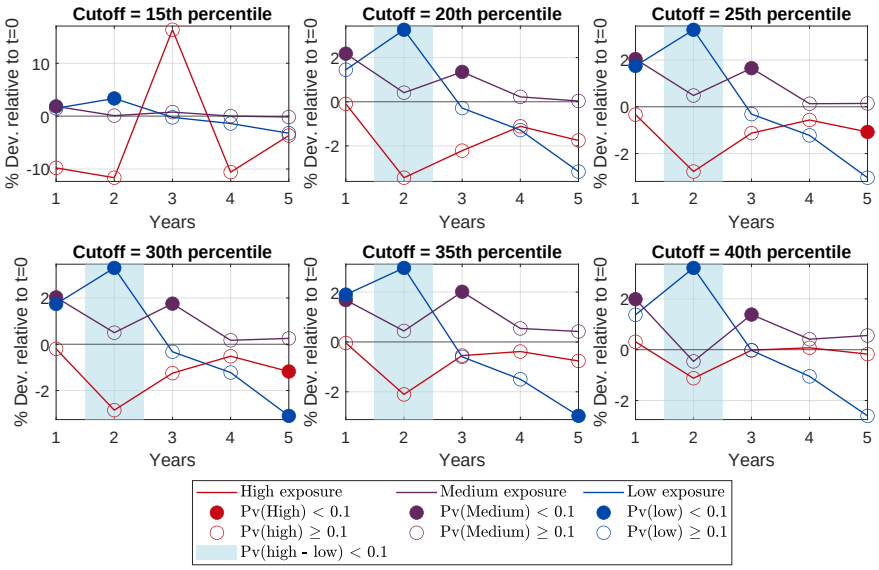
Note: The figure displays impulse response estimates of bankruptcies to land enclosure shocks, with confidence intervals at the 90% level. Each panel corresponds to values of β_0^h from estimating Equation (22) using data from 1793 - 1830, with a different number of lagged control $l = 1, \ldots, 6$. The responses are scaled as percentage deviations from the pre-enclosure level.

Figure 16: Agricultural Intensity and the Effect of Waste Enclosures: Robustness to Cutoff Choice



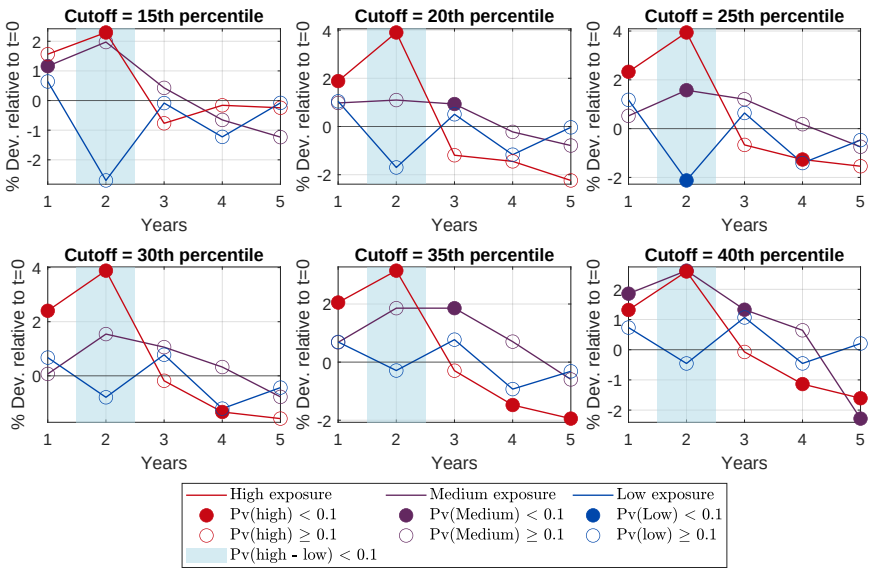
Note: This figure reports impulse responses estimated via Equation (23) using the total area of waste area enclosures in the solid lines, and defining exposure dummies using the share of workers in a county-year observation engaged in agriculture. Each panel reports the results from estimating Equation (23) using the cutoff level indicated in the title for the low exposure and high exposure group. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the high and low exposure interaction coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.

Figure 17: Secondary Sector Intensity and the Effect of Waste Enclosures: Robustness to Cutoff Choice



Note: This figure reports impulse responses estimated via Equation (23) using the total area of waste area enclosures in the solid lines, and defining exposure dummies using the share of workers in a county-year observation engaged in the secondary sector. Each panel reports the results from estimating Equation (23) using the cutoff level indicated in the title for the low exposure and high exposure group. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the high and low exposure interaction coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.

Figure 18: Exposure to Weather Shocks and the Effect of Waste Enclosures:



Note: This figure reports impulse responses estimated via Equation (23) using the total area of waste area enclosures in the solid lines. Each panel reports the results from estimating Equation (23) using the cutoff level indicated in the title for the low exposure and high exposure group in terms of exposure to our weather shock variable. The shock is constructed such that high exposure indicates that weather conditions were particularly unfavorable. Full points indicate that the point estimate is statistically significant at a 90% confidence level. Shaded area indicates that the difference between the high and low exposure interaction coefficients is statistically significant at a 90% confidence level where inference is based on doubly clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to a new land enclosure of 1k acres.