Land Reforms in Developing Financial Markets: Lessons from England's Land Enclosures 1750-1830*

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Abstract

Land privatization, or "titling," is a cornerstone of development policy. While titling is typically thought to improve allocational efficiency, its impact on financial markets remains less understood. We study the financial role of titling by leveraging an ideal institutional setting in 1750 – 1830 England, in which land with common use rights was gradually privatized. Informed by key institutional and financial features in England during this time, we develop a theory of the nexus between titling reforms, credit market access, and the use of land as collateral. Using a novel database of personal defaults, we find that titling land with common use rights *raises* local bankruptcies, a key prediction of our model. The effect is especially pronounced in industrialized regions, among industrial occupations, and during downturns, highlighting that local economic conditions are pivotal in determining the financial effect of land reforms.

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, or *titling*, is regarded as a critical reform for developing economies because it can improve resource allocation and stimulate economic growth. In theory, titling should increase landowners' incentives to invest in their land, both by securing future returns and by expanding access to credit markets through the ability to pledge land as collateral. While some empirical studies have found support for a financial role of titling, the extent to which this collateral-based mechanism operates depends critically on institutional features such as the security of property rights and the development of financial markets.[1]

Identifying the financial effects of land titling is difficult because reforms usually coincide with at least one of three confounding factors. First, property-right enforcement is often weak, so newly issued titles do not fully eliminate expropriation risk. Second, titling reforms for arable land can also alter agricultural technology or factor use, blurring collateral effects with productivity effects or agglomeration. Third, the beneficiaries are usually poorer households with low financial literacy and limited trust in formal institutions, that might not participate in credit markets. Any of these channels can shift credit outcomes, making it hard to isolate the collateral-based mechanism from other forces.

Enclosures of waste in Eighteenth-century England provides a rare laboratory in which none of these obstacles bind: property rights were well enforced; the waste land we study had little direct value in cultivation; and recipients were relatively wealthy landed individuals. Furthermore, the level of development in Eighteenth-century England is similar to that of many developing countries today, making it a valuable case study for present day development policies.[2] This paper formalizes how enclosures affected financial markets indicating that enclosures should make credit more available and raise bankruptcies. Leveraging these insights, we digitize the complete universe of bankruptcy notices published in the London Gazette (around 51,000 cases) and merge them with all Parliamentary *enclosure acts* from 1750–1830 (1,600 acts). A Poisson local-projections design shows that granting title to 1,000 acres of waste land raises county-level bankruptcies by 1.1 percent in the first year and 2.0 percent in the second, with no pre-trend. The magnitudes are consistent with the collateral-competition mechanism developed in our model.

Enclosure was a legal process by which customary or communal rights to land were extinguished and replaced with exclusive, individualized ownership. Between 1750 and 1830, approximately 5.9 million acres (about 18 percent of England's land area) were enclosed, largely through Acts of Parliament (Turner 1984). Importantly, property rights were broadly secure in England at this time (Clark 1996) implying that expropriation risk was not a con-

[1] See e.g., Feder et al. (1988), de Soto (2000), Deininger (2003), Feder and Feeny (1991), Besley (1995), Deininger and Chamorro (2004), Besley and Ghatak (2010), Galiani and Schargrodsky (2010), and Manysheva (2022).

[2] According to the Maddison project database estimates, GDP per capita in the U.K. was 2.70 thousand 2011 dollars in 1750 and 3.55 in 1830, making it comparable to 2022 Senegal (2.66), Cameroon (2.81), Kenya (3.40), or Zambia (3.34) among others (Bolt and van Zanden, 2025).

cern. Enclosures changed the feudal nature of landholding rights facilitating the broader use of land as collateral within a financial system dominated by secured lending due to legal and structural frictions (Hodgson 2017, p.6).

We exploit a unique feature of titling reforms during this period and focus on a subset of enclosures involving non-agricultural land known as *common waste*: uncultivated terrain such as moorlands, heaths, marshes, and steep hillsides. Unlike *common fields*, which were used for agricultural production but had limited passage rights and functioned more like private property, waste was common land with usage rights to all the village farmers who used it mainly to graze animals, gather fuel, or cut turf (Clark and Clark 2001). Enclosure abolished these rights and transferred ownership to private individuals.

Unlike many titling reforms in developing economies, the beneficiaries of waste enclosures were relatively wealthy and more likely to participate in formal credit markets. Moreover, the enclosure of waste during this period was sizable, covering about 4 percent of England's land area. By increasing the stock of available collateral, the enclosure of waste had the potential to alter credit allocation under the prevailing institutional constraints. By focusing on the titling of waste rather than on agricultural land, we isolate its effect on credit access.

We begin our analysis with a deep historical overview of the economic and financial conditions in which these land reforms took place. We highlight a number of key institutional features which are crucial for understanding the financial effects of land reforms. First, land enclosures involved a convoluted approval processes, beginning with a petition filed by the owners of at least seventy five percent of the land in the perish as measured by value. following which, these petitions underwent a parliamentary approval process that took years making their approval and importantly the timing thereof as good as random. Second, despite its lack of agricultural use, waste land was valuable, as a source of raw materials and pasture land and where used for these purposes prior to enclosure by members of the community. Third, finance was dearly needed but much constrained. Financial markets were relatively active at this time, but their functioning was impeded by usury laws, lending by quasi-banks, and people often raising funds from multiple sources simultaneously. Fourth, lending often involved collateral and land (including waste) was frequently used as collateral. Finally, bankruptcy laws were strict sometimes with dire personal consequences and no separation between personal and corporate entities. All these factors taken together imply that securing a land enclosure grant was a valuable way to obtain collateralizable assets and improve one's standing in the local financial market.

To understand the mechanisms underlying the financial effects of land titling, we embed these key historical and institutional features into a stylized dynamic endogenous default model. 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 interest rate is capped at the legally-binding usury rate. Instead, financial in-

termediaries 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, posting 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 enclosures of waste 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, enclosures induce the financial sector to compete over a larger volume of lending and reduce the equilibrium collateral requirements. However, by raising market access overall, enclosures ultimately increase 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. To do so, we construct a novel panel database of ancient English counties between 1750-1830, combining information on enclosure acts with newly digitized data on bankruptcy events.[3] We construct this novel bankruptcy dataset by digitizing the public notices published in the *London Gazette*. Our dataset includes the universe of bankruptcies as all bankruptcy notices were mandated to be published in the *London Gazette* by the 1705 Bankruptcy Act. The resulting dataset provides details on the location and occupation of the bankrupt individuals, and includes over sixty thousand cases.

We combine our bankruptcy data with the full set of approximately 1,600 Parliamentary acts that gradually enclosed waste in England, each establishing property rights over specific plots of land. Using a Poisson local projections model à la Jorda (2005), we assess the effect of land enclosures on bankruptcies. Our results can be given a causal interpretation based on features of the historical enclosure process: both the acceptance or rejection of petitions by Parliament, and the timing of an enclosure award (due to the lengthy and often unpredictable administrative procedure) were effectively independent of local credit conditions. 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.

An important mechanism in our model is that waste enclosures increase credit market access and overall borrowing in the local areas affected by the enclosures. While our findings using our digitized bankruptcy data are consistent with this interpretation, additional

[3] Given the scarcity of systematic local banking data (Pressnell 1956, p.322), bankruptcies serve as a critical indicator of financial conditions in this period.

credit market data is extremely limited; thus, direct tests of this model mechanism are difficult. Instead, to provide further validation of our model-based interpretation, we test several corollaries of our theory.

Our model implies that we should observe stronger effects of enclosures on bankruptcies when risk and competition in the financial sector are higher. Both the rise in risk (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; these years include a rise in geopolitical tensions with the coming of the Napoleonic wars and higher degrees of industrialization. Moreover, we see the largest impact in highly industrialized counties, precisely where financial needs and project risks are greatest.

Another prediction of our model is that bankruptcies should be more responsive to enclosures in downturns when productivity is lower. To this end, we leverage regional weather variation captured by the width of tree rings in England during our sample period (specifically, narrower rings indicate that growth conditions were less favorable, implying lower agricultural yields). Interacting this shock series for agricultural yields with land enclosures, we find that the financial effects are amplified during economic downturns. Consistent with our theory, when waste enclosures occur during adverse economic conditions, we find a substantially larger rise in bankruptcies.

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 further validate our financial interpretation of the effects of waste enclosures, we repeat our empirical analysis using open field enclosures instead. 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. Unlike waste enclosure, open field enclosures yield an immediate real effect in the opposite direction, generating a decline in bankruptcies following an enclosure act. This finding is consistent with our model and further substantiates the financial nature of the effect observed for waste enclosures.

Related literature. Our study offers valuable insights into several strands of existing literature. From a historical perspective, it makes a novel contribution by foregrounding the financial dimension of land enclosures—an aspect that remains understudied despite its importance to England's industrialization. This is in contrast to most existing research, which focuses on the impact of enclosures on agricultural productivity (e.g., McCloskey 1989; Allen 1992; Heldring et al. 2022) or on its broad economic outcomes (e.g., Bogart and Richardson 2009). By doing so, we shed new light on the financial pressures and insolvency risks tied to the enclosure of waste—an aspect largely overlooked in studies of England's industrial

transformation.

We also contribute to the literature examining the effect of titling reforms on access to credit, particularly in the presence of inefficient enforcement of debt contracts. Several studies have provided evidence supporting the existence of a positive effect of land titling on credit supply (e.g. Feder, Onchan, Chalamwong, and Hongladarom 1988, Feder and Feeny 1991, Besley 1995, Deininger and Chamorro 2004, Besley and Ghatak 2010, Galiani and Schargrodsky 2010). However, many of these studies focus on low-income countries; environments with a near-total reliance on agriculture; or institutional settings in which formal land titling and registration still do not necessarily translate into secure tenure in practice. As discussed in Manysheva (2022), all of these frictions make it difficult to identify the impact on credit markets. Our setting is uniquely suited to isolate the access to credit channel by focusing solely on the privatization of non-agricultural land with common use rights, in a context where property rights are already secured and in which the land titling reforms occurred amongst a relatively wealthier population.

Our empirical work leverages the surprising timing in which land titles were granted to examine their effects on the local credit market. Our results provide evidence that titling improve financial market access, and show how this effect is stronger during downturns and in more industrial settings, consistent with our theoretical mechanism. The results offer valuable lessons for implementing future land reforms in developing countries demonstrating 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 ultimate effects on developing economies.

Our work is also related to a rich tradition in the macroeconomic literature considering the role of factor misallocation à la Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) in accounting for cross-country differences in economic development. In particular, several studies analyze 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). These studies typically conceptualize collateral requirements using an exogenous collateral constraint as in the seminal contributions of Evans and Jovanovic (1989) and Kiyotaki and Moore (1997). By contrast, our model and institutional setting jointly present a context where the collateral requirements, and the constraints faced by the entrepreneurs themselves, arise endogenously as equilibrium outcomes. We thus add to this theoretical literature by developing a framework which can capture the key dynamics when intermediaries compete over collateral, due to institutional frictions such as usury laws.

The remainder of the paper proceeds as follows. Section 2 outlines the institutional context of our study. Section 3 develops our theoretical framework and derives key main testable predictions. Section 4 describes our database and empirical analysis. Section 5 studies the main mechanisms that affect our results. The final section concludes.

2 Institutional Setting: England 1750–1830

This section documents the institutional and economic background for our analysis. We emphasize four themes. First, Parliamentary enclosure—especially of land with common-use rights such as *waste*—created new, individually titled assets and thus a shock to the stock of collateral. Second, the enclosed land was ultimately concentrated among wealthier landholders who could bear enclosure costs and who had ready access to credit markets, allowing the collateral shock to translate into greater loan demand and active mortgaging of allotments. Third, although the decision to initiate enclosure reflected local conditions, the award date was pushed around by procedural frictions and disputes, rendering its timing effectively orthogonal to short-run shocks. Lastly, private credit markets were fragmented and constrained by binding *usury* ceilings, so lenders could not compete on interest rates. In this environment, our theoretical framework stated in Section 3 predicts that by lowering the private cost of posting collateral for the wealthy, enclosure raises loan demand and reduces equilibrium collateral requirements, expanding credit at the margin to riskier borrowers and increasing bankruptcies.

2.1 The Enclosure of Land

Enclosure was not simply a matter of fencing fields but a statutory procedure that transformed long-standing land-use rights. Given the generally strong enforcement of land rights by this period (Clark, 1996), the principal financial effect ran not through basic security of tenure but through pledgeability: enclosure converted diffuse or customary rights into standardized, saleable, mortgageable parcels (Pressnell, 1956; Habakkuk, 1965; Hodgson, 2017; Bogart and Richardson, 2009).

Our study focuses on the high-enclosure decades 1750–1830, when Parliamentary acts and awards dominated. Roughly 5.8 million acres (about 18% of England) were enclosed by 1830, with clustering around 1760–1780 and again during the Napoleonic era (Turner, 1980, pp. 66, 81); for documentary coverage see Tate and Turner (1978). Two forms of Parliamentary enclosure are analytically distinct. The enclosure of *open fields* consolidated scattered arable strips into compact farms in severalty.[4] By contrast, enclosure of land with customary usage rights, such as pasture, woods, meadows, and *waste* (*i.e.*, land often unsuited to intensive tillage but valuable for grazing, fuel (peat, turves), and materials (clay, gravel, stone) (Mingay, 1997, pp. 8–9)). The distinction matters for our empirical focus: open-field enclosure primarily reorganized production (a productivity channel) (Heldring et al., 2022), whereas enclosing commons and waste created new, individually titled assets (a collateral channel).

[4] Under the open-field system, holdings were scattered, unfenced, and subject to common rules on crops and fallow.

Process, timing, and recipients. Substantial landholders coordinated locally and, once a working agreement emerged, sponsored a petition for a private enclosure bill. Many bills were withdrawn or failed before passage; this preliminary phase could be brief or highly protracted (Mingay, 1997, pp. 20–21). Neeson (1993, p. 275) reports that 14% of private bills reaching Parliament failed in 1715–1774. When a bill passed, Parliament named commissioners who took oaths, appointed a surveyor, issued precepts and public notices, and convened meetings to receive claims and objections. They surveyed and valued lands and rights (including tithes, manorial incidents, and common uses), laid out public and occupation roads, and heard disputes and appeals. Commissioners then drafted the schedule of allotments (including set-outs for roads, the lord, and the tithe owner), apportioned costs, and sealed the final award—usually with an attached map—thereby vesting title to newly defined parcels and extinguishing prior common rights (Turner, 1980; Tate and Turner, 1978). Fees for petitions and bills, commissioners' remuneration, surveying, fencing, and road-making were charged to the parish or to allottees; smaller right-holders frequently sold their parcels to meet charges, increasing concentration of ownership (Turner, 1980, pp. 113–116); (Mingay, 1997, pp. 98–100). Procedural frictions, objections, and administrative backlog often created substantial delay, pushing the award date idiosyncratically relative to short-run economic conditions.

Collateralization of newly allotted land. Enclosed waste retained economic value through grazing, fuel, and materials, and in some locations through conversion or leasing. Case studies from Lancashire (e.g., Croston Finney) and Somerset show post-award leasing, sales, and mortgages reflecting land quality, situation, and expected enclosure costs (Rogers, 1993; Williams, 1972; Buchanan, 1982). Parish deed series and award clauses frequently permitted and recorded mortgages "of lands *allotted by the Enclosure Award*," including waste parcels; these instruments were used both to finance enclosure costs and for subsequent borrowing (Pressnell, 1956, pp. 349–355, esp. 350); (Mingay, 1963, pp. 97–98). In short, enclosure manufactured assets that were documented and immediately usable as collateral.

2.2 Fragmented Finance, Usury Ceilings, and Collateral

Eighteenth-century English credit markets were active yet structurally constrained. Following 1688, the state secured credible access to long-term borrowing (Dickson, 1967; North and Weingast, 1989), but private intermediation remained shallow and geographically fragmented. Statutes in 1697, 1707, and 1708 endowed the Bank of England with privileges and limited all other banks to small partnerships, impeding scale and branching outside London. A three-tier system emerged: the Bank of England (public finance), London private bankers, and proliferating *country banks* (Pressnell, 1956, p. 75). The latter grew from fewer than a dozen in the 1750s to over 700 by 1810 (Pressnell, 1956, p. 127), but were typi-

cally undercapitalized, reliant on London agents, and confidence-sensitive; their notes were prone to runs in crises (Calomiris and Haber, 2015; Temin and Voth, 2013; Hodgson, 2021; Turner, 2014).[5] Public borrowing absorbed a large share of savings (Quinn, 2001; Temin and Voth, 2013), and failures rose in wartime and recessions. In textiles—the leading industrial sector—many collapses reflected liquidity shortages rather than asset insufficiency (Hudson, 1986, p. 203).

A central distortion was the presence of *usury ceilings* that capped private lending rates (while government borrowing was effectively exempt). When the ceiling bound, intermediaries could not price risk via interest; they priced risk via security. Longer-maturity and riskier credits therefore required mortgages or closely related collateral (Calomiris and Haber, 2015, p. 96). Archival work on London houses shows that collateralized lending ("money lent on mortgage, bond, etc.") dominated the longer end at Hoare's (1778–1797) and Goslings (1796) (Gent, 2016, pp. 101, 106); more broadly, mortgages became a major component of intermediation (Joslin, 1954; Hodgson, 2021; Turner, 1981).

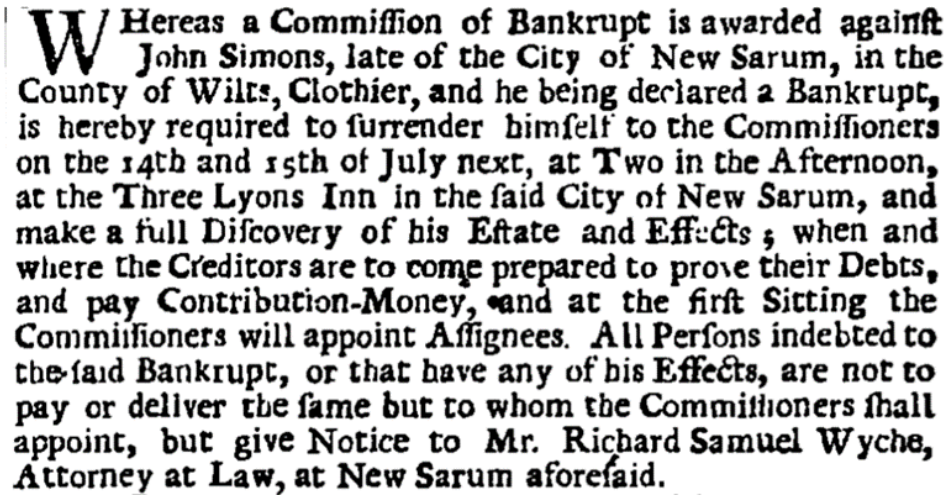
In this environment, access to credit was closely related to land ownership: holders of land—and entrepreneurs who first acquired it—could pledge it and tap longer-maturity finance, while most firms stitched together short, local credits and remained fragile (Casson, 1993; Wilson, 1995; Chapman, 1979). The edge was legal as well as financial: mortgagees on real property had priority and stood outside the bankruptcy estate, so only the debtor's equity of redemption passed to assignees; outside bankruptcy, ordinary executions typically reached movables rather than land (Hoppit, 1987, pp. 49, 59).

Bankruptcy law (1750–1830). Between 1570 and 1861 English bankruptcy applied to traders (those "using the trade of merchandise"). Statutes of 1542 (asset seizure for creditor protection) and 1571 established the framework; practice was regularized by the 1705 Act, which required notices in the *London Gazette*, set meetings for creditors to prove debts, and standardized procedure (Carlos et al., 2019, pp. 485–486). The law also fixed petitioning thresholds and catalogued "acts of bankruptcy": under 21 Jac. I c. 19 (1623/4) a commission could issue on the petition of *one* creditor owed at least £100, *two* creditors jointly £150, or *three or more* jointly £200 (Cooke, 1812)[6]. Cases often involved many creditors (e.g., 549 cases in 1710–1714 list 8,424 individual creditors—about sixteen per case) (Carlos et al., 2019, Table 2).

Petition and adjudication. Upon receipt of a creditor's petition, the Lord Chancellor appointed bankruptcy Commissioners to verify eligibility under these statutory conditions

[5] The Bank of England nonetheless fostered market development in important respects; see, for example, Hodgson (2017) and O'Brien and Palma (2023).

[6] Classic acts included "keeping house" (concealing oneself to avoid process), absconding, fraudulent conveyance or concealment of effects to defeat creditors, non-payment after formal demand, and *lying in prison for two months for debt*; proof of *any one* such act sufficed to ground a petition (Blackstone, 1766, Book II, ch. 31); see also Cooke (1812).



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.

Figure 1: Example of bankruptcy notice in the *London Gazette*

Note: John Simons, a clothier from the City of New Sarum (Wiltshire), was declared bankrupt on 6 June 1732. The notice specifies the time and place of his appearance before the commissioners and the meetings for creditors to prove their debts. Source: *The Gazette* (London Gazette), 6 June 1732, Issue 7098, p. 2. https://www.thegazette.co.uk/London/issue/7098/page/2

and, if satisfied, to establish a Commission of Bankruptcy (Blackstone, 1766, Book II, ch. 31). In practice there was often a short administrative interval between filing the petition and both the formal establishment of a Commission and the publication of the declaration in the *Gazette*, reflecting the time required to verify eligibility. To gauge the length of this interval, we matched forty entries in the bankruptcy docket books (recording the establishment of Commissions of Bankruptcy) to the corresponding *Gazette* notices: the lag from petition to public declaration typically ranged from one to two weeks, with the longest delay in the sample being about one month, indicating that the investigation period between petition and declaration was generally brief (docket-book sample; data courtesy of Ann Carlos). Later legislation formalized recency requirements for the act of bankruptcy itself—for example, the *Bankruptcy Act 1914* required that an act generally occur *within six months* before presentation of the petition.

Treatment of land and security. Mortgagees on real property had priority and stood outside the bankruptcy process: they enforced their liens directly and were paid first, while only the equity of redemption (the bankrupt's residual interest) vested in the assignees; unmortgaged freeholds/leaseholds vested in full and could be sold for the estate. Outside bankruptcy, ordinary executions typically reached only movables (goods, stock-in-trade), not land, which gave landholders more scope for refinancing or composition before a commission issued (Hoppit, 1987, pp. 49, 59).

Two contemporaneous cases make the advantages of land concrete. Samuel Oldknow (1756–1828), a cotton manufacturer born at Anderton (Lancashire) and trained in the muslin trade, expanded in the late 1780s by acquiring estates around Mellor and Marple and in

1793–1795 completed *Mellor Mill*. As trade tightened in the 1790s he financed operations by mortgaging his estates and, from 1800, operated in partnership with Richard Arkwright Jr. (dissolved 1805). Control over the enterprise effectively shifted to Arkwright Jr. through the mortgage and partnership structure, while Oldknow remained on site as manager—a textbook case of land-backed scaling and creditor control via security rather than through a formal bankruptcy (Pressnell, 1956, pp. 349–355); see also Unwin (1924); Hudson (2002).

By contrast, Henry Cort (c. 1740–1800), originally a navy agent at Gosport, purchased the Funtley/Fontley forge and slitting mill in 1775 and patented grooved rolls (1783) and puddling (1784). Lacking bankable landed collateral, he relied on insider finance linked to the Navy Pay Office (the Jellicoe family). After Adam Jellicoe's death in 1789, the Crown asserted priority over misapplied public funds; Cort's assets, including the patents, were seized under extent and he was declared bankrupt, never returning to large-scale production. Here, plant and patents proved weak security relative to land in the contemporary legal–financial environment (Ashton, 1924; **?**).

With these institutional features and historical details established, we now proceed to present a stylized model of such credit markets, discuss the resulting equilibrium, and illustrate how enclosures can lead to a credit boom.

3 Theoretical Framework

Understanding the institutional features is critical to making sense of the financial effects of land enclosures during this period. Given frictions in credit markets and the high reliance on secured lending, newly enclosed land had the potential to affect the equilibrium demand and supply of credit through its use as collateral. However, given the complexities of the historical setting, we first build a formal framework to clarify key transmission channels. 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: lenders face a binding usury rate; there exists a " many-to-many" relationship between lenders and borrowers; and competition for funds is imperfect and fragmented. Thus, the use of costly collateral endogenously arises to partially overcome these frictions.

In our model, 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 if 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.[7] 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 the usury ceiling). 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.[8]

The CES assumption captures firms' limited ability to freely substitute borrowing across different lenders, reflecting historical realities such as relationship banking, geographic con-

[7] 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 $z_{i,t}$.

[8] 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.

straints, or reputation-based lending prevalent in the English financial system at the time. 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

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

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 $\eta_t(j)$ is higher.

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

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*

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

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

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

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 collat-

eral $g_{i,t}(j) = \eta_t(j)\ell_{i,t}(j)$. 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

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

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

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

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

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

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

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

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

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}. Similarly to standard models of monopolistic competition, η_t (which functions as the equilibrium price) is set at a markup θ over the bank's marginal cost of lending.

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.[9]

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 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 of* $c_{i,t}$ *denoted by* $\bar{c}_{i,t} \equiv \bar{c}\left(\eta_t, z_{i,t}, q_{i,t}\right)$ *such that*

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

[9] 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).

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

$$\frac{\partial \bar{c}}{\partial \eta} \propto v_{i,t}^D > 0. \tag{16}$$

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.

Additionally, 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.

3.3 Model Predictions: Land Enclosures

Given the results in Prop. 2, we can 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 $\mathscr{R}_t \equiv \left\{i : \mathscr{W}_{i,t} = \mathscr{W}_{i,t}^R\right\}$ and $\mathscr{D}_t \equiv \left\{i : \mathscr{W}_{i,t} = \mathscr{W}_{i,t}^D\right\}$, respectively. The aggregate loan amounts by (*ex-ante*) repayment or default are given by $V_t^R \equiv \int_{i \in \mathscr{R}_t} v_{i,t}^R \, \mathrm{d}i$ and $V_t^D \equiv \int_{i \in \mathscr{D}_t} v_{i,t}^D \, \mathrm{d}i$. Finally, define the mass of firms in each of these groups as $\mu_t^R \equiv \int_{i \in \mathscr{R}_t} \mathrm{d}i$ and $\mu_t^D \equiv \int_{i \in \mathscr{D}_t} \mathrm{d}i$.

Our experiment consists of selecting a subset of incumbent firms $i \in \mathscr{R}_t$, who benefit from the enclosure which reduces 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_t^R, but no change in V_t^D or fractions μ_t^R, μ_t^D. 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, (16) in Prop. 2 implies that our model predicts that following the enclosure, the total number of defaulting firms will *increase*.

The intuition for our model prediction is as follows. Land enclosures increase loan demand primarily from firms with higher continuation values, for whom the gains from re-

paying loans are substantial. Thus, the average unit borrowed in this economy is more likely to be repaid and is therefore safer from the bank's perspective. As a result, banks are willing to provide cheaper credit, putting downward pressure on required collateral η_t. This reduction, in turn, increases the default incentives of firms that were closer to the default threshold, bringing about a rise in (endogenous) defaults.

Note that while the number of defaulting firms increases, the total amount of repayment in the aggregate increases, which supports the overall higher lending volume. Additionally, improved credit market access implies that more productive firms are able to borrow and produce more, while the defaulting firms are (all else equal) less productive. While a full dynamic welfare analysis is beyond the scope of our paper, the model implication that bankruptcies increase does not imply that the collateral channel of land enclosure is harmful.

4 Empirical Analysis

This section empirically evaluates our theory on the role of land enclosures in affecting credit availability by examining the level of defaults. Our key theoretical prediction, as stated in Proposition 2, suggests that the enclosure of waste can lead to an equilibrium increase in defaults. We begin our empirical analysis by describing our newly digitized bankruptcy database. We leverage this unique database, merged with data on Parliamentary enclosure awards at the county-year level, to study how enclosures affect local bankruptcies by exploiting temporal and regional variation in the data. Our empirical strategy uses a panel local-projections-based analysis to document that indeed the enclosure of waste is associated with a rise in local bankruptcies, and that this rise is robust.

4.1 Data: Main Variables

Our empirical analysis is based on a balanced panel that contains historical information on 42 English counties between 1750 and 1830. Our panel includes 3,321 county-year observations.[10]

The main variables in the dataset are the number of bankruptcies, our primary outcome variable, and the area of waste land enclosures awarded, our chief policy of interest. Table **??** presents summary statistics for these main variables as well as characteristics of the economic environment used in our analysis: population[11] and sectoral composition of the

[10] 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, but 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.

[11] 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. 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;

workforce in each county.[12]

The average county sees 15.4 bankruptcy events every year, and that bankruptcy is more common later in the study periods. However, it is important to stress that bankruptcies occur throughout our study period, serving as evidence of financial activity even during the early years, before most enclosures. This period is one of profound social change. Observe that population, enclosures, and bankruptcies all see a secular rise. However, the sectoral composition of the labor force remains roughly stable, with most workers engaged in the primary sector (agriculture and mining), and the secondary sector (industry) coming as a close second. There is substantial county-level variation in the workforce's sectoral composition.

Table 1: Descriptive Statistics by Period

	1750–1769 (N=820)	1770–1789 (N=820)	1790–1809 (N=820)	1810–1830 (N=861)	Total (N=3,321)
Number of bankruptcies	4.85	9.67	17.03	29.44	15.42
	(10.30)	(20.04)	(32.96)	(53.25)	(34.86)
Population (thousands)	152.61	173.91	210.11	276.66	204.88
	(99.50)	(120.52)	(161.95)	(236.91)	(171.75)
Number of waste enclosures	0.13	0.34	0.52	0.92	0.48
	(0.61)	(0.89)	(1.50)	(2.37)	(1.54)
Enclosed waste area (1k acres)	167.92	352.50	366.56	650.43	387.64
	(1441.36)	(1372.94)	(1421.23)	(2193.03)	(1658.86)
Share of workers in agriculture	46.68	47.30	47.05	45.75	46.86
	(12.49)	(13.53)	(14.50)	(14.46)	(13.66)
Share of workers in the secondary sector	39.26	38.82	38.32	38.32	38.74
	(10.90)	(11.88)	(12.27)	(11.88)	(11.73)

Note: This table reports sample means by county-year within each period; standard deviations in parentheses.

Bankruptcies. Our main outcome variable is the number of bankruptcies at the county–year level. To measure it, we assembled a new, fully digitized database from all public bankruptcy notices printed in the *London Gazette* between 1705 and 1830. As discussed in Section 2, publication in the *Gazette* was a statutory requirement for qualifying petitions; each notice reports the bankrupt's name, occupation, location, and the date of the declaration (see Figure 1). The resulting micro-level corpus allows us to code occupations to five-digit HISCO, geolocate places, and aggregate consistently to spatial and temporal units, enabling analyses that were previously impracticable (e.g., county-by-decade dynamics, occupational com-

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), table 8 The data is available at a decennial frequency. Linear interpolation was used for conversion to annual figures.

[12]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).

position over time, and robustness to alternative geographic partitions). For background on eighteenth-century bankruptcy, see Hoppit (1987).[13]

In what follows, we use notices published between 1750 and 1830, recording the number of bankruptcy events, their location, and the bankrupt's occupation (coded at the five-digit HISCO level). To limit cases linked to disturbances in the financial sector, we exclude bankrupts whose occupations indicate they were likely creditors or financial intermediaries (e.g., bankers, discount brokers)[14] Our baseline further excludes London—a major financial center with dense personal ties and potentially different credit mechanisms[15] The resulting baseline dataset contains 51,251 individual bankruptcy records. Figure 3 maps the distribution of bankruptcies across counties and decades. Bankruptcies are observed virtually nationwide from the start of our period, and their frequency rises secularly over time, consistent with the expansion of financial activity and broader economic development.

Land enclosure Awards. The main explanatory variable is the county-year measure of enclosures of waste awarded as measured by the area enclosed. It comes from the digital data compiled by Satchell et al. (2017), which contains the population of Parliamentary awards of enclosure between 1606 and 1902, including the location of the enclosed land, year of award, area, and type of enclosure. We begin in 1750, when Parliamentary acts more reliably reflected the actual timing of land enclosure, whereas earlier acts often legalized or recorded enclosures that had already taken place informally. Of the 4,691 acts that were awarded between 1750 and 1830, 1,600 were of waste; these enclosures can be observed in Figure 2. The enclosure of waste was more common in the North-West and its relative importance began to grow in 1800.[16] About 20.6% of our county-year-level observations experienced an enclosure of waste. As discussed in section 2.1, we consider the timing in which the enclosure awards were granted as a source of exogenous variation.

4.2 The Effect of Land Enclosures on Local Bankruptcies

Empirical strategy. Using our database, we estimate the effect of a waste enclosure award in county i at time t on bankruptcies in the same county during year t and the following years. To do so, we employ a local-projections-based (Jorda, 2005) identification strategy by

[13] Hoppit (1987) was pioneering in assembling the first systematic narrative and counts for 1700–1800, but his series was not digitized and, for 1711–1764 (except 17 months in 1723–1724), relied on docket books compiled before final confirmation. Our series was constructed independently; it extends coverage through 1830 and is constructed entirely from London *Gazette* notices transcribed into a fully digital, machine-readable corpus.

[14] We classify as financial: 44000 ("Insurance, Real Estate, Securities or Business Services Salesmen, n.e.c."), 44100 ("Insurance, Real Estate or Securities Salesmen, n.e.c."), and 44140 ("Stock Broker"). In the codebook file these appear at 4400, 4410, and 44140 respectively; the labels are identical.

[15] We also estimate all specifications with London included and the main results are unchanged.

[16] (see also Tables B.2 and B.1 in Appendix B) for a summary of enclosed waste area by county and decade.

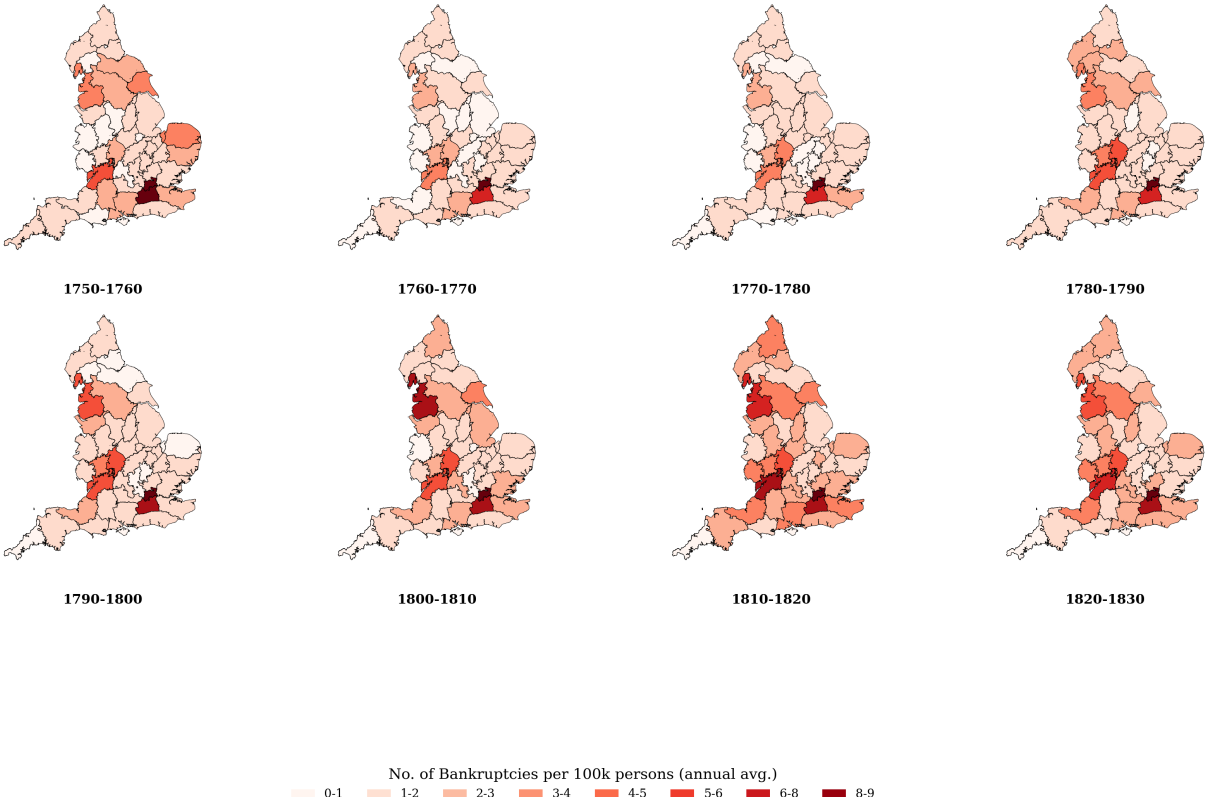


Figure 2: Bankruptcies Per 100k Capita

Note: The figure presents on each panel a heat map indicating the average number of bankruptcies in each ancient county of England by decade.

estimating the following equation

$$BR_{i,t+h} = \exp\left(\delta_t^h + \alpha_i^h + \beta_h ENC_{i,t} + \boldsymbol{\gamma^h} X_{i,t} + \epsilon_{i,t}^h\right), \tag{17}$$

where $BR_{i,t}$ denotes the number of bankruptcies in county i at year t, $ENC_{i,t}$ denotes the total area of waste enclosures awarded, measured in thousands of acres. Our coefficient of interest is β_h, which corresponds to the expected percentage change in the number of bankruptcies h periods after a waste enclosure of 1k acres was approved by parliament. We estimate the impulse response coefficients β_h for different horizons $h = 0, 1, \ldots, 5$.

To control for nationwide common trends as well as county-invariant omitted variables, we include time and county fixed effects (δ_t^h and α_i^h, respectively). We also include a wide range of controls in $X_{i,t}$. First, we control for population $pop_{i,t-1}$, i.e., the population one year before to enclosure award to control for changes in bankruptcies resulting from shifts in population and its correlates such as economic development.[17] We further control for $l = 4$ lagged values of $ENC_{i,t}$ to control for anticipation effects arising from recent enclosure awards in that particular region. We also control for $l = 4$ lagged values of $BR_{i,t}$ to control for

[17] Only one lagged value is included as this variable is interpolated from decennial frequency.

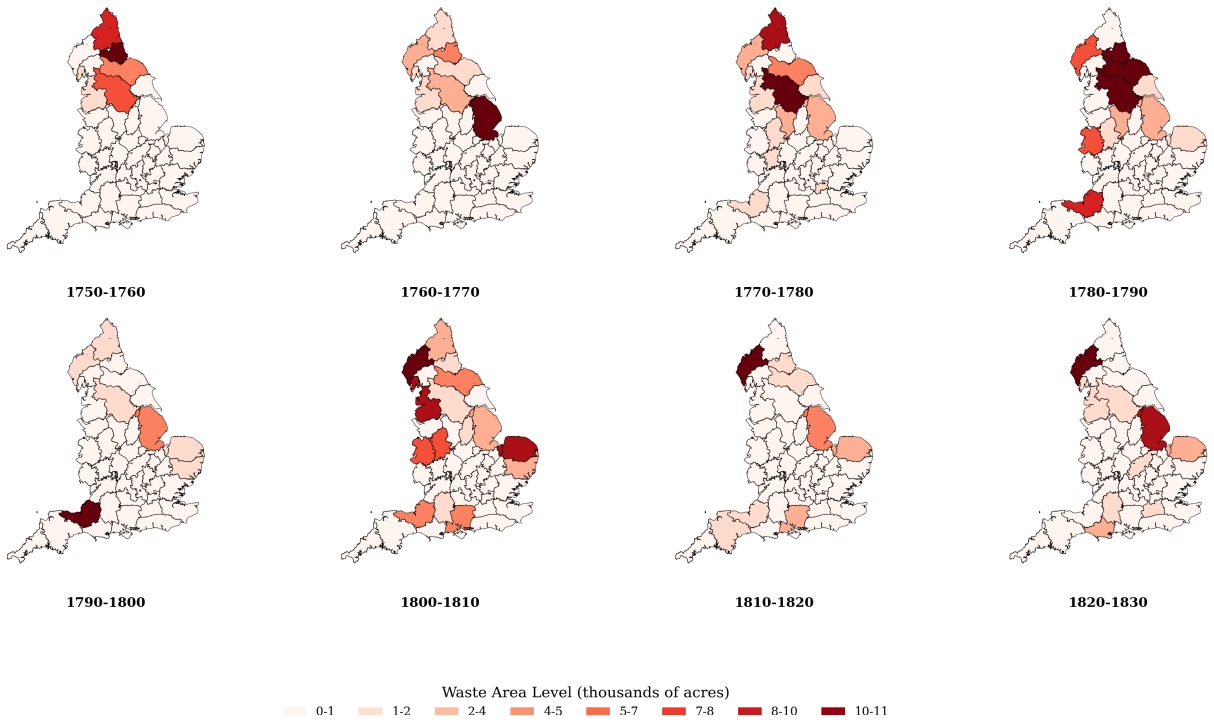


Figure 3: Waste Enclosures

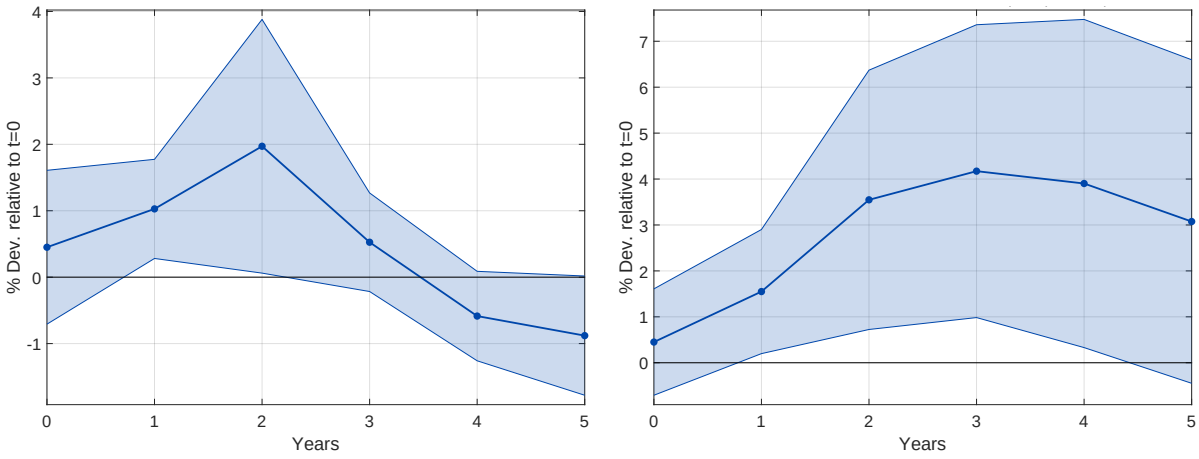
Note: The figure presents on each panel a heat map indicating the total area of waste enclosures awarded at every decade by ancient counties of England.

local financial cycles and any persistence in outcome. 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 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 (Wooldridge 1999). 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, up to an autocorrelation of order l.[18]

Results. Figure 4a reports our baseline results. We find that after a waste enclosure of 1k acres was granted, bankruptcies in the county increased by 1.0% within the first year and 2.0% in the second year following enclosure approval. This increase is both statistically significant and economically meaningful. To put these numbers in perspective, conditional on any waste area being enclosed, the median area of enclosed waste is 863 acres, and the aver-

[18] Our baseline includes $l = 4$ lags, but all results in this section are not sensitive to this choice. Using different lag orders ranging between $l = 1, \ldots 6$ yields similar results; see Appendix C.



(a) Annual response (b) Cumulative response

Figure 4: The Effect of Waste Enclosures on Bankruptcies

Note: Impulse response of bankruptcies with respect to the enclosure of waste expressed either in annual flows in panel (a), β_h from estimating equation (17), or in cumulative terms in panel (b), β_H converted to annual terms from estimating equation (18). Shaded areas indicate 90% confidence intervals where inference is based on double-clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies following the enclosure of 1k acres.

age is 1,839 acres, with some areas experiencing enclosures of over 20,000 acres of waste.[19] Thus, conditional on experiencing an average-sized waste enclosure award, the county was 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 following the enclosure.

Given that most credit in this period was short-term, typically lasting a few months to a year (Gent (2016); Hoppit (1987); Temin and Hans-Joachim (2008))—it is likely that the enclosure of waste primarily expanded access to this type of borrowing. As our model predicts, by increasing the stock of collateralizable assets, enclosure reduced borrowing constraints and enabled greater access to credit, especially among artisans and small producers. Many of these borrowers were already operating near the margin of solvency, and the sudden expansion in available credit likely caused some to overextend, resulting in default.

Given that the model is non-linear, the conversion from annual effects to cumulative effects is not as straightforward as it usually is. To verify that what we see is indeed an overall rise in bankruptcies post enclosure, consistent with a local credit boom, we also estimate the following cumulative response function

$$\sum_{h=0}^{H} BR_{i,t+h} = \exp\left(\delta_t^H + \alpha_i^H + \beta_H ENC_{i,t} + \boldsymbol{\gamma^h} X_{i,t} + \epsilon_{i,t}^h,\right), \tag{18}$$

where the cumulative effect of enclosures on bankruptcies at times $h = 0 \ldots H$, denoted by β_H, and $X_{i,t}$ includes the same controls as before. Reports from estimating this regression

[19] For more detailed enclosure area and acts statistics see Appendix Tables B.2 and B.1.

are reported in Figure 4a, where β_H is multiplied by $1+H$ to normalize the resulting estimate to the deviation from the average annual level. The results clearly show a rise in local bankruptcies in the year following enclosure. This rise peaks at 4.2% of the annual number of bankruptcy events three years after an enclosure of 1k acres is awarded.

Robustness Checks. Results in this section establish that waste enclosures lead to a rise in local bankruptcies. Several choices we made in the analysis might affect this result; all robustness checks for this section are reported in Appendix C and are summarized in brief below.

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 C.1 replicates the analysis in Figure 4a using the average area awarded per enclosure act in a given year instead of the total area and finds consistent results with our baseline.

Second, our results might be affected by the number of lags we choose to include when estimating equation (17). Appendix C demonstrates that our results are not sensitive to controlling for anything from one year to six years of lagged values.

Finally, to assess our interpretation of the enclosure award timing as an exogenous event, we propose and implement a pre-trend test consistent with our baseline estimation using equation (17) and find no evidence of a statistically significant pre-trend, regardless of the lag order chosen, validating our assumption that enclosure grant timing was exogenous. These tests are formally introduced and reported in Appendix C.

Having established that enclosures of waste indeed led to a rise in bankruptcies, we go on to consider what channels and mechanisms underlie this response.

5 Understanding the Mechanisms: What Drives the Rise in Defaults?

This section considers the mechanisms that drive the rise in bankruptcies documented in the previous section. We begin by going back to our model and studying which factors our theory predicts should lead to a stronger response. Next, we examine how country-level characteristics drive a stronger response in the data. Finally, we leverage the occupational dimension in our data to study which groups are most present among the post-enclosure bankruptcies.

5.1 Heterogeneous Response: Theory

Recall from Prop. 2 that $\bar{c}_{i,t}$ is the maximum value of collateral costs for which firm i will choose to repay. The following Proposition studies how this threshold value varies as a function of different model objects.

Proposition 3 (Endogenous Default Comparative Statics)**.** *Under the same assumptions as Prop. 2, there exist values* $\check{q}, \check{c}, \check{\beta}$ *such that* $0 \leq q_{i,t} < \check{q}, 0 \leq c_{i,t} < \check{c}, \check{\beta} < \beta < 1$ *implies*

$$\frac{\partial \bar{c}}{\partial z} \propto \frac{v_{i,t}^R}{\gamma(\eta_t v_{i,t}^R)} > 0, \tag{19}$$

$$\frac{\partial \bar{c}}{\partial q} \propto A - z_{i,t}\left(f(v_{i,t}^R) - f'(v_{i,t}^R)v_{i,t}^R\right) < 0, \tag{20}$$

and

$$\frac{\partial^2 \bar{c}}{\partial \eta^2} \propto -\frac{2v_{i,t}^D v_{i,t}^R \gamma'(\eta_t v_{i,t}^R)}{\gamma(\eta_t v_{i,t}^R)} + \frac{1}{z_{i,t} f''(v_{i,t}^R)} < 0, \tag{21}$$

$$\frac{\partial^2 \bar{c}}{\partial \eta \partial z} \propto -\frac{v_{i,t}^R f(v_{i,t}^R)\gamma'(\eta_t v_{i,t}^R)}{\gamma(\eta_t v_{i,t}^R)^2} < 0, \tag{22}$$

$$\frac{\partial^2 \bar{c}}{\partial \eta \partial q} \propto v_{i,t}^R\left[z_{i,t}\left(f(v_{i,t}^R) - f'(v_{i,t}^R)v_{i,t}^R\right) - A\right] > 0. \tag{23}$$

In Prop. 3, we first study how the cutoff value varies as a function of firm productivity or riskiness. The first result in (19) shows that the default threshold 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 (20) 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_t is already high, result (21) 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 (22) shows that for very productive firms, the default threshold is less responsive to increases in required collateral. Recall from the discussion of (19) 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 (23) 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.

5.2 Model Predictions: Land Enclosures and Heterogeneity

Given the results in Prop. 3, we return to the enclosure experiment considered in Section 3.3. Recall that in the model, land enclosures imply a subset of firms face an exogenous decline in the cost of posting collateral, which results in an equilibrium decline in the required collateral η_t and an *increase* in the number of defaulting firms. The results from Prop. 3 therefore make the following additional predictions:

1. The increase in defaults is *mitigated* for more productive firms.

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

3. The increase in defaults is *amplified* for riskier firms.

5.3 Heterogeneous Response: Empirical Analysis

Our empirical results thus far establish that waste enclosures lead to a rise in local bankruptcies. According to our model, the mechanism by which such bankruptcies occur is through an increase in the supply of land used as collateral, leading to an equilibrium easing of credit market conditions. Given limited financial data at this time, it is difficult to test this model mechanism directly. Instead, to help validate our theory-based interpretation of the results, we turn our attention to additional testable predictions of our theory. Substantiating these predictions not only increases our confidence in the model, but more importantly offers insights into the empirical channels that are at work. To do so, we leverage the panel dimension of our database and use county-year variation in county characteristics, and interpret the sensitivity of these results through our model.

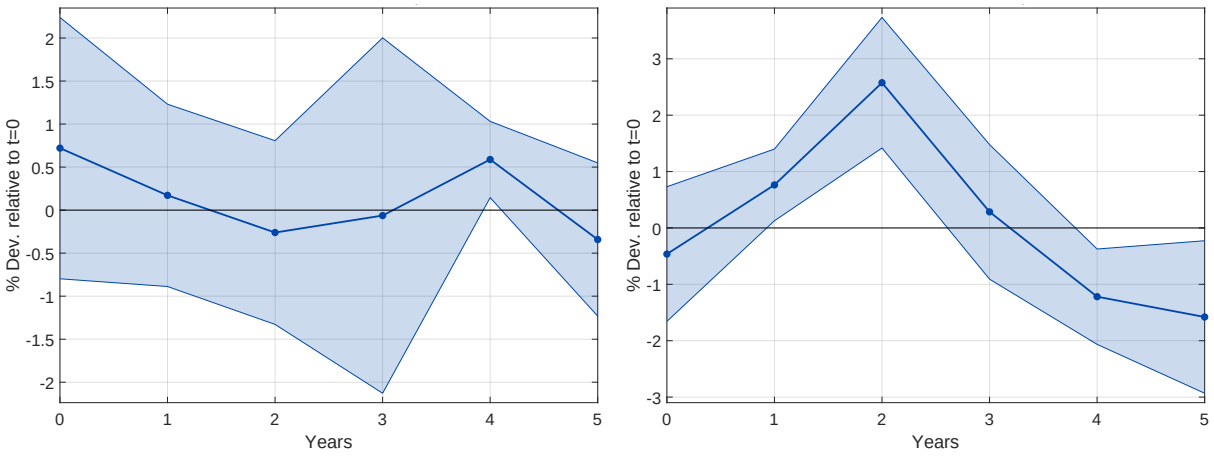
A first pass of this can be clearly observed by a sample splitting exercise. Specifically, the years of 1750-1830 saw fast-paced industrial developments, which changed the available investment opportunities and increased the degree of inherent risk involved with business ventures. In addition, following 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 on bankruptcies should be stronger during the years of 1793 onward, as these were characterized by more industrial risk, geopolitical risk, and banking competition.

To test this prediction, panels (a) and (b) of Figure 5 repeat our baseline analysis from Figure 4a, but split the sample into the years 1750-1792 and 1793-1830 respectively. Consistent with our theory, Figure 5 demonstrates that indeed the years 1793-1830 account for most of the effect of waste area enclosures on bankruptcies. In contrast, in the former part of the sample, we find smaller and statistically insignificant effects.

The Role of Industrialization. Risk is a key factor that we expect should amplify the effect of enclosures on bankruptcies. Our study period is one where industrialization picks up pace, and along with it, a rise in the idiosyncratic risk associated with new technologies and techniques. 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:

$$BR_{i,t+h} = \exp\left(\delta_t^h + \alpha_i^h + \left[\beta_h + \beta_h^{75+}\mathbb{I}_{i,t}^{75+} + \beta_h^{25-}\mathbb{I}_{i,t}^{25-}\right] \times ENC_{i,t} + \boldsymbol{\gamma^h} X_{i,t} + \epsilon_{i,t}^h\right), \tag{24}$$

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^{th} or below its 25^{th} percentile correspondingly and zero otherwise. This flexible and functional-form-free strategy allows us to pick up factors



(a) 1750–1792 (b) 1793–1830

Figure 5: The Effect of Land Enclosures on Bankruptcies

Note: The solid lines report values of β_h from estimating equation (17) for 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 double-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 award of 1k acres.

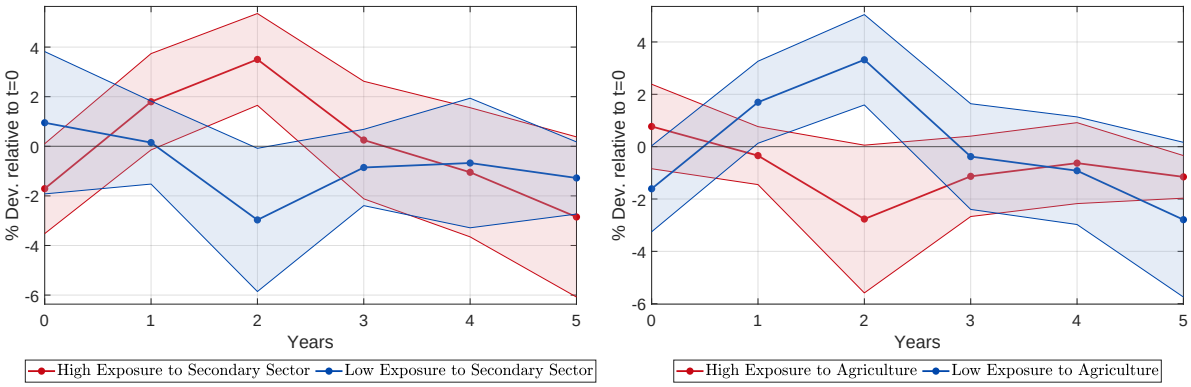
that amplify or dampen the response of bankruptcies to the enclosure award.[20] Note that the effect of enclosure award on bankruptcies in the high exposure country-years is given by $\beta_h + \beta_h^{75+}$ and similarly for the low exposure country-years by $\beta_h + \beta_h^{25-}$. As before, the control vector $X_{i,t}$ includes: population at $t-1$; the number of bankruptcies $BR_{i,t}$; $l = 4$ lagged values of $BR_{i,t}$ and $ENC_{i,t}$; and also the exposure dummies $\mathbb{I}_{i,t}^{75+}$ and $\mathbb{I}_{i,t}^{25-}$. We again estimate impulse responses for horizons $h = 0, 1, \ldots, 5$.

We estimate equation (24) using a set of exposure variables measuring the economic specialization of a particular county-year observation (proxied by shares of workers engaged in a given sector).[21]The results in Figure 6 present 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 waste, compared with the 2% in Figure 4a. 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.[22]

[20]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 D 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 experiencing high exposure.

[21]This data and its sources and processing were briefly discussed in section 4.1.

[22]In Figure 7 we estimate equation (24), but with the exposure dummies given by the assignment into Wrigley's three categories.



(a) Secondary Sector (b) Agriculture

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

Note: This figure reports impulse responses estimated via equation (17) using the total area of waste area enclosures. Impulse responses are presented as the total effect of enclosures on bankruptcies within each exposure group, such that estimates with high exposure are given as $\beta_h+\beta_h^{75+}$ and for low exposure as $\beta_h+\beta_h^{25-}$. Each panel reports a set of impulse responses estimated using a separate exposure variable indicated in the title. 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 a new land enclosure of 1k acres.

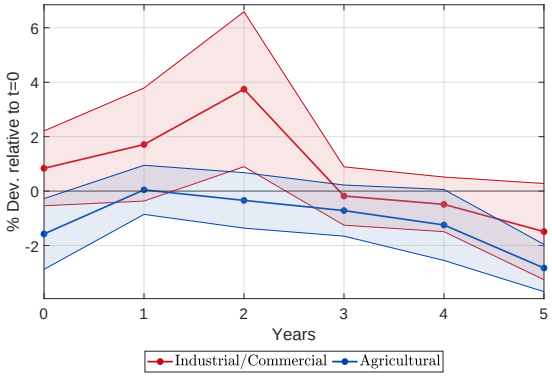


Figure 7: Exposure to Industrialization and the Effect of Waste Enclosures: Wrigley County Classification

Note: This figure reports impulse responses estimated via equation (24) using the total area of waste area enclosures in the solid lines, and defining exposure using Wrigley's classification. 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 a new land enclosure of 1k acres.

Business Cycle Risk. Another potential channel through which the effect of waste enclosures on bankruptcies might be mediated according to our theory is the state of the real economy. We can think of business cycle fluctuations as a uniform decline in productivity for all productive units (as in standard real business cycle models). Our theory indicates that if firms are less productive, the effect of waste enclosures on bankruptcies should be ampli-

fied. To obtain a measure of exogenous fluctuations in real activity we leverage a measure of historical standardized tree ring growth series.[23] 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.[24]

We use this tree ring series to construct a new weather shock variable as follows. We fit an ARMA model to each of the tree ring series in each locality, allowing us to flexibly capture the expectations for agricultural conditions in each locality.[25] We then extract the residuals from the raw tree ring series with the fitted ARMA model to yield a weather shock variable.

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. Last, it is a continuous measure indicating differences in intensities of growth conditions and not an indicator variable. We interpret this series as a supply shock in an agricultural society, indicating surprisingly bad agricultural yields.

We again use the specification in equation (24) to study how differential exposure to weather shocks potentially change how waste enclosures affect bankruptcies. We find that following waste enclosures, high exposure to adverse agricultural conditions leads to an amplified response of bankruptcies (the red line in Figure 8). This result is consistent with the view that privatizing land during bad times has a stronger effect than doing so during a boom.

To recap the above discussion, we have demonstrated that more industrialized counties, and economic downturns are times when enclosures contribute more substantially to bankruptcies. Through our theory, we interpret this increase as resulting from a rise in local credit availability. We now consider several additional channels that may drive our result, which are inconsistent with our theory-based interpretation of the data.

[23] 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.

[24] 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, and are available here: https://www.metoffice.gov.uk/research/climate/maps-and-data/about/districts-map.

[25] All tree ring series are stationary according to an augmented Dickey-Fuller test, thus we reject models involving cointegration. We choose model parameters for each tree ring series by minimizing the Bayesian information criterion (BIC) using a parameter grid approach.

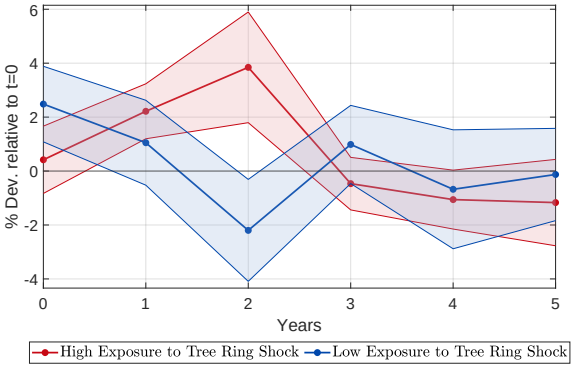


Figure 8: Exposure to Weather Shocks and the Effect of Waste Enclosures

Note: This figure reports impulse responses estimated via equation (24), and defining exposure dummies using our weather shock measure. Impulse responses are presented as the total effect of enclosures on bankruptcies within each exposure group, such that estimates with high exposure are given as $\beta_h + \beta_h^{75+}$ and for low exposure as $\beta_h + \beta_h^{25-}$. The shock is constructed such that high exposure indicates that weather conditions were unfavorable. 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 a new land enclosure of 1k acres.

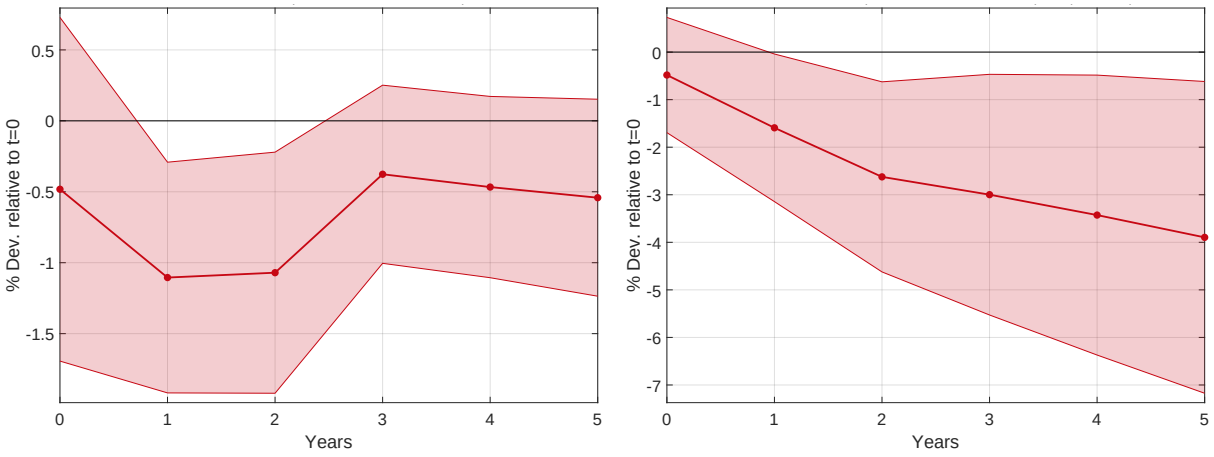
5.4 Alternative Hypotheses

Financial Effects vs Real Effects. Our theory predicts that the observed rise in bankruptcies following waste enclosures in Figure 4a 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 a consequence of changes in the local supply of 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 particular 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)), without introducing a new pledgable asset. In the context of our model, this is akin to a rise in productivity for some firms.[26] Our theory tells us that the two types of enclosures should result in different effects on bankruptcies. Reforms open field enclosures that raise the productivity of some firms should reduce bankruptcies, while waste enclosures should increase them.

Figure 9 repeats the analysis in Figure 4 using open field enclosures. We find effects of the

[26] 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.



(a) Annual response (b) Cumulative response

Figure 9: The Effect of Open Field Enclosures on Bankruptcies

Note: Impulse response of bankruptcies with respect to the enclosure of waste expressed either in annual flows in panel (a), β_h from estimating equation (17), or in cumulative terms in panel (b), β_H converted to annual terms from estimating equation (18). Shaded areas indicate 90% confidence intervals where inference is based on double-clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies following the enclosure of 1k acres.

opposite sign: open field enclosures are followed by a reduction in bankruptcies. This finding is in line with our theoretical framework and lends further support to our financial interpretation of the effects of waste enclosure shocks from our baseline results. Namely, a real productivity-enhancing effect of enclosures of waste should lead to a decline in bankruptcies, not to the observed increase.

Extinguishment of common use rights. The enclosure of waste took away common use rights and thus changed the availability of waste land as a source of raw materials and pastureland. It is possible that the rise in bankruptcies we observe is not the result of a credit boom, but rather of a sudden shock to the way common people produced and worked in the region, leading them to default. To assess this story, we turn now to the occupational dimension of our database and ask, who are the people who go bankrupt following a waste enclosure?

We create several new county-year bankruptcy series that sum not the total bankruptcies but rather only those bankruptcies in which the bankrupt belongs to a single occupation or group of occupations in that county-year.

To formally study this issue, we modify our baseline specification and estimate for each occupation *occ* the following equation

$$\sum_{h=0}^{3} BR_{i,t+h}^{occ} = \exp\left(\delta_t^{occ} + \alpha_i^{occ} + \beta^{occ} ENC_{i,t} + \boldsymbol{\gamma} X_{i,t}^{occ} + \epsilon_{i,t}^{occ}\right). \tag{25}$$

The above is estimated using only bankruptcy events for individuals belonging to a specific occupational group, occ. Our outcome of interest is the sum of bankruptcies in the year of enclosure and the subsequent three years, as the responses we observe are concentrated within this time frame. As in our baseline estimation, we control for time and county fixed effects, population at $t-1$, and four lags of total bankruptcies ($BR_{i,t}$) and the enclosure variable, we also control for the sum of bankruptcies within that particular occupation in the four year before the enclosure ($\sum_{t=-1}^{-4} BR_{i,t}^{occ}$) to control past occupation-level shocks.[27] Similarly to our treatment of the estimates obtained from equation (18), we also multiply the raw estimates by four to obtain the interpretation of percent deviations from the annual average number of bankruptcies.

Results from estimating equation (25) are presented in Figure (**??**). We report the results of all bankruptcies, as well as those of individuals engaged in the primary, secondary, and tertiary sectors. Here we exclude trade from the secondary sector to be analyzed separately, and add the financial sector back after hving excluded it from our baseline. The rise in bankruptcies after an enclosure is only significant for persons with occupations in the secondary sector. Those occupied in the tertiary sector and trade have consistent, but not statistically significant, point estimates. Importantly, occupations pertaining to the primary sector do not seem to respond in a statistically significant way to the enclosure, and the point estimates are negative. That is, our newly bankrupt individuals are precisely those not directly affected by the extinguishment of common use rights, i.e., persons engaged in industry, trade, and services, and not farmers.

6 Concluding Remarks

This paper proposes a theory and supporting evidence on the link between land reforms and access to credit. Our theory is tailored to study a historically significant case study at the height of the Industrial Revolution, a period of significant change where land reforms were substantial and numerous, allowing us to draw lessons from the past for our modern context. We demonstrate that when land is used as collateral and collateral serves as a margin of competition, an influx of good collateralizable assets occurs, thereby raising continuation values for productive incumbents, generating a credit boom 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

[27] Note that summing occupation-level bankruptcies across multiple years is advantageous here, since for some very narrow occupational groups, we will not have enough non-zero observations to estimate this regression.

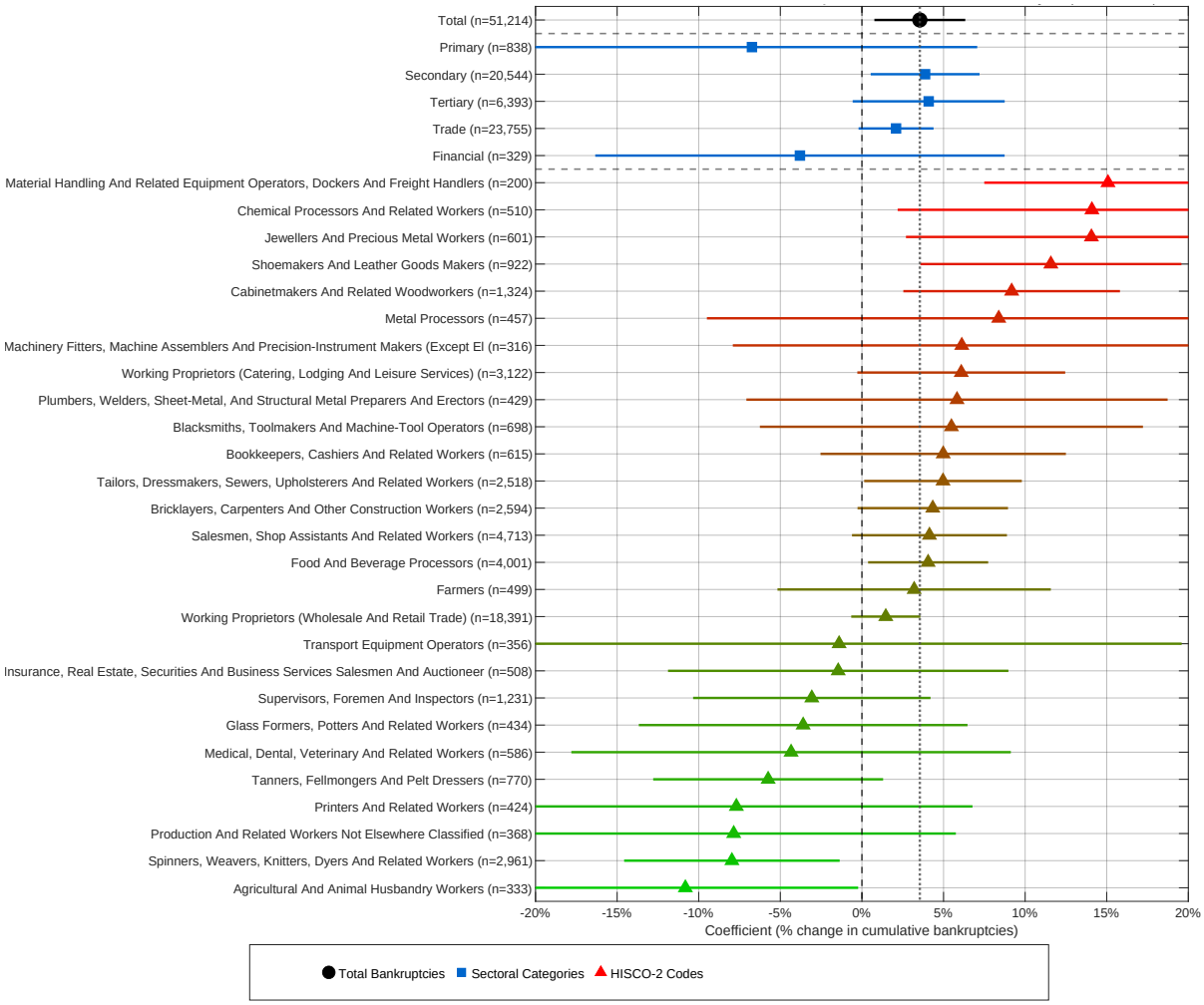


Figure 10: The Effect of Waste Enclosures on Bankruptcies by Sectors

Note: Each marker indicates the value of β^{occ} from estimating equation (25) for each occupation or occupational group indicated on the vertical axis. Circle indicates the effect on all occupations, squares indicate the effect on broad occupational groups, and triangles indicate narrower occupations at the two-digit HISCO level. Error lines indicate 90% confidence intervals where inference is based on double-clustered standard errors at the county and year levels. Estimates are expressed in percentage changes in the number of expected bankruptcies due to the enclosure of 1k acres of waste relative to the annual baseline. The number of total bankruptcy events of persons belonging to the particular occupation or group is reported in parentheses. Groups containing fewer than 200 events were excluded.

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 alluded to this possibility, we are the first to offer evidence of this theory. These results are significant, as they offer a unique insight into the functioning of financial markets during a pivotal moment in the history of industrialization, thereby contributing to our understanding of the economic context of the Industrial Revolution.

Examining our results with modern eyes and in the contemporary context enables our theory and findings to offer 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 (19); $\frac{\partial \bar{c}}{\partial q}$ approaches $-\infty$ at the rate in (20); $\frac{\partial^2 \bar{c}}{\partial \eta^2}$ approaches 0 from below at the rate in (21); $\frac{\partial^2 \bar{c}}{\partial \eta \partial z}$ approaches (22); and $\frac{\partial^2 \bar{c}}{\partial \eta \partial q}$ approaches $+\infty$ at the rate in (23).

□

Appendix B Additional Tables

Tables B.2 and B.1 report the number of enclosure acts awarded, the number of acres enclosed, and the average acres enclosed per act at the decade and county level, respectively.

Table B.1: Parliamentary Enclosure Acts by decade

Decade	# Acts	Total acres enclosed	Avg. acres / act
1750	27	23,925	886
1760	77	113,772	1,478
1770	159	161,510	1,016
1780	122	127,536	1,045
1790	169	129,530	766
1800	255	171,046	671
1810	464	366,478	790
1820	313	188,735	603
1830	14	4,804	343

Note: This table reports enclosure statistics by decade for decades beginning with the year in the first column (1830 is only one year).

Table B.2: Parliamentary Enclosure Acts by county

Ancient county	# Acts	Total acres enclosed	Avg. acres / act
BEDFORDSHIRE	4	952	238
BERKSHIRE	7	3,367	481
BUCKINGHAMSHIRE	6	2,091	349
CAMBRIDGESHIRE	6	7,078	1,180
CHESHIRE	36	20,674	574
CORNWALL	6	2,628	438
CUMBERLAND	84	180,568	2,150
DERBYSHIRE	65	29,566	455
DEVON	26	24,565	945
DORSET	21	25,276	1,204
DURHAM	37	73,633	1,990
ESSEX	25	7,557	302
GLOUCESTERSHIRE	14	5,088	363
HAMPSHIRE	51	39,155	768
HEREFORDSHIRE	13	2,699	208
HERTFORDSHIRE	6	7,825	1,304
HUNTINGDONSHIRE	1	511	511
KENT	23	4,375	190
LANCASHIRE	66	52,510	796
LEICESTERSHIRE	17	10,231	602
LINCOLNSHIRE	115	139,522	1,213
MIDDLESEX	11	10,925	993
NORFOLK	144	70,743	491
NORTHAMPTONSHIRE	8	9,890	1,236
NORTHUMBERLAND	43	64,314	1,496
NOTTINGHAMSHIRE	19	16,434	865
OXFORDSHIRE	15	6,725	448
RUTLAND	0	0	—
SHROPSHIRE	71	38,693	545
SOMERSET	137	94,405	689
STAFFORDSHIRE	57	41,404	726
SUFFOLK	63	20,220	321
SURREY	28	15,178	542
SUSSEX	20	8,948	447
WARWICKSHIRE	18	5,734	319
WESTMORLAND	31	34,754	1,121
WILTSHIRE	32	13,078	409
WORCESTERSHIRE	30	15,959	532
YORKSHIRE, EAST RIDING	26	13,841	532
YORKSHIRE, NORTH RIDING	79	69,598	881
YORKSHIRE, WEST RIDING	139	96,622	695

Note: This table reports enclosure statistics by ancient county.

Appendix C Robustness Checks to Section 4.2

This appendix discusses several robustness checks to substantiate the main finding in Section 4.2, 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 of 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. We replicate the findings from Figure 4a, using the average awarded waste area enclosure per act in a given county-year observation, instead of the total area enclosed. Figure C.1 reports the results of this analysis 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 even when considering agglomeration effects.

Lag Order Selection Estimating Equation (17) 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 affect our results, we report in Figure C.2 how our results change when we

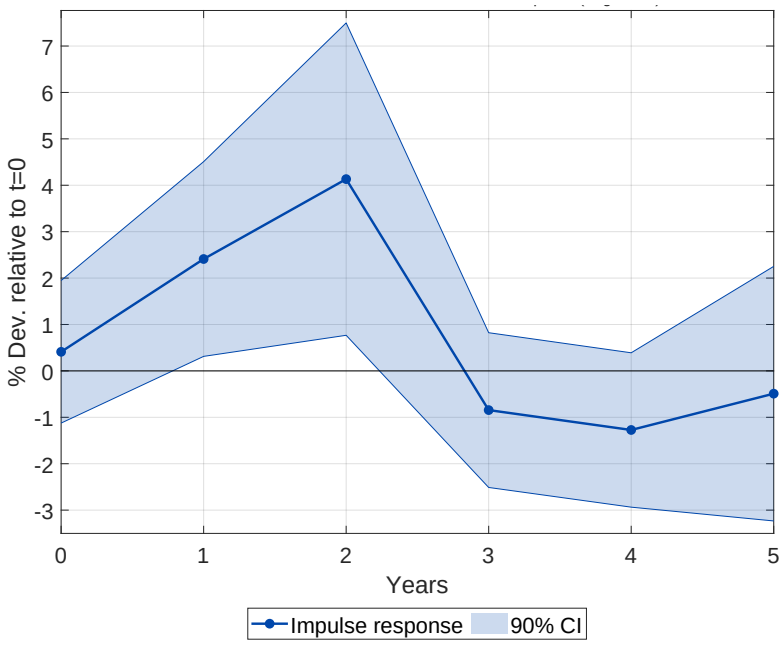

Figure C.1: The Effect of Land Enclosures on Bankruptcies

Note: This figure reports in the solid lines values of β_h from estimating Equation (17) 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.

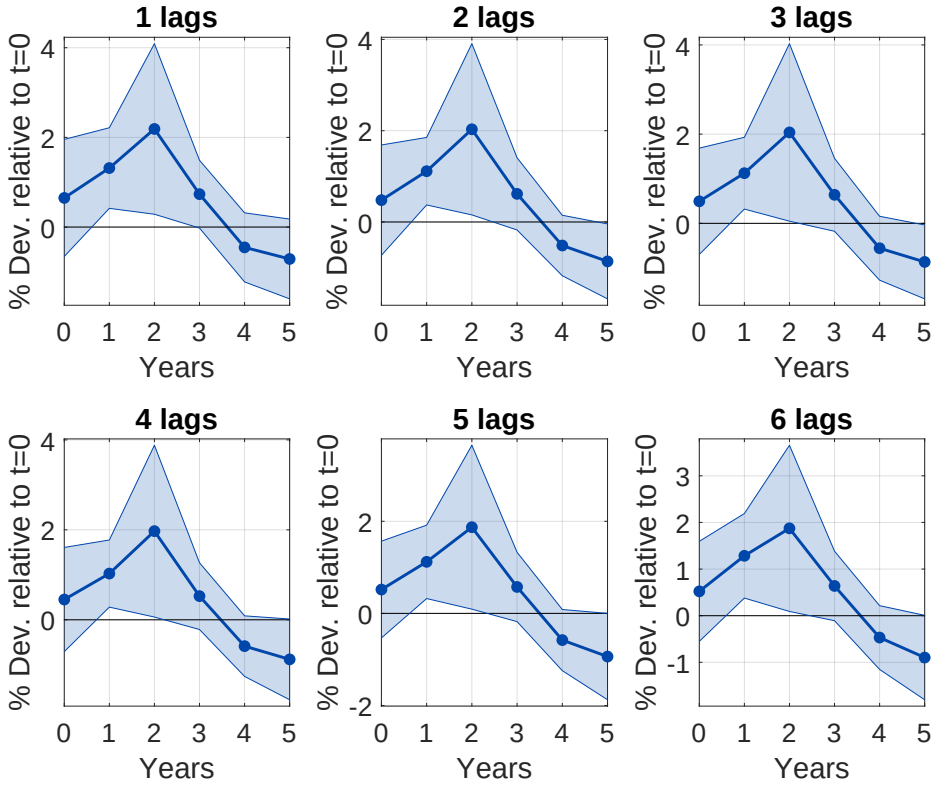

Figure C.2: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1750 - 1830: Robustness to Lag Order Selection.

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_h from estimating Equation (17) using data from 1750 - 1830 with a different number of lagged controls $l = 1,\ldots,6$. The responses are scaled as percentage deviations from the pre-enclosure level.

use values ranging from $l = 1$ to $l = 6$.

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:

$$BR_{i,t-h} = \exp\left(\delta_t^h + \alpha_i^h + \beta_h^{pre-trend} ENC_{i,t} + \boldsymbol{\gamma^h} X_{i,t-h-j} + \epsilon_{i,t}^h\right), \tag{C.1}$$

where $h \in \{-1,\ldots,-5\}$. $\beta_h^{pre-trend}$, 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 C.3 reports the results of the estimation of equation (C.1), finding no evidence of a statistically significant pre-trend. To demonstrate that this result is also unaffected by the number of included lags, we re-estimate equation (C.1) using values of l ranging from 1 to 6 and finding consistently no

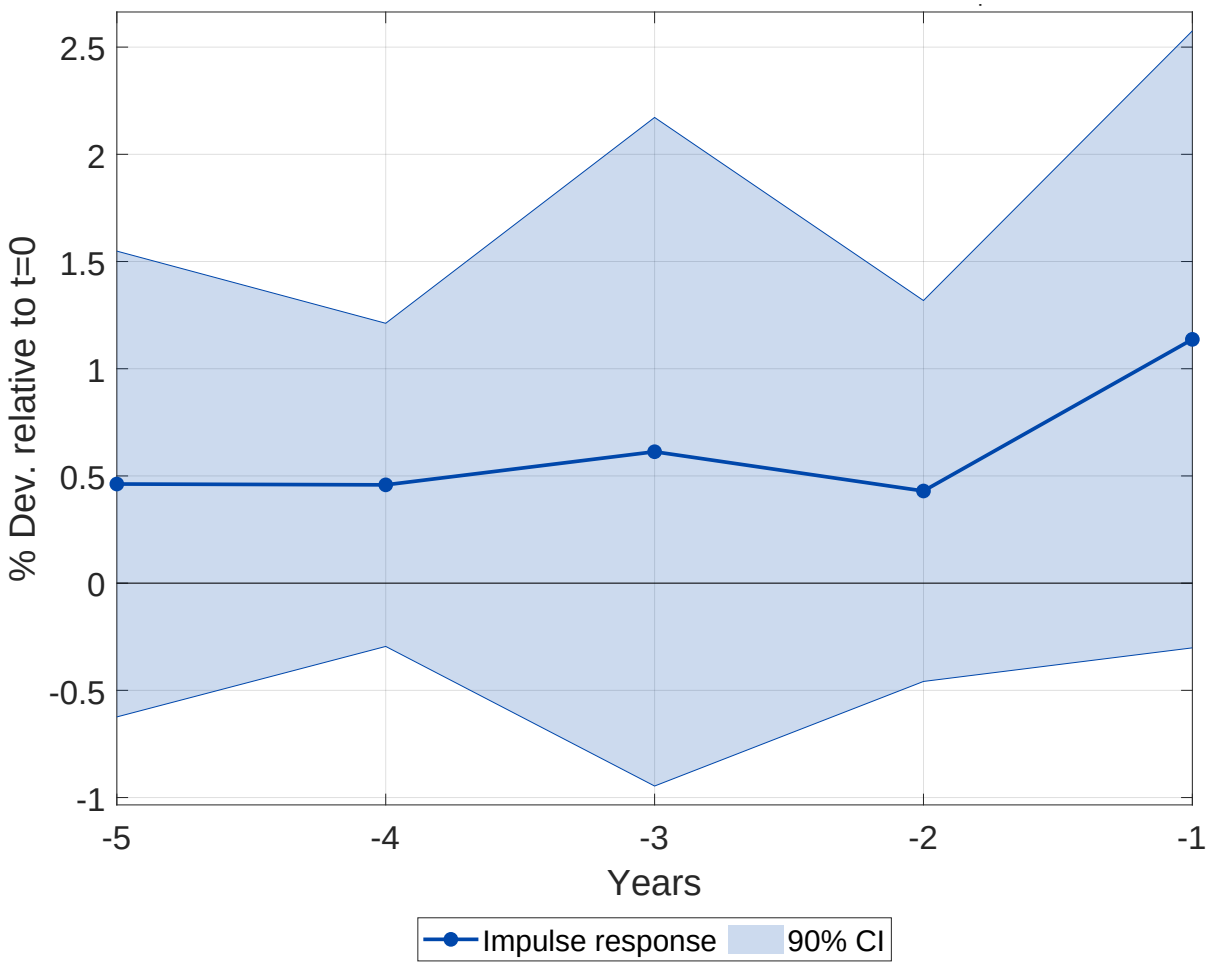

Figure C.3: The Effect of Waste Enclosures on Bankruptcies: Pretrend Test

Note: This figure reports in the solid lines values of $\beta_h^{pretrend}$ from estimating Equation (17) 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.

statistically significant pretrend. This exercise is presented in Figure C.4.

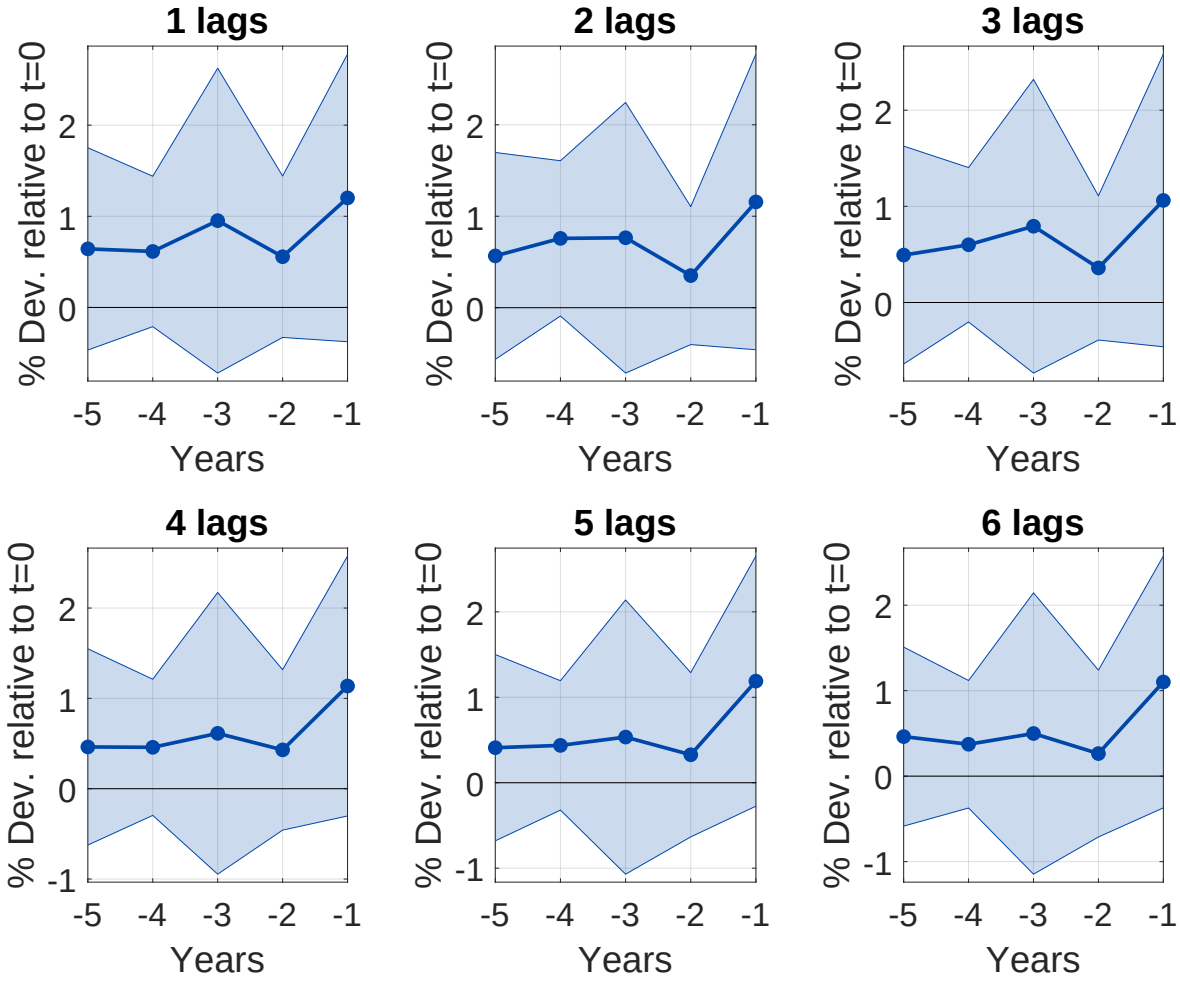

Figure C.4: The Effect of Waste Enclosures on Bankruptcies: Pretrend Test: Robustness to Lag Order Selection.

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_h from estimating Equation (17) 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.

Appendix D Robustness Checks for Section 5

Lag Order Selection and Sample Splitting Figures D.1 and D.2 demonstrate that the sample splitting exercise reported in Figure 5 is also unaffected by our choice of lag order in Equation (17).

Cutoff Selection for Figures 6 and 8 The specification in Equation (24) 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 robustness checks to all results hinging on this specification to see that they are not sensitive to this cutoff choice. We maintain symmetry in our robustness checks and re-

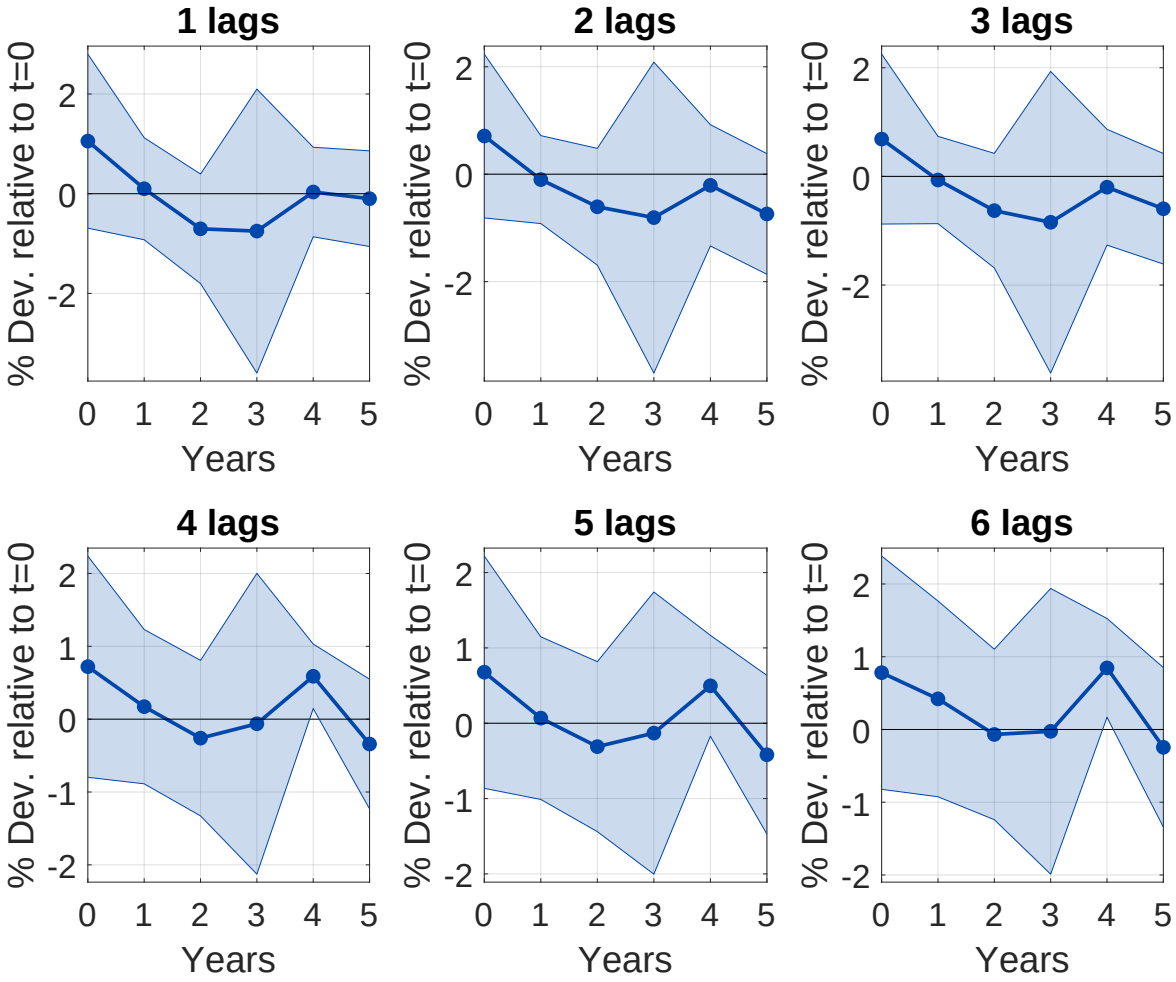

Figure D.1: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1750 - 1792: Robustness to Lag Order Selection.

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_h from estimating Equation (17) 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.

estimate Equation (24) 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 D.3 and D.4 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 D.5 demonstrates that as in Figure 8 of the main text, high exposure to the weather shock amplifies the effect of waste enclosures on bankruptcies.

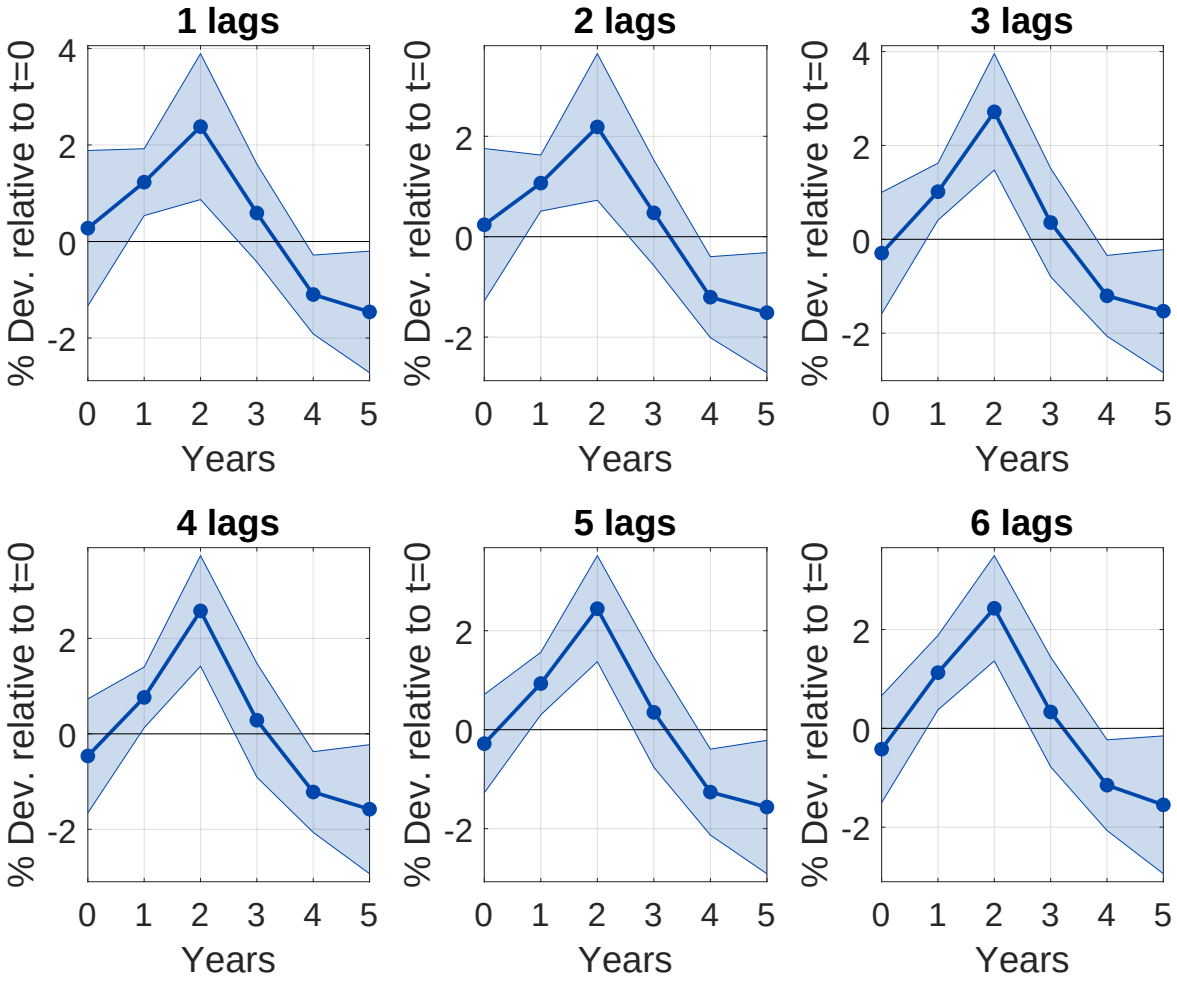

Figure D.2: Impulse Response of the Effect of Waste Enclosures on Bankruptcies 1793 - 1830: Robustness to Lag Order Selection.

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_h from estimating Equation (17) 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.

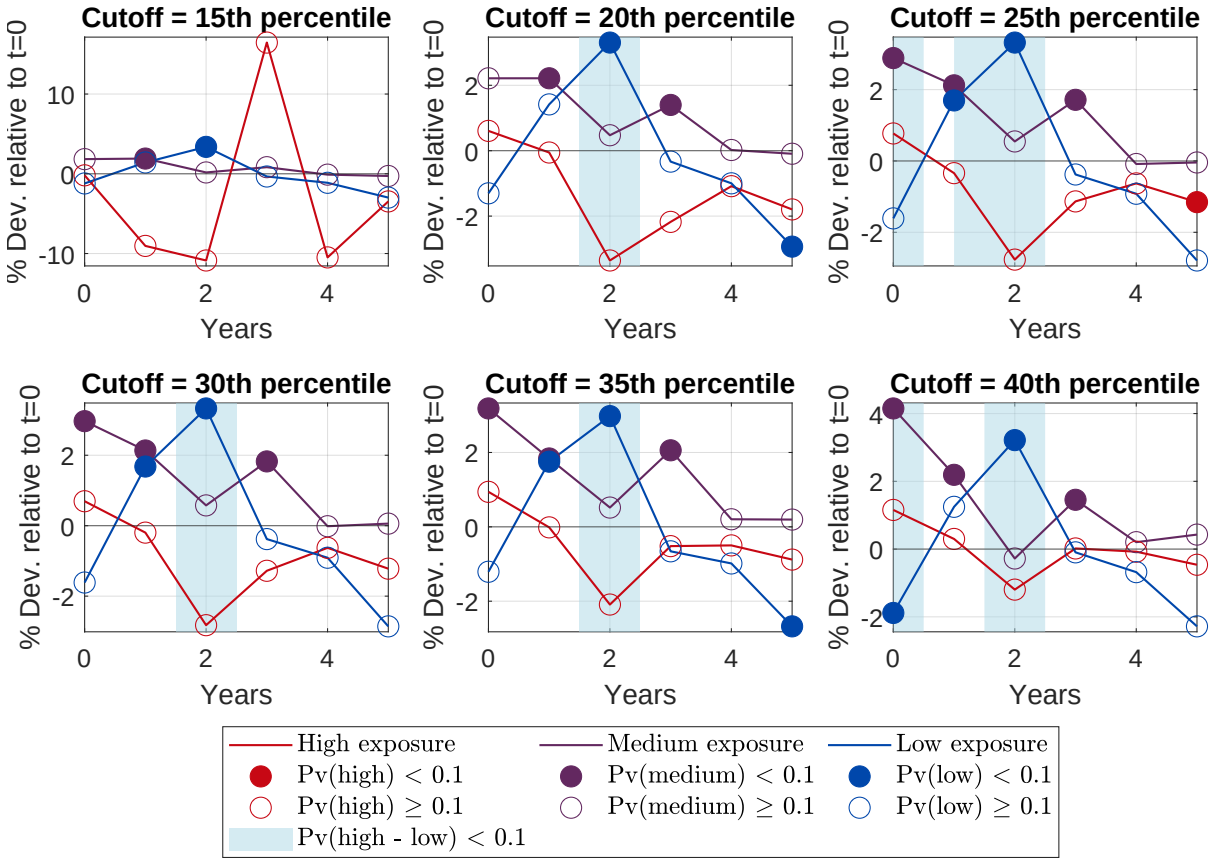

Figure D.3: Agricultural Intensity and the Effect of Waste Enclosures: Robustness to Cutoff Choice

Note: This figure reports impulse responses estimated via Equation (24) 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 (24) 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.

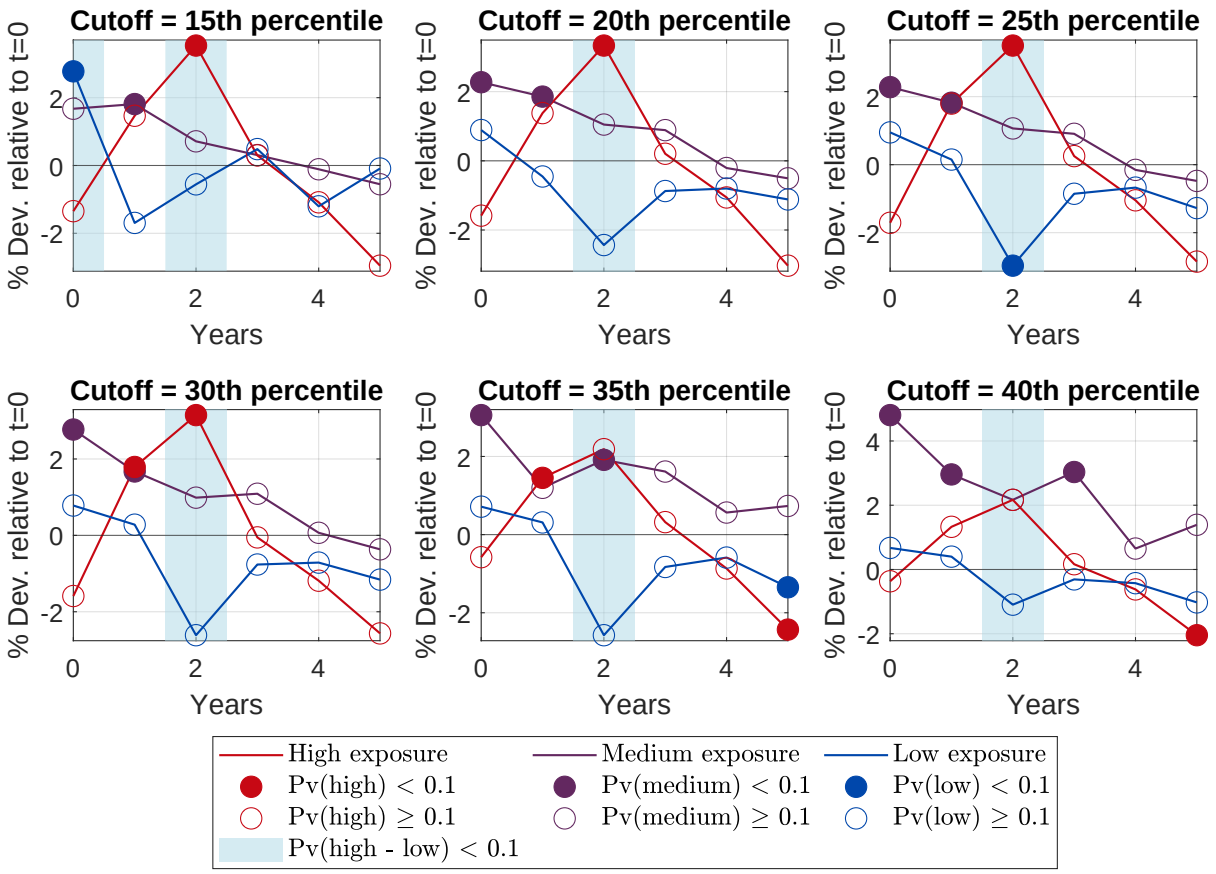

Figure D.4: Secondary Sector Intensity and the Effect of Waste Enclosures: Robustness to Cutoff Choice

Note: This figure reports impulse responses estimated via Equation (24) 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 (24) 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.

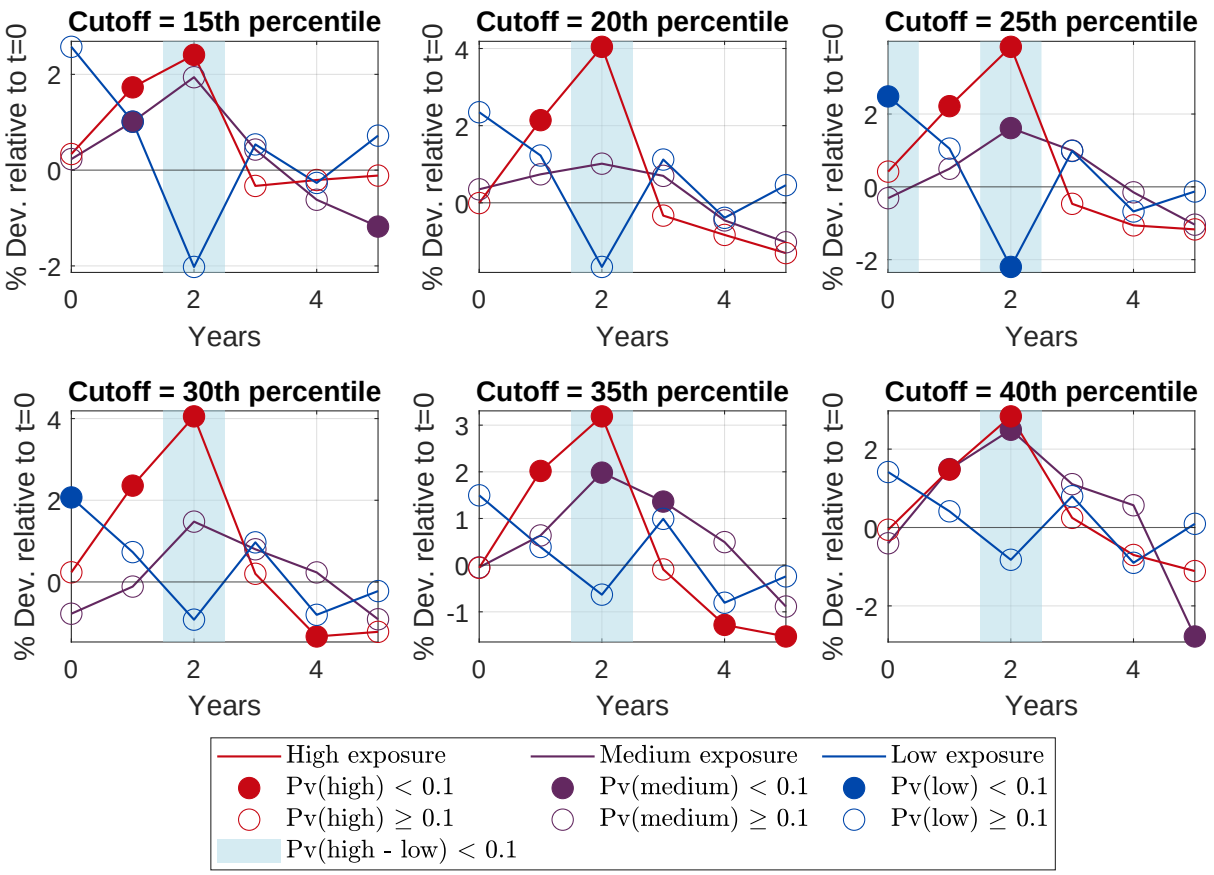

Figure D.5: Exposure to Weather Shocks and the Effect of Waste Enclosures:

Note: This figure reports impulse responses estimated via Equation (24) using the total area of waste area enclosures in the solid lines. Each panel reports the results from estimating Equation (24) 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.