Essays on Finance in History

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Chenzi Xu

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Dissertation Advisors:
Professor Jeremy Stein
Professor Kenneth Rogoff

Author:
Chenzi Xu

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Abstract

This dissertation presents three essays on financial markets in various historical contexts to assess their role in international trade, private money creation, and safe assets creation, respectively. Chapter 1 shows that a temporary financial sector shock can have long-lasting consequences for the patterns of international trade. Using the most severe banking crisis in British history as a laboratory, I find that countries more exposed to the bank failures in London had significant losses in exports market share for four decades, and that the effects were most severe in countries with higher contractual frictions and limited access to alternative forms of financing. Chapter 2, joint with he Yang, studies a policy change in the United States, the National Banking Act of 1864, that improved the quality of the liabilities issued by federally regulated national banks. Using an exogenous change in the cost of gaining access to a national bank, we find that the improvement in the liabilities' usefulness as a money-like asset had strong effects on a local economy's commercial and trade activities. Chapter 3 presents evidence demonstrating that a demand for safe assets issued by the central country is a feature of the international monetary system that predates the modern era. Using institutional and empirical evidence from the pre-WWI classical gold standard era, I show that investors were willing to pay a premium for holding the economy's safest asset. In addition, the historical setting allows me to instrument for the supply of safety using shocks to gold mining stemming from weather fluctuations in South Africa.

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To my family.

0 | Preface

This dissertation comprises of three independent chapters in the areas of economic history and finance that are tied together by the themes of persistence, money, and credit.

All three chapters are historical, and economic history provides the lens for examining the first theme of persistence. Persistence is a topic that is uniquely suited to being studied by economic historians. In this dissertation, persistence refers to two types of phenomenon: the first is the potentially *long-lasting* effects from events or shocks, and the second is institutions or events that *recur* despite differences in time periods or settings. The first type of persistence can only be seen through the long lens of history, in which time tells us why and how long certain changes lasted. The second type of persistence lends us insight on "fundamental" characteristics of economies.

In chapter one, I capture the persistent effects of a temporary shock to financial markets on patterns of international trade. This type of persistence can be viewed as either a slow transition path from one equilibrium to the next, or else a shift to a new equilibrium completely. In the second view of persistence as recurrence, I focus on events or institutional characteristics that re-emerge over time despite disruptions (or abatements). Financial crises (the topic of my first chapter) and the institutional traits of the international monetary system (the topic of my third chapter) are both persistent in this sense.

Finance provides the lens for the themes of money and credit. Money, money-ness, and the real economic consequences of having access to money are themes that I explore in chapters two and three. In particular, I focus on *private* money creation from the liabilities issued by financial institutions. While much of the literature on these instruments has focused on their negative externalities from a risk-shifting perspective or in crisis states, I show how two historically significant institutions (such as the Office of the Comptroller of the Currency in the United States and the Bank of England in the United Kingdom) implemented policies that guaranteed the safety of these liabilities, and hence positively affected commercial transactions.

The final theme is credit. Financial crises are often told as stories about shocks to credit: bank failures and debt defaults lead to loss of access to both short-term and long-term credit markets. The crisis at the center of my study in chapter 1 led to a severe contraction in the short-term trade credit that exporters relied on for international trade. Although credit recovered within a few years, the patterns of trade were disrupted for four decades. In this case, while lack of access to credit is the precipitating force in the persistent effects, recovery in credit is not itself enough to restore the original equilibrium. In chapter 2, while it is not possible to fully rule out the changes to credit provision after the National Banking Act, we argue that the nature of lending (on the asset side of the balance sheet) did not change nearly as much as the nature of transactions (operating through the liabilities side of the balance sheet). In both these chapters, while credit is relevant, it does not tell the full story, and the study of finance benefits from examining both what it can and cannot explain.

1 | Reshaping Global Trade: The Immediate and Long-Run Effects of Bank Failures

1.1 Introduction

Banking crises have occurred repeatedly in countries across the income spectrum throughout history, and a recent empirical literature has shown that they have severe consequences for short-term real economic activity.[1] Models of the macroeconomic response to financial sector disruptions typically imply that recovery in the health of the banking sector will lead to recovery in the real economy (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). However, the short-term adjustments triggered by banking crises appear to have longer lasting economic consequences (Cerra and Saxena, 2008). International trade is a sector that is both sensitive to the costs of external finance (Amiti and Weinstein (2011); Paravisini *et al.* (2014)) and could theoretically exhibit path dependence, where a one-time temporary shock leads to a persistent change in the composition of exporters (Baldwin, 1988; Baldwin and Krugman, 1989). Yet establishing the causal effect of bank failures on exports beyond the level of the firm is difficult because local conditions simultaneously

[1] Recent work includes Chodorow-Reich (2014), Benmelech *et al.* (2016), Huber (2018) on employment, and Ashcraft (2005), Richardson and Troost (2009), Calomiris and Mason (2003), Frydman *et al.* (2015) on investment and output.

impact economic activity and banking sector health. Even when it is possible to isolate an exogenous shock to the domestic banking sector, studies have been limited to examining short-term outcomes within one country.

This paper causally estimates the impact of bank failures on international trade in a unique historical setting that lends global coverage and makes it possible to study long-term effects. The laboratory is the natural experiment arising from the most severe financial crisis in British history, the 1866 London banking crisis, which occurred when London was the center of the global financial system and British multinational banks were the dominant providers of trade credit around the world. I show that the crisis disrupted the normal flow of credit. Using the bank-level shocks from the crisis, I find that this temporary shock had both immediate and long-lasting effects on international trade patterns.

The 1866 crisis was caused by the unexpected bankruptcy of the fraudulent financial market intermediary Overend and Gurney. Its announcement of bankruptcy led to panic and severe bank runs on all London banks. Crucially, Overend and Gurney was not itself involved in trade finance or trade-related activities.[2] However, in the immediate aftermath, 12 percent of British multinational banks (weighted by size) failed.[3] These multinational banks borrowed funds in London and lent them abroad through subsidiary offices in cities around the world. Headquarter failures in London severed this funding structure and necessitated that all foreign operations stop as well. Port cities and countries around the world differed in their pre-crisis dependence on the British banks that failed and were therefore differentially exposed to the crisis in London.

Several features of the historical setting make it well-suited for identifying the causal effect of exposure to bank failures on exporting activity. First, British multinational banks were dominant and had global reach: they provided over 90 percent of trade credit in cities around the world, and they operated in countries that accounted for 98

[2] See appendix A.5.2.

[3] There were 128 multinational banks, of which 22 failed.

percent of world exports in 1865.[4] Their competitive advantage relative to other local, or even European alternatives, stemmed from their unique structure of lending abroad but drawing funding from the largest money market in the world. Subsidiary locations dependent on British banks paid a lower cost of capital on average but were exposed to fluctuations in the cost of credit from London. This structure of global operations meant that a single shock in the international financial center—the failure of London's largest financial market intermediary—impacted banking activity around the world.[5]

Second, these multinational banks were chartered to provide trade credit, which establishes a natural link between their operations and exporting activity (Baster, 1934). The banks' similarities in funding and management structure also makes it likely that they affected exports through the same channels across locations. Third, outside of Britain, there was no post-crisis government or policy intervention in the macroeconomy, so the estimated effects are not conditional on the degree of the response.[6] Finally, the 1866 crisis was followed by almost five decades of relative global peace, one of the longest in modern history, when both goods and capital flows faced few barriers, in what was known as the First Age of Globalization (O'Rourke and Williamson, 1999). Together, these features allow me to empirically isolate the effect of bank failures from other determinants of local economic development and to examine the process of recovery over many decades.

In order to conduct the empirical analysis, I construct several new datasets of historical trade and financing activity around the world, at the port city and country levels. First, I collect over 11,000 handwritten loan contracts from archival records comprising the universe of pre-crisis British bank lending relationships in cities around the world. To my knowledge, these are the only data with full global coverage of the dominant financial

[4] Author's calculations based on the locations and operations of British banks and non-British banks, and the value of exports across countries in 1865.

[5] International capital reversals continue to cause cross-border contagion today. Cetorelli and Goldberg (2011); Huber (2018); Iyer *et al.* (2013); Paravisini *et al.* (2014); Peek and Rosengren (1997, 2000); Puri *et al.* (2011); Schnabl (2012) study their effects in a variety of different national contexts.

[6] Romer and Romer (2018) document that in the post-Bretton Woods era, the output decline following financial crises is highly dependent on policymakers' ability to enact post-crisis countercyclical policies.

center's banking relationships in any time period, and they make it possible to causally link a single shock to outcomes around the world. Second, I quantify city-level exporting activity in the short-term using a dataset of comprehensive shipping activity in port cities around the world built from the daily *Lloyd's List* newspaper.[7] Third, I build a panel of exporting and financing activity at the country- and city-levels, respectively, from 1850–1914.

To identify the causal relationship between bank failures and exporting activity, I use a difference-in-difference (DD) estimator with continuous treatment intensity, allowing for a control group of places with no exposure to British banks in 1866. I measure a location's exposure to bank failures as the fraction of its credit pre-crisis that came from the banks operating in that location that failed, where locations are cities and countries, respectively. This measure follows a Bartik/shift-share structure of exposure to bank-health shocks used in Greenstone *et al.* (2014), Chodorow-Reich (2014), and Amiti and Weinstein (2018) among others at the firm-level.[8] This strategy is based on the theoretical and empirical evidence that banks lend locally since contractual frictions between banks and their borrowers increase with distance (Mian, 2006; Petersen and Rajan, 2002; Sharpe, 1990).

Identification relies on there not being a simultaneous shock to a location that would cause both its exports to decline and the banks operating there to fail. First, I show that bank failures are uncorrelated with observable characteristics of the banks themselves, which helps to address the key endogeneity concern that riskier banks sorted to locations that would have experienced exports declines anyways. Consistent with the environment of limited knowledge during the 1866 panic, worse banks (proxied by observable pre-crisis balance sheet characteristics) did not experience more severe runs and were not more likely to fail. Second, and more importantly, I verify that bank failures are mostly

[7] Annual country-level shipping activity is highly correlated with annual values of exports, and I verify my short-term findings at the country-level using values of exports.

[8] Several contributions to this literature also estimate the within-firm effects using connections to multiple borrowers (Amiti and Weinstein, 2018; Blattner *et al.*, 2018). However, the within-firm variation is only useful when outcomes are also at the bank-firm level (see Khwaja and Mian (2008)). In my analogous exercise using location-level effects, exports are not observed at the bank-location level.

uncorrelated with observable characteristics of subsidiary locations, for example of their value of exports, specialization in particular commodities, or military conflicts. The lack of location-level correlations with bank failures helps to address the endogeneity concern that these characteristics were the proximate cause of both bank failures and exports declines. Finally, I control for potentially confounding observable factors and include a number of robustness checks to provide additional evidence for the identifying assumption.

My analysis proceeds in the following way. First, I examine whether this finance-driven shock to trade costs lowered exporting activity in the short-term. Second, I establish that the disruption to finance was temporary: cities more exposed to bank failures in 1866 had access to the same number of banks as less-exposed cities by 1871.[9] Third, I examine the long-run effects: if exporting activity primarily depended on short-term financing, recovery should follow. However, if the temporary financing shock severely disadvantaged exporters during this period of massive growth in global trade, then the initial loss of market share abroad would lead to persistently lower levels of exports in the long-run.

I find that exposure to the failure of these multinational banks caused large and immediate contractions on both the intensive (the amount exported) and extensive (whether they exported at all) margins of exporting activity within and across countries. Ports exposed to a 10 pp increase in bank failures shipped 5.6 percent less the year following the crisis compared with unexposed ports within the same country. The intensive margin findings are larger than Amiti and Weinstein (2011) and Paravisini *et al.* (2014)'s firm-level results in more recent settings. The difference is most likely because bank failure is more extreme than declines in bank health and less prone to measurement error. In addition, I find extensive margin losses in the number of exports destinations

[9] I measure access to banks by building a dataset of the universe of city-level multinational bank subsidiary operations around the world in five-year windows from 1850-1914. I count banks of all nationalities.

and the likelihood that a port traded at all. These results are consistent with findings in modern data documenting that credit constraints have a negative impact on firm entry into exporting (Berman and Héricourt, 2010).

At the country-level, I estimate an even larger loss in shipping activity from exposure to bank failures, suggesting that general equilibrium forces did not substantially reallocate exporting activity within the exporting country. I explicitly test for any short-term reallocation by estimating the response of port-level shipping to the average level of bank failure exposure in other ports within a country, controlling for each port's own exposure. The effect is not significantly different from zero. Since ships are highly mobile across ports, this result suggests that the binding friction was the costly process of forming new lending relationships (Bernanke, 1983; Rajan, 1992).

Having established the short-term effect of this financing shock on exporting activity, I show that the losses across countries persisted for decades in the aggregate and in terms of market share despite fast recovery in the banking sector. After 1866, there is an immediate and permanent divergence in the aggregate levels of exports between countries with above average exposure to bank failures compared to those with below average exposure. This divergence is driven by an increase in the growth rate of exports for less exposed countries right after the crisis.[10] Benchmarked against estimates of the elasticity of trade to physical distance, exposure to an above average bank failure shock after two years is equivalent to a 30.5 percent increase in a country's distance to its trade partners. These initial differences lead to a 1.8 percent difference in the average annual growth rate of exports from 1866 until 1914.[11]

In order to estimate the market share effect, I extend my short-term DD identification strategy and estimate the cross-sectional elasticity of country-level values of exports

[10] The main analysis stops in 1914 because of the economic and institutional upheavals of WWI. However, the divergence persists until 2014, indicating that countries more exposed to bank failures never experience a compensating positive growth shock.

[11] The partial equilibrium framework I have adopted can only estimate counterfactual declines in global trade volumes assuming that there is no across-country exports substitution. However, I provide evidence of high exports substitutability, leading to a shift in the *patterns* of global trade if not the global levels.

to bank failures in every year in a dynamic DD. This estimator compares the relative amounts imported by a given country in a given year from exporters exposed to varying degrees of bank failure, controlling for bilateral measures of geographical and institutional distance.[12] Incorporating the bilateral resistance measures means this estimator takes the form of a fixed effects estimation of a general structural gravity equation used to quantify the responsiveness of exports to trade costs (Head and Mayer, 2014). I find that there are no differential pre-trends from 1850–1866, a large negative effect beginning in 1867, and statistically significant differences in exports market share until 1900. I also show that the patterns of persistence and recovery cannot be explained by random divergence among countries over time and are robust to a large number of alternative explanations. While the estimated effects are not statistically significant after 1900, the point estimates are persistently negative, and the magnitude in 2014 is still 53 percent of the average magnitude from 1866–1900, indicating a very slow process of convergence.

The path dependence in exports patterns lends empirical evidence to the possibility of multiple equilibria in the geographic distribution of economic activity (Allen and Donaldson, 2018; Bleakley and Lin, 2012; Davis and Weinstein, 2002; Kline and Moretti, 2014a; Redding and Sturm, 2008). While the literature has focused on the role of physical capital and geographic characteristics in determining initial conditions, to my knowledge this paper is the first to show that temporary shocks to financial capital can be the proximate source of divergence. The persistent losses that I document are consistent with a framework of high substitutability across exporters (a country-level analogue to the homogeneous firms in Baldwin and Krugman (1989)), which is plausible in this institutional setting in which the vast majority of trade was in raw commodity goods.

Next, I explore two mechanisms for the long-term losses: an exporter's lack of access to alternative sources of trade financing and an importer's ability to substitute to other exporters selling similar products. Without ruling out the possibility of concomitant

[12] The importer-year fixed effects control for all country-level shocks experienced by the importer, such as aggregate demand or income shocks.

factors, I explore two mechanisms. First, to proxy for the availability of alternate financing sources that could be accessed after the crisis, I use the number of non-British banks operating in each port city, and find that access to other banks alleviates one third of the baseline short-term reduction in exporting. In the long-term, exporters with access to alternative banking networks were almost completely shielded from the cost of the initial exposure to British bank failures. Second, I compare relative recovery rates within groups of countries exporting similar goods. Countries facing more competition in exports markets did not have any recovery in their bilateral trade relationships by 1914. As a placebo, countries within random groupings followed the same baseline patterns of recovery by the 1900s.

This paper shows that there are immediate and long-term global consequences from disruptions to the dominant financial market, and it is related to a number of literatures. In the modern economy, credit conditions in peripheral countries have been found to be disproportionately associated with capital flows from the United States (Eichengreen and Rose, 2004; Gourinchas *et al.*, 2012). Rey (2015) shows that the ultimate source of these credit cycles may be monetary policy transmitted through global banks. Separately, there is a large literature on the Bank of England's policies during its pre-WWI hegemony that highlights its influence over the pound sterling (Bagehot, 1873; Flandreau and Ugolini, 2013; Schwartz, 1987). This paper empirically joins these two strands of literature to concretely illustrate how the conditions in the dominant financial market affect real activity globally.

Methodologically, I use quasi-random variation in bank failure at the location-level, analogous to the firm-level measures of exposure used in recent studies (Frydman *et al.*, 2015; Gan, 2007). In particular, my strategy is similar to studies in which the shocks to the domestic banking sector originated abroad (Peek and Rosengren, 2000; Puri *et al.*, 2011; Schnabl, 2012). While I find that real economic activity contracted even in the historical setting, I also estimate these effects in the macroeconomy, beyond the level of the firm, and in the long-term across all countries.

A separate literature has been able to correlate domestic banking crises with deep, persistent output declines across countries (Bordo and Haubrich, 2010; Cerra and Saxena, 2008; Kaminsky and Reinhart, 1999; Krishnamurthy and Muir, 2017; Reinhart and Rogoff, 2009a; Schularick and Taylor, 2012). My estimation establishes this relationship causally. In contrast to the multi-country studies, I focus on one crisis, which provides a single institutional context and a clear interpretation of the role of banks within it. Using one setting also avoids the difficulties of comparing very different shocks across countries and time (Romer and Romer, 2017). While the Global Financial Crisis has also shown that crises originating in the core are not just of historical interest, comparable data on the bank linkages in 2008 are not available, and it would only be possible to observe effects for one decade.

Finally, this paper's focus on exports speaks to the growing literature on the role of finance in trade. There has been revived interest in this topic following the Great Trade Collapse of 2008, but the existing literature has not reached a consensus. Most studies use the cross-industry variation in external finance dependence from Rajan and Zingales (1998a) and measure a firm's access to finance from firm balance sheets (e.g. Chor and Manova (2012); Iacovone and Zavacka (2009)), while others adopt a structural approach (e.g. Alessandria *et al.* (2010); Eaton *et al.* (2016)). Their findings vary from finding large to insignificant effects.[13] In contrast, I directly observe the trade financing constraint from bank-level shocks as in Amiti and Weinstein (2011) and Paravisini *et al.* (2014), and I find strong support for the financing channel. In addition, I also find a much larger decline in trade relative to output, consistent with patterns in the modern data.

[13] Ahn *et al.* (2011) posits the range of conclusions could stem from inconsistent or incorrect measurement of trade credit, especially when proxied by standard measures of external finance dependence. In addition, Feenstra *et al.* (2014) notes that trade finance acts through different mechanisms from standard external financing.

1.2 London's banks: institutional & historical context

This section provides an overview of the institutional structure of British multinational banks and international trade finance in the 19th century. It describes the events leading up to the London banking crisis of 1866 and the consequences of the firm Overend and Gurney's failure.

1.2.1 Trade finance & British banking dominance

Contractual frictions were a major barrier to establishing international trading relationships in the 19th century, just as they still often are today (Antràs and Foley, 2015; Auboin, 2012). Due to the long lag between the initial shipment by exporters, the receipt of goods by importers, and their final sale by importers, purchase and payment was staggered, and there was room for default on both sides. Importers were not willing to directly finance exporters (through cash-in-advance payment) when the exporter was risky and losses were unlikely to be recouped. These contractual frictions were particularly high for exporters in countries of low institutional quality or in new markets.[14] Exporters waiting for payments faced higher working capital costs, and contemporary 19th century accounts indicate that uncertainty over payments restricted many firms from expanding to new markets (Mackenzie, 2013; Reber, 1979).

Banks overcame these frictions by directly financing exporters during the period of shipment. British multinational banks operated locally through subsidiary offices, which allowed them to build long-term relationships and gave them superior knowledge of an exporter's risk. These offices conducted the banks' business of lending via short-term, often collateralized, loans called "banker's acceptances." Banker's acceptances were

[14] Antràs and Foley (2015) presents a symmetric case where the contractual friction could bind for either the importer or exporter. Empirically, they study a modern US-based exporter whose partners varied in their contractual quality. However, in the historical context, the financing friction did not bind for importers because lending to finance purchases was not the norm.

a special form of a bill of exchange, which was a general debt obligation that could be written between any two parties. Bills of exchange had the feature of joint liability, meaning that in the case of default by the original debtor, the "acceptor" (in this case the bank) was liable for the debt. This feature transformed the bills from bearing the idiosyncratic risk of the individual exporter into bearing the bank's credit risk instead.

In addition, British multinational banks had accounts at the Bank of England, which promised to lend against collateral guaranteed by its customers at the Bank's Discount Window. The term "Discount Window" comes from the transaction of "discounting" bills of exchange that took place there. Discounts most resembles a modern-day repurchase agreement: the seller received the face value of the bill minus the discount rate (haircut) at the initiation of the transaction, and he paid the full face value in return for the security at its maturity. At maturity, the bill was presented to the original borrower via his accepting bank for repayment, and the debt was terminated.[15]

The bills accepted by British multinational banks and implicitly guaranteed by the Bank of England were useful debt and investment instruments, analogous to short-term Treasury bills today.[16] Banker's acceptances were flexible and customizable, so in theory they could be accepted for any debt obligation. However, the British multinational banks at the center of this study used them to finance international trade. The relationship these banks had to the Bank of England and the London money market allowed them to form the backbone of international trade finance in the 19th century.

Three institutional details are relevant for interpreting the effect of British multinational bank failures on trade. First, they were chartered to only fund trade and were not permitted to act as commercial banks and invest in long-term, illiquid assets (Chapman, 1984; Muirhead and Green, 2016). Second, contemporaries emphasized that British banks were not limited to funding trade with Britain, and in fact were integral for trade that had

[15] Flandreau and Ugolini (2013) and Anson *et al.* (2018) study the rules governing the Bank of England's discounting activity during different 19th century banking crises.

[16] The modern Treasury bill was proposed by Walter Bagehot in 1877 and modeled after these commercial bills to allow the government to borrow at short maturities in a similar manner (BOE, 1964).

no British counterparties (Baster, 1934; Jenks, 1927).[17] Third, the safe and liquid features of their bills meant that banks could remit them back to their London headquarters which then resold them on the London money market.[18]

Access to London was integral to subsidiary office operations and provided British multinational banks with two advantages over local, and even other European, banks: remitting bills back to London freed up local capital for more acceptances, and the headquarters issued stock and deposits in London, where the cost of capital was low, to lend abroad. These two factors contributed to British banking dominance and global reach. In 1866 on the eve of the London banking crisis, the countries that British banks operated in accounted for 98 percent of the value of global exports. A conservative estimate is that these banks provided 91 percent of the trade credit in a given city.[19] To my knowledge, this paper is the first to study the international implications of the 1866 London banking crisis.

1.2.2 London banking crisis of 1866

The 1866 banking crisis was the largest ever shock to the London money market, when 22 out of 128 multinational banks headquartered in London (12% of banks by size) failed.[20] The closures of the headquarters in London necessitated that subsidiary operations abroad close as well, which constricted the supply of credit in subsidiary locations.

The 1866 crisis was caused by the unanticipated bankruptcy of the firm Overend and

[17] Jenks (1927) writes on p. 69, "[American imports of] wines from France, coffee from Brazil, sugar from the West Indies, and silk from Hong Kong were paid alike with bills on London."

[18] In London, the short-term funds circulated among banks who bought/sold securities to generate their preferred maturity distribution, members of the London Stock Exchange who borrowed from banks to purchase bonds, and interbank lenders who facilitated the transactions (Nishimura *et al.*, 2012, p.18).

[19] These two figures are the author's own calculations. The first is based on the bank-city lending relationships. The second assumes that non-British banks were the same size as British banks. Since British banks were almost certainly larger than non-British banks, this figure is a lower bound to the amount of trade credit they supplied. This circle of funding made the business of international banking potentially very profitable, and Kisling (2017) documents that German banks began entering this market in the later part of the 19th century to compete with British dominance.

[20] This was also the last time there were bank runs in the United Kingdom until 2008. Anna Schwartz referred to the 1866 crisis as the "Last English Financial Crisis" (Schwartz, 1987).

Gurney, the largest and most prestigious interbank lender in the City of London. Its business was buying and selling liquid, short-term bills of exchange from and to London banks. It did not lend long-term on illiquid assets, and it had no overseas operations. Crucially for the purposes of this study, it did not lend for the purposes of trade.

Overend's business had been built over decades by earlier generations of partners such that by the mid-19th century, it was called the "Corner House" in London. In the early 1860s, a younger generation of partners took over the firm and let it be run by "wily sycophants" who mismanaged the firm's assets with speculative and illiquid investments that quickly began to fail (King, 1936, p. 246).[21]

However, the true state of affairs was not known to the public, and the firm successfully converted its ownership structure from a privately held company to a publicly-listed joint-stock firm in July 1865 as a gamble to recover its losses.[22] *Banker's Magazine*, a leading financial market publication, fully endorsed the firm as one of the best in the City of London when Overend & Gurney announced its share offering. Less than one year later, Overend announced its bankruptcy on the morning of May 11, 1866, and *The Times* reported the following:

> It cannot be denied that about mid-day the tumult became a rout. The doors of the most respectable Banking Houses were besieged [...] and throngs heaving and tumbling about Lombard Street made that narrow thoroughfare impassable.

Overend's failure had two immediate effects on the London money market: the first was a negative supply shock for cash because a major intermediary could no longer fulfill the liquidity needs of banks in London. The second was an intense positive demand shock for bank funds as the news caused depositors to panic and run on the banks. In conjunction, the failure froze the short-term credit market in London for several days, and liquidity was unattainable except at the Bank of England Discount Window.[23] During the

[21] Appendix A.5.2 discusses the details of Overend's business in the period before its failure.
[22] Appendix A.5.2 gives the full text of the original prospectus.
[23] Appendix Figure A20 plots the full time series of the daily lending at the Bank of England Discount

week, all London banks suffered runs, and ultimately 22 institutions were forced to close or suspend operations. See Appendix A.5.1 for the full institutional details.

1.3 Measuring exposure to London's crisis around the world

The goal of my empirical analysis is to estimate the causal relationship between a location's access to bank credit and exporting activity. I follow the literature and model the underlying relationship between bank credit and economic outcomes by relating the natural log of exports EX_{lt} at location l in time t to the natural log of the amount of bank credit:

$$\ln(EX_{lt}) = \alpha + \gamma \ln(\text{Credit}_{lt}) + \Gamma' X_{lt} + \varepsilon_{lt} \tag{1.1}$$

Identifying γ from Equation 1.1 is challenging for two reasons. First, direct measures of bank credit are of an equilibrium outcome that conflates supply and demand for credit, so places that demand less bank credit are also likely to have less trade. Equation 1.1 will therefore not satisfy the orthogonality conditions that $\mathrm{E}[\text{Credit}_{lt}\varepsilon_{lt}] = 0$ because ε_{lt} includes the unobserved local economic conditions that are positively correlated with bank credit, which biases γ upward. Second, there might be reverse causality: firms in locations that are already less productive can weaken their banks' balance sheets through non-performing loans and cause those banks to contract their lending or even to fail.

I overcome these two challenges by using the multinational structure of British banking where subsidiary operations depended directly on their headquarter's health. Banks whose headquarters in London failed generates plausibly exogenous variation for their subsidiary cities' and countries' exposure to bank failures. In the rest of this section I describe how I measure location-level exposure to bank failures and discuss the evidence for the identifying framework.

Window. May 11 is marked by the red vertical line. There are no extant records of Overend & Gurney's day-to-day operations before the crisis, so it is not clear whether depositors were acting on information tying banks to the firm. I discuss the possible sources of information available in Appendix A.5.1.

1.3.1 Measuring the shock to bank credit

The total bank credit in Equation 1.1 is the sum of the credit extended by each bank b: $\text{Credit}_{lt} = \sum_b \text{Credit}_{lbt}$. This location-level total can be rewritten as the sum of the shares of each bank in a location (city or country) and the bank size: $\text{Credit}_{lt} = \sum_b z_{lbt} \times \text{Credit}_{bt}$ where

$$z_{lbt} = \frac{\text{Credit}_{lbt}}{\text{Credit}_{lt}} \tag{1.2}$$

I calculate location l's pre-crisis dependence (at $t = pre$) using the loans that were originated in the six months before May 1866 to avoid the endogeneity of post-crisis sorting among bad banks and bad locations. The shares $z_{lb,pre}$ sum to equal one in each location.

The crisis in London generates bank-level shocks that affect locations through their pre-crisis dependence $z_{lb,pre}$ on each bank. I use the shock of bank failure in 1866, which is captured by the binary variable $\mathbb{I}(\text{Failure}_b)$ and takes the value of 1 if the bank failed and 0 otherwise. Each location's exposure to bank failure Fail_l is the average of failure rates across its banks, weighted by the pre-crisis importance of each bank to a location:

$$\text{Fail}_l = \sum_b z_{lb,pre} \times \mathbb{I}(\text{Failure}_b) \tag{1.3}$$

Fail_l takes the form of a Bartik instrument with the following first stage relationship:

$$\Delta \ln(\text{Credit}_{lt}) = \alpha_1 + \beta_1 \text{Fail}_l + \Gamma_1' X_{lt} + \nu_{lt} \tag{1.4}$$

Fail_l is a location-level analogue to the firm-level exposures to bank-level shocks used elsewhere in the literature, for instance in Chodorow-Reich (2014); Paravisini *et al.* (2014). As in other Bartik instruments, the intuition for identification is that each location is a small contributor to a bank's overall operations and is therefore unlikely to drive the bank-level outcomes. I discuss instrument validity in section 1.3.2.

Estimating the first stage relationship in Equation 1.4 requires location-level lending in both the pre- and post-crisis periods. Data limitations (discussed in more detail in section 1.4.1) prevent this, but there is a strong pseudo first-stage relationship between exposure to bank failures and credit contractions at the bank-level, shown in Table A1. Given the lack of a first stage, the empirical results will be presented in terms of the reduced form relationship between exposure to bank failures and the change in log exports instead:

$$\Delta \ln(EX_{lt}) = \alpha_2 + \beta_2 \text{Fail}_{lt} + \Gamma_2' X_{lt} + \epsilon_{lt} \tag{1.5}$$

The reduced form coefficient β_2 in Equation 1.5 is straightforward to interpret as the semi-elasticity of the response of trade activity to bank failures in location l.[24]

In all calculations of the total trade credit in a location, I only observe the amounts extended by British banks, which leads to measurement error in the endogenous variable Credit_{lt}. However, the instrument constructed from the shares and failure rates of British banks will still be valid for the change in *all* credit as long as either non-British banks do not provide trade credit, or the post-crisis credit supply of non-British bank credit is uncorrelated with the failure rates of British banks across locations. Since British banks conservatively provided over 90% of trade credit and I find no evidence of an immediate correlation between the non-British bank response and British bank failures, it is unlikely that the measurement error in the endogenous variable drives the results. Appendix A.3 gives the proof and empirical evidence.

1.3.2 Validity of reduced form estimation

The reduced form relationship in Equation 1.5 will causally identify the effect of contractions in bank credit on exports if Fail_l satisfies the standard exclusion restriction for

[24] Estimating the reduced form relationship means it is not possible to distinguish between the many different roles of banking activity, such as credit provision or risk assessment. Given these banks' role as providers of trade credit, I focus on the credit channel, but any form of banking activity that matters for exporters would also be affected by the bank failures.

an instrumental variable: $\mathrm{E}[\mathrm{Fail}_l \varepsilon_l] = \mathrm{E}[\sum_b z_{lb} \mathbb{I}(\mathrm{Failure}_b) \varepsilon_l] = 0$. It is apparent from the exclusion restriction that in a shift-share setting, the instrument is immediately satisfied if bank failures are randomly assigned, but it does not require it.

The instrument will be valid if the bank-level shocks are uncorrelated with the average location-level characteristics that determine exporting activity in the locations most exposed to each bank (Borusyak *et al.*, 2018).[25] The identifying assumption is that banks did not sort to locations such that characteristics of the locations were correlated with both failures of the British multinational banks operating there and declines in exports activity. One example of problematic sorting would be that banks that failed chose to operate in locations that experienced a boom in the pre-period and a bust post-1866. Declines in exports and failures of the banks operating in those locations would coincide and be falsely attributed to the London crisis. To the extent that any boom and bust cycle is observable, they can be included as controls in the reduced form estimation.

In the following subsections, I first show that bank failure rates themselves were not correlated with observable characteristics of bank activity gleaned from balance sheets nor with geographic concentration. Randomness in bank failures is sufficient to meet the requirements for identification, but I do not rely solely on it. Next, I test the identifying assumption directly and show that bank failure rates were also mostly not correlated with observable characteristics of the locations where they were operating. To the extent that certain characteristics were correlated with bank failures, they are included as controls in all the specifications to residualize their effect on exports activity. Using the Oster (2017) bounds, I argue that it is unlikely that there were correlations in unobserved characteristics that would affect the results.

[25] In Goldsmith-Pinkham *et al.* (2018), identification can come from exogeneity in the shares $z_{lb,pre}$ without any information from the shocks. This condition would be satisfied if there were no sorting between banks and locations in ways that matter for exports activity–in other words, that banks chose locations randomly on those dimensions. However, it is likely that certain banks specialized in certain areas or commodities, and therefore those assumptions are less suitable for this context.

Correlation between bank characteristics and bank failure rates

Banks are balanced across almost all observable pre-crisis bank characteristics (Table 1.1). Panel A only has publicly-held—a.k.a. joint-stock—banks that published balance sheets, and Panel B has all banks including privately owned banks that did not publish balance sheets.

The balance sheet characteristics of the banks that failed are not statistically or economically different from those of the banks that did not fail (Panel A). These characteristics are proxies for measures of bank health and risk-taking. Banks had on average £1.48 million equity capital, of which almost half was already paid by investors, and their reserve funds, deposit liabilities, total size of the balance sheet, leverage ratio, and reserve ratio were also similar.

In Panel B, I include all other observable characteristics that are available for all the banks. Panel B shows that banks that survived were on average older. Age would be a potential confounder if older banks operated in locations that were less likely to experience declines in exports. However, the relationship is driven by private bank outliers such as Coutts which dates from the 16th century, and the difference disappears when those outliers are removed. Additionally, I control for the average weighted age of banks in each location, which residualizes the age effect from the correlation between bank credit and exports activity and leaves the residual relationship between bank credit and exports activity.

Geographical region of specialization also did not predict bank failure. For each bank, I calculate the total credit extended to each geographic region such as North America or the UK itself to test whether exposure to these regions are correlated with failure.[26] Banks that failed were not more exposed to individual regions than banks that did not fail. This balance helps to address the concern that bank failures and export contractions were

[26]In Table A2, I calculate each bank's geographic exposure as the share of total assets to rescale by bank size. All measures are balanced there as well.

Table 1.1: *Pre-crisis comparison of bank characteristics*

Panel A: Balance sheet characteristics (joint-stock banks)

	All		Not Failed		Failed		Diff	
Capital, authorized (£m)	1.48	(1.06)	1.44	(1.06)	1.67	(1.07)	-0.23	(0.29)
Capital, paid up (£m)	0.59	(0.38)	0.61	(0.38)	0.47	(0.39)	0.15	(0.10)
Deposits (£m)	2.22	(2.73)	2.29	(2.82)	1.85	(2.37)	0.44	(1.14)
Reserve fund (£m)	0.13	(0.12)	0.13	(0.11)	0.15	(0.16)	-0.02	(0.04)
Total size (£m)	4.81	(6.11)	5.08	(6.46)	3.73	(4.48)	1.35	(1.83)
Leverage ratio	0.24	(0.14)	0.25	(0.14)	0.23	(0.11)	0.02	(0.05)
Reserve ratio	0.06	(0.07)	0.06	(0.07)	0.06	(0.06)	0.01	(0.03)
N	95		76		19		95	

Panel B: Other characteristics (all banks)

	All		Not Failed		Failed		Diff	
Trade credit (£k)	105.79	(246.77)	112.57	(264.53)	73.16	(130.51)	39.41	(57.9)
Age (years)	35.91	(53.62)	40.88	(57.16)	11.33	(15.37)	29.54	(12.6)**
Cities (#)	13.75	(22.83)	14.90	(24.56)	8.23	(9.80)	6.67	(5.3)
Countries (#)	7.62	(8.89)	7.90	(9.26)	6.32	(6.84)	1.58	(2.1)
Asia (£k)	46.04	(170.08)	49.42	(184.96)	29.74	(59.65)	19.68	(40.0)
Africa (£k)	8.17	(25.08)	7.13	(21.95)	13.20	(36.90)	-6.07	(5.9)
N. America (£k)	13.59	(44.91)	15.65	(48.79)	3.68	(13.07)	11.97	(10.5)
S. America (£k)	6.99	(34.12)	7.79	(37.25)	3.13	(9.21)	4.66	(8.0)
Australia (£k)	6.41	(17.25)	7.00	(18.58)	3.58	(7.87)	3.42	(4.0)
Europe (£k)	12.21	(27.39)	10.87	(25.41)	18.70	(35.41)	-7.83	(6.4)
Brit. Emp. (£k)	48.25	(149.40)	53.47	(162.52)	23.13	(46.02)	30.34	(35.0)
UK (£k)	12.37	(39.96)	14.70	(43.56)	1.14	(2.67)	13.57	(9.3)
N	128		106		22		128	

Notes: Table 1.1 Panels A and B shows bank-level balance across characteristics for banks that failed and did not fail. All variables are measured at the end of 1865 before the crisis. Balance sheet variables were only published for publicly traded banks; these are reported separately in Panel A. "Not Failed" and "Failed" refers to whether a bank suspended or closed during the crisis. Means are reported first, and standard deviations are given in parentheses. "Diff" refers to the difference in means between groups. Standard errors are reported in parentheses for the "Diff" column. £k denotes units of thousands of pounds sterling. £m denotes units of millions of pounds sterling. Leverage ratio is defined as capital (paid and reserves) divided by total assets. Reserve ratio is defined as reserve assets divided by deposit liabilities. Significance is marked by $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. *Sources:* Bank of England Archives C24/1, *Banker's Magazine*, *The Economist*.

simultaneously caused by a shock that was systematically correlated with their geography. Examples of such shocks include weather patterns that led to widespread crop failures and declines in output or regional boom-and-bust patterns. In addition, banks in the two groups were similarly geographically diversified, operating in an average of almost 14 cities and 8 cities.

Correlation between location characteristics and bank failure rates

Bank headquarters were exposed to shocks in London, but these shocks could be correlated with the characteristics of the banks' subsidiary locations. Correlations between location-level characteristics and a location's exposure to bank failures are problematic if those characteristics are the ultimate drivers of exports activity. For example, if the banks that failed were primarily operating in countries focused on cotton production, and those countries were also the ones with the largest declines in exports, then shocks to the cotton industry could simultaneously be causing both the bank failures and exports outcomes.

One way to test the exogeneity of bank-level failure rates to location-level characteristics is to calculate each bank's exposure to those characteristics and correlate them with the bank failure rates (Borusyak *et al.*, 2018). The advantage of testing the bank-level relationship rather than the location-level relationship, the latter of which is standard in the literature, is that performs the standard error correction described in Adão *et al.* (2018).[27]

I examine the observable pre-crisis location-level characteristics at both the port-level and the country-level, since those are the two units of observation I use. At the port-level, the observable characteristics include the volume of exports (proxied by the number of ships from the *Lloyd's List*), the importance of the United Kingdom as a destination, the

[27] Adão *et al.* (2018) show that when the source of identification from a shift-share instrument are the shocks, the standard errors of regressions of the instrument on location characteristics tend to over-reject the null hypothesis. Intuitively, the location-level tests target randomness in the shares, but when the location shares themselves are not suitable instruments, the covariance between the shocks and the shares may be relevant. Borusyak *et al.* (2018) show that implementing the Adão *et al.* (2018) standard error correction is equivalent to translating the location-level characteristics into bank-level exposure rates.

geodesic distance to London, the latitude, the number of destinations, the availability of non-British banks, and whether the port is a capital city.[28] At the country-level, observable characteristics include the total value of exports, the value of exports within industries, the share of commodities in the composition of exports, the currency system, and whether the country was engaged in conflict. These characteristics help to capture heterogeneity in size and trade patterns. Each bank's share-weighted average exposure $\bar{X}_b$ to these pre-crisis characteristic X_l is calculated as $\bar{X}_b = \frac{\sum_l z_{lb} \times X_l}{\sum_l z_{lb}}$ where larger weights are given to locations more dependent on bank b. The transformed location-level characteristics $\bar{X}_b$ are normalized and individually regressed on bank failure rates:[29]

$$\bar{X}_b = \alpha + \beta \mathbb{I}(\text{Failure}_b) + \varepsilon_b \tag{1.6}$$

Table 2.3 reports the results and shows that there is balance on almost all characteristics.[30] While most observable characteristics are uncorrelated with failure rates, it is still possible that other unobservable characteristics are correlated. In the main empirical analysis, I rely on the Oster (2017) bounds to argue that the degree of unobserved heterogeneity would have to be unreasonably large to drive the main results.

In terms of port-level characteristics, Panel A shows that two factors are unbalanced: banks operating in ports with a higher fraction of exports going to the UK were more likely to fail, and those operating in ports that were also the capital cities within countries were less likely to fail.[31] These characteristics will all be included as controls in the

[28] Results are similar using sailing distance (without access to the Suez Canal) instead of geodesic distance to London. Figure A5 plots the relationship between the two types of distances and discusses the data sources.

[29] The regressions are weighted by $\hat{z}_b$, which is the average location exposure to bank b: $\hat{z}_b = \frac{1}{L}\sum_{l=1}^{L} z_{lb}$. The weighting is necessary to translate location-level relationships to bank-level relationships. The full derivation for the equivalence is given in Borusyak *et al.* (2018).

[30] It is worth noting that given the number of hypothesis tests being run, it would not be surprising for some of them to reject the null.

[31] As discussed in Borusyak *et al.* (2018), the advantage of transforming all the specifications into shock-level (bank-level) regressions is that it makes it clear which shocks (banks) are the most relevant for the results. At the port-level, port cities are matched to the closest geographic city of financing, which makes it possible that some cities are not the closest for any port. If certain banks operated in only unmatched

Table 1.2: *Correlation between bank failures and pre-crisis location characteristics*

$$\bar{X}_b = \alpha + \beta \mathbb{I}(\text{Failure}_b) + \varepsilon_b$$

Panel A: Port characteristics

	Ships	Ships stm	Frac to UK	Dist to London	Latitude	Non-Brit banks	Destinations	Capital city
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(Failure)	0.197	0.127	1.032***	-0.161	0.362	-0.433	-0.399	-0.666***
	[0.227]	[0.246]	[0.213]	[0.164]	[0.212]	[0.313]	[0.250]	[0.201]
N	122	122	122	122	122	122	122	122

Panel B: Country characteristics

	Exports values	Frac commodities	Gold	Silver	Bimetallic	Conflict: any	Conflict: interstate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(Failure)	0.239	-0.221	-0.404	-0.00674	0.344	0.208	-0.0530	0.346***
	[0.130]	[0.261]	[0.216]	[0.192]	[0.215]	[0.178]	[0.201]	[0.0894]
N	128	128	128	128	128	128	128	128

Panel C: Country characteristics: exports composition

	Cotton, raw	Cotton, manu	Grains	Bullion	Sugar	Coffee	Alcohol	Tobacco
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(Failure)	-0.0375	-0.0925	0.106	-0.0457	0.384**	-0.0622	-0.146	-0.0608
	[0.109]	[0.0672]	[0.0727]	[0.0730]	[0.167]	[0.197]	[0.216]	[0.0623]
N	128	128	128	128	128	128	128	128

Notes: Table 2.3 reports estimates from the bank-level regression of bank exposure to location characteristics pre-crisis on bank failure rates. The dependent variable is $\bar{X}_b$, the share-weighted exposure of banks to location characteristics, normalized to have zero mean and unit variance. The coefficients are interpreted as the standard deviation increase in the average bank exposure to a particular characteristic if the bank failed. Panel A includes location characteristics from the port panel. There are 122 observations instead of the full 128 because 6 banks operated in cities which were not the closest city for any port. Panels B and C includes country-level characteristics like the monetary standard and presence of conflict in the exporting country in 1865/1866, and the industry composition of exports in 1865. Regressions are weighted by each the average location's exposure to bank b. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

baseline specifications to residualize the direct effect that they have on any decline in exports.

In order to address the possibility of commodity booms and busts, I categorize each country's exports by two-digit SITC categories and test balance across the top eight categories. The full distribution of exports by SITC categories is plotted in Figure A1. Raw cotton and cotton manufactured goods are the largest components of textile fibers (category 26) and textiles (category 65), respectively, but I isolate these from their two-digit categories because of their historical significance. In particular, in 1866 after the American Civil War ended, there was a large disruption in global cotton markets as the US South began producing cotton again (Beckert, 2015). Banks exposed to the post-war cotton shock, either because they specialized in the cotton trade or because they operated in cotton-exporting countries, could have failed because of disruptions to the cotton market and exports from those places could have fallen for the same reasons, leading to a spurious correlation between bank failures and declines in exports.

Table 2.3 Panel B shows that there is no correlation between exposure to different currency standards (gold, silver, or bimetallic) and bank failure rates. Panel B also checks for balance in exposure to conflicts with interstate conflicts separated from all other types (intrastate and extrastate). There is a strong correlation between exposure to non-interstate conflicts and bank failures, but these effects are driven by the small number of those types of conflicts. Table 2.3 Panel C shows that banks that failed were not differentially exposed to either raw cotton exports or cotton manufactured goods. There is also balance across the other major commodities, including bullion, grains, coffee, alcohol, and tobacco. However, banks operating in countries that exported more sugar were more likely to fail. The location-level characteristics that are correlated with bank failure rates are included as controls in the main empirical specifications to address their potentially confounding

cities, they would be irrelevant in the port-level relationship between exposure to financing and declines in exports. The smaller number of observations in Panel A reflects exactly this fact: at the port-level, six banks operated in cities that were not matched to any ports. These are smaller banks, and excluding them entirely makes no difference at the country-level.

effects.

1.4 Data

This paper combines several newly collected and digitized historical datasets. In this section, I give an overview of the most important datasets and variables that I constructed. I provide full details, discussion, and documentation in Appendix A.6.

1.4.1 Exposure to bank failures

I use the Bank of England's handwritten records of city-level lending by banks pre-crisis to calculate the importance of banks to locations, $z_{lb,pre}$. The Bank of England kept detailed records of every transaction that occurred at its Discount Window. Banks facing their depositors' demands during the banking crisis discounted bills of exchange at the Bank of England because it was the only source of liquidity during the crisis. I interpret the bills that these banks brought in for discount as an unbiased representation of the universe of loans extended by British banks in locations around the world. One concern is that the bills discounted by the Bank of England suffer from selection bias because worse banks may have held worse collateral, and the bills they held are underrepresented in the data. However, the relevant selection is at the bank-location level, not just at the bank-level. In order for this type of selection to be driving the results, it would need to be the case that locations with export growth are attributed with falsely low measures of exposure to bank failures, and vice versa for locations with export contractions. All contemporary and modern evidence on the London money market indicate that by the mid-19th century, the only relevant attributes of bills were the banks that accepted them and their maturity. Several additional institutional details provide evidence that selection is unlikely to be an issue. I discuss these in detail in Appendix A.5.3.

I use the ledgers from 1865-1866 to build a dataset of over 11,000 individual loans from the 128 banks that had international operations in the year before the crisis. An example of a ledger page is shown in Figure 1.1a. For each handwritten loan record, I document the bank that originated and guaranteed the loan, the city the loan was extended in, the amount of the loan, and the date it was brought to the Bank of England to be discounted. Deciphering the hand-writing was not trivial. When there was uncertainty about the city of origination, I looked for other loans extended to the same borrower to compare entries. I was able to identify the location and geocode 99.7% of the value of loans. These banks operated in a total of 180 cities outside of the United Kingdom, and they lent over £11.2 million in the year before the crisis. The general lack of data on lending via bills of exchange has been well-documented, and to my knowledge, there are no other comprehensive empirical studies of British bank-intermediated finance during this period despite their role in global financial markets.[32]

Figure 1.2a maps the geographic distribution of exposure to bank failures, Fail_l at the city level. The size of the points measures the pre-crisis amount of British lending in the city, and the color portrays the bank failure share. This map shows within and across-country variation in failure rates. Figure A2 plots the full distribution of exposure across ports and countries.

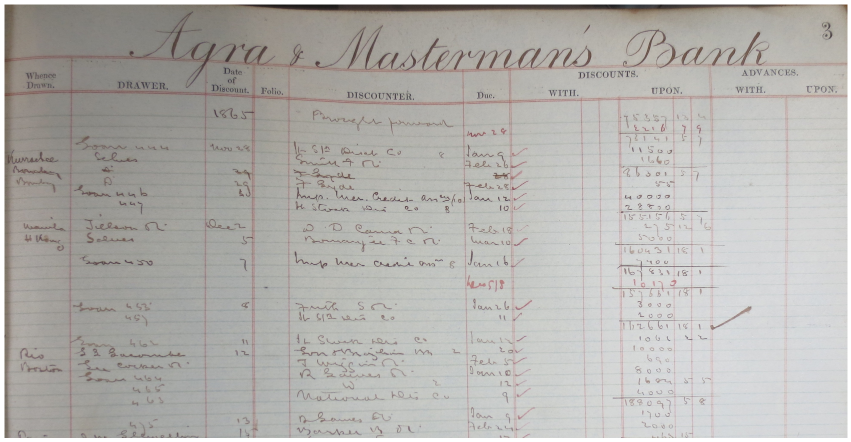
1.4.2 Immediate outcomes

I build a port-level panel of bilateral shipping activity for ports outside the United Kingdom using the daily publications of the *Lloyd's List* newspaper for the years 1865-1867. An example of this source from September 5, 1866 is shown in Figure 1.1b and

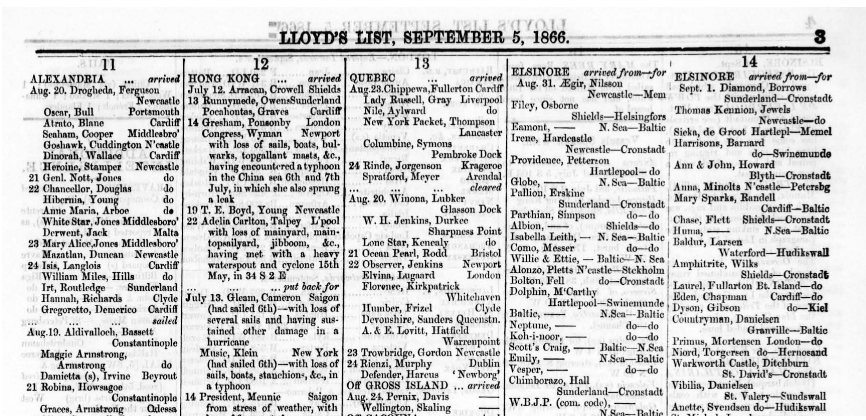
[32]Scholars have attempted to estimate the aggregate size of the trade bills market with the "stamp revenue" (taxes), but these are poor estimates and contain no geographic detail (Nishimura, 1971a). Nishimura (1971a) notes that the other source of records would be the surviving balance sheets from a few of the largest banks during the period, but they similarly have no geographic detail. Jones (1995) estimates the geographical distribution of total assets of British multinational banks for certain benchmark years between 1860-1970, but he does so by defining broad regions (such as Asia, North America, Europe without the UK) and attributing all of a bank's assets to that region. These data are informative of broad patterns, but they are too limited for empirical studies. Reber (1979) discusses the general lack of records that survive from the international subsidiaries of British banks.

Figure 1.1: *Data sources*

(a) *Excerpt of the Bank of England Discount Office ledgers*



(b) *Excerpt of the Lloyd's List*



LLOYD'S LIST, SEPTEMBER 5, 1866. 3

11

ALEXANDRIA ... *arrived*
Aug. 20. Drogheda, Ferguson Newcastle
Oscar, Bull Portsmouth
Atrato, Blane Cardiff
Seaham, Cooper Middlesbro'
Goshawk, Cuddington N'castle
Dinorah, Wallace Cardiff
Heroine, Stamper Newcastle
21 Genl. Nott, Jones do
22 Chancellor, Douglas do
Hibernia, Young do
Anne Maria, Arboe do
White Star, Jones Middlesboro'
Derwent, Jack Malta
23 Mary Alice, Jones Middlesboro'
Mazatlan, Duncan Newcastle
24 Isis, Langlois Cardiff
William Miles, Hills do
Irt, Routledge Sunderland
Hannah, Richards Clyde
Gregoretto, Demerico Cardiff
... ... *sailed*
Aug. 19. Aldivalloch, Bassett Constantinople
Maggie Armstrong, Armstrong do
Damietta (s), Irvine Beyrout
21 Robina, Howsagoe Constantinople
Graces, Armstrong Odessa

12

HONG KONG ... *arrived*
July 12. Arracan, Crowell Shields
13 Runnymede, Owens Sunderland
Pocahontas, Graves Cardiff
14 Gresham, Ponsonby London
Congress, Wyman Newport
with loss of sails, boats, bulwarks, topgallant masts, &c., having encountered a typhoon in the China sea 6th and 7th July, in which she also sprung a leak
19 T. E. Boyd, Young Newcastle
22 Adelia Carlton, Talpey L'pool
with loss of mainyard, maintopsailyard, jibboom, &c., having met with a heavy waterspout and cyclone 15th May, in 34 S 2 E
... ... *put back for*
July 13. Gleam, Cameron Saigon
(had sailed 6th)—with loss of several sails and having sustained other damage in a hurricane
Music, Klein New York
(had sailed 6th)—with loss of sails, boats, stanchions, &c., in a typhoon
14 President, Mennie Saigon
from stress of weather, with

13

QUEBEC ... *arrived*
Aug. 23. Chippewa, Fullerton Cardiff
Lady Russell, Gray Liverpool
Nile, Aylward do
New York Packet, Thompson Lancaster
Columbine, Symons Pembroke Dock
24 Rinde, Jorgenson Krageroe
Spratford, Meyer Arendal
... ... *cleared*
Aug. 20. Winona, Lubker Glasson Dock
W. H. Jenkins, Durkee Sharpness Point
Lone Star, Kenealy do
21 Ocean Pearl, Rodd Bristol
22 Observer, Jenkins Newport
Elvina, Lugaard London
Florence, Kirkpatrick Whitehaven
Humber, Frizel Clyde
Devonshire, Sanders Queenstn.
A. & E. Lovitt, Hatfield Warrenpoint
23 Trowbridge, Gordon Newcastle
24 Rienzi, Murphy Dublin
Defender, Harcus 'Newborg'
Off GROSS ISLAND ... *arrived*
Aug. 24. Pernix, Davis ——
Wellington, Skaling ——

ELSINORE *arrived from—for*
Aug. 31. Ægir, Nilsson Newcastle—Mem
Filey, Osborne Shields—Helsingfors
Eamont, —— N. Sea—Baltic
Irene, Hardcastle Newcastle—Cronstadt
Providence, Petterson Hartlepool—do
Globe, —— N. Sea—Baltic
Pallion, Erskine Sunderland—Cronstadt
Parthian, Simpson do—do
Albion, —— Shields—do
Isabella Leith, — N. Sea—Baltic
Como, Messer do—do
Willie & Ettie, — Baltic—N. Sea
Alonzo, Pletts N'castle—Stckholm
Bolton, Fell do—Cronstadt
Dolphin, M'Carthy Hartlepool—Swinemunde
Baltic, —— N.Sea—Baltic
Neptune, —— do—do
Koh-i-noor, —— do—do
Scott's Craig, —— Baltic—N.Sea
Emily, —— N.Sea—Baltic
Vesper, —— do—do
Chimborazo, Hall Sunderland—Cronstadt
W.B.J.P. (com. code), —— N.Sea—Baltic

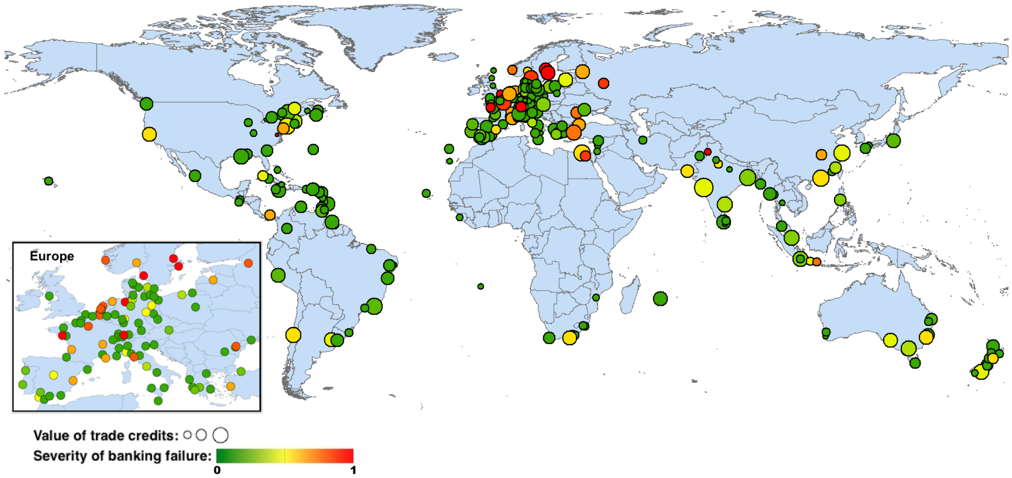
14

ELSINORE *arrived from—for*
Sept. 1. Diamond, Borrows Sunderland—Cronstadt
Thomas Kennion, Jewels Newcastle—do
Sieka, de Groot Hartlepl—Memel
Harrisons, Barnard do—Swinemunde
Ann & John, Howard Blyth—Cronstadt
Anna, Minolts N'castle—Petersbg
Mary Sparks, Randell Cardiff—Baltic
Chase, Flett Shields—Cronstadt
Huma, —— N.Sea—Baltic
Baldur, Larsen Waterford—Hudikswall
Amphitrite, Wilks Shields—Cronstadt
Laurel, Fullarton Bt. Island—do
Eden, Chapman Cardiff—do
Dyson, Gibson do—Kiel
Countryman, Danielsen Granville—Baltic
Primus, Mortensen London—do
Niord, Torgersen do—Hernosand
Warkworth Castle, Ditchburn St. David's—Cronstadt
Vibilia, Danielsen St. Valery—Sundswall
Anette, Svendsen do—Hudikswall

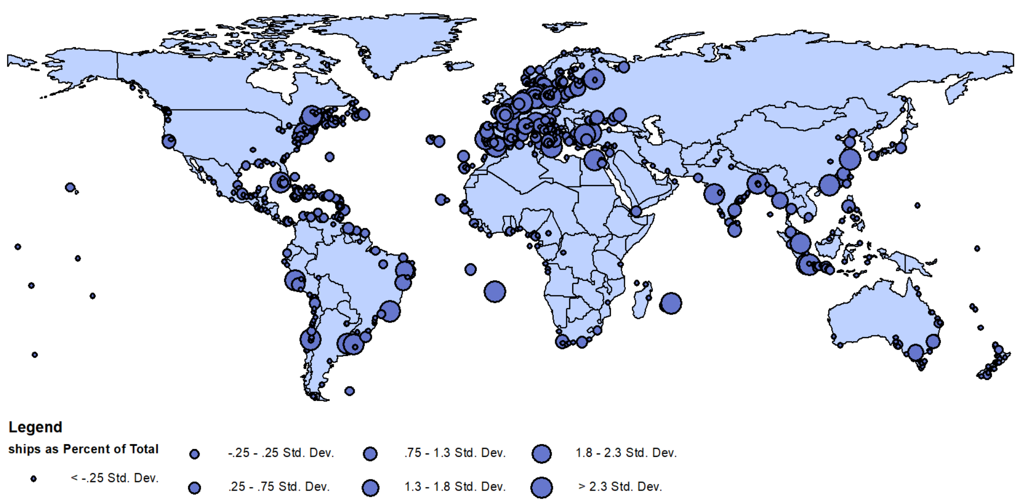
Notes: Data for Figure 1.1a come from Bank of England Archives C24/1. This is an example of the original records used to construct the financing data. The name of the bank, Agra and Masterman's, is written at the top. The column on the far left, "Whence Drawn," give the city where the credit was originally issued. The column on the far right, "Upon," gives the values of the loans. Data for Figure 1.1b come from the British Library. This excerpt from the *Lloyd's List* of September 5, 1866 show the organization of the records and the typical information available. Under each port, ships are listed individually with their name, their captain's name, type of ship, whether they arrived to the port or sailed from it, the destination of their movements, and the date of the event. Coastal (i.e. domestic) trade was omitted from the records for non-British ports.

Figure 1.2: *Geography of banking and trade*

(a) *British multinational bank lending and failures*



(b) *Port-level trade activity*



Notes: Figure 1.2a maps the distribution of the city-level exposure to bank failures Fail_l. The size of the points denote the log value of total credit at each city and the color gradient denotes the exposure to failure, ranging from 0 to 1. Figure 1.2b maps the distribution of shipping activity at ports in the pre-crisis year. The size of the points denote the log number of ships leaving. Ports in the United Kingdom are not included. Source: *Lloyd's List*.

the method for extracting the route info is described in appendix A.6. I digitized the daily newspapers for all shipping events and geocoded 99.8% of the origination ports to 377 unique ports. Over 8,000 unique destinations were geo-coded and assigned to 60 countries.[33] Figure 1.2b maps the distribution of pre-crisis activity levels for the ports around the world where the size of the dots denotes the log number of ships. One drawback of the *Lloyd's List* data is that it does not report values of the goods onboard. However, there is a strong positive correlation between the number of ships leaving a country in a year and the total value of the country's exports, shown in Figure A3.

1.4.3 Long-term outcomes

For the long-term outcomes, I measure exports and access to bank-intermediated finance for the period 1850-1914. The country-level panel of bilateral trade are constructed from publicly available datasets of historical trade statistics along with my own contributions to create a meta-dataset that is, to my knowledge, the most comprehensive available. These datasets cover a variety of time periods and territorial border changes, so I standardize country definitions to the smallest landmass unit that is consistently reported over all the years.[34]

I measured access to bank-intermediated finance at the city-level in five-year intervals by digitizing the annual editions of the *Banking Almanac*. I assigned the banks nationalities according to the *Banking Almanac* when available and other primary sources. Table 1.3 reports the descriptive statistics for ports and countries in 1865. The average port saw 130 ships leaving in the pre-crisis period and had 7 pp exposure to failed banks with one standard deviation of 19 pp. The average country-level exposure to bank failures was 11 pp with a standard deviation of 17 pp.

[33] Destinations are inconsistently listed as countries or cities, so they are aggregated to a larger unit of observation. This also minimizes sparsity in the dataset while remaining an effective way to control for demand-side shocks.

[34] These units most closely resemble pre-WWI borders.

Table 1.3: *Summary statistics: Ports and countries*

	Ports			Countries		
	mean	median	sd	mean	median	sd
Exposure to failed British banks	0.07	0.00	(0.19)	0.11	0.03	(0.17)
Exposure in British Empire	0.03	0.00	(0.05)	0.08	0.06	(0.10)
Exposure outside British Empire	0.10	0.00	(0.22)	0.12	0.02	(0.20)
Exports	127.99	32.00	(231.05)	12.49	2.15	(32.96)
Fraction exports to UK	0.39	0.30	(0.34)	0.62	0.69	(0.37)
Destinations (# countries)	7.60	5.00	(7.28)	3.95	2.00	(8.32)
Distance to destination ('000 km)	5.31	5.12	(3.48)	6.12	5.26	(3.51)
Banks	6.03	3.00	(7.54)	5.27	1.00	(9.96)
Non-British banks	0.60	0.00	(1.06)	2.97	0.00	(8.74)
Fraction in British Empire	0.34	0.00	(0.47)	0.33	0.00	(0.47)
N	289			55		

Notes: Table 1.3 shows summary statistics from the port-level panel of shipping activity and the country-level panel of values of exports. All variables are measured at the end of 1865, before the crisis. "Exports" is measured by the number of ships departing for ports, and by the value of exports in millions of pounds sterling for countries. Fraction of exports to the UK is similarly calculated using the number of ships and values of exports.

1.5 Immediate impact on trade

This section contains my results on the immediate effect of bank failures on exporting activity on both the intensive and extensive margins. There would be a contraction in exports if bank failures raised the cost of financing sufficiently for trade to be unprofitable. I first identify the effects using within-country variation from port-level shipping activity before turning to across-country variation with country-level shipping activity and values of exports.

1.5.1 Intensive margin effect: baseline specification

I examine the immediate impact of bank failures on exports using the two-period panel of port-level shipping activity. Each port in the port-level panel is matched to the closest city of financing by geodesic distance, and its exposure to bank failures Fail_{po} is assumed to come from that city. For example, the port of Piraeus in Greece is designated as receiving its funding from Athens. This empirical strategy is based on the theoretical and empirical evidence that banks operate locally.[35] Ports more than 500 km from the nearest city of financing are given an exposure of 0, and I include a time-varying intercept for these ports so that there is a control group of completely unexposed ports.[36] This control group allows for ports that are still connected to London but experienced no bank failures to react differently from ports that were not connected to London at all.

In the raw data, there is a strong negative correlation between exposure to bank failures and the difference in the log number of ships sailed in the post-period relative to the pre-period. Figure 1.3a plots the binscatter and linear fit within-country at the port-level, and

[35] Sharpe (1990) presents a theoretical framework for why contracting frictions between banks and borrowers are higher at greater distances. Petersen and Rajan (1994, 2002) present empirical evidence on the importance of geographical proximity to lending activity.

[36] The results are not sensitive to the 500 kilometer boundary and the main coefficients are robust for a range of distances. The results are also robust to not including the time-varying intercept for distant ports. See Figure A4 for the coefficient plot for the baseline specification estimated using different distance cutoffs.

Figure 1.3b shows a similarly negative relationship across countries. I formally estimate the effect of bank failure exposure on exports in a difference-in-difference regression:

$$\ln(S_{pot}) = \beta \text{Fail}_{po} \times \text{Post}_t + \alpha_p + \gamma_{ot} + \varepsilon_{pot} \tag{1.7}$$

where S is the number of ships leaving from port p in origin country o in period t. Following the trade literature, the dependent variable is in logs to reduce the effect of outliers. As in Paravisini *et al.* (2014), I separate the intensive and extensive margin effects rather than transforming the zeros. The intensive margin sample is constructed from shipping activity five quarters pre- and post- May 1866 and limited to ports active in both periods.[37]

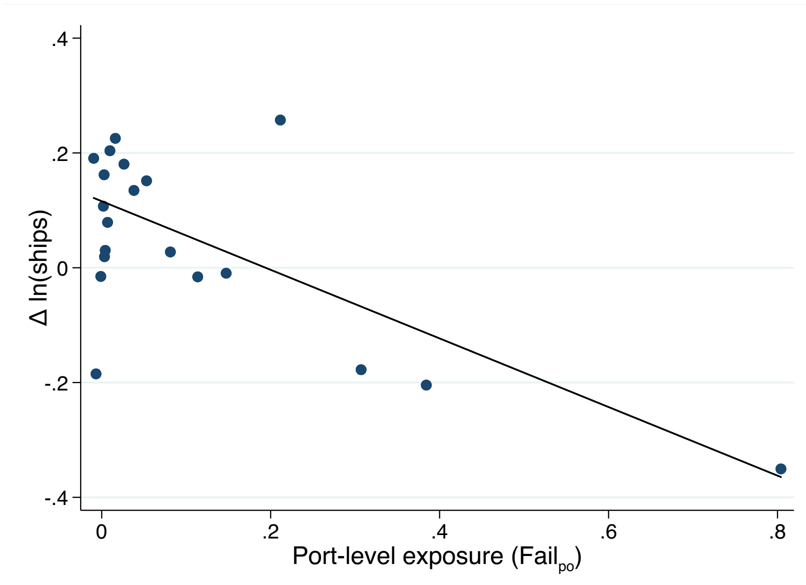
β is the coefficient of interest, which we would expect to be negative if increases in the cost of financing from bank failures reduced exports. Post_t is an indicator for the post-crisis period that control for macroeconomic shocks affecting the exports trend over time. For example, changes due to the overall level of interest rates following the crisis would be absorbed this way. Port fixed effects α_p absorb all time-invariant port-specific differences in levels of shipping, including differences correlated with their exposure to bank failures. Origin-country-period fixed effects γ_{ot} flexibly control for all observed and unobserved characteristics at the country-level that affected shipping. Insofar as ports within countries exported a similar composition of goods pre-crisis, these serve as proxies for any country-level industry specialization shocks such as factor endowment and factor price movements. Including these fixed effects means β is identified off within origin-country variation in exposure to bank failures.[38] Regressions are weighted by the pre-crisis size of ports, measured by shipping activity in the pre-crisis year, to estimate the economically meaningful average effect and to avoid confounding the estimation

[37] I choose 5 quarters to estimate roughly 1 year pre- and post-crisis, allowing for lags in the response time.

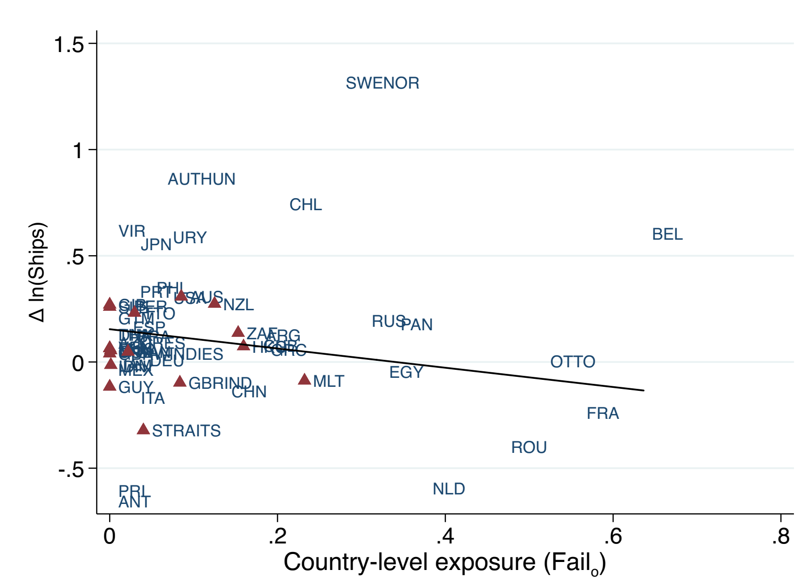
[38] Countries with only one port are effectively dropped from this estimation. These account for 16 of the 578 observations (2.8 percent). These come from 8 ports, which reduces the effective number of countries in the estimation from 54 to 46.

Figure 1.3: *Correlation between exposure to bank failures and shipping in 2 year window*

(a) *Port-level relationship*



(b) *Country-level relationship*



Notes: Figure 1.3a is a binscatter plot of the correlation between the change in the ln number of ships from the post-crisis period to the pre-crisis period (for the crisis occuring on May 11, 1866) and the port-level exposure to bank failures. This plot is residualized on country-level shipping so it plots the within-country relationship. Figure 1.3b is a scatterplot of the correlation between the change in the ln number of ships and country-level bank failures. Countries within the British empire are marked with a red triangle. The full list of country abbreviations (some of which are non-standard to account for colonies) is given in Appendix A.5.4.

with an endogenous post-crisis response. Standard errors are clustered by the country of origin to allow for heteroskedasticity and within-country spatial correlations.[39]

The estimation strategy compares outcomes in port cities that received a large financing cost shock to those that received a small shock before and after the London banking crisis. Unlike a standard DD, the treatment intensity is continuous. The distribution of treatment is well-represented across the entire range of exposure (Figure A2a).

Identification requires that there are no shocks correlated with the bank failures that occurred simultaneously. First, I address these concerns by controlling for all location-level characteristics that are correlated with bank failures. Second, I use another characteristic of the historical context—the nascent international telegraph system—to show that the timing of the effect is consistent with when the news from London would have reached the ports.

Baseline results

Table 1.4 presents the baseline results with controls added individually. The point estimate in column 1, estimated across all ports without the country fixed effects, indicates that ports exposed to complete British bank failure shipped 68.7 percent less than unexposed ports in the post-crisis year. The within-country comparison in column 2 gives a similar magnitude. The similarity in the estimates implies that differences in origin-country characteristics are not driving the main results.

These magnitudes are larger than those estimated by Amiti and Weinstein (2011) and Paravisini *et al.* (2014), who estimate the effect of bank-level shocks on Japanese and Peruvian firms, respectively.[40] There are two likely reasons for the difference: first,

[39] Clustering at the country-level is reasonable because exporting activity is likely to be more correlated within countries than across them. Standard errors could also be clustered by the city of financing to account for serial correlation. Results are robust to clustering by this lower level of aggregation.

[40] Amiti and Weinstein (2011) proxy bank health with a decline in its market-to-book value. Scaling their main coefficient in Table 3 to a 100 percent decline in market-to-book would imply that a firm's annual exports values declined by 9 percent. Paravisini *et al.* (2014) instrument for bank credit supply with the bank's dependence on foreign funding. Scaling their baseline IV coefficient in Table 5 to a 100 percent contraction in bank credit supply would imply a 19.5 percent contraction in the volume of exports.

Table 1.4: *Immediate effect of bank failures on port-level shipping*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Fail}_{\text{po}} \times$ post	-0.687***	-0.655***	-0.670***	-0.659***	-0.596***	-0.557***	-0.394***	-0.327**
	[0.247]	[0.124]	[0.123]	[0.203]	[0.129]	[0.122]	[0.131]	[0.133]
Capital city $\times$ post			Y					
Age of banks $\times$ post				Y				
# non-Brit banks $\times$ post					Y			
Fraction to UK $\times$ post						Y		
$\text{Destination}_{\text{d}} \times$ post FE							Y	Y
$\ln(\text{distance}_{\text{od}})$								Y
$\text{Country}_{\text{o}} \times$ post FE		Y	Y	Y	Y	Y	Y	Y
Port_{p} FE	Y	Y	Y	Y	Y	Y	Y	Y
N	578	578	578	578	578	578	2532	2532
Ports	289	289	289	289	289	289	262	262
Destinations							54	54
Clusters	54	54	54	54	54	54	51	51
β*	-.693	-.66	-.675	-.665	-.598	-.557		
δ	60.98	45.46	47.68	34.96	39.17	41.11		

Notes: Table 1.4 reports estimates from the difference-in-difference regressions from the two-period panel of port-level shipping activity in the year before and after the crisis. The dependent variable in columns 1 to 6 is the ln of the total number of ships departing in each period. The dependent variable in columns 7 and 8 is the ln of the number of ships departing for each destination in each period. Fail_{po} is the share of the port's banks that failed during the crisis. The mean of Fail_{po} is 0.07, and the standard deviation is 0.2. post is a dummy for the post-crisis year that takes the value of 1 after May 1866 and 0 otherwise. The time-invariant control variables are measured in 1865 and interacted with the post dummy. They include an indicator for the port being a capital city within the country, the average ln age of banks, the number of non-British banks, and the fraction of shipping to the UK. Column 8 controls for the ln geodesic distance between the origin and destination countries. The sample is restricted to ports ship in both the pre- and post-period. Results from implementing the Oster (2017) test of selection on unobservable characteristics are reported in the last two rows. β^* is a bound on $\text{Fail}_{po} \times$ post if selection on unobservable is as large as selection on unobservables ($\delta = 1$). δ is the degree of selection on unobservables necessary for the estimated coefficient to be 0. Standard errors in brackets are clustered by country of origin. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

complete bank failure is a qualitatively more extreme outcome than declines in bank health; second, financing frictions in the 19th century are most likely larger than in the modern-day because information frictions were much higher.

Robustness to controls

I address the concern that the bank failures are correlated with other factors that are responsible for the decline in exports by including observable location-level characteristics as controls in the baseline regression. These controls are based on the port-level characteristics that were not balanced between banks that failed and did not fail in Table 2.3 and deal with any confounding effect they may have in driving the results. They include the number of non-British banks, the average age of the banks, whether the port is the capital city, and the fraction of ships going to the UK in the pre-crisis year.[41]

The coefficients in Table 1.4 columns 3-6 after including these controls remain stable and statistically significant. Column 7 shows the coefficients after including all controls. Implementing the recommended bounds in Oster (2017) shows that selection on location-level unobservable characteristics is minimal. These bounds are calculated using changes in the magnitude of the coefficient and the R^2 after controlling for observable characteristics. β^* is the inferred true coefficient if the unobserved bias is as large as the observed bias, and δ is the inferred bias that could induce the estimated β to be zero. I report these as β^* and δ in the last two rows. These calculations show that β^* is almost identical to the estimated β, and that the degree of unobservables bias would have to be at least 35 times larger than the degree of observables bias.

The baseline effects are also not due to demand shocks. Since the United Kingdom accounted for 30% of global trade during this period, a particular concern is that unobserved declines in UK demand are driving the results. I modify Equation 1.7 so that the dependent variable is $\ln(S_{podt})$ where S_{podt} is the number of ships sailing from port p

[41] Bank-level characteristics are aggregated to the port-level using the pre-crisis shares $z_{lb,pre}$ of the importance of each bank to each location.

in country o to destination country d in period t, and I include destination time-trends γ_{dt}.[42] γ_{dt} will accommodate all import demand shocks that might be confounding the effects, especially those from the United Kingdom. In this specification, β is estimated off the variation across ports shipping to the same destination-country.[43] As before, I limit the sample to origin-destination pairs that ship in both periods to isolate the intensive margin effect. Table 1.4 column 7 reports a coefficient of -0.39, which is smaller than the baseline coefficient, but statistically significant at the 1 percent level as before.

Although there is a large amount of heterogeneity in the treatment, the binscatter in Figure 1.3a might raise concerns that the results are driven by a few outliers. I show that this is not the case. Results are robust to trimming or winsorizing the top and bottom 10 percent of the observations.

Allowing for news lags

So far, I have assigned a single treatment date for all ports in the DD estimation. However, in reality there were long communication lags in the mid-19th century because the global telegraph network was not fully connected. Basing the post-crisis event date on May 11 for all ports around the world falsely attributes pre-crisis shipping events to the post-crisis period for ports far away from London, which can bias the difference-in-difference estimates. An alternative method bases the event date of the crisis for each port on the date that news from London would have reached the port. For all ports, I calculate the average news lag between when shipping events occurred and when it was reported in the *Lloyd's List*.[44] For major cities, I validate these calculations with the first local newspaper reporting of the banking crisis.

[42] $\sum_p S_{podt} = S_{pot}$: the sum of shipping to all destinations is equal to the dependent variable in the baseline specification.

[43] Destinations that only ship from single ports within origin countries are effectively dropped from the estimations. These singleton observations account for 5 of the 2,532 observations.

[44] Juhász and Steinwender (2017) similarly use lags in the *Lloyd's List* reports to measure communication times to London before and after the global telegraph network was established. Juhász (2018) uses the *Lloyd's List* data to track port activity during the Napoleonic blockade and document its reliability as a source for trade flows.

Communication times are highly correlated with the geodesic distance, although there are outliers due to the burgeoning telegraph network. Figure A6 shows the relationship between (geodesic) distance to London and the average news lag in days. The last cities to receive the news were those in the interior of China and New Zealand. To allow for some flexibility in the effective arrival date, I mark the month of the news date as spanning two weeks on either side of the calculated news arrival date. I build a balanced panel of shipping activity around the news arrival date to that port. I validate the port-level results using the port-specific news arrival dates to mark the post-period and report the estimates in the appendix.

Intensive margin effects: values of trade

Shipping S is a proxy for the volume of exports which may overstate the true effect if there was an increase in the capacity utilized on ships post-crisis; conversely, it will understate the true effect if ships were filled to lower capacity post-crisis. In addition, overland trade will not be captured by ship movements. I overcome the limitations in the *Lloyd's List* shipping data by using the annual country-level bilateral values of trade dataset to estimate the effects of the bank failures over calendar years.

I estimate the short-term losses in a dynamic difference-in-differences specification for the years 1865-1870:

$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt} \tag{1.8}$$

This specification includes leads and lags to the shock interacted with treatment Fail_o which makes it possible to visualize any pretrends and the evolution of the effect over time. The dependent variable is the log value of exports EX_{odt} (in nominal pounds sterling) from origin country o to destination country d in year t. β_t is the coefficient of interest, which is estimated every year and captures the semi-elasticity of exports values from country o to country d to bank failure exposure.

As in the port-level estimation, I control for the effect of the origin country not having any British banks at all in 1866, which separates the effect of any exposure from the degree of exposure to failed banks.[45] X_{ot} includes pre-crisis country characteristics that are interacted with a post-crisis dummy. Destination-country year fixed effects γ_{dt} control for demand shocks to address the concern that countries exposed to bank failures were exporting to destinations that contracted their demand for other reasons.[46] I omit the covariate for the first year at $t = 1865$ in the estimation and normalize it to zero. Standard errors are clustered at the unit of treatment, the exporter country, following Abadie *et al.* (2017).[47]

Equation 1.8 is the fixed effects estimation of a structural gravity model standard in the international trade literature (Head and Mayer, 2014). Gravity models relate the volume of trade flows to the sizes of the importing and exporting countries and the inverse of the distance (geographic and institutional) between them.[48] I control for the distance between countries dist_{od} as a standard measure of bilateral resistance. Allowing θ_t to vary by year flexibly controls for shocks to the effective distance between countries due to technological advances. The one departure from the standard fixed effects estimation using panel data is the absence of origin-country year fixed effects because those are collinear with the treatment. However, to the extent that Fail_o affects other economic conditions (such as GDP) that also affect exports, origin-country year characteristics are an endogenous outcome and not a suitable control.[49]

Table 1.5 presents the results for the coefficient on Fail_o estimated annually. The

[45] These countries accounted for 2% of the value of exports in 1866, and results are robust to not controlling for the non-exposed group.

[46] Including γ_{dt} as a control variable restricts the estimation to destination countries that import from more than one country.

[47] Other work has concluded that it is important to account for the dyadic nature of trade data (Cameron and Miller, 2014). I show that results are robust to different ways of clustering in Table A5.

[48] Gravity can be micro-founded from most international trade models, including ones featuring perfect competition, monopolistic competition, and monopolistic competition with fixed costs of entry.

[49] Most applications of gravity study the effect of bilateral trade shocks, such as a regional trade agreement or a currency union, which allows for the shock to be at the bilateral country level.

coefficient β_{1865} is statistically indistinguishable from 0 across all specifications, which confirms that there were no pre-trends in the outcomes, and that the decline in trade was concurrent with the banking crisis. In column 2, β_{1867} is interpreted as the log-point decline in exports in 1867 relative to 1866 in countries exposed to bank failures relative to countries not exposed, all exporting to the same destination country. The magnitude is around -1 in all specifications meaning that the average country (exposed to 11 percent bank failures) exported 9.1 percent less in the year after the crisis. This coefficient is larger than the baseline from Table 1.4, which suggests that ships were likely filled to lower capacity post-crisis. Using the longer panel of outcomes also shows that the contractions in 1867 worsen in 1868 and are economically and statistically lower every year until 1870. In section 1.6.1, I explore the long-term effects until the end of the First Age of Globalization in 1914.

1.5.2 Extensive margin effects

Many models of international trade have firms paying a fixed cost in order to export their products (Chaney, 2016; Melitz, 2003). In these models, shocks to the cost of capital will impact the extensive margin of exporting activity if exporters use external finance to pay fixed costs of entry. Empirically, the extensive margin of entry and exit into exporting activity has been shown to explain a large share of the variation in trade flows (Helpman *et al.*, 2008).

I categorize the extensive margin of exporting activity in two ways: the first is the number of unique destinations that a port trades with conditional on trading at all, and the second is the likelihood that a port engages in any international trade. I estimate extensive margin losses to the number of destinations using the specification in Equation 1.7 with the log of the number of unique destinations as the dependent variable. I report the within-country results in Table 1.6 column 2: ports completely exposed to bank failures exported to 29.5 percent fewer destinations than unexposed ports. The effects are

Table 1.5: *Immediate effect of bank failures on country-level values of exports*

$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$						
	(1)	(2)	(3)	(4)	(5)	(6)
β_{1865}	-0.208	-0.240	0.0690	-0.183	-0.260	-0.236
	[0.198]	[0.214]	[0.155]	[0.229]	[0.314]	[0.216]
β_{1867}	-0.842*	-0.921	-1.038	-0.920	-0.921	-0.999
	[0.446]	[0.603]	[0.647]	[0.603]	[0.603]	[0.643]
β_{1868}	-1.835***	-1.611***	-1.732**	-1.611***	-1.612***	-1.599***
	[0.410]	[0.551]	[0.769]	[0.551]	[0.551]	[0.568]
β_{1869}	-1.883***	-1.872***	-1.844***	-1.871***	-1.872***	-1.931***
	[0.338]	[0.410]	[0.447]	[0.409]	[0.409]	[0.418]
β_{1870}	-1.669***	-1.633***	-1.389***	-1.632***	-1.633***	-1.607***
	[0.349]	[0.434]	[0.434]	[0.434]	[0.433]	[0.443]
Controls	Y	Y	Y	Y	Y	Y
$\text{Country}_{\text{o}}$ FE	Y	Y	Y	Y	Y	Y
$\text{Region}_{\text{ot}}$ FE			Y			
$\ln(\text{cotton}_{\text{o}}) \times$ Post				Y		
$\ln(\text{cotton manu}_{\text{o}}) \times$ Post					Y	
$\ln(\text{population}_{\text{o}}) \times$ Post						Y
$\text{I(Brit bank}_{\text{ot}})$	Y	Y	Y	Y	Y	Y
$\text{Country}_{\text{d}}$	Y					
$\text{Country}_{\text{dt}}$		Y	Y	Y	Y	Y
N	2952	2952	2952	2952	2952	2571
Clusters	83	83	83	83	83	67
Adj. R^2	0.573	0.551	0.543	0.551	0.551	0.546

Notes: Table 1.5 reports estimates from the annual dynamic difference-in-difference regressions from the panel of country-level values of trade. The dependent variable is the ln value of exports from origin country o to destination country d. There are 83 exporting countries from 1865-1870. Fail_o is the share of the country's banks that failed. post is a dummy for the post-crisis years 1867-1870. Baseline controls are the log distance between country o and country d. Cotton, cotton manufactured goods, and population are calculated in 1865 and interacted with the post dummy. Countries that did not export cotton are given ln values of zero. Controls for the log of population reduces the sample size due to data limitations. Standard errors in brackets are clustered by the origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

even stronger at the country-level. These results provide suggestive evidence that there were negative spillovers from highly exposed ports to the rest of the country rather than redistribution.[50]

The second test of extensive margin effects categorizes ports as "Entering" into international trade if there is no exporting activity in the pre-crisis period and positive exports in the post-crisis period, and "Exiting" if the reverse is true. I estimate a linear probability model on a one-period cross-section of all ports where E_{po} is an indicator for either Entry or Exit and standard errors are clustered by the origin-country:

$$\Pr(\text{E}_{po}) = \alpha + \beta \text{Fail}_{po} + \gamma_o + \Gamma' X_{po} + \varepsilon_{po} \tag{1.9}$$

The full sample of 377 ports active in either period is 30 percent larger than the baseline sample of intensive margin ports (those active in both periods). 52 of the new ports were entries and 36 were exits, which implies a high degree of turnover in this window.[51] Table 1.6, columns 4 and 6 present the within-country likelihood of Entry_{po} and of Exit_{po}, respectively. The point estimates are economically and statistically significant for Entry and not significant for Exit. A port exposed to the average level of bank failures was 2.4 percent less likely to begin exporting at all.[52]

1.5.3 Limited within-country substitution

Having established that exposure to bank failures caused large intensive and extensive margin declines in shipping at the port-level, I next address whether the contractions in the local economy had aggregate implications at the country-level. To what extent could

[50]These results are analogous to the findings in Huber (2018) that firms within a county that did not directly experience a financing shock still performed worse post-crisis from declines in aggregate demand.

[51]Ports likely remained active in domestic, coastal trade. However, the *Lloyd's List* did not track nor report on these types of ship movements.

[52]Similarly, Berman and Héricourt (2010) find that access to finance influences the firm entry decision, but that it has no effect on the exit decision.

Table 1.6: *Extensive margin effect of exposure to bank failures*

	Port destinations		Country destinations	I(Port Entry)		I(Port Exit)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Fail}_{\text{po}} \times$ post	-0.225**	-0.295***					
	[0.112]	[0.113]					
$\text{Fail}_{\text{o}} \times$ post			-0.484***				
			[0.163]				
Fail_{po}				-0.161***	-0.193**	0.143	0.137
				[0.0499]	[0.0806]	[0.123]	[0.159]
Port controls $\times$ post	Y	Y					
Port controls				Y	Y	Y	Y
Port_{p} FE	Y	Y					
$\text{Country}_{\text{o}} \times$ post FE		Y					
Country controls $\times$ post			Y				
$\text{Country}_{\text{o}}$ FE			Y		Y		Y
N	574	574	108	377	377	377	377
Ports	286	286		377	377	377	377
Clusters	54	54	54	55	55	55	55

Notes: Table 1.6 reports estimates of the effect of the exposure to bank failures on the extensive margin of shipping activity. The dependent variable in columns 1 and 2 is the ln number of unique destinations accessed by ports. The dependent variable in column 3 is the ln number of unique destinations accessed by countries. The sample in columns 1 to 3 is restricted to ports that were active in both the pre-shock and the post-shock periods. The dependent variable in columns 4 and 5, "I(Port Entry)" is a binary variable that takes the value of 1 for a port that was not active in the pre-shock period and became active in the post-shock period, and 0 otherwise. The dependent variable in columns 6 and 7, "(Port Exit)" is a binary variable for a port that was active in the pre-shock period and became inactive in the post-shock period. The sample in columns 4–7 includes all ports that were ever active in the year around the crisis.
All variables are defined the same way as in Table 1.7. Standard errors in brackets are clustered by country of origin. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

exporters ship from a neighboring port? I first estimate the relationship between country-level exposure and shipping, and then I directly estimate the degree of substitution between ports.

I aggregate shipping activity across ports within a country and estimate the country-level analogue of the baseline DD in Equation 1.7. The dependent variable is $\ln(S_{ot})$ where S_{ot} is the total number of ships departing a country per period ($S_{ot} = \sum_p S_{pot}$). Fail_o is calculated according to Equation 1.3 from country-level shares of pre-crisis dependence on individual banks. γ_o controls for time-invariant country-level characteristics. β is identified off across-country variation in the exposure to bank failures, so it is not possible to control for origin-country time trends. However, I do control for pre-crisis country-level characteristics that are correlated with the degree of bank failure. Table 1.7 presents the baseline estimation with the full set of controls and directly compares the port and country-level outcomes. The baseline coefficient in column 2 at the port-level is -0.558, which is almost identical to the coefficient in column 4 at the country-level of -0.595. These estimations reaffirm the patterns shown in Figure 1.3b. Table A4 reports robustness to controlling for all the country-level characteristics.

Next, I directly estimate the degree of substitution among ports in a country by asking whether more exposure to bank failures in the rest of the country benefits a port, controlling for its own exposure. I construct a measure of the average exposure to bank failures in the cities in the rest of the country, leaving out the port's own city of financing.[53] Since it is a city-level measure, it is not collinear with the origin-country trends.[54] I include this measure as an additional control to Equation 1.7:

$$\ln(S_{pot}) = \beta \text{Fail}_{po} \times \text{Post}_t + \psi \overline{\text{Fail}}_{other,o} \times \text{Post}_t + \alpha_p + \gamma_{ot} + \Gamma' X_{pot} + \varepsilon_{pot} \tag{1.10}$$

[53]This measure is calculated by removing each city's contribution from the country-level exposure measure. A measure calculated by port would double-count cities that financed more than one port and generate variation based on the number of ports rather than variation from the differences among cities.

[54]I also estimate specifications without γ_{ot} where $\overline{\text{Fail}}_{other,o} \times \text{Post}_t$ proxies for origin-country trends.

Table 1.7: *Immediate effect of bank failures on port- and country-level shipping*

	Port		Country		Port		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Fail}_{\text{po}} \times$ post	-0.713***	-0.558***			-0.711***	-0.722***	-0.568***
	[0.274]	[0.189]			[0.248]	[0.153]	[0.187]
$\text{Fail}_{\text{o}} \times$ post			-0.505**	-0.595**			
			[0.223]	[0.251]			
$\text{Fail}_{\text{other p,o}} \times$ post					0.0912	-0.421	-0.311
					[0.0715]	[0.426]	[0.401]
ln(sugar) $\times$ post				Y			
non-Brit banks $\times$ post	Y	Y		Y			Y
Port controls $\times$ post	Y	Y					Y
Port_{p} FE	Y	Y			Y	Y	Y
$\text{Country}_{\text{o}} \times$ post FE		Y				Y	Y
$\text{Country}_{\text{o}}$ FE			Y	Y			
post FE			Y	Y			
N	578	578	108	108	578	578	578
Ports	289	289			289	289	289
Clusters	54	54	54	54	54	54	54

Notes: Table 1.7 reports estimates from the difference-in-difference regressions from the two-period panel of port-level shipping activity and country-level shipping activity in the year before and after the crisis. In Columns 1–2 and 5–7, the dependent variable is the ln of the total number of ships departing each port in each period; in Columns 3–4 it is the total number of ships departing each country in each period. Fail_{po} is the share of the port's banks that failed during the crisis, Fail_{o} is the share of the country's banks that failed, and $\text{Fail}_{other,po}$ is the country-level share of bank failures outside of port p. post is a dummy for the post-crisis year. The port controls consist of an indicator for the port being a capital city within the country, the average ln age of banks, the number of non-British banks, and the fraction of shipping to the UK. The country controls consist of the ln of the value of sugar exports in 1865, and the number of non-British banks. Countries that did not export sugar are given a given a ln value of 0. All controls are interacted with the post dummy. The sample is restricted to ports ship in both the pre- and post-period. Standard errors in brackets are clustered by country of origin. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

ψ is the main coefficient of interest. It controls for a port's own exposure to bank failures and measures the semi-elasticity of its own exports to the rest-of-country exposure to bank failures. $\psi > 0$ indicates that a higher degree of exposure in the rest of the country benefits a port, and it implies that exporters from the rest of the country can find alternative financing in the port. $\psi > 0$ would suggest that this channel of within-country substitution could reduce the country-level losses. In Table 1.7 column 6, I report a negative coefficient of 0.311. This estimate is not statistically significant, but it contributes further evidence that exporters were not able to relocate within-country. It provides suggestive evidence that city-level shocks had negative spillovers to the rest of the country.

1.6 Long-term impact on trade

The previous section showed that British bank failures negatively impacted exports immediately after the crisis. In this section, I examine the long-run effects of the temporary financing shock using the full panel of country-level values of exports from 1850-1914. First, I use the across-country variation in exposure to document the persistent effects then on the total values of exports and on bilateral trade relationships. Second, I explore two channels that lengthened the recovery process.

1.6.1 Baseline results across countries

Total exports

First, I show the patterns of divergence in the raw data. In Figure 1.4a, I plot the annual aggregate values of exports for countries binned into above and below-average exposure to bank failure, where the average exposure is defined in the cross-section of countries, and levels for each group are indexed to equal 1 in 1866.[55] This figure shows that before

[55] The patterns are almost identical using medians. Binning the countries into two groups is equivalent to using a standard DD estimator with a treatment and control group.

1866, exports were expanding at the same rate between the two countries so there are no differential pre-trends between the groups, but after 1866 there is an immediate divergence in levels that does not recover.[56] Figure 1.4b graphs the difference between the two groups, which corresponds to the DD estimate with binary treatment.

The permanent divergence arises from a temporary jump in the annual exports growth rates of unaffected countries in the four years after the crisis. In Figure A8, I plot the annual growth rate of exports and show that they are very similar pre-crisis, diverge after the crisis in 1867, and then converge again to the same pattern by 1880. In the pre-crisis period, the average annual growth rates are 12 and 11 percent for the less exposed (solid line) and more exposed groups (dashed line), respectively. This difference is not significant; the p-value for difference in means is 0.77.[57] In 1867 the less exposed group (solid line) grew 31 percent while the more exposed group (dashed line) grew 6 percent, and in 1868 the growth rates were 21 and 12 percent respectively. The cumulative difference in the annual growth rates between the two groups after the first two years is 33.6 percent. This initial difference in export growth rates is the main driver of the average annual difference in growth rates of 1.8 percent per year between groups from 1867–1914.[58]

Next, I benchmark these findings against estimates of the elasticity of trade with respect to geographic distance. Using my dataset, I estimate a trade elasticity of -1.1 to geodesic distance.[59] Relative to this elasticity, increasing an exporter's exposure to bank failures from below to above average is equivalent to increasing its geographic distance

[56] The country-level divergence shown here is another piece of evidence that there was little within-country reallocation of exporting activity.

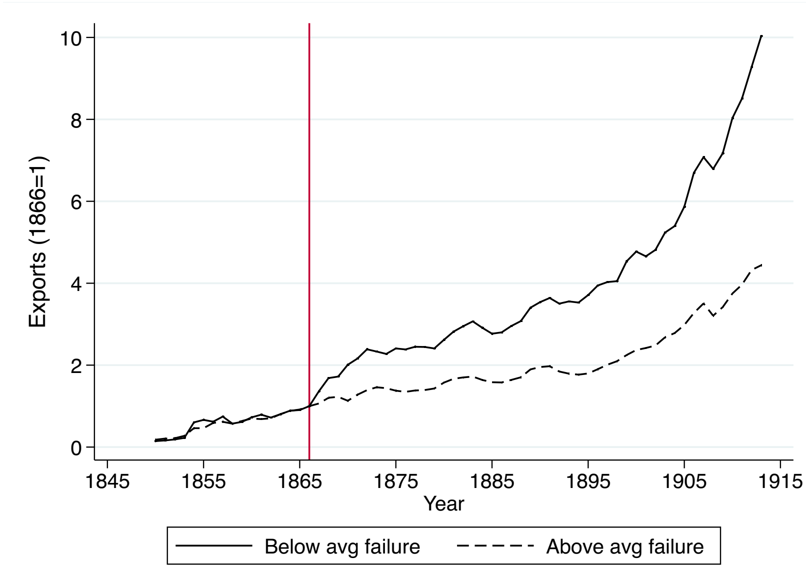
[57] In the immediate pre-crisis period from 1860–1865, the average annual growth rates were 6.4 and 6.0 percent, respectively, and the p-value for the difference in means is 0.92.

[58] The average annual growth rates from 1867–1914 are 4.5 and 2.7 percent for the less exposed and more exposed groups of countries, respectively. This is calculated using the 1914 values of exports, which were 8.47 and 3.59 times the values in 1866 for the two groups, respectively.

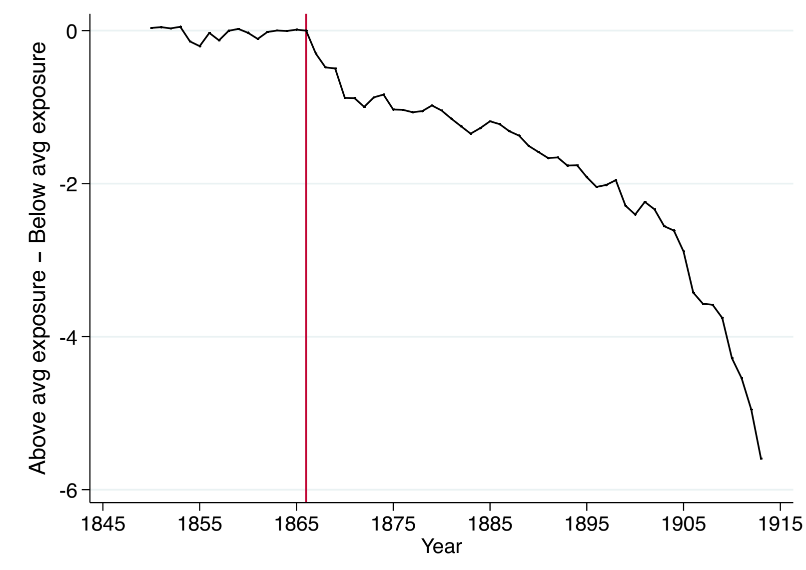
[59] In other words, a 1 percent increase in physical distance between two countries reduces the trade flows between them by 1.1 percent. This elasticity is, coincidentally, exactly the average elasticity found in the literature based on the survey of structural gravity by Head and Mayer (2014). It is slightly larger than the average estimate of -0.93 found in all gravity papers. Table A6 reports the estimates and robustness to controlling for gravity measurements of bilateral resistance.

Figure 1.4: *Aggregate exports, grouping countries by above and below average exposure to bank failures*

(a) *Exports by group*



(b) *Difference between groups*



Notes: Figure 1.4a plots the raw data for the total value of exports by groups of countries from 1850–1914. Countries are binned into two categories: "Below avg failure" refers to countries that experienced below average exposure to bank failures in London, where the average rate was calculated in the cross-section of exporting countries in 1866. "Above avg failure" refers to countries that experienced above average exposure to bank failures. Exports values are normalized to equal 1 in 1866. Figure 1.4b plots the difference between the values for the two groups. The vertical line marks 1866. Figure A7 plots the coefficients and standard errors from the equivalent regression.

to its trading partners by 30.6 percent after the first two years. As a concrete example of the magnitudes, if Spain only exported to the United States, then above average exposure to the shock is equivalent to moving Spain over 1,400 miles to modern-day Turkey.[60]

The impact on exports is much larger than the impact on GDP, although there also appears to be a permanent effect on GDP levels. In Figure A9, I plot aggregate GDP for the same two groups of countries, binned by above and below average exposure to bank failures. The difference in the average annual growth rates in output is only 0.6 percent, which is one third of the difference for exports. As in the Great Trade Collapse of 2008, the difference in exports is much larger than the difference in GDP, so the trade-specific losses cannot be driven by productivity declines that affect output as well.

Bilateral exports

I formally estimate the effect of exposure to bank failures on bilateral exports with Equation 1.8, which allows for demand shocks in the form of destination-country-year fixed effects. I allow β_t to vary annually and at five-year intervals ($[1850, 1855], ..., [1911, 1914]$). β_t should be interpreted as the semi-elasticity of the response to exposure to bank failures in the exporting country by a given importer in a given year. For example, how much less is France predicted to import from Chile (20 percent exposure) than Brazil (2 percent exposure) in the year 1900?

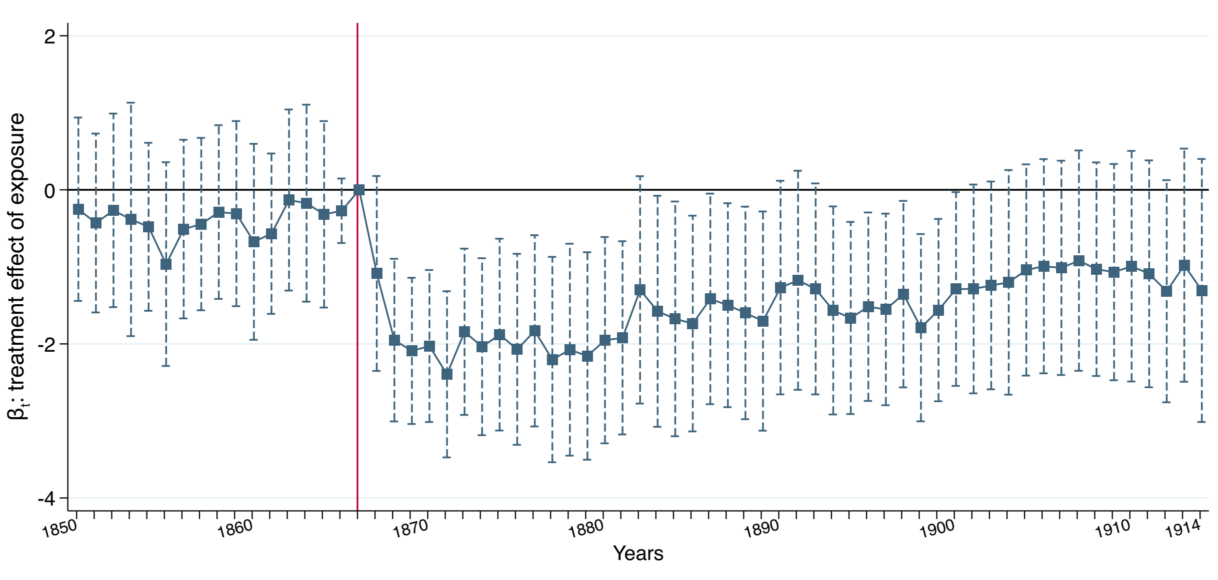
Figures 1.5a and 1.5b plot the estimated β_t coefficients annually and at five-year intervals, where β_{1866} and β_{1861-5} are the omitted categories in each specification, respectively. β_t reflects the relative exports in the cross-section with a continuous measure of exposure and therefore does not necessarily imply a drop in the aggregate levels of world trade. The estimated coefficients support the patterns in the raw data that exposure to the crisis had no effect on exports pre-crisis, but that it immediately lowered trade flows between countries afterward. I report the point estimates in Table A7 (Column 2).

[60] These distances are the shortest route between the geodesic centers of each country. The distance between the US and Spain is 4,715 miles, and between the US and Turkey is 6,327 miles.

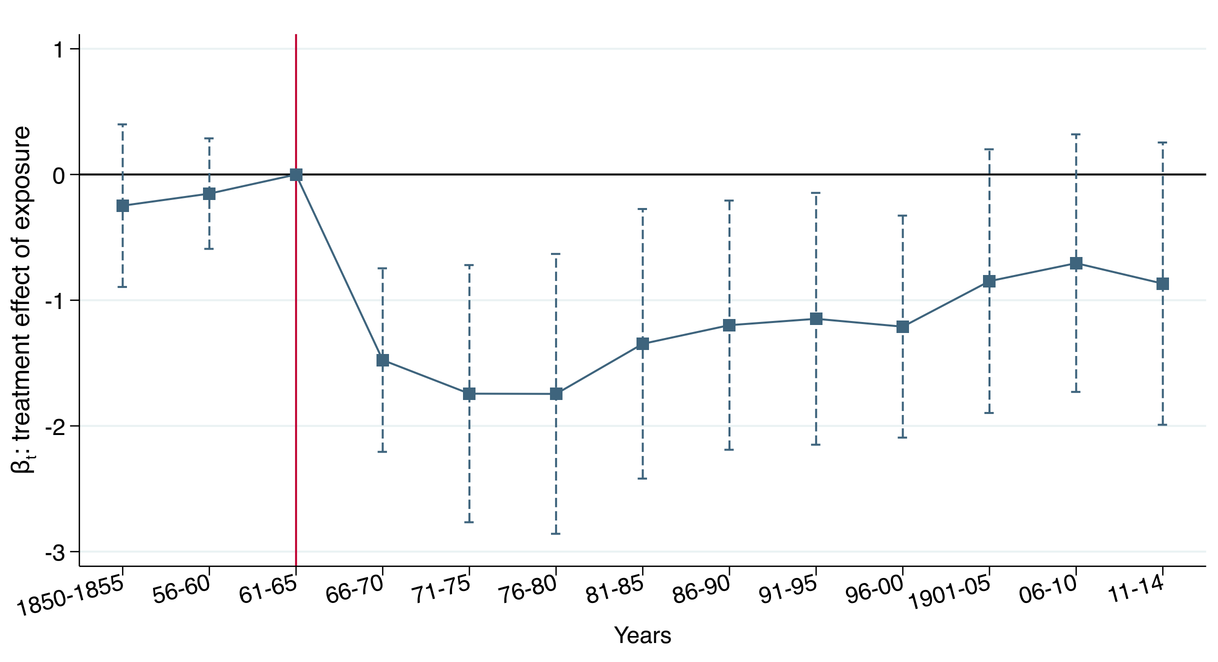
Figure 1.5: *Financing shock has long-term effects on exports*

$$\ln(\mathrm{EX}_{odt}) = \beta_t \mathrm{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\mathrm{dist})_{od} + \varepsilon_{odt}$$

(a) *β_t estimated annually*



(b) *β_t estimated every 5 years*



Notes: Figure 1.5 plots the β_t point estimates and 95 percent confidence intervals for the specification given in equation 1.8 estimated on the country-level panel of trade. The dependent variable is the ln value of exports. The specification includes origin country o FE, destination country-year dt FE, and time-varying controls for the bilateral distance between countries. β_t is the treatment coefficient on the effect of exposure to failed banks on exports in each group of years. Standard errors are clustered by the origin country. See Table A7 column 1 for the point estimates. N = 67,378.

The persistence is striking: destination countries imported less from exporters that had been exposed to bank failures for almost 40 years. The average estimated annual coefficient from 1867–1900 is -1.71 log points. $\beta_{1901-05}$ is the first period when the effect is not statistically different from zero. However, the average magnitude of the coefficients after 1900 is -1.11, which is still 65 percent of the average effect until 1900. The average estimated coefficient from 1867–1914 is -1.53 log points, and given the average exposure of 11 percent, implies that the (partial equilibrium) reduction in world exports during this period was 17 percent per year.

I expand the bilateral estimation to encompass all years from 1850–2014 and plot the estimated coefficients and 95 percent confidence intervals in Figure A10 (coefficients reported in Table A8 Column 2), marking the years corresponding mostly closely to the two world wars. The full time horizon shows that there is a very slow pattern of convergence, with coefficients mostly not statistically different from zero after 1930. However, the estimated coefficient in the final period, $\beta_{2011-14}$ is -0.81, which is 53 percent of the estimated effect from 1867–1914.[61]

The burden of the losses falls on new trade relationships that had not existed before 1866. In Figure A13, I categorize bilateral relationships by whether they are new or pre-existing, and I show that the same exporters had larger losses in their new relationships. This result is consistent with the institutional context in which banks provided the financing that overcame initial contracting frictions between importers and exporters. It also suggests the persistent effects can be driven by the early loss in market share, and that country characteristics that would protect them from those losses would also generate faster recovery.

[61] Table A8 Column 3 shows that among the original group of countries that were active in international trade in 1866, the magnitudes of the effects are as large and statistically significant in 2014 as in the pre-WWI period.

Robustness

I test the robustness of the long-term results by controlling for observable characteristics that could be confounding factors, and by implementing the Fisher exact test.

In Table A7 Columns 3–8, I show robustness to a variety of origin-country controls, including the pre-crisis characteristics that are correlated with bank failures. In Table A9 I report the estimates after including standard gravity covariates, such as shared language, shared land border, and being in the same European empire. Additional robustness includes controlling for pre-crisis and contemporary military conflicts (Table A10); exchange rate regimes pre-crisis (Table A10); industry composition of exports pre-crisis (Table A11); financial crises like sovereign debt, domestic debt, stock market crashes both contemporaneous and in 1865 (Table A13 and A14); and ability to issue long-term debt or equity in London (Table A15).[62] The static and the time-varying versions of all of these controls do not affect the statistical significance or the qualitative patterns of the results.

I also test the robustness of the long-term results by implementing the Fisher exact test for randomization inference. This test is conducted by reassigning treatment randomly without replacement to compare the estimated treatment effect against hundreds or thousands of placebos. This test is one way to check for the possibility that at longer time horizons, countries diverge for other reasons, and the bank exposures are correlated with those long-term changes. Assigning the treatment randomly will show whether the long-term negative effects could arise naturally from the data for reasons unrelated to the banking shock. If that is the case, the distribution of estimated coefficients will become more negative left with each subsequent group of years. If there is no such drift, the distribution should remain around zero, as is the case in randomization tests in the cross-section.

[62]It is only necessary to control for characteristics in the origin-country or between country-pairs because the baseline specification includes destination-country year fixed effects, which will absorb conflicts occurring in the destination country.

In this test, I redistribute the shocks randomly and simulate the data 1,000 times, then estimate the long-term effects in Equation 1.8 using the simulated data. I plot the distribution of the coefficients for each group of five years in Figure A14. These plots show that the coefficients are centered around zero in all periods. The lack of drift suggests that the long-term effects are not likely to have been generated by unobserved processes of divergence.

Banking sector recovery

A natural explanation for the persistent effects is that the banking sector does not recover. Given British banking dominance, the shock in London could have caused a permanent retrenchment in multinational banking, especially in the locations most affected by bank failures. I test this hypothesis explicitly using the city-level panel of banks. I find that multinational banking did not retrench: Figure A11 shows that the global distribution of banks became consistently more widespread and denser with time. I plot the total number of banks and the composition of banks by nationality at the city-level by above and below average exposure to banks that failed in figure A12. Figure A12a shows that cities that were more exposed to bank failures had access to the same number of banks as cities that were less exposed. This figure shows that the persistent effects across countries could not be explained by the size of the banking sector, measured by the number of banks.[63]

While there is no difference in the total number of banks, there is a change in the composition of nationalities among banks. Figure A12b shows that British banks did not tend to return to the locations that had experienced a higher degree of failures, but that domestic and other European banks filled the gap, likely responding to the credit supply gap left by British banks (Figures A12c and A12d). These patterns are consistent with the

[63] A full time-series for the balance-sheet characteristics of all the banks is not available. The balance-sheets for a subset of banks are available in 1901, which I use to verify that banks are of similar average size across nationalities.

historical consensus that after 1870, France and Germany actively sought to expand their financial presence around the world to compete with Britain (Einzig, 1931; Kisling, 2017). However, I formally control for the number of banks of different nationalities and show that these do not alter the persistent effects in the baseline results (Table A16).

1.6.2 Channels for persistence

Having established that exposure to bank failure affects economic activity in the long-run, I explore two channels for the persistent effects: exporters' lack of access to alternative forms of financing and importers' ability to substitute to less credit-constrained exporters. These two channels are trade-specific mechanisms that would address the relative decline in exports relative to output.

Access to alternative financing

Exporters who had more than one banking relationship would have been able to source some credit from these other relationships. The presence of non-British banks could have provided an alternative source of financing that may mitigate the main effects of bank failures. In appendix A.4, I present additional evidence that exports were less affected in trade relationships that can substitute away from British financing.

Immediate effects within countries

I use the port-level panel to test this hypothesis in the short-term using within-country variation. I do not observe non-British financing relationships directly so I proxy for them using the number of non-British banks pre-crisis. I re-estimate Equation 1.7 with an interaction term between exposure to failure and the number of non-British banks:

$$\ln(S_{pot}) = \beta \text{Fail}_{po} \times \text{Post}_t + \phi \text{Fail}_{po} \times \text{non-Brit}_{po} \times \text{Post}_t + \alpha_p + \gamma_{ot} + \Gamma' X_{pot} + \varepsilon_{pot} \quad (1.11)$$

ϕ is the main coefficient of interest: $\phi > 0$ means that conditional on exposure to bank failures, exports were higher in ports that had access to non-British banks. Table 1.8 (Column 2) confirms that having access to more non-British banks pre-crisis mitigated the main losses. At the port-level, there is no correlation between the number of non-British banks and the likelihood of bank failure, so this result is not driven by any trends correlated to non-British banks. The magnitude of ϕ (non-Brit banks $\times$ $Fail_{po}$ $\times$ post) is 34 percent of the baseline effect. The estimated coefficient is statistically significant at the 1 percent level, but the economic magnitude depends on assumptions about the size and effectiveness of non-British banks relative to British banks in providing trade credit. Assuming the same size and effectiveness, the average port had access to 0.6 non-British banks, which means that access to other bank-intermediated finance mitigated the main effect of exposure to bank failures by 20 percent.

Table 1.8: *Port access to alternative sources of financing*

	(1)	(2)
$Fail_{po}$ $\times$ post	-0.936***	-0.805***
	[0.227]	[0.240]
non-Brit banks $\times$ $Fail_{po}$ $\times$ post	0.290***	0.270**
	[0.111]	[0.106]
non-Brit banks $\times$ post	Y	Y
Port controls $\times$ post		Y
$Country_o$ $\times$ post FE	Y	Y
$Port_p$ FE	Y	Y
N	578	578
Ports	289	289
Clusters	54	54

Notes: Table 1.8 reports estimates of the effect of access to alternative forms of financing on shipping activity. The dependent variable is the ln of the number of ships sailed. non-Brit banks is the number of non-British banks in the port's city of financing in the pre-crisis year. All other variables are defined the same way as in Table 1.7. Standard errors in brackets are clustered by the origin-country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Long-term effects across countries

I estimate the long-term effects of gaining access to alternative banking networks by using the nationalities and identities of the multinational banks within each city in the five year windows from 1850-1914. French and German banks are the most important alternatives because they accessed the second and third largest money markets in the world after London, and were created to compete with British banks (Einzig, 1931; Kisling, 2017).

I construct a binary variable called "European bank" ($\mathbb{I}(\text{EB}_o)$) that takes the value of 1 when the exporting country has access to either a French or German bank, and 0 otherwise. This variable proxies for access to the most likely alternative to the London money market. I estimate the following:

$$\begin{aligned}\ln(\text{EX}_{odt}) = \theta_t \text{Fail}_o \times \mathbb{I}(\text{EB}_{od}) + \beta_t \text{Fail}_o + \lambda_t \mathbb{I}(\text{EB}_{od}) \\ + \Psi' \text{X}_{od} + \gamma_o + \gamma_{dt} + \varepsilon_{odt}\end{aligned} \tag{1.12}$$

λ_t absorbs the time-varying effect of access to common banks across all countries. X_{od} are standard gravity variables of bilateral resistance.[64] Figure 1.6 plots β_t in orange and θ_t in blue. Interacting $\mathbb{I}(\text{EB}_o)$ with the exposure to failure each year estimates the additional effect of access to alternative financing for exposed places. The full effect for exposed places is $\theta_t + \beta_t$, which is close to 0 for most years, indicating that countries without access to other financing networks are the ones driving the main losses seen in Figure 1.5.

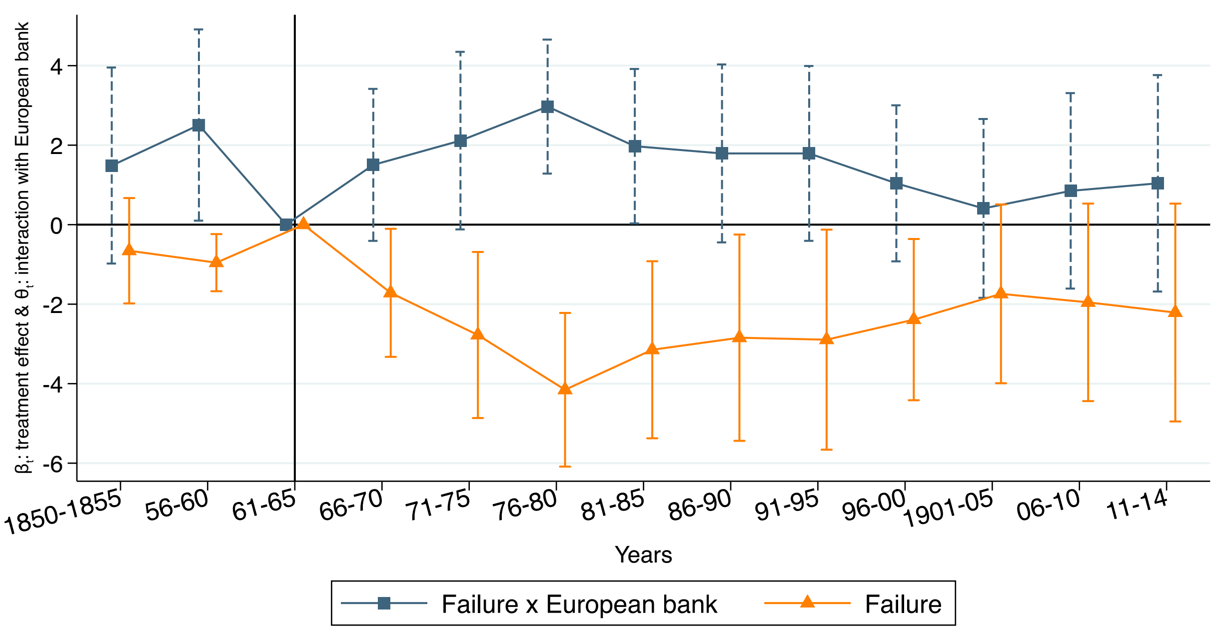
Exports substitutability

In this section, I depart from financial frictions and discuss frictions arising from competition in exports markets. A trade cost shock between parties can lead importers to source from new relationships or to increase the amount they buy from pre-existing relationships. In the 19th century, most countries exported commodities that were produced by multiple other countries, leading to a high degree of substitutability across countries. As an example, a country importing sugar could choose among a number of producers in the Caribbean and South America. Countries exporting the same goods can therefore be

[64] The results are robust to not including them and to allowing them to vary over time.

Figure 1.6: *Recovery is better with access to other banks*

$$\ln(\text{EX}_{odt}) = \theta_t \text{Fail}_o \times \mathbb{I}(\text{EB}_{od}) + \beta_t \text{Fail}_o + \lambda_t \mathbb{I}(\text{EB}_{od}) + \Psi' X_{od} + \gamma_o + \gamma_{dt} + \varepsilon_{odt}$$



Notes: Figure 1.6 plots the β_t and θ_t point estimates and 95 percent confidence intervals for the specification given in equation 1.12 estimated on the country-level panel of trade. The dependent variable is the ln value of exports. The specification includes origin country o FE, destination country-year dt FE, time-varying controls for the bilateral distance between countries, and time-varying indicators for common land border, common European colony, and common language. "Failure $\times$ European banks" is the interaction effect of exposure to failed banks on exports in countries with access to other European banks. "Failure" is the treatment effect of exposure to bank failures for all countries. Standard errors are clustered by the origin country. N = 67,378.

modeled as homogeneous firms with different variable trading costs. A large shock to the cost of exporting from one country can lead competing exporters to enter into that country's markets.

First, I use the industry composition of a country's exports pre-crisis, categorized by two-digit SITC codes, to test for importer substitution among similar countries. The global value of exports by SITC is shown in Figure A1. I calculate the top SITC group by geographic region and include these as time-varying controls. This estimation is restricted to the 44 countries with the exports composition, so the results are noisy, but they indicate no recovery.

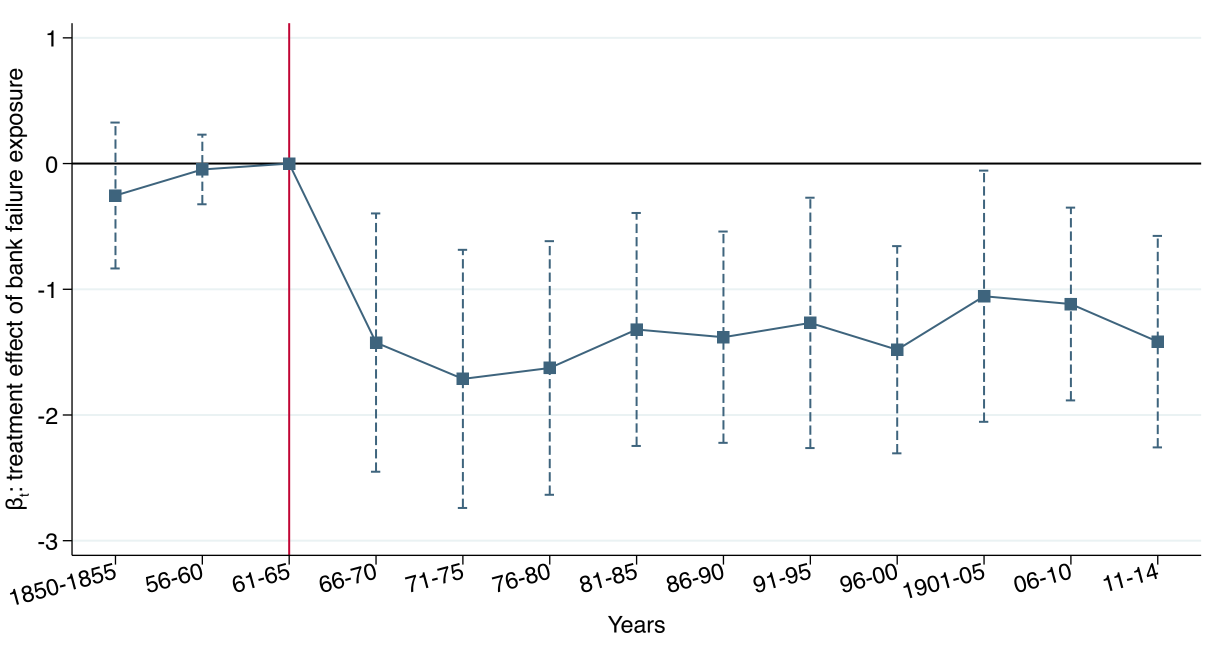
Next, I proxy for similarity in exports products using each country's geographic region to include countries where product-level exports data are not available. I validate that geographic region is a reasonable proxy for the goods exported by evaluating the proxy on the subset of 44 countries with observable industry composition in 1865. For each region, I identify the top three exports categories by SITC codes and calculate the fraction of the total value of exports from the region that fall into those categories.[65] This fraction is equivalent to an exports-weighted average of the cross-country exports concentration within the top three categories. Figure A15 shows that this fraction is above 0.5 for all regions and averages 0.73 across regions, indicating that exports are very similar within region.

I compare the countries within regions to each other by including origin-country region-year fixed effects in the baseline specification in Equation 1.8. The additional controls restrict the variation such that β_t is estimated off comparisons of countries in the same geographic area exporting to the same destination in the same year. Figure 1.7 (Table A7 Column 8) shows that there is no recovery in this setting. The qualitative interpretation is that within regions, countries that are more exposed to bank failures experience exports losses for longer than the other countries in the group. I also re-estimate the baseline with

[65]Each region has at least two countries, and the primary exports for all countries outside of Northwest Europe are raw commodity goods.

Figure 1.7: *Recovery is worse within groups of countries with similar exports*

$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \psi \text{Region}_{ot} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$



Notes: Figure 1.7 plots the point estimates and 95 percent confidence intervals for the specification given above estimated on the country-level panel of trade. The dependent variable is the ln value of exports. The specification includes origin-country region-year FE, origin country *o* FE, destination country-year *dt* FE, and time-varying controls for the bilateral distance between countries. β_t is the treatment coefficient on the effect of exposure to failed banks on exports in each group of years. Standard errors are clustered by the origin country. See Table A7 column 8 for the point estimates. N = 67,378.

region-year fixed effects using the subsample of countries that have SITC information and verify that the patterns are similar. The coefficients are plotted in Figure A18, and the point estimates are reported in Table A7.

Second, I test for positive spillovers within region by estimating the effect of other countries' average exposure on a given country's exports, controlling for that country's own exposure. The prediction is that there should be positive spillovers because a trade cost shock to certain countries will benefit their competitors with similar exports. I find evidence of positive spillovers (Figure A17), but the estimates are noisy.

The sustained persistence of the effects within regions are not driven by the smaller sample comparisons. In a robustness check, I conduct a Fisher exact test for the country groups by simulating 1,000 random group assignments and re-estimating the coefficients. I plot the distribution of the five-year coefficients in Figure A16. This figure shows that the true estimates are very similar to the simulated estimates for the years until 1900. At that point, the true coefficients are larger in magnitude than the average simulated coefficient. These results suggest that substitution in real goods markets, where importers sourced from less exposed countries that could provide similar goods, can explain the persistent effects

1.7 Conclusion

Standard macro-finance and trade models imply that financial crises only affect the real economy as long as the financial sector has not recovered, yet crises lasting just a few years have been correlated with declines in GDP and trade lasting at least a decade. This paper uses a salient historical setting and novel archival data to provide new causal evidence on the real economic effects of bank failures in the long-term. The most severe banking crisis in British history serves as a laboratory where London's role as the global financial center meant that bank failures in London were exported abroad to cities and countries around the world. Exposure to bank failures caused large immediate declines in exporting activity on both the intensive and extensive margins within and across countries, and that the country-level losses persisted for almost four decades.

The main contribution is to document that even a short-lived financing shock can lead to persistent divergence in the geographic distribution of economic activity. The persistent effects are driven by countries without access to alternative bank networks and by those in more competitive exports markets. First, having access to non-British banks mitigates one third of the losses in the short-term and almost all of them in the long-term. Second, the countries whose competitor in major exports markets were highly exposed to the bank failures benefited. Within groups of countries exporting similar goods, more exposed exporters had no recovery by 1914. This hysteresis empirically documents the theoretical argument that one-time trade cost shocks can permanently affect the distribution of trade activity (Baldwin and Krugman, 1989).

The results in this paper contributes to our understanding of the real costs of financial crises, especially in the long-run. The slow post-crisis recovery among advanced countries in recent decades suggests that the historical record is more relevant than ever. It also provides further evidence that international trade is a sector particularly sensitive to the costs of external finance, but it highlights how short-term changes to trade costs affect long-term trade relationships. While this paper focuses on the impact of losing banks that intermediated trade, it also showed that having access to other forms of finance mitigated the long-term losses. Gaining an understanding of how access to finance expanded trade networks in both the current and First Ages of Globalization would be a fruitful avenue for future research.

2 | National Banks and the Liabilities Channel of Local Economic Activity[1]

2.1 Introduction

There is a large literature on the importance of financial intermediaries in economic growth both across countries (e.g. Rajan and Zingales (1998b)) and within the United States (e.g. Jayaratne and Strahan (1996)). Causally establishing the specific role that banks play in promoting growth is challenging because financial institutions are not allocated randomly and the local economic conditions will be correlated with characteristics of the bank itself. In addition, most of the empirical evidence in this literature has focused on the assets side of the balance sheet through the bank lending channel, yet many innovations to the banking sector have been on the liabilities side with, for instance, the introduction of deposit insurance. In the modern economy, there is no variation in the quality of the two most common forms of bank debt—bank notes and demand deposits.[2] While several theoretical papers have shown that banks can issue liabilities that are sufficiently riskless that they can act as a transactions medium (Gorton and Pennacchi, 1990; Stein, 2012),

[1] Co-authored with He Yang

[2] The former is printed by the central bank with some exceptions such as Scotland and Northern Ireland whose currency is supplied by several private institutions, and the latter is government-insured.

there is little empirical evidence demonstrating their effects on the real economy.

In this paper, we explore the effects of secure bank liabilities on the real economy by studying the historical period after the National Banking Act of 1864. The Act created a new class of federally regulated "national banks." With the aim of promoting banking sector stability, regulatory capital requirements were set for national banks based on town population, creating a plausibly exogenous entry cost for new banks in towns near the population cut-off. In addition, it mandated that all national bank notes could be redeemed for their nominal value. These two characteristics of the historical setting therefore provide a natural experiment for local economies gaining access to stable bank liabilities that could better serve as a medium of exchange to facilitate trade and growth.

More specifically, the first key regulatory difference between national banks and pre-existing "state banks" was the capital requirements based on the population of the town in which the bank was incorporated.[3] In towns with fewer than 6,000 people the capital requirement was $50,000, and in towns with 6,000-50,000 people the capital requirement doubled to $100,000.[4] The discontinuous jump means that towns just below the population cutoff at 6,000 faced significantly lower entry costs for establishing a national bank than towns just above the cutoff. These requirements were directly relevant for local national bank entry as the banks were not allowed to branch. In addition, national banks were more circumscribed in their lending practices, which were, in conjunction with the higher equity capital requirements, designed to make them more stable.

The second key regulatory difference was that national banks were required to circulate a standard currency, which grew out of the concerns that uncertainty over the value of bank notes depressed economic activity (e.g. Cagan (1963); Knox (1900)). Prior to the establishment of national banks, state banks printed their own notes that only circulated

[3]State banks were so called because they were chartered under state legislation, which in general were more lax than the newly introduced federal legislation.

[4]The capital requirement was based on the population of incorporated localities, which could be cities, towns, boroughs, or villages in some states. For simplicity we will refer to all localities as "towns" going forward. The capital requirement was $250,000 in towns with population above 50,000.

locally and traded at discounts relative to one another (Ales *et al.*, 2008; Gorton, 1999). The varying discounts introduced spatial and temporal price uncertainty that raised transactions costs. By gaining access to a uniform currency, towns increased their "market access" by reducing trading cost with distant places.[5] We interpret the introduction of national banks as a shock to a town's market access that should positively affect its trade activity.

We use the different regulatory capital requirements as an exogenous source of variation in gaining a national bank by instrumenting for bank entry with town population being below the 6,000 threshold, according to the most recently published census. We focus on the towns that gained a national bank for the first time in order to capture the impact of directly accessing the more stable national bank notes. Our analysis begins with the 1870 census rather than 1860 one to allow for the disruptions caused by the Civil War to equilibrate.

Our sample consists of towns that had fewer than 6,000 people in 1870 and no national bank as of 1875, and had between 4,000 and 8,000 people in 1880.[6] Choosing a small population bandwidth of 4,000–8,000 allows us to limit our sample to towns that are likely to be similar in both observable and unobservable characteristics. Among these similar towns, some crossed the 6,000 population cutoff in the 1880 census, which doubled the entry cost for a national bank. The identifying assumption is that there was not a concurrent shock to lower-populated places that would cause them to grow faster after 1880. We control for observable differences in their growth trajectory as proxied by population growth, a towns financial development in the pre-period as proxied by the number of state banks in the town, as well as the area's transportation condition as proxied by the number of railroads in the county. The predicted first stage is that towns

[5]The term market access is a reduced form expression for the costs of trading with all other places. It arises from general equilibrium trade theory, and the market access for a given location is a function of the sizes and trading costs of transacting with all other locations.

[6]The analysis is not sensitive to choosing 1875 as the first year we calculate whether a town has a national bank. We show robustness to other years in the appendix.

that did not cross the population threshold should be more likely to establish a national bank.

We show that our instrument strongly predicts the likelihood of a town having a national bank in the mid-1880s: having fewer than 6,000 people in 1880 is associated with 30% higher probability of gaining a national bank as of 1885.[7] Controlling for a town's growth trajectory in the pre-period greatly alleviates endogeneity concerns with the relationship between population levels in 1880 and future growth in these places. We also show that pre-period observable characteristics were not significantly different between the towns with a population above 6,000 versus those had below 6,000 population in 1880, both conditionally and unconditionally. The balance on observables further suggests that selection on unobservable characteristics is less of a concern.

Having established that lower regulatory capital requirements increased bank entry, we first show that national bank entry significantly shifted the composition of goods produced toward traded goods while not affecting total agricultural production. Output of traded crops (those listed on the Chicago Board of Trade), such as wheat and oat, crowded out non-traded crops, such as rye and barley. The pure compositional change avoids confounding effects from other bank activities that would also affect the levels of production. It suggests that the shift towards traded products was due to the access to a stable currency that reduced transactions frictions. We also find that national bank entry did not impact agricultural capital that was financed by short-term credit (proxied by fertilizers expenditure) or long-term credit (proxied by the value of land and fixtures on farms). National bank lending to the agricultural sector was overall limited, which is consistent with the evidence that there were restrictions against lending to agriculture (Knox, 1900).[8]

[7] This finding are consistent with Fulford (2015), Gou (2016) and Carlson *et al.* (2018) which also use the population cut-offs governing national banks' regulatory capital requirement in the late 19th and early 20th centuries. This result follows an older literature by Sylla (1969) and Sylla (1982) that the high capital requirements imposed by the National Banking Act hindered financial development.

[8] The call reports do not provide information on the nature of the loans the banks held, so it is not possible to test this directly.

We further demonstrate the positive impact of national banks on trade using direct measures of local trade activity as proxied by employment in trading sectors. In particular, we use contemporary business directories with town-level coverage and the full count Censuses of Population to show that there was a relative increase in the number of commission merchants, buyers, and shippers in places that gained national banks. We also show that placebo professions that might capture general growth, such as architects and doctors, did not differentially benefit from gaining a national bank.

Next, we study the impacts of national banks on the manufacturing sector, as manufacturing products are tradable and therefore the sector likely benefited from the increased trade activity following national bank entry. We use the decennial Census of Manufactures to show that places that gained a national bank experienced significantly greater growth in total production between 1880 and 1890. Accessing national banks caused counties to increase their manufacturing output by $310 per capita from 1880 to 1890 (about $8,620 in 2018 dollars) or about 50% relative to 1880 levels. These results are not driven by the number of state banks before 1880 and the number of railroads in 1880.

The growth in manufacturing output appears to be driven by growth in inputs and employment whereas manufacturing capital was not significantly affected. These results suggest that national banks were unlikely to have facilitated growth through extending long-term loans for capital acquisition (consistent with Fulford (2015)). Instead, outputs growth was likely driven by short-term working capital and liquidity provision operating through the assets side of the balance sheet, as well as transactions costs reduction in inputs and outputs trading operating through the liabilities side.

Since the period we study was a part of the Second Industrial Revolution, when organized industrial R&D within firms emerged (Bruland and Mowery, 2006), we postulate that the significant manufacturing production could also be attributed to innovation. We use the number of patents at the county level as a proxy for manufacturing sector

R&D output.[9] We find that places that gained national banks had higher increases in innovation output, measured by number of patents granted to local inventors. One possible explanation for this result is that the increased trade activity in places gained a national bank led the manufacturers to greater market access and exposed them to more varieties of products, which could therefore incentive innovation for more product differentiation.

Lastly, we examine whether the positive effect of local national bank entry on manufacturing sector growth persisted over time, and find that the elevated levels of production persisted until the 1900s.[10] The initial growth in conjunction with the growth in trade and innovation may contribute to the persistence. In particular, the short-term changes in trade and innovation activity likely gave places with national banks a comparative advantage in the manufacturing sector over a longer period.

Our results indicate that the more stable national banks played an important role in local economic growth, and that the liability channel has first-order impact on production decisions and economic development. However, given that the entry of a national bank brought multiple changes in banking services, it is not possible to fully disentangle the relative importance of asset- and liability-side channels. For example, without detailed information on each national bank's loan portfolio, we cannot rule out the possibility that increased trade activity, proxied by changes in trade-related professions, may also be a result from trade finance provided by national banks.

Our identification strategy follows a number of papers studying bank behavior in the postbellum United States, and in particular those that use the regulatory capital requirements based on population as a source of exogenous variation. For example, Gou (2016) uses the introduction of a new population cutoff in the early 20th century to

[9] We provide evidence that at the county level, the number of patents obtained by local residents was strongly correlated with manufacturing production between 1850 and 1890, and therefore is a reasonable proxy for manufacturing sector R&D in this period.

[10] The county-level data on manufacturing do not exist for 1910, and the levels are no longer significantly different by 1920. Given the large amount of changes that likely occurred in WWI, we stop our analysis on the long-term effect at 1900.

study the effect of capital requirements on bank stability. Similarly to Fulford (2015) and Carlson *et al.* (2018), we focus on the 6,000 cutoff in the 1880 census, and as in Carlson *et al.* (2018) we also control for town population growth following the previous census as a proxy for a town's overall growth trajectory. Unlike Fulford (2015), we use a more geographically disaggregated unit than the county, and in contrast to Carlson *et al.* (2018), we focus on towns that gained a national bank for the first time rather than incumbent entry.[11]

To the best of our knowledge, this paper is the first to provide empirical evidence that secure and stable bank liabilities can positively affect real economic activity by acting as a form of privately issued money. While the large literature on the importance of bank debt liquidity has mostly focused on their fire-sale externalities and their role in raising financial fragility (Admati and Hellwig, 2014; Diamond and Dybvig, 1983; Stein, 2012), this paper studies a context in which they are truly safe assets (backed by federal bonds) and therefore create a Gorton and Pennacchi (1990)-type transactions medium.[12] In addition, our focus is on the real economic effects rather than decomposing and pricing the safety and liquidity premia for these assets (Krishnamurthy and Vissing-Jorgensen, 2012; Nagel, 2016). In that sense, we provide evidence for a sub-national monetary channel in the tradition of Friedman and Schwartz (1965); Romer and Romer (1989).

Furthermore, this paper adds to the literature of the historical determinants of economic growth in the United States. This literature has focused on various factors, such as technological innovations that reduced transportation costs (e.g. Donaldson and Hornbeck (2016)), information acquisition costs (e.g. Feigenbaum and Rotemberg (2014)), or

[11]The concurrent work by Carlson *et al.* (2018) focuses on the role of bank competition and thereby requires a different sample of towns. Their analysis primarily focuses on the asset side of the balance sheet and shows implications for bank lending behavior, leverage, and survival during the 1893 Panic.

[12]Quadrini (2017) develops and calibrates a multi-sector model to show how the financial intermediation sector can impact productivity through the bank liability channel. In his paper, bank liabilities provide insurance for economic agents who become less constrained in their investments, which is different from our monetary channel. Kashyap *et al.* (2002) study the synergy between lending and deposit-taking in liquidity provision, and Pennacchi (2006) shows that the federal safety net provided by deposit insurance promotes banks' ability with liquidity provision. Our paper does not study the implication of stable bank liabilities on lending.

changes in demographics (e.g. Sequeira *et al.* (2018)). This paper is complementary, and contributes to the better understanding of how the banking sector has impacted economic activities in the late 19th century (Carlson *et al.*, 2018; Fulford, 2015; Landon-Lane and Rockoff, 2007; Rousseau and Sylla, 2005; Rousseau and Wachtel, 1998; Weiss, 2018).[13] In particular, our results are consistent with Sylla (1982), which argues that the National Banking Act's high regulatory capital requirements held back economic development by failing to expand the bank note supply sufficiently.

The rest of the paper is organized as follows. Section 3.2 discusses the historical context around the time period studied, and provides motivating facts for the assets and liabilities channels. Section 2.3 explains the data collection, sample construction, and the empirical strategy. Section 3.4 presents the empirical results on the effect of national bank entry on real economic outcomes, such as production in the agricultural and manufacturing sectors, local trade activity and innovation output. Section 2.5 concludes.

2.2 Historical context

In this section, we provide an introduction of the historical background before and after the National Banking Act of 1864.

2.2.1 The Free Banking Era

Between the expiration of the charter of the Second National Bank in 1836 and the establishment of the Federal Reserve system in 1913, there was no unified banking system in the United States.[14] The National Banking Act of 1864 marked an intermediate step when federally-regulated banks operated alongside state-regulated banks. The period

[13]Both Fulford (2015) and Carlson *et al.* (2018) attribute the impact of national banks to the credit channel on the asset side of the balance sheet. While Fulford (2015) studies rural counties that gained national banks for the first time, Carlson *et al.* (2018) studies the role of competitive entry on incumbent banks' lending behaviors.

[14]See Appendix B.4 for more historical background on the First and Second National Bank before the Free Banking Era.

before the National Banking Act was the Free Banking Era. During the Free Banking Era, bank were chartered by their states and were subject to different regulations. State banks were prevented from branching, and interstate banking was forbidden. Regulatory oversight was generally weak, and bank runs and failures were frequent (Grada and White, 2003). There was no formal system of interbank lending nor a lender of last resort, and the banking sector experienced regular periods of booms and busts.[15] As a result, the antebellum banking system was fragmented, loosely regulated, and local economies were exposed to the conditions of their local banks.[16]

A well-known feature of the Free Banking Era was that banks issued their own bank notes which were only redeemable at face value in specie at the originating bank's office. In 1860 on the eve of the Civil War, there were almost 1,600 state banks, each issuing its own bank notes. In large cities, the notes from hundreds of banks circulated at any given time. The fact that there were so many bank notes in different designs means that they were hard to verify and subject to counterfeit. Publications known as "Bank Note Reporters and Counterfeit Detectors" were crucial for determining the legitimacy of a currency. Figure B1(A) displays an example of a private bank note from Massachusetts with face value $20, where the name and location of the issuing bank is prominently displayed. Figure B1(B) shows the written description for the same bank's notes in a printed "counterfeit detector," where the $20 bill is described in the bottom left corner.

The lack of regulatory oversight from state legislations meant that banks often issued notes beyond their redemption capabilities, causing uncertainty in the value of their bank notes.[17] Due to the asymmetric information in bank notes value and the physical redemption costs, the bank notes did not generally trade at par with each other, creating

[15]There were two exceptions: the Suffolk Banking System that served New England banks between 1827 and 1858, and a nonprofit collective founded in 1853 (Weber, 2012).

[16]See Rockoff (1991) for a comprehensive review of the key characteristics of the Free Banking Era.

[17]Milton Friedman referred to the phenomenon of banks over-inflating their currency to the point of not being able to meet redemption as 'wildcat banking,' a term that is now frequently applied to the Antebellum period in American banking. Gorton (1996) shows that discounts on bank debt can also arise from a lack of credit history.

numerous and constantly changing exchange rates among the currencies (Ales *et al.*, 2008; Gorton, 1999). The large volatility in state bank notes value over time also indicates significant time-varying idiosyncratic bank risks. For example, Figure 2.1 plots average discounts of state bank notes in several states relative to banks in Philadelphia.[18] Despite the relatively low cost of acquiring information on the state banks in nearby regions, the discounts and premiums were as high as 10% (Figure 2.1(A)).

The discounts were more extreme for banks located farther away, as it became more costly to verify the operational status of those banks, and information asymmetry problem was exacerbated(Gorton, 1999). Figure 2.1(B) plots the average state bank notes discounts for four states farther away from Philadelphia. The discounts were as high as 80%, which meant that a bank note with face value of $1 in Mississippi would only be worth $0.2 in Philadelphia. The final cost of buying goods in Philadelphia with Mississippi bank notes would therefore be five times the nominal price. Furthermore, under the unit banking structure, local price shocks could also easily lead to more bank failures (Bordo, 1998).

The high levels of relative discounts were sometimes due to falling state bond prices (Rolnick and Weber, 1982) or the anticipation of state bank failures. For example, Illinois banks committed over 5 million dollars between 1836 and 1842 to building a canal that would connect the Illinois River and Lake Michigan, hoping to reduce transportation cost to a larger market. However, this investment completely drained state funds, and caused a wave of state bank failures in Illinois.[19] As a result, the relative discount of Illinois state bank notes averaged at around 70% in 1842, compared to about 15% in the previous year. Similarly, Rockoff (1975) estimates that losses on notes due to bank failures ranged from 7% in Indiana to 63% in Minnesota.

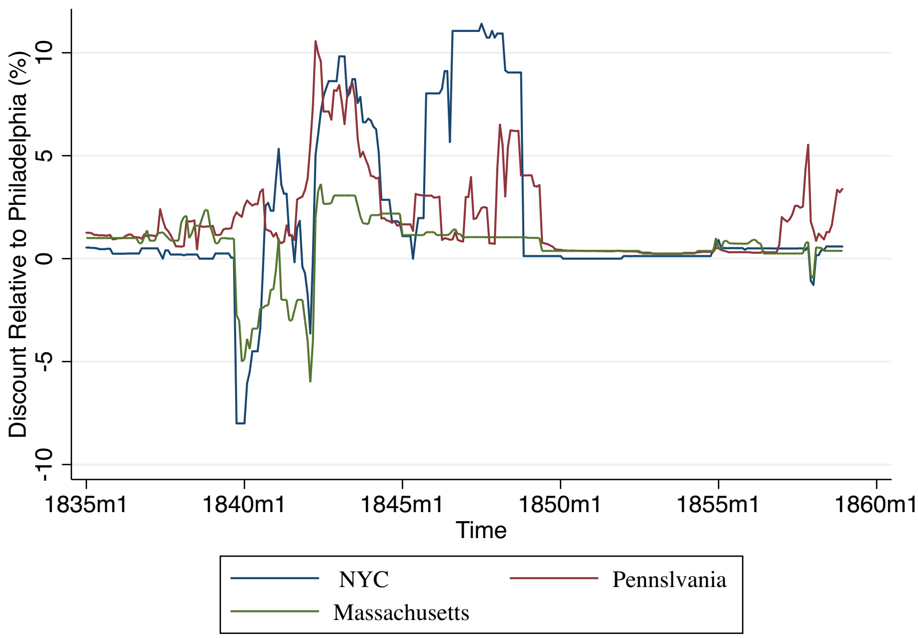
The real costs of uncertainty and volatility from circulating multiple currencies created

[18]This data is collected in Ales *et al.* (2008) and the original source is *Van Court's Bank Note Reporter and Counterfeit Detector* published monthly in Philadelphia between February 1839 and December 1858.

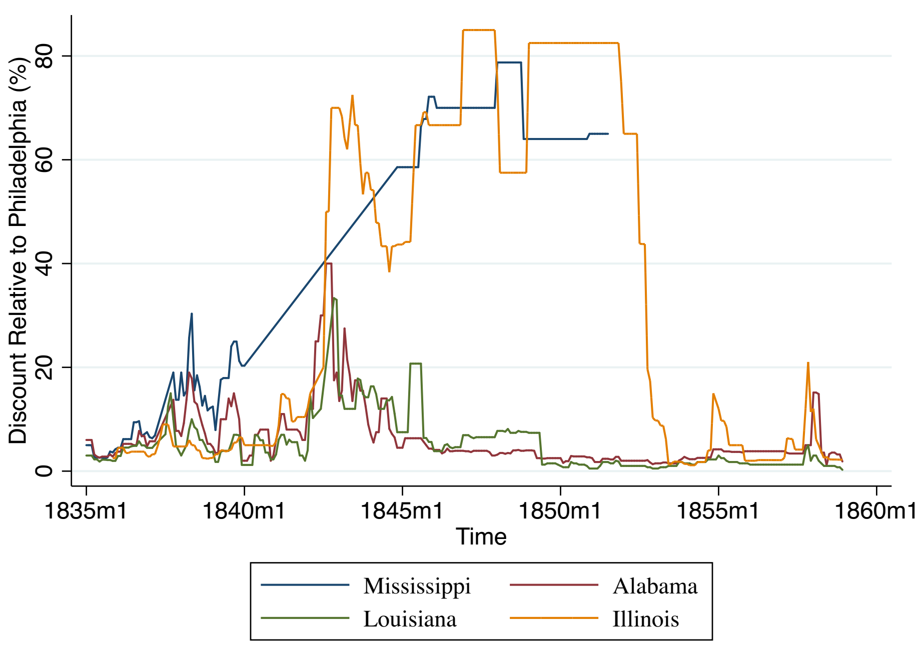
[19]https://cyberdriveillinois.com/departments/archives/teaching_packages/early_chicago/doc3.html State bank notes were usually collateralized with state bonds, and significant drops in the value of collateral often caused bank failures.

Figure 2.1: *Relative discounts on state bank notes relative to Philadelphia*

(a) *Regions close to Philadelphia*



(b) *Regions far away from Philadelphia*



Notes: Figure 2.1 plots the monthly average discounts on state bank notes relative to banks in Philadelphia. Data is from Ales *et al.* (2008). The original source is *Van Court's Bank Note Reporter and Counterfeit Detector* published monthly in Philadelphia between February 1839 and December 1858.

large frictions in exchange and trade, and called attention of policy makers.[20] In 1863, Senator John Sherman from Ohio cited the uncertain values in bank notes as costly for every citizen. In Congress, he argued for the passage of the National Banking Act explicitly in terms of securing a stable medium of exchange:

> This currency will be uniform. It will be printed by the United States. It will be of uniform size, shape, and form; so that a bank bill issued in the State of Maine will be current in California; a bank bill issued in Ohio will be current wherever our Government currency goes at all; and a bank bill issued in the State of Connecticut will be freely taken in Iowa or anywhere else. There is *no limit to its convertibility*. It will be of uniform value throughout the United States. I have no doubt these United States notes will, in the end, be taken as the Bank of England note now is all over the world, as a medium, and a standard medium of exchange [...] They will be safe; they will be uniform; they will be convertible. Those are all the requisites that are necessary for any system of currency or exchange.[21]

The cost of illiquidity of state bank notes, together with the need to raise money for the postbellum federal government, eventually led to the passage of the National Banking Act after the Civil War.

2.2.2 The National Banking Era

The National Banking Act that initially passed in 1863 and was amended in 1864 aimed to stabilize the banking system and create a network of national banks that were subject to federal regulations. The newly introduced national banks differed from state banks in many important ways in this dual-banking system.

First, national bank notes were required by law to have uniform value and be redeemable at all national banks in addition to the issuing bank. The bank notes were backed 110% by federal bonds, which made them risk-free. Compared to the volatility

[20] Weber (2003) shows that antebellum interbank payment system was consistent with trade patterns, which suggests that banks attempted to facilitate trade. See Appendix B.4 for contemporary examples of how the uncertain value of state bank notes led to legal disputes and inconvenience in exchange. More recent scholars, such as Cagan (1963), similarly attribute currency stability to economic growth in the second half of the 19th century.

[21] Senate floor, February 10, 1863; http://www.yamaguchy.com/library/spaulding/sherman63.html

and uncertainty in the value of state bank notes, the stability and convertibility of national bank notes made them a better medium of exchange.

Second, national banks were subject to more strict federal regulations that were designed to prevent bank failures. To limit risk-taking behaviors, national banks were encouraged to make short-term loans and were not allowed to take land as collateral (White, 1998).[22] These restrictions may have limited capital accumulation that would require long-term credit, and essentially prevented farmers to obtain credit from national banks, given their most valuable collateral would be farmland. In contrast, state banks were often encouraged to extend credit to the agricultural sector, and in fact, some states even required a minimum fraction of loans to farmers (Knox, 1900). In terms of the mechanics of regulatory oversight, the Comptroller of the Currency required five reports on bank operations per year, whereas state banks typically reported their balance sheets once or twice a year to state regulators.[23] The restrictions in banking business and more rigorous oversight resulted in stability in national banks — between 1875 and 1890, the average national banks failure rate was about 0.25%, compared to 2.5% of state banks.[24] The significantly higher state bank failure rate suggests that state bank liabilities were risky during the time period we study. Table 2.1 provides a summary of some key distinctions between national banks and state banks.

National banks also shared some similarities with state banks. Most importantly, national banks were prevented from branching and operated both privately and locally. More specifically, any group of 5 or more people could apply for national bank charter together, and the National Banking Act explicitly required that at 75% of the directors must have local residency, limiting their ability to choose locations for bank operation.

To induce state banks' conversion to national banks, the Treasury collected a 2% tax on state bank notes, and increased it to 10% in 1865. The tax greatly diminished state

[22]In contrast, state banks competed with national banks by imposing weaker restrictions on bank portfolios (White, 1982).

[23]See Calomiris and Carlson (2018) for more details on national bank supervision.

[24]Data provided by EH.net.

Table 2.1: *Comparison of National Banks and state banks*

	State banks	National banks
Notes	various backing	backed 110% by federal bonds → uniform value
Capital requirement	low	high → more costly to establish
Monitoring	2 reports/year to state	5 reports/year to OCC → more oversight
Stability	2.5% failure rate	0.25% failure rate → more stable
Lending	no restrictions	high restrictions → less lending to farms

Notes: Table 2.1 lists key distinctions between national banks and state banks. Bank failure rates are calculated for the period between 1875 and 1890.

bank's ability to issue and circulate their bank notes. However, state bank notes were still in use for decades.[25] To compete with national banks, state banks gradually adopted checking accounts, which helped them to issue bank debt without being taxed. Checking accounts provided convenience in transactions, but the uncertainty of their value over time and in more distant places remained — a check could only be cleared when both the status of the banks and that of the personal account could be verified. [26] As a result, national bank notes still had significant advantage in facilitating transactions.

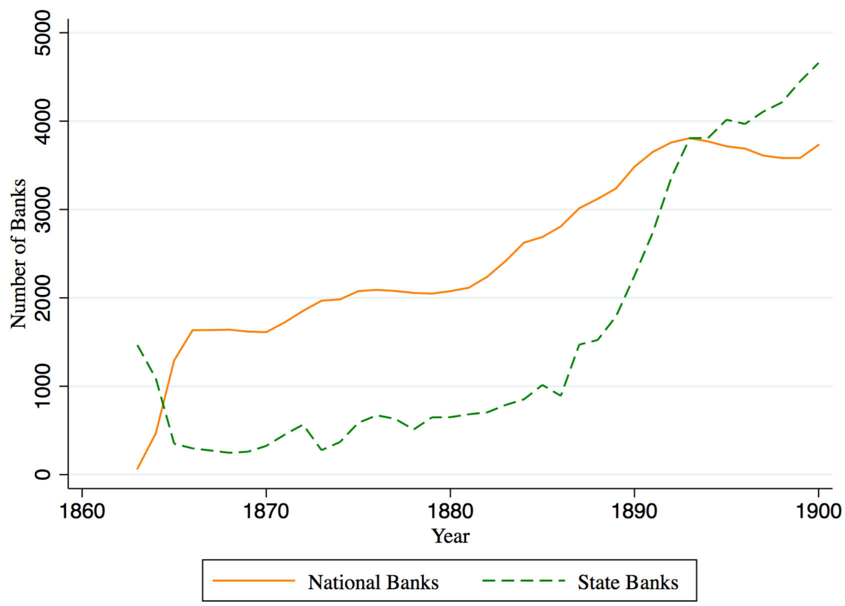
Figure 2.2 shows the evolution of the number and total assets of national banks and state banks from 1863 to 1900. In the aggregate, national banks replaced many state banks in the first few years after the Act (Jaremski, 2014). They grew similarly in both number and total size after 1870, especially between mid-1870s and mid-1880s. We therefore focus on national bank entries during this steady-state growth period in this paper.

[25] As of the second half of 1870s, many *national* banks still report state bank notes outstanding.

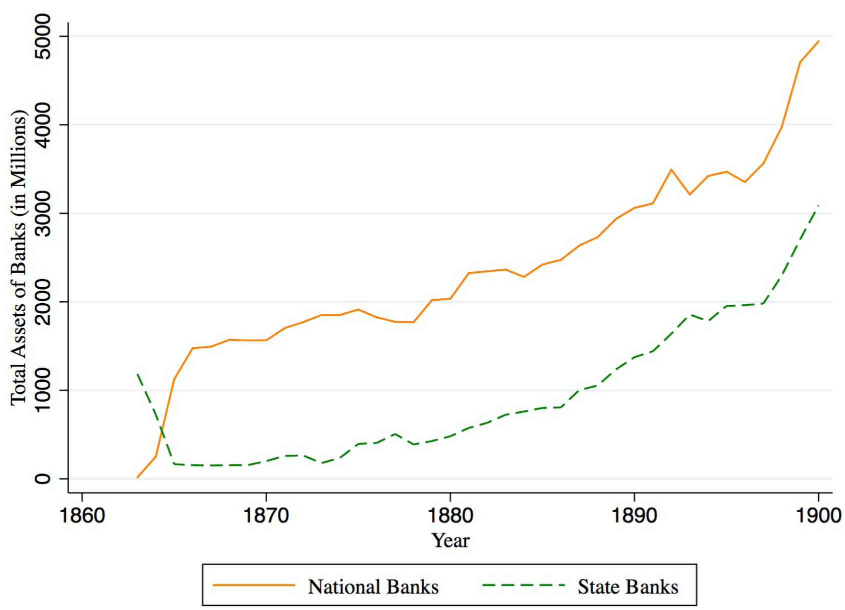
[26] Check clearing also caused more pressure on state banks' reserves, as when checks are deposited and cleared the issuing bank would immediately lose reserves, whereas bank notes could be used to settle transactions without immediate demand for the reserve (Briones and Rockoff, 2005).

Figure 2.2: *National and state banks: (1863-1900)*

(a) *Number of banks*



(b) *Total assets by bank type*



Notes: Figure 2.2 plots the total numbers and assets of national and state banks in the United States between 1863 and 1900. Data is obtained from EH.net operated by the Economic History Association.

In view of the historical context, the National Banking Era provides a unique opportunity to study the impact of financial intermediaries on growth, and it can shed light on the real costs stemming from unstable bank liabilities. Although few private banks issue their own currency in the modern day, the fundamental friction of uncertainty in the value of monetary instruments can be extended to a large variety of assets that are still used for transactional purposes.

2.3 Data & empirical strategy

In this section, we explain our data sources, sample construction, and the empirical strategy for identifying national bank entries.

2.3.1 Data sources

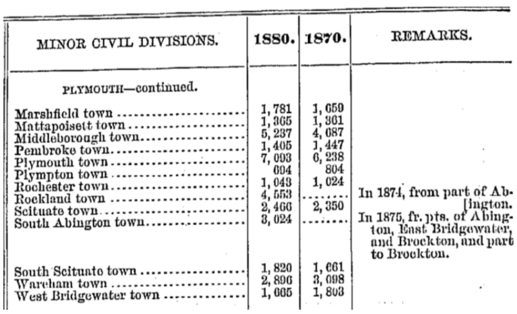
In order to study the effects of national bank entry between the mid-1870s to mid-1880s on outcomes between 1880 and 1890, we combine several historical data sources. Some examples of the raw sources are shown in Figure 2.3. First, in order to obtain city- and town-level population, we use the original reports of the 10th and 11th decennial census. (Figure 2.3(A)) The publicly available digitized census records report total county-level populations as well as population in areas above 2,500 people, but the city- and town-level population data are only available in the original census reports. We therefore manually collected this data on towns and cities.

Second, we use two sources for bank location information. The national bank location data in 1875 is obtained from the Annual Report of the Comptroller of Currency shown in Figure 2.3(B). Locations of national banks in 1885 are obtained from *The Banker's Almanac and Register* of 1885. As we can see from Figure 2.3(C), it provides detailed location information for national banks, as well as state banks and private bankers.

We consider three sets of outcomes. The first set is from the decennial Census of

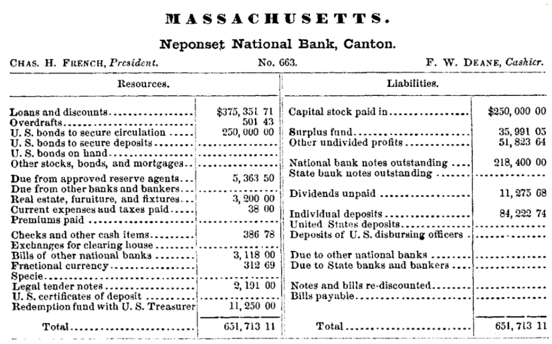
Figure 2.3: *Exhibits of data sources*

(a) *Decennial Census: 1880 and 1890*



MINOR CIVIL DIVISIONS.	1880.	1870.	REMARKS.
PLYMOUTH—continued.			
Marshfield town	1,781	1,659	
Mattapoisett town	1,365	1,361	
Middleborough town	5,237	4,087	
Pembroke town	1,405	1,447	
Plymouth town	7,093	6,238	
Plympton town	694	804	
Rochester town	1,043	1,024	
Rockland town	4,553	....	In 1874, from part of Abington.
Scituate town	2,466	2,350	
South Abington town	3,024	....	In 1875, fr. pts. of Abington, East Bridgewater, and Brockton, and part to Brockton.
South Scituate town	1,820	1,661	
Wareham town	2,896	3,098	
West Bridgewater town	1,665	1,803	

(b) *Annual Report of the Office of the Comptroller of Currency (1875)*



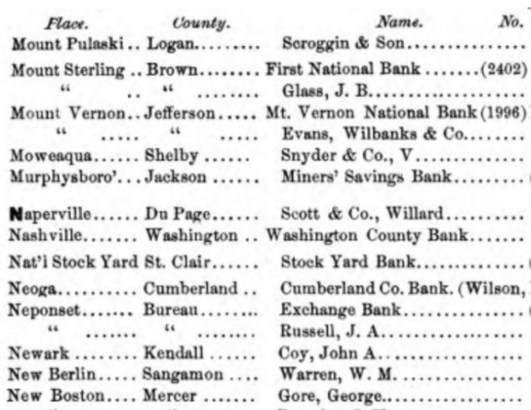
MASSACHUSETTS.

Neponset National Bank, Canton.

CHAS. H. FRENCH, *President.* No. 663. F. W. DEANE, *Cashier.*

Resources.		Liabilities.	
Loans and discounts	$375,351 71	Capital stock paid in	$250,000 00
Overdrafts	501 43		
U. S. bonds to secure circulation	250,000 00	Surplus fund	35,991 05
U. S. bonds to secure deposits	....	Other undivided profits	51,823 64
U. S. bonds on hand	....		
Other stocks, bonds, and mortgages	....	National bank notes outstanding	218,400 00
		State bank notes outstanding	....
Due from approved reserve agents	5,363 50		
Due from other banks and bankers	....	Dividends unpaid	11,275 68
Real estate, furniture, and fixtures	3,200 00		
Current expenses and taxes paid	38 00	Individual deposits	84,222 74
Premiums paid	....	United States deposits	....
Checks and other cash items	386 78	Deposits of U. S. disbursing officers	....
Exchanges for clearing house	....		
Bills of other national banks	3,118 00	Due to other national banks	....
Fractional currency	312 69	Due to State banks and bankers	....
Specie	....		
Legal tender notes	2,191 00	Notes and bills re-discounted	....
U. S. certificates of deposit	....	Bills payable	....
Redemption fund with U. S. Treasurer	11,250 00		
Total	651,713 11	Total	651,713 11

(c) *The Banker's Almanac and Register (1885)*



Place.	*County.*	*Name.*	*No.*
Mount Pulaski	Logan	Scroggin & Son	
Mount Sterling	Brown	First National Bank	(2402)
"	"	Glass, J. B.	
Mount Vernon	Jefferson	Mt. Vernon National Bank	(1996)
"	"	Evans, Wilbanks & Co.	
Moweaqua	Shelby	Snyder & Co., V	
Murphysboro'	Jackson	Miners' Savings Bank	
Naperville	Du Page	Scott & Co., Willard	
Nashville	Washington	Washington County Bank	
Nat'l Stock Yard	St. Clair	Stock Yard Bank	
Neoga	Cumberland	Cumberland Co. Bank. (Wilson,	
Neponset	Bureau	Exchange Bank	
"	"	Russell, J. A.	
Newark	Kendall	Coy, John A.	
New Berlin	Sangamon	Warren, W. M.	
New Boston	Mercer	Gore, George	

(d) *Zell's Business Directory (1875 and 1887)*

MAINE.

Bangor.—Ayer & Plummer——Cram G.——Lord H.——McConville P.——McLaughlin H.——Prescott R. S.——Quimby H. C. & Co.——Sands H. S. & Co.——Stetson & Co.——**STEWART T. J. & CO.**——Veazle A. P. & Co.
Bath.—Woodward S. T.
Calais.—Boardman Bros.
Eastport.—Buxton E. S.——Wadsworth S. L.
Gardiner.—Neal B. A. & Son.
Lewiston.—Crowell C. S. & Co. (prod.)——Maxwell O. M. & Co.

Notes: Figure 2.3 displays screenshots of data sources that require hand-digitization used in this study. Figure 2.3(A) shows the town-level population data source, 2.3(B) shows an example from the 1875 Annual Report of the Comptroller of the Currency, where banks reported their location and balance sheet conditions. 2.3(C) shows bank location information from the *Banker's Almanac and Register* in 1885, and 2.3(D) displays example for local business data.

Manufactures and the Census of Agriculture from 1860 to 1900.[27] We retrieve output, input, as well as capital for both sectors in each county, and we obtain per capita measures by dividing these values by the total number of male laborers above the age of 21. We focus on per capita measures because county boundaries evolved as new counties were incorporated throughout the 19th century, and therefore total production values could be measured incorrectly.[28] In addition, we choose adult male laborers as denominator for two reasons. First, employment by sector was subject to inconsistent reporting both within and across census years (Carter and Sutch, 1996). Scaling outcomes by the number of adult male population therefore allows us to better compare production outcomes between and across sectors and census years. Second, studying outcomes scaled by the labor force also allows us to better understand the relative magnitudes of the various components in each sector, such as capital and inputs. One drawback with the census data is that all values were reported at the county level. In order to better measure the the effect of national bank entry at the town level, we use the ratio of town population in our sample to all town population in the county as analytical weight in all regressions with county-level outcomes.[29]

Second, we obtain city- and town-level business activities from the *Zell's Classified United States Business Directory* in 1875 and 1887. This directory lists names of all businesses and professionals in a town (see Figure 2.3(D) for an example), and to the best of our knowledge, has not been used in prior studies.[30] We counted the businesses in the directory associated with trade-intensive versus not trade-intensive professions for all towns in 1875 and 1887. Since we lack measures of trade flows between towns, we

[27]The Census of Manufacturing does not appear to be available in an easily accessible form for 1910. The next available census of manufacturing is from 1920, but since that was after both WWI and the establishment of the Federal Reserve system, we consider it outside the reasonable period of outcomes to study.

[28]For example, (Hornbeck, 2010) adjusts for farmland size changes.

[29]The census defined town population as the population residing in towns with above 2,500 people.

[30]The 1875 *Zell's Classified United States Business Directory* was digitized by the authors from an original copy in the Boston Public Library. The 1887 directory was obtained from the Baker Business Archives at Harvard Business School.

use the number of commission merchants as a proxy for local trade activity, and use the number of architects, a profession that was unlikely to be associated with trade activity, as a placebo occupation. We also complement the *Zell's* with occupational records from the full count censuses of 1880 and 1900.[31]

Third, we examine the effect on local innovation at the county level using historical patent data from Petralia *et al.* (2016). The data provides counts of all patents granted within counties, which proxy for research and development investments for product differentiation. Summary statistics for the main variables used in this paper can be found in Table 2.2.

In some specifications, we also control for the number of state banks in a town as well as the number of railroads in a county prior to the outcome period. The state banks location data in 1876 is digitized using *The Banker's Almanac and Register* of 1876. Data on railroad access in 1875 and 1880 is obtained from Atack (2016).

2.3.2 Instrument for national bank entry

Our empirical design relies on the differences in regulatory capital requirements imposed on national banks based on the size of the town in which the bank was chartered to operate. We study national bank entry between 1875 and 1885, where the variation in capital requirements were based on population in 1880.[32] We focus on capital requirement differences based on the 1880 census instead of the 1870 one for two reasons. First, some towns changed names and incorporation status during the Civil War, causing a misalignment between 1860 and 1870 census, making it difficult to select towns faced the same lower capital requirements in the 1860s and study national bank entry post 1870. Second, in the first few years after the enactment of the National Banking Act, many

[31]The 1890 full count census was largely lost in a fire, and the full count 1870 census is currently not available.

[32]The mid-1870s to mid-1880s appears to be a steady-state growth period when the respective growth trends of national banks and state banks were similar in the aggregate (Figure 2.2).

Table 2.2: *Summary statistics*

Variable	$Pop_{1880} \in [4000, 6000]$		$Pop_{1880} \in (6000, 8000]$	
	Mean	Std. Dev.	Mean	Std. Dev.
Average No. of national banks (1885)	0.4	0.9	0.7	2
Average No. of other financial institutions (1885)	1.1	2.4	1.4	3.2
Average capital (1884, in thousands)	87	48	170	175
Leverage (1884)	3.2	1.0	3.6	1.6
Bank notes per capita (1884)	12.5	10.3	13.6	13.8
Loans per capita (1884)	46.9	35.5	70.3	51.5
Deposit per capita (1884)	37.2	30.3	46.8	31.5
County-level per capita changes (1880:1890):				
Δ Manufacturing production	72.9	163.6	135.6	528.2
Δ Manufacturing inputs	.6	100.6	61.2	445.1
Δ Manufacturing capital	206.4	179.9	284	308.8
Δ Agricultural production	-25.8	35.1	-23.6	23.3
Δ Agricultural fixture value	-136.5	207.1	-92.70	199.8
Δ Fertilizers expenditure	0.3	1.0	0.2	1.1
Δ Commission Merchants (Town-level, 1875-1887)	0	0.52	-0.27	0.93
Δ Architects(Town-level, 1875-1887)	0.26	0.60	0.41	0.67
% Δ Buyers and Shippers (County-level, 1880-1900)	0.89	1.19	0.60	0.73
% Δ Architects(County-level, 1880-1900)	0.75	1.13	0.99	1.68
% Δ Patents(County-level, 1870s-1880s)	0.53	0.72	1.25	3.12
Number of Observations	126		22	

Notes: Table 2.2 presents descriptive statistics of conditions of national bank in the sample as well as main variables used in the paper. Number of national banks and other financial institutions are obtained from the *Banker's Almanac and Register* of 1885, and bank balance sheet data is from the Annual Report of the Comptroller of Currency in 1884. County-level per capita changes in manufacturing and agricultural sector outcomes are calculated from the decennial Census of Manufacturers and Census of Agriculture in 1880 and 1890. Outcomes are scaled by number of male population above age 21. Town-level changes in the number of commission merchants and architects are calculated from the *Zell's Classified United States Business Directory* in 1875 and 1887. County-level percentage changes in buyers and shippers, and architects are calculated from the full-count census in 1880 and 1900. Percentage changes the number of patents are calculated from historical patent data assembled by Petralia *et al.* (2016).

national banks were formed by conversion from state banks (Jaremski, 2014). These state banks often had large capital stock even though the official requirements were in general low. As a result, the capital requirement stipulated by population cutoff only had a weak impact on entries of national banks in the earlier period.

Specifically, the regulation required that:

$$\text{Capital stock paid in} \geq \begin{cases} \$50,000 & \text{if population} \leq 6{,}000 \\ \$100,000 & \text{if } 6{,}000 < \text{population} \leq 50{,}000 \\ \$250,000 & \text{if population} > 50{,}000. \end{cases}$$

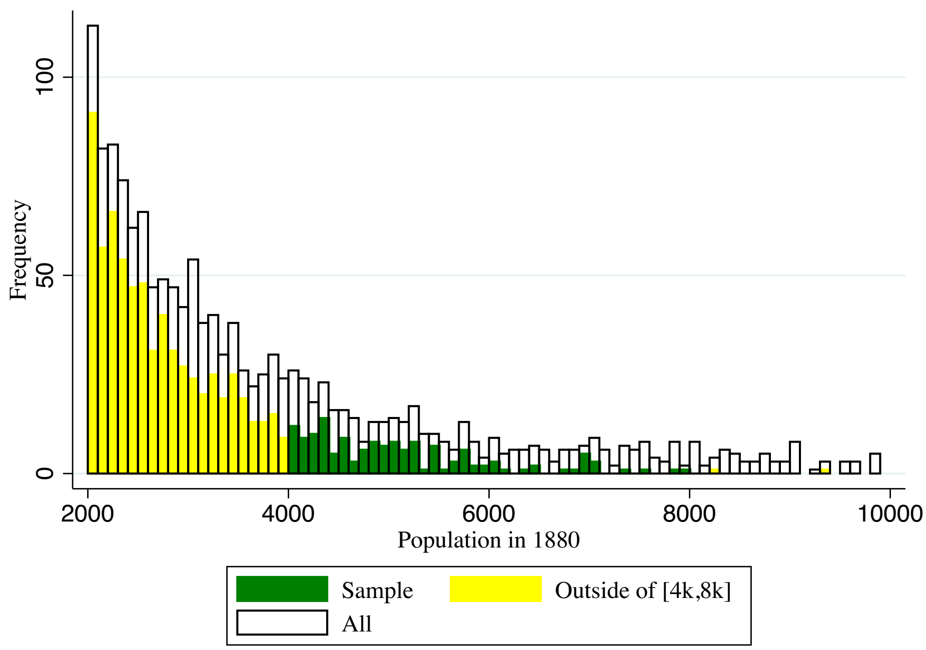
We focus on the cutoff at 6,000 and use the indicator of a town having below 6,000 population as an instrument for bank entry. [33] It is worth noting that the $50,000 difference in required capital was not trivial for a town in the 1880s: within our sample, it is about 140 times of average manufacturing wage in 1880. In addition, due to the no-branching rule, bank owners could not apply for a national bank charter in a small town but conduct business with customers from a large town. Furthermore, the residency requirement on bank directors also imposed frictions for towns to seek capital outside of the town.

Figure 2.4 shows the distribution of town size for all towns with between 2,000 and 10,000 population in 1880, represented by the uncolored bars. The colored bars represent all towns with fewer than 6,000 people in 1870 that did not have a national bank as of 1875. The insufficient mass in the immediate vicinity of the 6,000 cutoff prevents us from taking full advantage of a regression discontinuity design. We therefore study towns within a slightly larger population bandwidth — those with 4,000 to 8,000 population in the 1880 census (represented by the green bars in Figure 2.4).

Selecting towns with fewer than 6,000 residents in 1870 implies that these towns all

[33] Gou (2016), Fulford (2015), and Carlson *et al.* (2018) also use such variations in capital requirements in their respective work.

Figure 2.4: *Histograms of town population in 1880*



Notes: Figure 2.4 plots the frequency of all towns with 2,000 to 10,000 population in 1880 census (labeled "All"), as well as after restricting the sample to having below 6,000 population in 1870 and not having a national bank in 1875 (green and yellow bars). The green bars labeled "Sample" show 1880 population distribution. All town population data is digitized by the authors from the original census reports.

faced the same lower entry cost before the publication of the 1880 census. This allows us to use differences in bank entry cost after the 1880 census to study subsequent bank entries and economic outcomes, as some of these towns crossed the 6,000 threshold which doubled a national bank's entry cost. As an example, consider Town A and Town B, each with 4,000 residents as of the 1870 census. In 1880, Town A grew to a population of 5,000, whereas Town B grew to 7,000 people. Without the capital requirement, the larger population in Town B would likely cause it to have higher demand for banking services. However, the capital requirement imposed a bank entry cost on Town B that was significantly higher than that of Town A.

The location distribution of towns in our sample is shown in Figure 2.5. Figure 2.5(A) separately indicates towns that had populations between 4,000 and 6,000 and those between 6,000 and 8,000 as of 1880. The map shows that our sample contains more towns in the northeast, and fewer in the south and the west. Figure 2.5(B) labels the towns that gained at least one national bank between 1875 and 1885 versus those that did not gain a national bank during this period.[34]

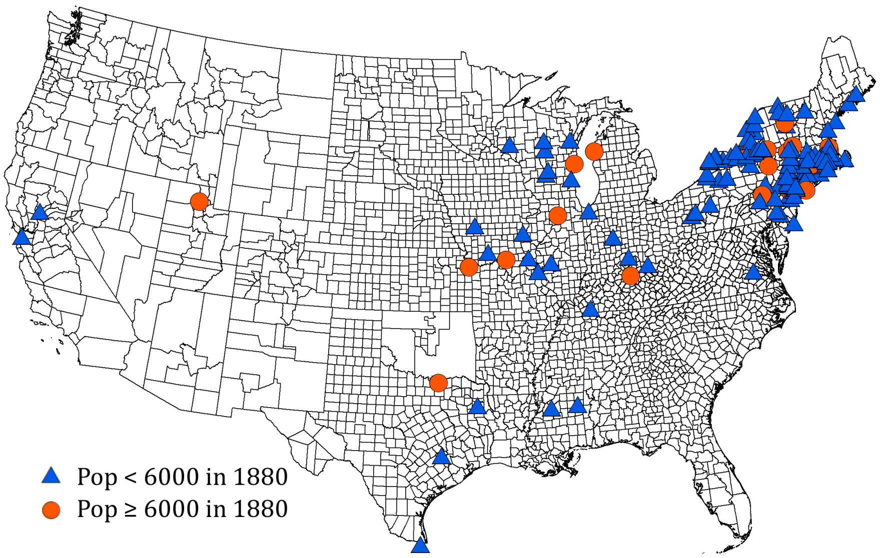
2.3.3 Pre-period balance

The identifying assumption for our instrument to be valid is that the towns were similar in other respects except for likelihood of bank entry. We address this concern in two ways. First, focusing on a relatively narrow population bandwidth around the 6,000 cutoff partly addresses the concern that the towns were not comparable. Second, we provide evidence that the average observable characteristics of towns in our sample are not significantly different as of 1880 except for in population. Panel A of Table 2.3 shows that the average difference in 1880 population between the two groups of towns is about 2,100, and the difference is mostly driven by larger population growth from 1870 to 1880. The number of state banks in these towns, number of railroads in 1875 and 1880, as well

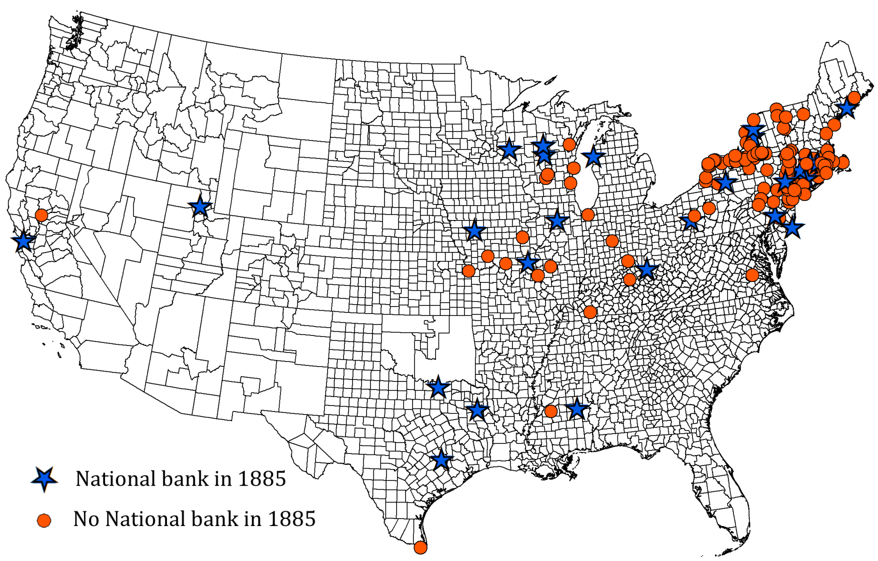
[34] Figure B2 shows the location distribution of all national banks in 1885.

Figure 2.5: *Maps of towns in the sample*

(a) *Towns in the sample*



(b) *Newly added national banks*



Notes: Figure 2.5 maps the locations of towns in the sample. Panel A plots all towns in the sample above versus below the 6,000 population threshold. Panel B plots the locations of newly added national banks in our sample.

as log market access cost in 1870 (calculated by Donaldson and Hornbeck (2016)) are all similar for the two sets of towns. Furthermore, average manufacturing and agricultural production, capital, as well as number of establishments were not different between these places, as shown in Panels B and C of Table 2.3.

The significant differences in population growth from 1870 to 1880 between the larger and smaller towns might raise the concern that crossing the 6,000 cutoff in 1880 may be correlated with later outcomes through non-bank channels. For example, places that rapidly expanded in the previous decade could continue to grow faster due to agglomeration effects. We therefore control for population changes between 1870 and 1880 to account for a town's overall growth trajectory in our analysis as in Carlson *et al.* (2018). For robustness, we also control for the number of state banks in a town as of 1876 and the number of railroads in 1875 or 1880 in some specifications. The number of state banks could proxy for a town's overall financial conditions before the outcome period, and the number of railroads could proxy for the area's overall transportation development. Both factors could also be important determinants for a place's future economic development.

2.3.4 First stage results

We show that our instrument is relevant for national bank entry through the first stage regression:

$$\mathbb{1}(\text{National Bank})_{i,s} = \beta \times \mathbb{1}(\text{Pop1880} < 6000)_{i,s} + \Gamma' X_{i,s} + \eta_s + \epsilon_i \tag{2.1}$$

for town i in state s. $\mathbb{1}(\text{National Bank})_{i,s}$ is an indicator variable for having at least one national banks in the town as of 1885, and $\mathbb{1}(\text{Pop1880} < 6000)_{i,s}$ is an indicator variable for having a town population below 6,000 in 1880 census. $X_{i,s}$ denotes town characteristics — population changes between 1870 and 1880, and in some specifications, the number

Table 2.3: *Pre-period covariate balance*

Panel A: Covariate balance

	All	Pop in [4k,6k]	Pop in (6k,8k]	Diff
Population in 1870	3970.9	3881.3	4484.1	602.8
	(1095.4)	(1032.5)	(1315.0)	(0.02)*
Population in 1880	5059.9	4743.6	6871.5	2128.0
	(924.6)	(526.9)	(541.4)	(0.00)***
Δ Population(1870:1880)	1089.0	862.2	2387.5	1525.2
	(1182.6)	(1055.7)	(1039.8)	(0.00)***
No. of state banks in 1876	0.6	0.6	0.8	0.2
	(1.0)	(1.0)	(1.0)	(0.49)
No. of railroads (1875)	4.4	4.5	3.9	-0.5
	(2.7)	(2.6)	(3.0)	(0.39)
No. of railroads (1880)	5.2	5.3	4.6	-0.7
	(2.9)	(2.8)	(3.2)	(0.31)
Log market access cost (1870)	15.8	15.8	15.8	-0.1
	(0.5)	(0.5)	(0.5)	(0.53)
N	148	126	22	148

Panel B: Covariate balance (census outcomes in 1880)

	All	Pop in [4k,6k]	Pop in (6k,8k]	Diff
Manufacturing, production (1880)	625.5	613.4	694.6	81.1
	(458.2)	(445.7)	(530.7)	(0.45)
Manufacturing, capital (1880)	372.4	369.0	391.9	22.9
	(278.6)	(277.0)	(293.8)	(0.72)
Manufacturing, establishments (1880)	23.9	24.2	22.2	-2.0
	(8.5)	(8.2)	(10.0)	(0.30)
Agriculture, production (1880)	148.4	152.3	126.5	-25.8
	(89.8)	(91.9)	(74.9)	(0.22)
Agriculture, capital (1880)	31.7	32.6	26.5	-6.1
	(19.2)	(19.6)	(16.3)	(0.17)
Agriculture, establishments (1880)	230.1	232.9	213.8	-19.1
	(126.6)	(127.5)	(122.7)	(0.51)
N	148	126	22	148

Panel C: Covariate balance (census outcomes in 1870)

	All	Pop in [4k,6k]	Pop in (6k,8k]	Diff
Manufacturing, production (1870)	662.7	666.7	640.3	-26.3
	(500.9)	(511.4)	(446.7)	(0.82)
Manufacturing, capital (1870)	347.4	349.9	333.1	-16.8
	(273.7)	(281.7)	(228.1)	(0.79)
Manufacturing, establishments (1870)	30.4	31.0	26.8	-4.2
	(11.5)	(11.1)	(13.5)	(0.11)
Agriculture, production (1870)	230.4	237.4	191.2	-46.1
	(133.7)	(135.4)	(118.6)	(0.14)
Agriculture, capital (1870)	37.3	38.8	28.6	-10.2
	(24.9)	(25.4)	(19.8)	(0.08)
Agriculture, establishments (1870)	220.2	222.2	208.7	-13.5
	(125.1)	(124.0)	(133.4)	(0.64)
N	147	125	22	147

Notes: Table 2.3 compares the average characteristics of towns above versus below the 6,000 cutoff in or before 1880. The first column shows the means (and standard deviations in parentheses) for each variable for All towns in our sample. The second and third columns restrict the sample to places with 4,000 to 6,000 population in 1880 census and 6,000 to 8,000, respectively. The last column shows the differences in means (and p-values in parentheses) on balance t-tests between the two samples. All values for census outcomes are per-capita based on the male population above age 21. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

of railroads in 1875 and the number of state banks in 1876. η_s denotes state fixed effects. Results presented in Panel A of Table 2.4 indicate that having population below 6,000 in 1880 is strongly associated with the likelihood of obtaining a national bank in 1885. This positive relationship is robust to controlling for railroad access and number of state banks in the towns. The point estimate suggests that the lower regulatory capital requirement is associated with roughly a 30% higher chance of having a national bank. Although conversion from state banks to national banks was concentrated in the years between 1863 and 1866, the statistically significant relationship between the number of state banks in a town in 1876 and having a national bank in 1885 suggests the likelihood that some national banks in our sample had been converted from state banks.

The relevance of the instrument for national bank entry can be further demonstrated using falsification tests with alternative population cutoffs near the 6,000 threshold. These falsification tests address the concerns that national banks tended to establish in smaller and maybe younger towns due to expectations for higher future growth. We show that the strong first stage results are unlikely to be induced by factors other than the capital requirements in the National Banking Act, as indicated by results presented in Panel B of Table 2.4.

Next, we show that pre-period observable characteristics were not sorted by the population cutoff at 6,000, conditional on population growth and state fixed effects. Figure 2.6 plots unstandardized coefficients from the regression

$$Y_{i,s} = \beta \times \mathbb{1}(\text{Pop1880} < 6000)_{i,s} + \Delta pop_{i,s} + \eta_s + \epsilon_i, \tag{2.2}$$

where $Y_{i,s}$ denotes various county-level outcomes from the Census of Manufacturers and Census of Agriculture in the periods 1870 and 1880, railroad access in 1875 and 1880, market access cost in 1870, as well as the town-level number of state banks in 1876. The number of state banks in 1876 and railroad access in 1875 and 1880 could

Table 2.4: *First stage regressions*

Panel A: First stage: preferred cutoff (6k)

	1(National Bank)	
	(1)	(2)
1(pop<6k)	0.305***	0.286***
	(0.104)	(0.0997)
Δ Pop(1870:1880)	0.000135***	0.000133***
	(0.0000354)	(0.0000341)
No. of railroads (1875)		-0.00349
		(0.0159)
No. of state banks (1876)		0.137***
		(0.0398)
State FE	Y	Y
Adj. R^2	0.229	0.289
N	148	148

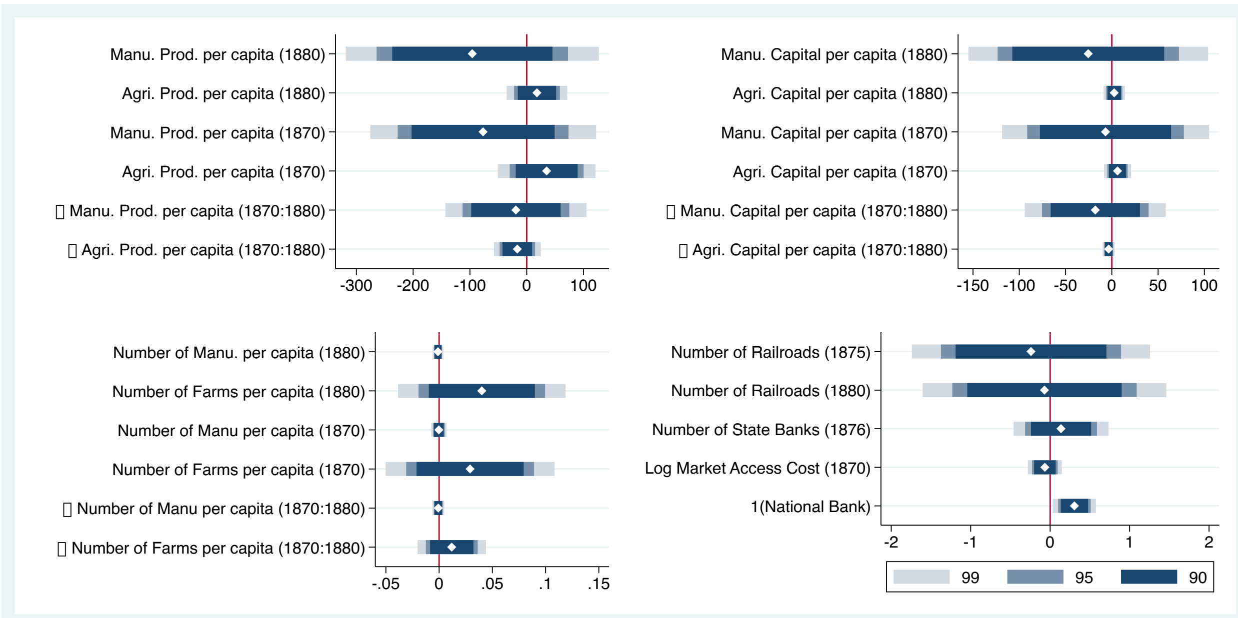
Panel B: First stage: alternative cutoffs

	(1) 5000	(2) 5500	(3) 6000	(4) 6500	(5) 7000
Population Cutoff	0.0646	0.103	0.305***	0.219*	0.209
	(0.0729)	(0.0922)	(0.104)	(0.113)	(0.147)
Δ Pop(1870:1880)	0.0000964***	0.000104***	0.000135***	0.000107***	0.000100***
	(0.0000348)	(0.0000364)	(0.0000354)	(0.0000336)	(0.0000336)
State FE	Y	Y	Y	Y	Y
Adj. R^2	0.180	0.183	0.229	0.199	0.188
N	148	148	148	148	148

Notes: Panel A of Table 2.4 presents results from the first stage regressions:
$x_t = \alpha + \beta * 1(\text{Pop1880} < 6000) + Z_t + \epsilon_t$ where x_t is either an indicator of gaining at least one national bank, or the number of national banks. Panel B presents results of the first stage regression using indicator of having at least one national banks in 1885 as dependent variable, and various population cutoffs as the RHS variable. * p<0.1, ** p<0.05, *** p<0.01.

be considered proxies of general conditions of a place's financial development and market access, which could influence growth potential in later decades. Similarly to Table 2.3, towns that were above or below the 6,000 cutoff did not have significant differences in all of these characteristics. Moreover, changes in per capita manufacturing and agriculture production, capital and number of establishments from 1870 to 1880 were also not significantly different. Similarity in all these observable characteristics provides reassuring evidence that our instrumental variable constructed from population cutoff does not correlate with local economic conditions prior to national bank entries.

Figure 2.6: *Conditional covariates balance*



Notes: Figure 2.6 displays unstandardized coefficients on the indicator of having below 6,000 population in 1880 for various outcomes $Y_{i,s}$ (production, capital and number of establishments/farms) from the regression $Y_{i,s} = \alpha + \beta 1(pop < 6,000)_{i,s} + \Delta pop_{i,s} + \gamma_s + \epsilon_{i,s}$ for town i in state s. The darkest shades represent 90% confidence intervals and the lightest shades represent 99% confidence intervals.

The relationship between the population cutoff at 6,000 and bank entry remains robust in wider population ranges around the 6,000 cutoff, and we provide more details in Appendix B.3. We choose the more conservative sample size for our main results since a greater population window raises concerns about comparability between the larger and smaller places. In addition, our first stage results are also robust to selecting a base year before the 1880 census and end-year after the 1880 census, and in Table B1 we provide two examples for periods between 1873 and 1883, and between 1877 and 1887. Furthermore, we present evidence in Figure B3 that national bank entries did not cluster in years right before the 1880 census was published, both in our sample and in the aggregate. In sum, national banks did not appear to have entered to a towns due to anticipation of their higher future growth, but bank entries were significantly affected by the population-based instrument.

2.4 Results

In this section, we present the results on how access to national banks impacted the local economy. We start by studying changes in the agricultural sector, as national banks provided limited lending to farmers due to their inability to extend loans collateralized by farmland. This condition provides us an ideal setting to fully explore the impact of stable bank liabilities on local economic development.

2.4.1 Changes in the agriculture sector

Agriculture was a growing sector in the late 19th century, especially in the west. On one hand, the rapid expansion of the railroad network reduced transportation costs of agricultural products (Donaldson and Hornbeck, 2016); on the other hand, national banks provided limited credit to farmers due to their inability to take farmland as loan collateral. This lending restriction likely limited farmers' ability to acquire new farmland or improve their current property (Fulford, 2015; Knox, 1900).

We focus on the one-period difference in county-level agricultural outcomes per capita between 1880 and 1890 and estimate:

$$\Delta Y_{i,s} = \beta \widetilde{\mathbb{1}}(\text{National Bank}) + \Gamma' X_{i,s} + \eta_s + \varepsilon_{i,s} \tag{2.3}$$

for town i in state s. $\widetilde{\mathbb{1}}(\text{National Bank})$ is an indicator of having at least one national bank in 1885, instrumented by the indicator of a town's population being below the cutoff at 6,000. β is the main coefficient of interest, which measures the change of the output response to having a national bank. X_{is} is a vector of control variables, and η_s

denotes state fixed effects, which capture certain state-level characteristics that could affect manufacturing production growth such as state tax or subsidy for agricultural production. Time-invariant characteristics of the counties are subsumed by the differences. The outcome variables of interest are calculated as per capita based on the male population above the age of 21.

We study three outcomes — agricultural outputs, value of land and fixtures (fences and buildings), as well as expenditure on fertilizers per capita. Changes in agricultural outputs are useful in gauging national banks' overall impacts on the agriculture sector. To better disentangle the various effects of national banks, we use changes in the value of farmland and fixtures as a proxy for the access to long-term credit, which was usually granted over a longer period on mortgage security (Pope, 1914). In contrast, credit for expenditure on fertilizers is considered as "working capital," as fertilizers were common inputs in the agricultural production. Therefore, fertilizers expenditure is a proxy for short-term credit accessibility. One additional advantage to study changes in fertilizers expenditure is that commercial fertilizer was first introduced in the 1840s, which was long before our sample period. Therefore, differences in the adoption of fertilizers was unlikely due to factors such as access to new innovation or information.

We find that none of agricultural production, farm's land and fixture value, or fertilizer expenditure was affected by national banks, as shown in Table 2.5. The results are consistent with national bank's limited provision of long-term credit for agricultural expansion and improvement on mortgage security. The insignificant results on changes in fertilizer expenditure further indicate that national banks did not play a significant role in short-term credit provision for agricultural inputs either. One possible explanation is that farmers did not have strong relationships with national banks because of the lending restrictions, and it also prevented them from taking out short-term loans from national banks.

Although total agricultural production was unaffected by entries of national banks, we

Table 2.5: *National Banks and local agricultural sector (1880-1890)*

Panel A: Changes in agricultural production outputs per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-11.36	-3.316			-9.331	3.708
	(7.140)	(7.816)			(19.33)	(24.90)
1(pop<6k)			-4.097	1.253		
			(9.396)	(9.280)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	-25.48	-25.48	-25.48	-25.48	-25.48	-25.48
Std. Dev. of Dep. Var.	33.54	33.54	33.54	33.54	33.54	33.54
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Changes in farmland value per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	12.46	-4.666			37.25	32.21
	(32.40)	(35.33)			(87.91)	(112.7)
1(pop<6k)			16.36	10.89		
			(42.25)	(41.91)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	-130.0	-130.0	-130.0	-130.0	-130.0	-130.0
Std. Dev. of Dep. Var.	205.9	205.9	205.9	205.9	205.9	205.9
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel C: Changes in expenditure on fertilizers per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	0.269	0.0279			0.185	-0.164
	(0.243)	(0.270)			(0.659)	(0.860)
1(pop<6k)			0.0812	-0.0554		
			(0.319)	(0.321)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	0.276	0.276	0.276	0.276	0.276	0.276
Std. Dev. of Dep. Var.	1.030	1.030	1.030	1.030	1.030	1.030
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Notes: Table 2.5 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is changes in agricultural production, value of farmland and fixtures (fences and buildings), and expenditure on fertilizers per capita between 1880 and 1890. Control variables include number of state banks in a town as of 1876, as well as number of railroads in 1880. Regressions are weighted by share of town population in the sample in 1880.* p<0.1, ** p<0.05, *** p<0.01.

show in Table 2.6 that production shifted significantly from non-traded crops to traded crops. "Traded crops" are defined as crops that were exchanged on the Chicago Board of Trade, which include wheat, oats, buckwheat, and Indian corn. In 1880, non-traded crops were only about 9.4% of total production, because American agricultural products exports increased greatly in the last quarter of the 19th century (Pope, 1914). The point estimates in Column 5 and 6 mean that 75% or all of production shifted from non-traded crops towards traded crops.

Table 2.6: *National Banks and the shift in agricultural production*

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-0.0167*	-0.0247**			-0.0710***	-0.102***
	(0.00856)	(0.00949)			(0.0267)	(0.0375)
1(pop<6k)			-0.0312***	-0.0345***		
			(0.0110)	(0.0111)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Fractions in 1880	0.0943	0.0943	0.0943	0.0943	0.0943	0.0943
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Notes: Table 2.6 presents results from the OLS, reduced form, and IV estimates of the effects of national banks on changes in the fractions of non-traded crops to total crops measured in bushels between 1880 and 1890. All columns include town population changes between 1870 and 1880 as a control variable. Additional control variables include the number of state banks in town as of 1876 and number of railroads as of 1880. Regressions are weighted by share of town population in the sample in 1880. * p<0.1, ** p<0.05, *** p<0.01.

While we cannot completely rule out the possibility that traded crops were more capital-intensive in some ways, the insignificant impact of national bank entries on both long-term and short-term credit obtained by farmers indicates that bank lending played little role in the agriculture sector in our sample overall.[35] The results provide evidence that national banks may have impacted production decisions through providing more

[35] Fulford (2015) finds that national banks positively affected agricultural sector production through providing working capital and liquidity in rural counties. Our samples may have little overlap as we use town-level population instead of county-level population for identification.

secure bank liabilities that facilitated transactions and trade. The shift towards traded crops production is also consistent with our finding on increased trade activity following national banks' entry.

2.4.2 Trade activity

We provide further evidence on the positive effect of national bank entry on local trade activity with both town- and county-level outcomes in this subsection.

Growth in trade-related occupations

We capture inter-regional trade flows by proxying it with trade-related occupations.[36] Commission merchant was a profession that sourced products from one place and sold at another. The merchants did not directly participate in production, but simply profited by facilitating trade and sales. Therefore, the number of commission merchants in a town can serve as an indicator of the volume of products sourced from potentially distant areas. We examine changes in town-level number of commission merchants, collected from the *Zell's Classified United States Business Directory* in 1875 and 1887.

We estimate the baseline Equation 2.3 to study the effect of gaining national banks on local trade activity by replacing the outcome variable to the changes in the number of commission merchants in a town between 1875 and 1887. Results are reported in Table 2.7. The IV estimates in Columns 5 and 6 of Panel A suggest that gaining a national bank between 1875 and 1885 is associated with 1.3 to 1.5 more commission merchants within a town in 1887. The effect is large compared to the mean of 0.14 in 1875. As a placebo test, we also analyze the relationship between national bank entries and changes in the number of architects — a profession that was likely to operate locally. we find no effect of national banks in all specifications, as shown in Table 2.7 Panel B.

To complement our analysis with the business directory data, we also use the full

[36] There was no official domestic trade flow statistics in the 19th century United States.

Table 2.7: *National Banks and local business (town-level)*

Panel A: Changes in the number of commission merchants

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	0.0624	0.189			1.278**	1.447**
	(0.137)	(0.141)			(0.624)	(0.650)
1(pop<6k)			0.390**	0.413***		
			(0.159)	(0.156)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Average No. in 1875	0.135	0.135	0.135	0.135	0.135	0.135
N	148	148	148	148	148	148
KP F-stat					8.676	8.212

Panel B: Changes in the number of architects (placebo test)

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	0.0126	0.0302			0.193	0.201
	(0.119)	(0.125)			(0.427)	(0.453)
1(pop<6k)			0.0590	0.0573		
			(0.142)	(0.142)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Average No. in 1875	0.00676	0.00676	0.00676	0.00676	0.00676	0.00676
N	148	148	148	148	148	148
KP F-stat					8.676	8.212

Notes: Table 2.7 presents results from the OLS, reduced form, and IV estimates of the effect of national banks entries on changes in number of trade-related business (commission merchants) and local-oriented business (architects). Changes are from 1875 to 1887. All columns include town population changes between 1870 and 1880 as a control variable. Additional control variables include the number of state banks in town as of 1876 and number of railroads as of 1875. Regressions are equal-weighted. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

count census of 1880 and 1900 which contains more occupation categories. We contrast growth in trade-related workers (buyers and shippers) to occupations that were unlikely to be affected by trade (architects, doctors, and teachers).[37] As before, we scale the number of workers in these occupations by county-level male population above the age of 21. The outcome variables are the growth rates in shares of the occupations as outcome variables.

We find that gaining a national bank positively impacted trade activity at the county level. Gaining a national bank led to 1.6 to 1.7 times higher changes in the share of buyers and shippers between 1880 and 1900, as shown in Panel A of Table 2.8. We again find no significant impact of national banks on changes in the share of architects as shown in Panel B of Table 2.8. More placebo test results using growth in shares of doctors and teachers can be found in Table B3.

Both town-level and county-level results show that gaining access to national banks led to more trade-related activity. The evidence is consistent with national bank's ability to provide more secure bank liabilities that could facilitate transactions with distant counterparties. The lower transactions frictions with national bank currencies may have propelled manufacturing sector growth by eliminating nominal price risks in sourcing inputs from and selling outputs to more locations, and providing local manufacturers greater access to inputs and outputs markets. However, we do not rule out national banks' impact on trade activity through the traditional lending channels. In fact, the significant greater change in manufacturing inputs per capita following national bank entry provides evidence that national banks likely provided short-term credit to the manufacturers. The short-term credit could also have been used for trade finance, which would also lead to increased local trade activity.

[37] The full count census of 1890 was lost in a fire.

Table 2.8: *National Banks and local business (county-level)*

Panel A: Percentage changes in share of buyers and shippers

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-0.213	-0.158			1.583*	1.727*
	(0.261)	(0.274)			(0.835)	(0.883)
1(pop<6k)			0.556**	0.574**		
			(0.269)	(0.270)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	0.850	0.850	0.850	0.850	0.850	0.850
Std. Dev. of Dep. Var.	1.139	1.139	1.139	1.139	1.139	1.139
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Percentage changes in share of architects (placebo)

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-0.0157	0.123			-0.548	-0.478
	(0.305)	(0.314)			(0.839)	(0.870)
1(pop<6k)			-0.192	-0.159		
			(0.319)	(0.315)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	0.788	0.788	0.788	0.788	0.788	0.788
Std. Dev. of Dep. Var.	1.221	1.221	1.221	1.221	1.221	1.221
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Notes: Table 2.8 presents results from the OLS, reduced form, and IV estimates. Dependent variables in Panel A and B are percentage changes in shares of buyers and shippers, and architects, among males above 21 years old from 1880 census to 1900 census, respectively. All columns include town population changes between 1870 and 1880 as a control variable. Additional control variables include the number of state banks in town as of 1876 and number of railroads as of 1880. Regressions are weighted by share of town population in the sample in 1880. * p<0.1, ** p<0.05, *** p<0.01.

Complementary evidence from prices

We also provide some complementary evidence on how national banks may have reduced transactions costs by comparing price changes in “trade-sensitive" goods versus “local" goods following national bank entry. Sellers of traded products had to bear the price risk associated with the uncertain currency values between their towns and the towns where they sourced the products. Therefore, price uncertainty was likely to drive up costs, leading to higher sale prices locally. On the other hand, selling locally produced goods did not involve transactions with non-local bank notes.

We collected data on the price of tea, New Orleans molasses, and starch from 1864 to 1880 in 9 towns from the supplementary reports on *The Average Retail Prices of Necessaries of Life* in *Statistics of Wages* published by the census office in 1886. These 9 towns had their first national banks between 1866 and 1878. We categorize tea and New Orleans molasses as “trade-sensitive" goods, as they were either imported and distributed from the ports, or produced specifically in New Orleans. Starch, on the other hands, is categorized as “local" good as it was likely to be locally produced from corn.

We find that the price of tea and New Orleans molasses dropped significantly with the access to national banks, whereas the price of starch was not impacted. As shown in Table 2.9, the price of tea dropped by about 30 cents after the towns had national banks, relative to the average price of $1.2 per pound (a 25% drop). Similarly, the price of New Orleans molasses dropped by about 25 cents per gallon from $1.1 per gallon (a 23% drop).

The results suggest that national banks may have helped to reduce transaction cost by providing a stable medium of exchange, and therefore positively impacted trade-intensive economic activity.

Table 2.9: *Price levels and existence of National Banks*

	(1) Price of Tea	(2) Price of Molasses	(3) Price of Starch
1(National Bank)	-0.294***	-0.250***	-0.0105
	(0.0844)	(0.0651)	(0.00775)
Year FE	Y	Y	Y
Pre-NB Mean	1.238	1.120	0.120
N	115	105	117
Adj. R^2	0.229	0.350	0.147

Notes: Table 2.9 presents results from estimating $P_{it} = \alpha + \beta 1(\text{National Bank})_{it} + \gamma_t + \varepsilon_{it}$ for tea, New Orleans molasses, and starch in 9 towns over 1864 to 1880. The first years of having at least one national bank in these town range from 1866 to 1878. Standard errors are clustered by year. *** p<0.01, ** p<0.05, * p<0.1.

2.4.3 Growth in the manufacturing sector

Having shown that national bank entry led to increased local trade activity, we turn to study the effect of national banks on the production in the manufacturing sector, since manufacturing outputs are considered as tradable products. We examine whether the gaining a national bank also led to higher manufacturing production as well as the possible driving forces.

We find that national bank entry led to economically and statistically significant higher growth in manufacturing production per capita between 1880 and 1890 even though we do not focus on the "manufacturing belt" states as in Jaremski (2014) and Carlson *et al.* (2018). We estimate the main specification in Equation 2.3 using differences in manufacturing production per capita as the outcome variable. The IV estimates from Table 2.10 show that gaining a national bank led to about \$229 to \$310 higher growth in manufacturing production per capita, which are about \$6,360 to \$8,620 in 2018 dollars. The average effect is 50% of the average of pre-period levels in 1880, which is very economically significant.

The smaller and statistically insignificant OLS estimates reported in Column 1-2 in Panel A indicate that national banks did not selectively enter into high-growth places.

Table 2.10: *National Banks and growth in manufacturing production*

Panel A: Changes in manufacturing production per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	39.87	57.43			228.5**	310.0**
	(32.97)	(36.16)			(100.4)	(136.0)
1(pop<6k)			100.4**	104.8**		
			(42.28)	(42.29)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	82.21	82.21	82.21	82.21	82.21	82.21
Std. Dev. of Dep. Var.	251.2	251.2	251.2	251.2	251.2	251.2
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Changes in manufacturing production per capita — subsamples

	OLS	RF	IV	OLS	RF	IV
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	56.13		312.0**	76.35*		386.3**
	(39.56)		(123.2)	(38.64)		(171.1)
1(pop<6k)		140.0***			114.9**	
		(50.78)			(44.38)	
State FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Same Treatment in County	Y	Y	Y			
Excluding CA and PA				Y	Y	Y
Mean of Dep. Var.	98.33	98.33	98.33	80.44	80.44	80.44
Std. Dev. of Dep. Var.	260.4	260.4	260.4	258.6	258.6	258.6
N	123	123	123	139	139	139
KP F-stat			12.55			7.987

Notes: Table 2.10 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is changes in manufacturing production per capita between 1880 and 1890. All columns include town population changes between 1870 and 1880 as a control variable. Additional control variables include the number of state banks in town as of 1876 and number of railroads as of 1880. Regressions are weighted by share of town population in the sample in 1880. In Panel B, Column 1-3 report results on counties where either all towns in sample are above or below the 6,000 cutoff. Column 4-6 report results on all states except for California and Pennsylvania. * p<0.1, ** p<0.05, *** p<0.01.

There may be two reasons why this was the case. First, location selection was greatly limited by the residence requirement for national bank's directors. The National Banking Act required that a national bank must have at least 5 directors, and at least 75% of them must have resided locally. This residence requirement generated frictions in selecting locations for bank operation, such that places that would likely benefit the most from national banks may not have suitable directors for them. Second, even in this later period, some national banks may have been converted from state banks. Since state banks were known to lend more to farmers (Knox, 1900), places with more state banks previously might have had a relatively underdeveloped manufacturing sector. As a result, there would be no significant effect of national banks on subsequent manufacturing growth overall.

Having established the main effects on manufacturing production per capita, we repeat the same analysis on two different subsamples to demonstrate robustness. The first subsample excludes all counties that had towns both above and below the 6,000 cutoff, and the second subsample excludes California and Pennsylvania. Results are shown in Panel B of Table 2.10.

The purpose for using the first subsample is to facilitate interpretation of the magnitude of the point estimates. There are a few counties containing both towns above and below the 6,000 cutoff, and using per capita manufacturing production calculated with county-level data could be less interpretable for these counties. As shown in Columns 1-3, after excluding these places, we still find a significant increase in manufacturing production per capita of similar magnitude to the baseline results.

The second subsample addresses concerns that changes in town size and growth were both due to gold rushes and discoveries of coal mines in each state, respectively. Gold rushes and new discoveries of coal mines were unlikely an important factor in our results. There were only a few gold rushes in the late 19th century United States compared to earlier of the century, and the coal industry was already relatively mature. Between 1870 and 1890, only the late 1870s Bodie Gold Rush in California (Sprague, 2011) and discovery of coking coal in the Connellsville region of southwestern Pennsylvania[38] could have impacted places in our sample. Results from Column 4-6 suggest that excluding towns in California and Pennsylvania has little impact on the main results.

We report more robustness and placebo test results in Appendix B.1. Results reported in Table B4 show that our main results are robust to alternative definition of labor force and inflation adjustment. In Panel A of Table B4, we calculate manufacturing production per capita by scaling production by male population between 18-44 years old, or the "prime-age" male labor. In Panel B, we adjust 1880 production value to 1890 dollars. Reliable CPI series was only published after the establishment of the federal reserve system in 1913, however, based on a limited price index, the Bureau of Labor Statistics estimates that there was about 10% deflation between 1880 and 1890.[39]

We also conduct a set of pre-period placebo tests using changes in manufacturing production per capita from 1870 to 1880 as the outcome variable, and results are reported in Table B5. We find no evidence that gaining a national bank between 1875 and 1885 had an impact on manufacturing growth in the 1870s, which further rules out the possibility of pre-trend in growth having simultaneous effects on town size and subsequent growth.

Decomposing growth in the manufacturing sector

Given the significant effect on manufacturing production, in this subsection we examine the components of manufacturing growth, including inputs, employment, and capital between 1880 and 1890. We re-estimate the baseline specification in Equation 2.3 with the different components of manufacturing sector as the dependent variable, and present the results in Table 2.11.

Manufacturing inputs value increased significantly more after gaining access to national banks. The IV estimates in Columns 5 and 6 of Panel A indicate that gaining a

[38] Source: https://eh.net/encyclopedia/the-us-coal-industry-in-the-nineteenth-century-2/
[39] Source: https://www.officialdata.org/

Table 2.11: *National Banks and growth in manufacturing inputs, employment, and capital*

Panel A: Changes in manufacturing inputs per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	27.01	34.75*			153.5***	205.4**
	(18.41)	(20.53)			(58.61)	(81.69)
1(pop<6k)			67.40***	69.40***		
			(23.43)	(23.83)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	9.643	9.643	9.643	9.643	9.643	9.643
Std. Dev. of Dep. Var.	193.3	193.3	193.3	193.3	193.3	193.3
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Changes in manufacturing employment per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	0.0194	0.0351*			0.113**	0.164**
	(0.0188)	(0.0209)			(0.0557)	(0.0760)
1(pop<6k)			0.0494**	0.0555**		
			(0.0242)	(0.0245)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	0.0740	0.0740	0.0740	0.0740	0.0740	0.0740
Std. Dev. of Dep. Var.	0.0868	0.0868	0.0868	0.0868	0.0868	0.0868
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel C: Changes in manufacturing capital per capita

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	2.508	44.01			55.86	132.0
	(37.18)	(41.16)			(101.5)	(133.1)
1(pop<6k)			24.53	44.62		
			(48.42)	(48.90)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	218.0	218.0	218.0	218.0	218.0	218.0
Std. Dev. of Dep. Var.	204.7	204.7	204.7	204.7	204.7	204.7
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Notes: Table 2.11 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is changes in manufacturing inputs, employment, and capital per capita between 1880 and 1890. All columns include town population changes between 1870 and 1880 as a control variable. Additional control variables include the number of state banks in town as of 1876 and number of railroads as of 1880. Regressions are weighted by share of town population in the sample in 1880.* p<0.1, ** p<0.05, *** p<0.01.

national bank led to \$154 - \$205 more in manufacturing inputs per capita, which are about \$4,280 and \$5,700 in 2018 dollars or 54% of the average level in 1880. The magnitudes here suggest that the increase in inputs value was responsible for 66% of the total output increase, assuming constant returns to scale. Similarly, gaining a national bank also led to significant growth in manufacturing employment. The IV estimates in Columns 5 and 6 of Panel B show that about 11-16 more people per 100 males above age 21 were employed in the manufacturing sector following national bank entry. However, the impact of national banks on manufacturing capital was positive but statistically insignificant, as shown in Panel C of Table 2.11. The magnitude (\$56-\$132) is also smaller compared to effects of national banks on manufacturing inputs.[40]

The results above on the decomposition of manufacturing output indicate that national banks led to significant growth through increased inputs and employment, but that their impact on capital investment was limited. There are several possible explanations for the null effect on capital. First, regulations encouraged national banks to make short-term loans rather than long-term loans (White, 1998). These loans provided working capital to meet short-term liquidity needs rather than long-term investment demands. The short-term credit may have also facilitated inputs sourcing, and the lack of long-term credit provision limited manufacturers' ability to acquire physical capital such as manufacturing factory land. Second, since the national banks were unit banks, their ability to diversify their loan portfolio with borrowers across different places was limited, which could discourage them from expanding their balance sheets. Third, large values of firm investment could not be easily accommodated, as a national bank could lend no more than 10% of its capital stock to one entity.[41] Broadly, many requirements impeded investment in the manufacturing sector, suggesting that the effect of national banks from the asset side of the balance sheet is limited.

[40] Carlson *et al.* (2018) find positive effect on manufacturing capital growth following new national bank entry, and suggest that banking competition leads to economic growth by inducing credit provision.

[41] That is to say, a bank with \$50,000 of capital stock could lend no more than \$5,000 to a firm.Source: National Banking Act of 1864, Sec. 29

One caveat to our interpretation is that manufacturing capital was estimated by establishment owners and was subject to mis-measurement in the census, which would bias the results toward zero. *Remarks on the Statistics of Manufactures* for the 1880 census explains how factory owners may not have correctly estimated the value of all physical capital used in production. For example, a manufacturer who rented a piece of factory land may or may not count the land as a part of capital. The measurement error is therefore likely to weaken the relationship between national banks and manufacturing capital growth.

So far, the results indicate that national banks facilitated manufacturing production from the assets side primarily by providing working capital. Given the large magnitude of impacts of national banks on manufacturing outputs and inputs, we explore other channels that could also have spurred the growth in the manufacturing sector. In Section 3.2, we provided an overview of the significant exchange frictions stemming from illiquid state bank notes. Since the National Banking Act required that the national bank notes must be redeemable at all national banks at par, we hypothesize that places with access to national bank notes experienced significant reduction in transaction cost when trading with distant regions. As a result, value of manufacturing production and inputs could both increase with greater access to inputs and outputs markets. We provide evidence for this channel next.

2.4.4 Growth in innovation

As the late 19th century was a part of the Second Industrial Revolution, when organized industrial R&D within firms emerged and science and technology were applied to product development (Bruland and Mowery, 2006), we postulate that the significant manufacturing production increase could also be driven by innovation. We examine whether national banks also had a significant impact on local innovation activity in this subsection.

We use the the number of patents obtained by residents within a county as measure for innovation activity (Petralia *et al.*, 2016).[42]. We first show that the number of patents can be a reasonable proxy for the manufacturing sector's research and development outcome by plotting the relationship between manufacturing and agricultural production per capita and the log number of patents obtained by local inventors in the previous decade in Figure 2.7. The plots show that local innovation output measured by the number of patents granted is strongly correlated with manufacturing production per capita, but is only weakly correlated with agriculture production per capita. Assuming patents contributed to total factor productivity, these correlations indicate that they were primarily innovations that benefited the manufacturing sector.

Having established that patents are a suitable proxy for manufacturing sector's innovation, we examine the percentage changes in the number of patents granted from the decade following 1870 and 1880 using the specification of Equation 2.3.[43] Gaining a national bank led to 105 to 134 percentage points higher increase in the number of patents across the two decades, as shown in Table **??**. The magnitude is economically significant, compared to the mean of 64 percentage points and standard deviation of 138 percentage points. We also conduct placebo tests by replacing the outcome variable with percentage changes in number of patents between the previous two decades (1860s and 1870s) and report the results in Table B6. The insignificant results imply that the difference in innovation output growth was not due to pre-existing trends.

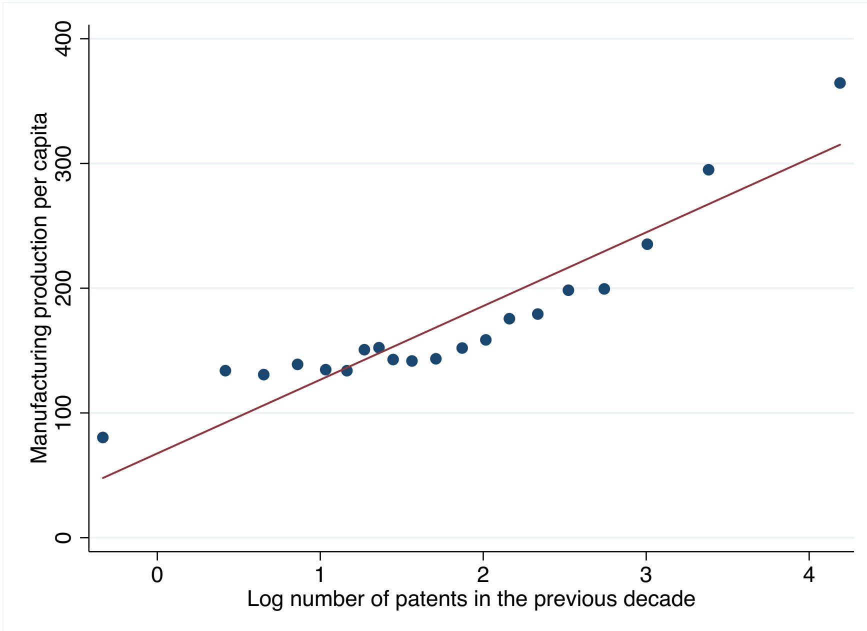
Assuming that firms primarily relied on internal financing for R&D like they do in the modern period in the United States (Bougheas, 2004; Hall, 2002), the results also indicate that the positive effect of national banks on innovation was not through the bank lending channel. Instead, the evidence is consistent with that manufacturers gained greater market access and were exposed to a greater varieties of products when product price uncertainty across locations is reduced after gaining a national bank locally. As

[42]Plant- or sector-level innovation measure is not available for our sample period

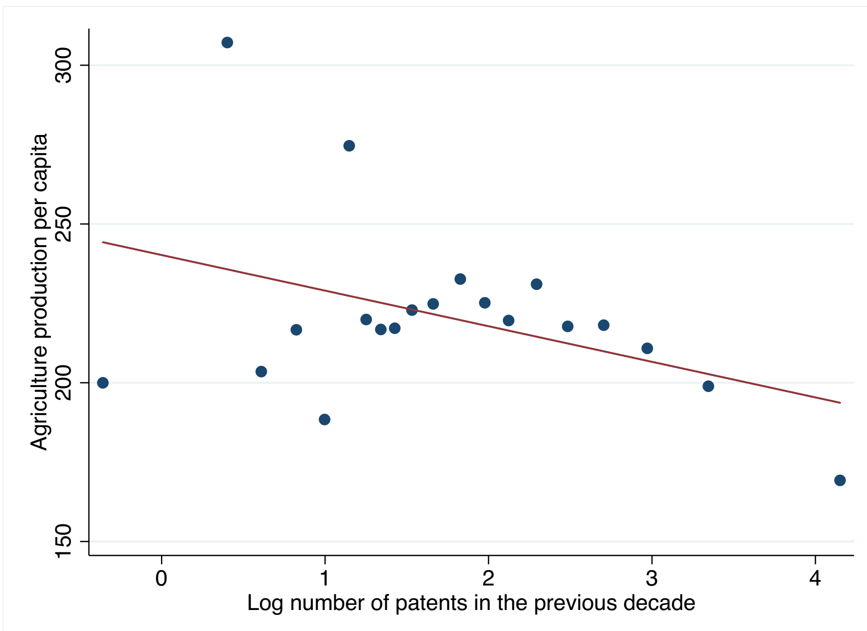
[43]We include the 10 years between 1871 to 1880, and 1881 to 1890, respectively.

Figure 2.7: *Production per capita and innovation*

(a) *Manufacturing production per capita and log number of patents*



(b) *Agriculture production per capita and log number of patents*



Notes: Figure 2.7 presents binscatter plots between manufacturing/agriculture production per capita in 1860-1900 census and log number of patents per county in the previous decade. The plots control for total county population, as well as state-year fixed effects.

a result, manufacturers may have incentive to to innovate and therefore become more competitive in a larger market and expand product lines.

The increased trade and innovation activity could both help to explain the significant growth in manufacturing production after national bank entries. Taken together, national banks likely facilitated manufacturing sector growth from both the assets and the liabilities sides of their balance sheets. On the assets side, short-term loans may have provided the working capital and liquidity for input sourcing and trade finance. On the liabilities side, granting easy access to secure and liquid bank liabilities may have increased production value by reducing transactions cost in trade and hence allowing local manufacturers to access more customers and produce more differentiated goods.

2.4.5 Long-term effects and spillover effects

In this part, we study whether the positive impacts of national banks on manufacturing production persisted over time led to any impacts on neighboring counties. The initial significant growth in the manufacturing sector may last for a longer time period due to the presence of agglomeration economies in manufacturing (Kline and Moretti, 2014b). In addition, greater industrialization, greater market access through trade and more innovation activity could also turn into comparative advantages in manufacturing production, which may sustain higher manufacturing production over a longer period (Sequeira *et al.*, 2018). We test this hypothesis next.

Long-term effects of national banks

To measure the long-term effects of national banks, we estimate a dynamic differences-in-differences model from 1860 to 1900, which makes it possible to visualize any pre-trends before the 1880 census was published and the persistence afterward. Specifically, we estimate the following:

$$Y_{ist} = \sum_k \beta_k \widetilde{\mathbb{1}}(\text{National Bank}) \times \mathbb{1}_{\{year=k\}} + \sum_k \gamma_k X' \times \mathbb{1}_{\{year=k\}} + \eta_{st} + \alpha_i + \varepsilon_{it}, \quad (2.4)$$

where Y_{ist} is the outcome in town i in state s at year t. We include leads and lags before and after 1880, and omit 1880 so that all outcomes are relative to the treatment period. β_k is the coefficient of interest, and it measures the elasticity of the output response to gaining a national bank in each of the lead and lag years. As before, $\widetilde{\mathbb{1}}(\text{National Bank})$ is the instrumented variable. γ_k allow the control variables X' to have time-varying effects. η_{st} are state-year fixed effects so that we compare outcomes within states and years, and α_i are town fixed effects that control for time-invariant characteristics such as geographical location and land quality.

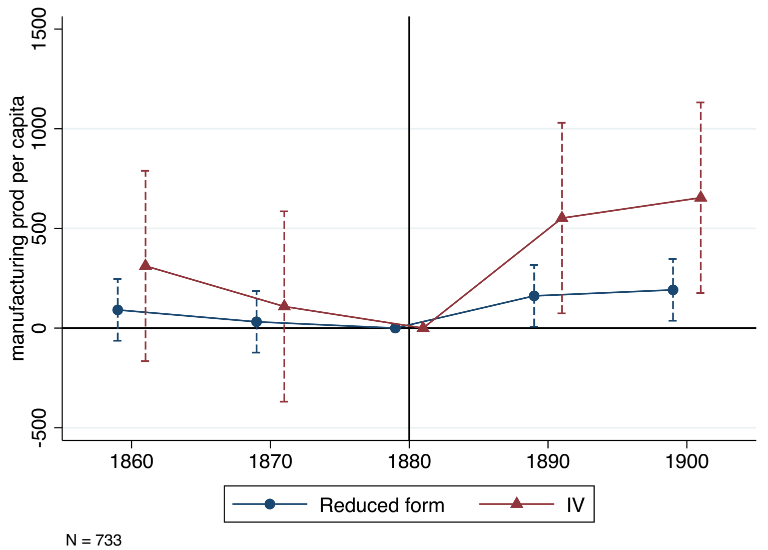
The full IV and reduced form dynamic difference-in-difference coefficients for manufacturing production plotted in Figure 2.8 show that the positive effect of national banks on manufacturing production between 1880 and 1890 persisted beyond a decade into 1890s as well. The figures also indicate that there were no differential pre-trends between the places that received national banks versus those that did not, instrumented by the population cutoff at 6,000.[44] Data from the 1910 Census of Manufacturers is not available, and we find no differential effect using the 1920 outcomes. However, 1920 was after the WWI and the establishment of the federal reserve system. We therefore do not attribute the result to conversion of growth.

Spillover effects

We also investigate whether there are indirect effects of national bank entries on the neighboring counties. On one hand, more active trade and increased innovation output could create positive spillover effects on the neighboring counties; on the other hand,

[44] We only show 2 pre-shock period coefficients here, as 1840 and 1850 census does not change the flat patters of the pre-shock trend.

Figure 2.8: *Persistent positive effect on manufacturing production*

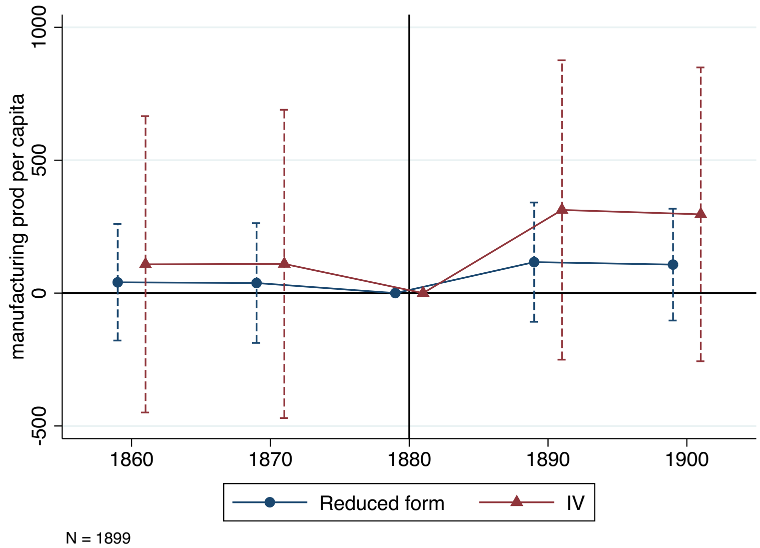


Notes: Figure 2.8 shows the dynamic diff-in-diff coefficients for the reduced form and the IV estimates of the effect of having a national bank on county-level manufacturing production value. The specification for the IV estimates is $Y_{ist} = \sum_k \beta_k \widetilde{\mathbb{1}}(\text{National Bank}) \times \mathbb{1}_{\{year=k\}} + \sum_k \gamma_k X' \times \mathbb{1}_{\{year=k\}} + \eta_{st} + \alpha_i + \varepsilon_{it}$. 1880 is the omitted year, and the vertical bars represent the 95% confidence intervals.

manufacturing production could become more concentrated in places that obtained national banks, leading to reallocation of manufacturing production away from the surrounding places.

We estimate the same dynamic differences-in-differences specification as in Equation 2.4 above, but replace the outcome variable to the changes in manufacturing production per capita of adjacent counties. We find positive point estimates for neighboring counties' manufacturing production per capita in 1890 and 1900, but the effects are noisy (see Figure 2.9), suggesting some positive net effects of national banks on adjacent counties.

Figure 2.9: *Spillover effect on neighboring counties*



Notes: Figure 2.9 shows the dynamic diff-in-diff coefficients for the reduced form and the IV estimates of the effect of having a national bank on neighboring counties' manufacturing production value. The specification for the IV estimates is
$Y_{ist} = \sum_k \beta_k \widetilde{\mathbb{1}}(\text{National Bank}) \times \mathbb{1}_{\{year=k\}} + \sum_k \gamma_k X' \times \mathbb{1}_{\{year=k\}} + \eta_{st} + \alpha_i + \varepsilon_{it}$. 1880 is the omitted year, and the vertical bars represent the 95% confidence intervals.

2.5 Conclusion

Financial intermediaries can facilitate economic growth through both the asset-side channel, such as providing long-term investment credit and short-term working capital, and the liability-side channel, such as issuing secure bank liabilities that could facilitate transactions across space and over time. This paper studies the late 19th century United States after the passage of the National Bank Act of 1864, and exploits a population-based capital requirement of national banks to study the causal effects of bank entry on the local economy, as well as provide empirical evidence on the importance of stable bank liabilities in the real economy.

We establish that a lower regulatory capital requirement defined discretely by town population strongly and robustly predicts a higher likelihood of national bank entry. The national banks had little impact on overall agricultural production, access to long-term credit (proxied by value of farmland and fixtures), or short-term credit (proxied by fertilizers expenditure). However, production significantly shifted from non-traded crops to traded crops, which provides evidence that the stability of national bank liabilities had first-order effects on the local economic development.

More generally, we find that local trade activity increased following national bank entry, which may especially benefit the manufacturing sector growth as manufacturing outputs are traded goods. We find significant and persistent greater increase in manufacturing production per capita following national bank entry. While manufacturing inputs, and employment also increased, capital did not significantly scale up. The results indicate that national banks extended limited long-term credit for capital acquisition, and the effect of national bank entry on manufacturing sector growth comes from lowering transactions costs with stable national bank notes and short-term credit provision. The increased trade activity facilitated by national bank's secure liabilities could also expose manufacturings to greater market access and therefore encourage in-firm innovation. We find that innovation activity, proxied by patents granted, also increased significantly after gaining a national bank. Together, the initial significant growth in the manufacturing sector as well as increased trade and innovation could contribute to the persistently higher level of manufacturing production for at least two decades. In sum, our results suggest that the newly entered national banks facilitated local economic development by providing safe liabilities with stable value across places and over time.

3 | Safety in the Gold Standard Era

3.1 Introduction

The modern global financial system is characterized by having a central country that provides both the dominant currency and a large fraction of the financial assets denominated in that currency. Since Bretton Woods, the United States has filled that role, and there is extensive empirical evidence documenting world demand for dollar assets and in particular, *safe* dollar assets (Bernanke, 2005; Caballero and Krishnamurthy, 2009; Maggiori, 2017). The US's ability to borrow at lower rates because of this demand has been deemed an "exorbitant privilege" since the Bretton Woods period (Gourinchas and Rey, 2007; Jiang *et al.*, 2019; Krishnamurthy and Vissing-Jorgensen, 2012; Maggiori, 2017).[1] In this literature, the pre-WWI classical gold standard era has often been described as a historical precedent to the current international monetary system, bearing all the same hallmarks. In that sense, this system is understood to have persistent features that speak to a global equilibria regardless of the particular identity of the central country. However, to my knowledge, there has been no study showing that the empirical patterns found in the post-Bretton Woods period actually hold historically, before the disruptions of WWI. Thus understanding the similarities and differences between these systems would be useful for understanding which institutional characteristics are truly relevant for the functioning of the international monetary system.

[1] The term was coined by Valéry Discard d'Estaing, the then French Minister of Finance, in the 1960s.

The assumption that the UK and US are analogues within their own historical periods is reasonable given the broad institutional similarities between the current and pre-WWI systems: historically, like the US, the UK had the most developed and deepest financial system, the pound sterling was the primary currency used in both international trade and sovereign and corporate debt issuance, and the decades before WWI were characterized by low capital and goods flows restrictions. However, the gold standard system of fixed exchange rates and low values of short-term government debt are also strikingly different from the floating rates and significant levels of government debt found today. Indeed, while the historical consensus is that the British, acting through the Bank of England, directed the international gold standard, there is actually little agreement on how this system even operated (Eichengreen and Flandreau, 1997).

In this paper, I take as the departure point the accepted idea that the United Kingdom, and in particular the Bank of England, was the center of the international monetary system. I then interpret the historical gold standard institutions in the context of modern macrofinance and ask whether the empirical patterns found in Krishnamurthy and Vissing-Jorgensen (2012) regarding the demand for safe assets holds. I focus on this feature because it is the linchpin for predictions about the central country's role as a global insurer (Maggiori, 2017) and foreign exchange rate dynamics (Jiang *et al.*, 2019).

I document a demand for safe assets where the supply of safety is captured by the gold holdings at the central bank. This is the relevant measure because these holdings constrain the central bank's ability to discount short-term securities in London. If the central bank were to discount more than this amount, it could only do so by printing bank notes not backed in gold, which would break the gold standard. The price of safety is captured by the spread between the short-term bills that were eligible to be discounted at the Bank of England ("bank bills") and the short-term bills that were not ("trade bills"). Both are forms of private money, but the former has a central bank guarantee attached to it. Using monthly yields collected from the *Economist* magazine from 1870–1914 for securities with 3, 4, and 6 month maturities, I show that the supply of safety is strongly negatively correlated with the price of safety (i.e. the spread). Since the Bank of England did not discount any bills with 4 or 6 month maturity, the lack of a clear relationship in that case acts as a placebo for the main findings.

The main finding is robust to the Nagel (2016) critique that the levels of the interest rates are driving the spread. Controlling for the level of the non-safe asset yield or the Bank of England's discount rate do not affect the empirical pattern. This is in part because of the gold standard adjustment process: the Bank of England raised its discount rate when gold was low in order to attract gold inflows, which also raised interest rates in the open market. High levels of interest rates are correlated with lower spreads, which is the opposite concern.

In addition, the historical context provides an opportunity to use exogenous shocks to gold mining output as an instrument for the supply of safety. I use deviations in rainfall as an instrument for gold mining output. I focus on the time period from 1890 to 1914 because those are the years that South Africa dominates world gold production. The gold mining industry in the Witwatersrand fields was unique in that output was almost solely a function of labor. The Chamber of Mines was established to enforce a monopsony over native labor, and laborers were heavily recruited. During droughts and agricultural depressions, the native population was more willing to work in the mines because of the diminished value of their outside option. The instrument can be applied both regionally and for the entire nation.

The rest of the paper is organized as follows. Section 3.2 discusses the institutional context of the classical gold stanard era. Section 3.3 explains the data collected. Section 3.4 presents the empirical results on the relationship between the supply of safety and the relative price of safety. Section 3.5 concludes.

3.2 Institutional context

In this section, I discuss the institutional details of the pre-WWI gold standard in the United Kingdom. I argue that gold was not only the monetary base but also the measure of safety in the financial system. First, I discuss how the gold standard was implemented in practice through rules that tied bank note issuance to the gold holdings at the Bank of England. Second, I discuss how short-term commercial bills of exchange were the primary liquid asset, but that their quality as a safe asset was determined by the gold held as assets by the central bank.

3.2.1 The functioning of the gold standard

The role of gold as the monetary base is usually dated to beginning in 1821, when Britain returned to specie payments at the pre-Napoleonic War parity (that had held since 1717). The Bank Charter Act of 1844 gave the Bank of England the exclusive right to note issuance, and it required that issuances above the fiduciary limit of had to be backed 1:1 in gold.[2] Since the Bank of England was still a private institution and continued to act as a bank to commercial interests in London, it took on its new responsibilities by splitting into the Banking and Issue Departments. The Banking department continued to engage in the normal business of banking, such as issuing deposits and discounting bills of exchange, while the Issue department held the gold stock that backed the money supply. By the 1860s, the vast majority of the money supply in England was in Bank of England notes while only a small fraction was in coined gold.

A simplified version of the Banking Department's balance sheet is show in Figure 3.1.

[2]The monopoly on note issuance was only granted for England and Wales; Scotland and Ireland continued to allows private banks to issue bank notes. Private banks that had already established a note issuance were grandfathered in and allowed to deplete this supply naturally over time. The fiduciary limit was initially set to £14 million, but it was raised to £17 million. £11 million is the amount that the government owed the Bank of England from its original loan, and the remaining £6 million difference was the amount that was authorized once the Bank took over the lapsed private bank notes. Therefore any issuance above £17 million was backed 100% in gold.

The Asset side is comprised of the bank's investments in government and other securities, the securities that were used as collateral for discounts and advances, and what was called the "reserve" of notes and coin.[3] While 40–50% of these reserves were in gold and the rest in notes, the total note supply was always above the fiduciary issue, so the notes held by the Banking department were fully backed by gold in the Issue department. The Liabilities side was comprised of deposits by the bank's customers (including the UK and other governments) and the capital of its shareholders.[4] The Issue Department balance sheet is simply gold coin and bullion (assets) and bank notes above the fiduciary issue (liabilities). Bank notes held by the public were marked as being in circulation; the rest was held by the Bank of England in the Banking Department.

Figure 3.1: *Banking Department balance sheet*

Assets	Liabilities
Securities: government	Deposits: government
Securities: other	Deposits: banks
Discounts & advances	Deposits: other
Reserve: notes & bullion	Capital
Total	Total

Notes: Figure 3.1 is a stylized balance sheet for the Bank of England's Banking Department.

Under the Bank Charter Act of 1844, the domestic money supply was entirely governed by the volume of gold held by the Issue Department at the Bank of England. Its appeal then (and now to those distrustful of monetary authorities) was that keeping the money supply out of the realm of policymakers would lead to price stability. Given a domestic currency's nominal peg to gold, if the economy grew faster than the supply of gold, the

[3]In contrast to the modern terminology of reserves being a central bank liability, here the term essentially refers to cash on hand, much like the reserves of a private bank.

[4]The Bank of England was established as a private institution in 1694 with shareholder capital, and it was not nationalized until 1946.

real price of gold would increase and incentivize mining, thereby increasing the supply and stabilizing prices (Barro, 1979). However, the mining response can be quite slow, as evidenced by the twenty years of deflation from 1873 to 1896.

3.2.2 Private money creation and the supply of safety

In this section, I argue that role of gold as a measure of safety in the financial system is tied to the role of private money creation in the British financial market. The relevant institutional context involves three factors: the established tradition of using bills of exchange (analogous to short-term commercial paper) as a store of value and medium of exchange, the relative scarcity of short-term government debt, and the Bank of England's implicit role as the Lender of Last Resort in the second half of the 19th century. Short-term commercial bills were the main liquid assets in the financial sector, and ones known as "bank bills" were eligible to be brought to the Bank of England's Discount Window. This central bank backstop essentially removed the credit risk on these instruments and made them the safe assets of the day. However, the Bank of England's constraint on meeting the demand at its Discount Window was the amount of cash on hand it held as assets. Excess demand could only be met by printing notes that were not fully backed by gold, marking a departure from the gold standard. I discuss this safety constraint in more detail below.

First, the financial instrument known as a bill of exchange, which is essentially a forward-dated IOU written by the payer and accepted by the payee, had been widely used in Britain in commercial transactions for well over a century. In Lancashire, bills of exchange almost completely replaced small denomination notes and coins as a substitute for money in the earlier part of the 19th century (Ashton, 1945). Mechanically, anyone who received a bill of exchange as payment for a good or service could use it to pay for goods/services in turn by having his creditor accept it. The bill would continue to circulate until it finally matured, usually one to three months after it was issued, and the original debt cleared between the payer and the ultimate payee.

The private money creation allowed by bills of exchange was recognized by contemporaries as having the same sorts of consequences for financial stability as described by Stein (2012). In fact, the 1772 British financial crisis was recognized as being caused by a troubled bank, the Ayr Bank, writing bills of exchange purely to extend their own credit lines (Kosmetatos, 2018). In addition, Henry Thornton pointed out that even if the bill was written for a real underlying commercial transaction (what was known as the real bills doctrine), the nominal value of the obligations it represented was multiplied by the number of times the bill was passed on (Thornton, 1802). As a result, the Bank of England adhered to the norm of only discounting bills that represented real economic activity and had not been accepted more than twice.

Merchant banks with well established reputations had a natural advantage in creating private money. The interest rate at which the payers borrowed from their creditors during the period of the bill depended on his credit risk. Merchant banks that could borrow at low rates therefore began to sell their guarantees for a fee to their own customers. The bills that they accepted from their customers became known as "banker's acceptances" and were considered the safest short-term assets in financial markets. As the banker's acceptances became more common, they were increasingly used to finance international trade around the world. British multinational banks operating in cities around the world accepted their customers' bills and remitted them back to London, where there was strong demand from domestic banks. Banks held these instruments as a form of collateral or as interest-bearing investments that could easily be converted into cash to meet depositor demand.[5]

Second, until WWI, short-term government debt was a negligible component of debt, and most of the UK's debt was in the form of long-term consol bonds. Indeed, the idea of the Treasury bill was first suggested by Walter Bagehot and modeled after the commercial bill of exchange to allow the government to also borrow short-term at low rates. However,

[5]See Xu (2018) for a lengthy discussion of the role of British multinational banks in providing international trade finance.

the UK government barely used this instrument until WWI. Estimates of the volumes of short-term commercial bills dwarf the supply of government debt (Nishimura, 1971b).

Third, the financial crises that occurred in 1847, 1857, and 1866 successively cemented the Bank of England's role as a Lender of Last Resort.[6] While the Bank maintained strict rules about which securities were eligible for the Discount Window, its willingness to discount those securities meant that they were the safest asset in the economy. However, the securities that the Bank could discount was limited by the size of its balance sheet. The Banking Department's balance sheet could not expand without issuing more deposits or raising more capital, so increasing its Discounts necessarily required either reducing its holdings of Securities (primarily government) or else reducing its Reserves of cash and gold.

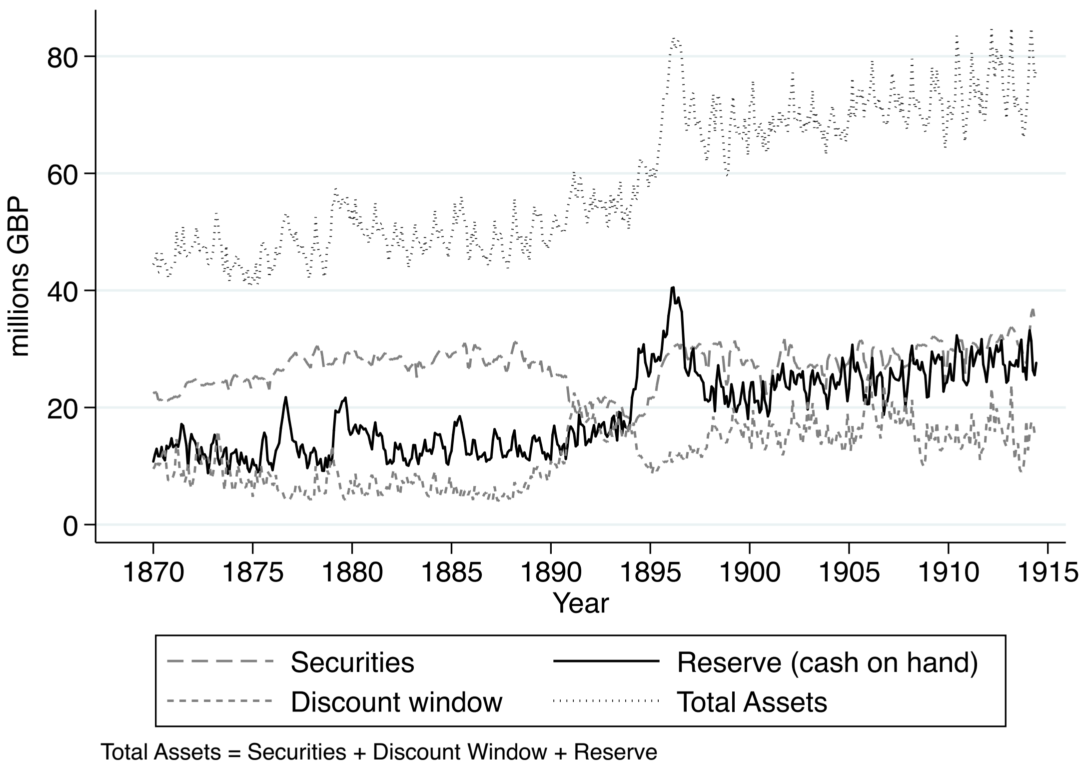
Figure 3.2 plots the time series of the primary components of the asset side of the Banking department's balance sheet. This series runs from 1870 to 1914, the decades that are considered to be the classical gold standard era. Only in 1890 does it appear that the increase in Discounts was funded by selling Securities. For most of the period, and particularly after 1895, there is a strong negative correlation between the amount of lending that the Bank engaged in at its Discount window and its Reserve holdings. Given both the institutional context and the empirical pattern, I therefore argue that the gold reserves at the Bank of England as the constraint on its ability to guarantee the safety of this form of private money.

3.2.3 South Africa mining

The majority of London's gold came from its overseas colonies, such as Canada, Australia, New Zealand, and South Africa. In South Africa, the Witwatersrand gold fields near Johannesburg are the largest in the world, and by 1914 accounted for almost 50% of

[6]During the crises listed, the demand for Discounts was so high that the Bank of England obtained permission from the Chancellor of the Exchequer to suspend the Bank Charter Act and thereby suspend the gold standard. Although the Bank obtained this permission, they did not actually use it.

Figure 3.2: *Composition of Assets in the Banking Department (1870–1914)*



Notes: Figure 3.2 plots the main categories of Assets in the Bank of England's Banking Department from 1870 – 1914. Source: Bank of England Archives C/1 Daily Accounts ledgers.

annual world production and 80% of British gold imports. Their discovery and subsequent development in the 1890s provided a significant, steady source of gold to London for twenty years. Unlike the fields in Canada and Australia that could be panned by hand, South African gold was very finely distributed in rock and could only be extracted by a process of drilling, crushing, and chemically treating the ore to release the gold content. During the early period of development, there was much uncertainty about the nature and size of the gold fields and whether the fields would be profitable. However, as the mines were developed, it became clear that labor was the binding constraint because vast volumes of ore had to be processed for small amounts of gold (Jeeves, 1985).

The main source of labor was the native South African population, although this population also had the outside option of living in their native areas. Conditions in the minefields were poor, with long hours, low pay, and little healthcare. The Chamber of Mines was an organization comprised of the individual mining companies that set wages and conditions such that they created a monopsony over labor. Their main difficulty was balancing their need to attract and recruit labor with their desire to keep wages low. According to the annual reports of the Chamber of Mines, native labor was almost in constant shortage, to the extent that they resorted to important migrant labor from China for many years (Richardson, 1982).

Despite the Chambers' policies for importing and coercing labor to work on the minefields, production was almost continually constrained by the labor supply the entire period.[7] I propose to use the annual deviations from ideal rainfall levels as an instrument for gold mining production, operating through the value of the agricultural (outside) sector available to native laborers. Since South Africa had no other industries besides mining and agriculture (which was used for domestic consumption rather than exported), it is unlikely that the rainfall affected the economy through other channels. While the main specification focuses on the annual deviations in South Africa, I can provide

[7]This relationship is borne out both in the contemporary reports on the industry as well as in the data plotting the correlation between labor supply and mining output.

robustness from subregions within the country. In addition, other first stage outcomes include native labor recruited and total labor on the mines.

3.3 Data

In this section, I describe both the data that I use for the main empirical exercise as well as the desired data for testing predictions generated by the modern safe assets literature.

3.3.1 Finance data

The financial markets data come from the Bank of England's archives and historical issues of the *Economist* magazine. The Bank of England published daily, weekly, and monthly summaries of its balance sheet. The disaggregated balance sheet is kept in ledgers at the Bank of England's archives.

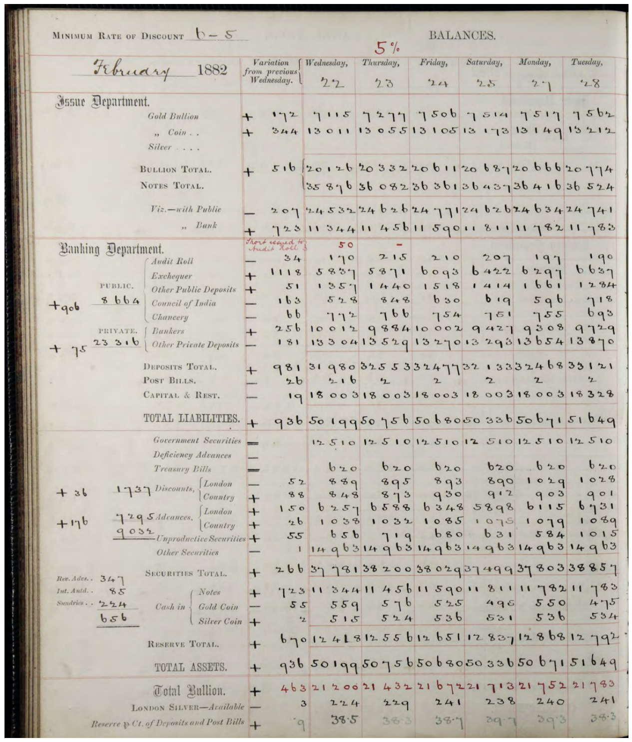
I collected the details of the weekly (Friday) composition of assets and liabilities in the Bank of England's Banking and Issue departments from 1870–1914. I also collected the yields on short-term commercial paper printed daily in the *Economist* magazine during this period for the same dates. These included rates on 3, 4, and 6 month bank bills and trade bills. The Bank of England's official discount rate, known as the Bank Rate, was also collected for these dates. Figure 3.3 panels A and B show the Bank's balance sheet for the week of March 24, 1882 and the rates published in the *Economist* for that week.

3.3.2 South African data

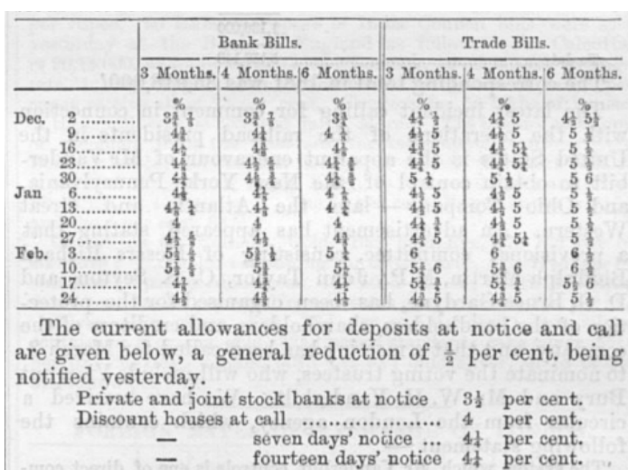
The data on South African mining come from a variety of sources. Government statistics provide aggregate mining output and exports to the UK annually. Weather stations in South Africa also recorded monthly rainfall in different areas of the country. The Chamber of Mines produced detail annual reports with monthly labor and production figures for each mine.

Figure 3.3: *Data sources*

(a) *Bank of England balance sheet*



(b) *Economist reports on rates*



	Bank Bills.			Trade Bills.		
	3 Months.	4 Months.	6 Months.	3 Months.	4 Months.	6 Months.
	%	%	%	%	%	%
Dec. 2	3¾ ⅞	3¾ ⅞	3¾	4¼ ½	4½ 5	4½ 5½
9	4⅛	4⅛	4 ⅛	4½ 5	4½ 5	5 ½
16	4½	4⅝	4½	4¾ 5	4¾ 5¼	5 ½
23	4½	4½ ⅝	4½ ⅝	4¾ 5	4¾ 5¼	5 ½
30	4½	4½ ¾	4½ ⅝	5 ¼	5 ½	5 6
Jan 6	4⅜	4½	4 ½	4½ 5	4½ 5	5 ½
13	4⅛ ¼	4⅛	4 ¼	4½ 5	4½ 5	5 ½
20	4	4	4	4¼ ½	4½ 5	5 ½
27	4½ ⅝	4½	4¾	4¾ 5	4¾ 5¼	5 ½
Feb. 3	5½ ⅝	5½ ⅝	5 ½	6	6	6 ½
10	5½ ⅝	5½	5½	5¾ 6	5¾ 6	6 ½
17	4⅞	4¾	4½	5¼ ½	5¼ ½	5½ 6
24	4½	4⅝	4½	4¾ 5	4¾ 5	5 ½

The current allowances for deposits at notice and call are given below, a general reduction of ½ per cent. being notified yesterday.

Private and joint stock banks at notice ... 3½ per cent.
Discount houses at call .... 4 per cent.
— seven days' notice ... 4¼ per cent.
— fourteen days' notice 4¼ per cent.

Notes: Figure 3.3 A shows a page from The Bank of England Archive C/1 Ledger for February 1882. Figure 3.3 B shows the yields on 3, 4, and 6 month maturity Bank Bills and Trade Bills published weekly in the *Economist*.

3.4 Demand for safe assets

3.4.1 Main results using OLS

The empirical strategy follows Krishnamurthy and Vissing-Jorgensen (2012), where I first estimate the elasticity of the spread to the supply of gold reserves:

$$i_t^{trade} - i_t^{bank} = \alpha + \beta_0 Gold_t + \Gamma X_t + \varepsilon_t \tag{3.1}$$

The variables i_t^{trade} and i_t^{bank} refer to the yield on trade bills and bank bills, respectively. $Gold_t$ is the value of gold at the Bank of England, normalized by GDP.[8] X_t denotes a vector of control variables which includes seasonality dummies as well as other controls such as the Bank of England discount rate.

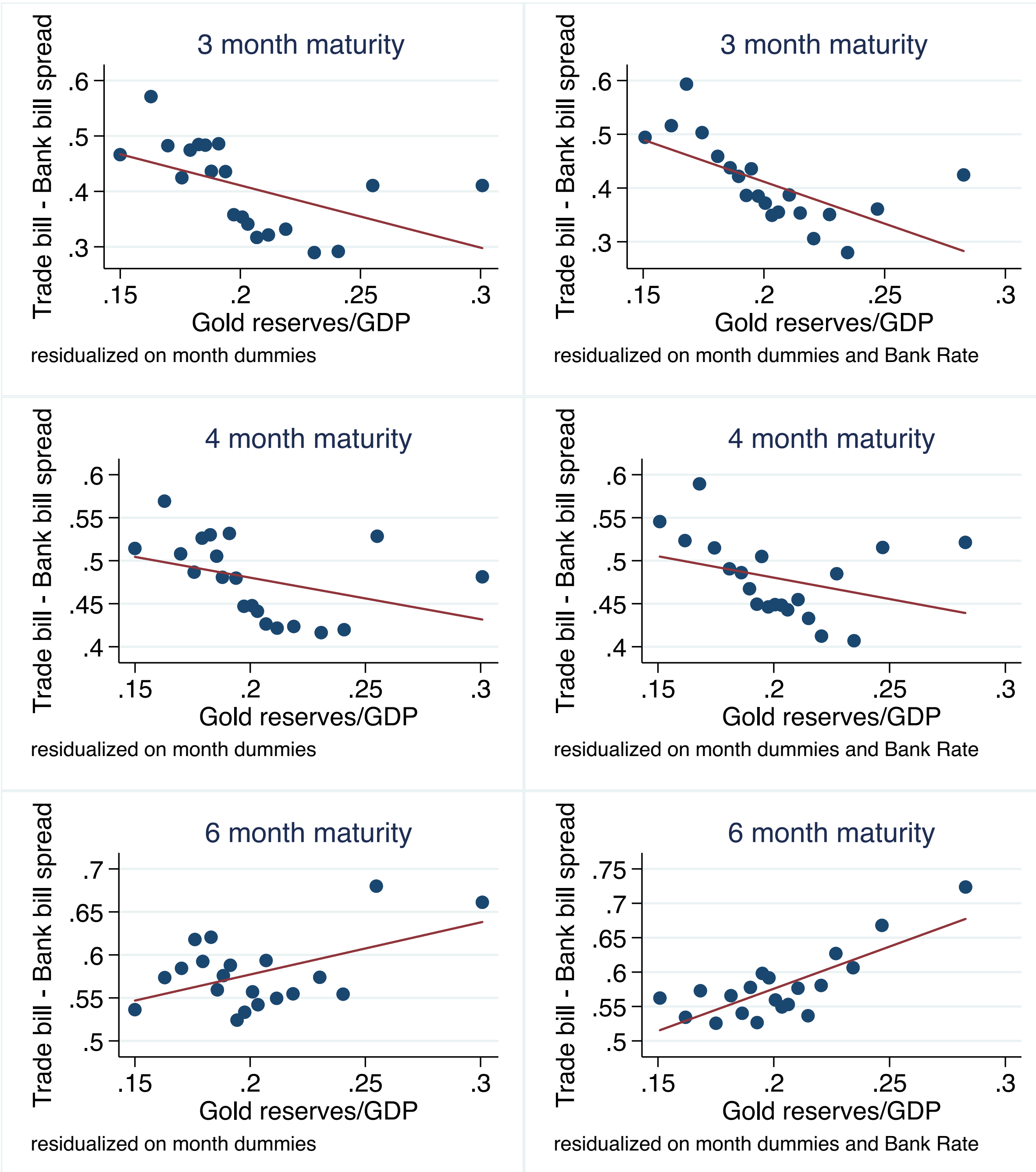
I estimate this regression on monthly data (using the end-of-month dates) from 1870 to 1914 and plot the relationship in Figure 3.4. These binscatters show a clear negative relationship between the supply of central bank gold and the spread between the assets eligible to be discounted and those that are not. In the first row, I focus on the spread for the three month maturity securities. The first figure controls only for seasonal flows while the second figure also controls for the policy discount rate.

In the second row, I plot the relationship for four and six month securities, respectively. The relationship remains negative at 4 months, but becomes positive at 6 months. These relationships are robust to a number of different normalizations and variables used to calculate the supply of safety (for instance, the supply of gold only in the reserves and total reserves including bank notes). Table 3.1 reports the coefficients and standard errors from the linear relationship using Newey-West standard errors with 12 lags.

The main coefficients of interest are in columns 1 and 2, which report the relationship

[8] The demand for safety is assumed to be proportional to the size of the domestic economy. In the baseline specification, I use the total (nominal) value of gold at the central bank.

Figure 3.4: *Relationship between supply of Gold/GDP and safety premium*



Notes: Figure 3.4 plots the binscatter and line of best fit from the OLS regression using monthly data from 1870–1914. The dependent variable is the spread between the yields on the safest asset ("Bank" bills) and the second safest asset ("Trade" bills). Gold is the total volume of bullion at the Bank of England, normalized by GDP. The Bank Rate is the Bank of England's reported discount rate, which affected the total level of rates in London. All specifications are residualized on monthly indicators to control for seasonality.

between the supply of safety and the price of safety for the assets with the relevant maturity (discountable at the Bank of England): 3 months. The coefficients can be interpreted as meaning a 1 pp increase in gold supply relative to GDP reduces the yield spread by 1.1 basis points. This negative relationship is not purely driven by the level of the interest rate, as shown in column 2 when we control for the Bank Rate.

Table 3.1: *Relationship between supply of safety (gold) and safety spread at different maturities*

	3 month		4 month		6 month	
	(1)	(2)	(3)	(4)	(5)	(6)
Gold	-1.124**	-1.560**	-0.483	-0.497	0.606	1.225**
	(0.555)	(0.622)	(0.411)	(0.455)	(0.512)	(0.524)
Bank Rate		-0.0348**		-0.00113		0.0491***
		(0.0150)		(0.0165)		(0.0176)
Month FE	Y	Y	Y	Y	Y	Y
N	524	524	524	524	534	534

Notes: Table 3.1 reports the estimates from the OLS regression using monthly data from 1870–1914. The dependent variable is the spread between the yields on the safest asset (“Bank" bills) and the second safest asset (“Trade" bills). Gold is the total volume of bullion at the Bank of England, normalized by GDP. The Bank Rate is the Bank of England’s reported discount rate, which affected the total level of rates in London. Columns 1 and 2 report estimates using securities with 3 month maturity; Columns 3 and 4 use 4 month maturities, and Columns 5 and 6 use 6 month maturities. All specifications are residualized on monthly indicators to control for seasonality. Standard errors are Newey-West with 12 lags. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

3.5 Conclusion

The historical precedent of the British-led gold standard provides a valuable opportunity to gain additional insight into the way the International Monetary System functions. A demand for US dollar-denominated safe assets is a striking pattern in today’s economy, and it appears that there is a historical analogue in the demand for British gold-backed short-term securities. In future work, it will be possible to use plausibly exogenous shocks to gold mining output to isolate this demand in a way that is not possible in today’s world.

In addition, macrofinance models on the role of the central country provide additional predictions that can be further tested historically, lending a broader and more externally valid understanding of the International Monetary System.

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A | Appendix to Chapter 1

A.1 Additional tables

Table A1: *Bank-level relationship between failure and credit supply*

	Δ% Credit_b			
	(1)	(2)	(3)	(4)
Failure_b	-0.782***	-0.869***	-0.971***	-0.946***
	[0.109]	[0.126]	[0.166]	[0.157]
Weighting	none	Capital, 1865	Liabilities, 1865	Size, 1865
N	31	31	31	31
Adj. R^2	0.398	0.413	0.511	0.488

Notes: Table A1 shows the regression results for the pseudo first stage relationship between bank failure and the credit supplied. The dependent variable is the percent change in the trade credit supply of individual banks. Banks that failed are given a trade credit supply of 0 in the post-crisis period. There are 31 banks that report the composition of their balance sheet. Column 1 reports the baseline, unweighted regression. In columns 2-4, the regressions are weighted by different proxies for firm size. Robust standard errors in brackets. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A2: *Bank balance on geographic exposure calculated as percent of assets*

	All		Not Failed		Failed		Diff	
UK %	0.09	(0.21)	0.10	(0.22)	0.06	(0.17)	0.04	(0.0)
Brit. Emp. %	0.39	(0.41)	0.42	(0.41)	0.28	(0.38)	0.14	(0.1)
Europe %	0.32	(0.39)	0.30	(0.38)	0.44	(0.39)	-0.15	(0.1)
Asia %	0.26	(0.34)	0.25	(0.34)	0.26	(0.35)	-0.01	(0.1)
Africa %	0.09	(0.21)	0.09	(0.21)	0.10	(0.21)	-0.01	(0.0)
N. America %	0.16	(0.31)	0.18	(0.33)	0.08	(0.22)	0.10	(0.1)
S. America %	0.05	(0.16)	0.06	(0.17)	0.04	(0.10)	0.02	(0.0)
Australia %	0.12	(0.29)	0.13	(0.30)	0.08	(0.24)	0.05	(0.1)
N	128		106		22		128	

Notes: Table A2 presents an alternative calculation to the geographic exposure shown in Table 1.1 Panel B. Each variable is the bank's percentage exposure to a geographic exposure, calculated as the credit extended to each geography over the bank's total lending. "Not Failed" and "Failed" refers to whether a bank suspended or closed during the crisis. Means are reported first, and standard deviations are given in parentheses. "Diff" refers to the difference in means between groups. Standard errors are reported in parentheses for the "Diff" column. Significance is marked by $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A3: *Robustness to removing cotton exporting countries: immediate effect of exposure to bank failures on port-level shipping*

	All (1)	excl USA (2)	excl Brazil (3)	excl Egypt (4)	excl all cotton (5)
$\text{Fail}_{\text{po}} \times$ post	-0.531***	-0.524***	-0.533***	-0.488***	-0.485***
	[0.171]	[0.175]	[0.181]	[0.167]	[0.184]
Capital city $\times$ post	Y	Y	Y	Y	Y
Age of banks $\times$ post	Y	Y	Y	Y	Y
# non-Brit banks $\times$ post	Y	Y	Y	Y	Y
Fraction to UK $\times$ post	Y	Y	Y	Y	Y
$\text{Country}_{\text{o}} \times$ post FE	Y	Y	Y	Y	Y
Port_{p} FE	Y	Y	Y	Y	Y
N	578	560	556	564	524
Ports	289	280	278	282	262
Clusters	54	53	53	53	51

Notes: Table A3 reports estimates from the difference-in-difference regressions from the two-period panel of port-level shipping activity in the year before and after the crisis. The dependent variable is the ln of the number of ships departing from each port. Fail_{po} is the share of the port's British banks that failed during the crisis. post is a dummy for the post-crisis year that takes the value of 1 after May 1866 and 0 otherwise. The time-invariant control variables are measured in 1865 and interacted with the post dummy. In columns 2–4, ports from the United States, Brazil, and Egypt are excluded respectively. In column 5, ports from all three cotton exporting countries are excluded. Standard errors in brackets are clustered by country of origin. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A4: *Robustness to controls: immediate effect of exposure to bank failures on country-level shipping*

Panel A: Industry composition of exports

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Fail}_o \times$ post	-0.498**	-0.584**	-0.523**	-0.505**	-0.519**	-0.555**	-0.582**
	[0.224]	[0.240]	[0.220]	[0.234]	[0.224]	[0.221]	[0.242]
non-Brit banks × post	Y						
ln(sugar) × post		Y					
ln(cotton raw) × post			Y				
ln(cotton manu) × post				Y			
ln(grains) × post					Y		
ln(tobacco) × post						Y	
ln(coffee) × post							Y
Country FE	Y	Y	Y	Y	Y	Y	Y
N	108	108	108	108	108	108	108
Clusters	54	54	54	54	54	54	54

Panel B: Monetary standard and conflict

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Fail}_o \times$ post	-0.507**	-0.501**	-0.581**	-0.595**	-0.512**	-0.501**	-0.464**
	[0.227]	[0.231]	[0.248]	[0.249]	[0.208]	[0.238]	[0.228]
Size × post	Y						
Gold × post		Y					
Silver × post			Y				
Bimetallic × post				Y			
Conflict, any × post					Y		
Conflict, interstate × post						Y	
Conflict, other × post							Y
Country FE	Y	Y	Y	Y	Y	Y	Y
N	108	106	106	106	108	108	108
Clusters	54	53	53	53	54	54	54

Notes: Table A4 reports estimates from the difference-in-difference regressions from the two-period panel of country-level shipping activity in the year before and after the crisis. The dependent variable is the ln of the number of ships departing from each country. Fail_o is the share of the country's banks that failed during the crisis. The mean of Fail_o is 0.11, and the standard deviation is 0.17. post is a dummy for the post-crisis year that takes the value of 1 after May 1866 and 0 otherwise. The time-invariant control variables are measured in 1865 and interacted with the post dummy. In Panel A, they include the ln values of sugar, raw cotton, cotton manufactured goods, grains, tobacco, and coffee exports. The ln values of industry exports are replaced with 0 if the country does not export those products. In Panel B, they include the size of the country proxied by the total value of exports, the monetary standard of the country, and engagement in conflict. Controls are added sequentially and the coefficients are stable. Standard errors in brackets are clustered by country of origin. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A5: *Robustness to different clustering: immediate effect of exposure to bank failures on country-level exports*

$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)
β_{1865}	-0.240	-0.240	-0.240	-0.240	-0.240
	[0.214]	[0.151]	[0.192]	[0.176]	[0.318]
β_{1867}	-0.921	-0.921	-0.921	-0.921	-0.921***
	[0.603]	[0.643]	[0.575]	[0.661]	[0.0689]
β_{1868}	-1.611***	-1.611***	-1.611***	-1.611**	-1.611***
	[0.551]	[0.585]	[0.506]	[0.616]	[0.393]
β_{1869}	-1.872***	-1.872***	-1.872***	-1.872***	-1.872***
	[0.410]	[0.584]	[0.493]	[0.519]	[0.263]
β_{1870}	-1.633***	-1.633**	-1.633***	-1.633***	-1.633***
	[0.434]	[0.621]	[0.536]	[0.540]	[0.293]
Controls	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y
I(Brit bank_{ot})	Y	Y	Y	Y	Y
$\text{Country}_{\text{dt}}$	Y	Y	Y	Y	Y
N	2952	2952	2952	2952	2952
Clustering	Orig country	Dest country	Orig-Dest pair	Multi: Orig, Dest	Multi: Orig, Dest, year
Adj. R^2	0.551	0.550	0.551	0.550	0.550

Notes: Table A5 reports estimates from the annual dynamic difference-in-difference regressions from the panel of country-level values of trade. The dependent variable is the ln value of exports from origin country o to destination country d. There are 83 exporting countries from 1865-1870. Fail_o is the share of the country's banks that failed. post is a dummy for the post-crisis years 1867-1870. Baseline controls are the log distance between country o and country d. Standard errors in brackets are clustered according to the row labeled "Clustering." $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A6: *Elasticity of trade to physical distance*

$$\ln(\text{EX}_{odt}) = \theta \ln(\text{distance})_{od} + \gamma_{ot} + \gamma_{dt} + \Gamma' X_{odt} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)
log distance $_{\text{od}}$	-1.116***	-1.021***	-0.982***	-1.194***	-1.037***
	[0.0851]	[0.0910]	[0.101]	[0.0856]	[0.101]
$\text{Country}_{\text{ot}}$ FE	Y	Y	Y	Y	Y
$\text{Country}_{\text{dt}}$ FE	Y	Y	Y	Y	Y
Common language × t		Y			Y
Common border × t			Y		Y
Common empire × t				Y	Y
N	67378	67378	67378	67378	67378
Clusters	119	119	119	119	119
Adj. R^2	0.530	0.548	0.534	0.559	0.564

Notes: Table A6 reports estimates for θ, the elasticity of trade to physical distance, from the above estimation. All specifications are estimated using the full panel of bilateral trade data from 1850–1914. The baseline specification is given in Column 1. Columns 2–5 control for standard gravity measurements of bilateral resistance. The dependent variable is the ln value of exports from origin country o to destination country d. The origin country-year fixed effects effectively drop the countries that only appear in the trade data for one year. There are 10 such countries and therefore only 119 clusters. Standard errors in brackets are clustered by origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Table A7: *Long-term effects of financing shock on country-level exports*

$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_{1850\text{-}1855}$	0.0309	-0.248	-0.217	-0.171	-0.180	0.311	-0.284	-0.254
	[0.217]	[0.330]	[0.413]	[0.343]	[0.344]	[0.486]	[0.306]	[0.296]
$\beta_{1856\text{-}1860}$	-0.0624	-0.152	-0.324	0.0465	-0.0696	-0.155	-0.0873	-0.0469
	[0.145]	[0.224]	[0.316]	[0.192]	[0.229]	[0.350]	[0.160]	[0.141]
$\beta_{1866\text{-}1870}$	-1.528***	-1.476***	-1.513***	-1.543***	-1.433***	-2.160***	-1.569***	-1.424***
	[0.322]	[0.372]	[0.407]	[0.415]	[0.410]	[0.579]	[0.577]	[0.524]
$\beta_{1871\text{-}1875}$	-1.772***	-1.743***	-1.841***	-1.618***	-1.651***	-2.206**	-1.587**	-1.713***
	[0.462]	[0.522]	[0.575]	[0.556]	[0.526]	[0.851]	[0.598]	[0.524]
$\beta_{1876\text{-}1880}$	-1.902***	-1.745***	-1.963***	-1.538***	-1.623***	-2.320**	-1.445**	-1.626***
	[0.521]	[0.568]	[0.651]	[0.564]	[0.557]	[0.891]	[0.568]	[0.515]
$\beta_{1881\text{-}1885}$	-1.483***	-1.347**	-1.475**	-1.221**	-1.221**	-2.160**	-1.200**	-1.320***
	[0.449]	[0.547]	[0.653]	[0.553]	[0.542]	[0.906]	[0.520]	[0.473]
$\beta_{1886\text{-}1890}$	-1.394***	-1.199**	-1.437**	-1.095**	-1.117**	-1.895**	-1.249***	-1.381***
	[0.390]	[0.506]	[0.621]	[0.523]	[0.526]	[0.858]	[0.453]	[0.429]
$\beta_{1891\text{-}1895}$	-1.319***	-1.148**	-1.457**	-0.979*	-1.008*	-1.887**	-1.346**	-1.267**
	[0.383]	[0.511]	[0.645]	[0.527]	[0.505]	[0.736]	[0.519]	[0.508]
$\beta_{1896\text{-}1900}$	-1.391***	-1.210***	-1.489**	-1.041**	-1.188**	-1.956***	-1.468***	-1.481***
	[0.325]	[0.451]	[0.611]	[0.481]	[0.459]	[0.648]	[0.415]	[0.420]
$\beta_{1901\text{-}1905}$	-1.046**	-0.848	-1.256*	-0.530	-0.993*	-1.523**	-1.090**	-1.055**
	[0.403]	[0.535]	[0.723]	[0.514]	[0.523]	[0.699]	[0.489]	[0.510]
$\beta_{1906\text{-}1910}$	-0.877**	-0.705	-1.104	-0.412	-0.846	-1.249	-0.891**	-1.117***
	[0.424]	[0.523]	[0.687]	[0.504]	[0.558]	[0.810]	[0.377]	[0.391]
$\beta_{1911\text{-}1914}$	-1.009*	-0.868	-1.234*	-0.583	-0.972	-1.093	-0.815*	-1.417***
	[0.521]	[0.573]	[0.731]	[0.551]	[0.624]	[0.846]	[0.452]	[0.429]
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y	Y	Y	Y
$\ln(\text{cotton}_o) \times$ t			Y					
$\ln(\text{cotton manu}_o) \times$ t				Y				
$\ln(\text{population}_o) \times$					Y			
SITC $\text{industry}_o \times$ t						Y		
$\text{Region}_o \times$ t							Y	Y
$\text{I(Brit bank}_o) \times$ t	Y	Y	Y	Y	Y	Y	Y	Y
Country_d	Y							
Country_{dt}		Y	Y	Y	Y	Y	Y	Y
N	67378	67378	67378	67378	55391	49006	49006	67378
Clusters	129	129	129	129	54	48	48	129
Adj. R^2	0.530	0.530	0.531	0.531	0.545	0.559	0.558	0.532

Notes: Table A7 reports the point estimates for the long-term effects of the credit shock on the value of country-level exports. The dependent variable is the log value of exports from origin country o to destination country d. Baseline controls are the log distance between country o and country d. Cotton, cotton manufactured goods, and population are calculated in 1865 and interacted with the 5-year dummies. Countries that did not export cotton are given ln values of zero. Controlling for pre-crisis population and the SITC industry of exports reduces the sample size to countries that were exporting pre-crisis. Column 7 artificially restricts the sample to countries with SITC codes available. Standard errors in brackets are clustered by the origin country. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A8: *Effect of bank failures from 1850–2014*

$$\ln(EX_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)		(2)		(3)	
$\beta_{1850\text{-}1855}$	0.202	[0.306]	-0.256	[0.356]	-0.117	[0.357]
$\beta_{1856\text{-}1860}$	-0.184	[0.192]	-0.317	[0.302]	-0.199	[0.299]
$\beta_{1866\text{-}1870}$	-2.430***	[0.837]	-1.985***	[0.595]	-1.752***	[0.598]
$\beta_{1871\text{-}1875}$	-2.793***	[0.984]	-2.386***	[0.847]	-2.090**	[0.838]
$\beta_{1876\text{-}1880}$	-2.779***	[0.993]	-2.248**	[0.869]	-1.928**	[0.853]
$\beta_{1881\text{-}1885}$	-2.429***	[0.828]	-1.789**	[0.771]	-1.480*	[0.756]
$\beta_{1886\text{-}1890}$	-2.367***	[0.662]	-1.689**	[0.678]	-1.428**	[0.678]
$\beta_{1891\text{-}1895}$	-2.369***	[0.688]	-1.694**	[0.700]	-1.376**	[0.671]
$\beta_{1896\text{-}1900}$	-2.432***	[0.558]	-1.800***	[0.607]	-1.579***	[0.585]
$\beta_{1901\text{-}1905}$	-2.163***	[0.600]	-1.451**	[0.700]	-1.367*	[0.690]
$\beta_{1906\text{-}1910}$	-1.982***	[0.533]	-1.270*	[0.645]	-1.196*	[0.665]
$\beta_{1911\text{-}1915}$	-2.276***	[0.531]	-1.519**	[0.634]	-1.447**	[0.669]
$\beta_{1916\text{-}1920}$	-3.666***	[1.009]	-2.859***	[1.088]	-2.720**	[1.121]
$\beta_{1921\text{-}1925}$	-2.487***	[0.637]	-1.755**	[0.739]	-1.833**	[0.793]
$\beta_{1926\text{-}1930}$	-2.010***	[0.601]	-1.433**	[0.700]	-1.530**	[0.741]
$\beta_{1931\text{-}1935}$	-1.598**	[0.628]	-1.031	[0.747]	-1.281	[0.786]
$\beta_{1936\text{-}1940}$	-1.725**	[0.688]	-1.061	[0.784]	-1.323	[0.829]
$\beta_{1941\text{-}1945}$	-2.925*	[1.588]	-2.291	[1.386]	-2.798**	[1.145]
$\beta_{1946\text{-}1950}$	-1.752**	[0.752]	-1.288	[0.803]	-1.625**	[0.776]
$\beta_{1951\text{-}1955}$	-1.934***	[0.669]	-1.404*	[0.739]	-1.643**	[0.764]
$\beta_{1956\text{-}1960}$	-2.010***	[0.654]	-1.488**	[0.719]	-1.727**	[0.748]
$\beta_{1961\text{-}1965}$	-2.102***	[0.624]	-1.558**	[0.705]	-1.774**	[0.749]
$\beta_{1966\text{-}1970}$	-1.799***	[0.632]	-1.240*	[0.735]	-1.568*	[0.782]
$\beta_{1971\text{-}1975}$	-1.461**	[0.680]	-0.848	[0.806]	-1.246	[0.858]
$\beta_{1976\text{-}1980}$	-1.402**	[0.669]	-0.762	[0.803]	-1.167	[0.843]
$\beta_{1981\text{-}1985}$	-1.512**	[0.688]	-0.891	[0.818]	-1.344	[0.865]
$\beta_{1986\text{-}1990}$	-1.353*	[0.694]	-0.735	[0.832]	-1.306	[0.875]
$\beta_{1991\text{-}1995}$	-1.756**	[0.691]	-1.145	[0.832]	-1.724*	[0.881]
$\beta_{1996\text{-}2000}$	-1.755**	[0.686]	-1.134	[0.817]	-1.882**	[0.835]
$\beta_{2001\text{-}2005}$	-1.630**	[0.720]	-1.020	[0.841]	-1.866**	[0.835]
$\beta_{2006\text{-}2010}$	-1.537**	[0.750]	-0.933	[0.858]	-1.878**	[0.809]
$\beta_{2011\text{-}2014}$	-1.413*	[0.773]	-0.806	[0.869]	-1.700**	[0.816]
Controls	Y		Y		Y	
Country_o FE	Y		Y		Y	
I(Brit bank_o) × t	Y		Y		Y	
ln(population_o) × t					Y	
Country_d	Y					
Country_{dt}			Y		Y	
N	665866		665866		414777	
Clusters	137		137		54	
Adj. R^2	0.654		0.680		0.748	

Notes: Table A8 reports the coefficients every five years. The control variables are the same as defined in Table A7. Standard errors in brackets are clustered by the origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A9: *Long-term effects: robustness to gravity measures of commonality*

$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{odt} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$						
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{1850\text{-}1855}$	-0.340	-0.259	-0.227	-0.324	-0.264	-0.273
	[0.322]	[0.306]	[0.315]	[0.334]	[0.324]	[0.316]
$\beta_{1856\text{-}1860}$	-0.203	-0.139	-0.186	-0.157	-0.139	-0.235
	[0.234]	[0.221]	[0.239]	[0.228]	[0.226]	[0.239]
$\beta_{1866\text{-}1870}$	-1.452***	-1.537***	-1.163***	-1.491***	-1.535***	-1.221***
	[0.329]	[0.342]	[0.391]	[0.306]	[0.347]	[0.379]
$\beta_{1871\text{-}1875}$	-1.732***	-1.797***	-1.383**	-1.754***	-1.797***	-1.446**
	[0.502]	[0.522]	[0.604]	[0.460]	[0.522]	[0.595]
$\beta_{1876\text{-}1880}$	-1.709***	-1.803***	-1.407**	-1.740***	-1.802***	-1.479**
	[0.558]	[0.571]	[0.656]	[0.536]	[0.570]	[0.653]
$\beta_{1881\text{-}1885}$	-1.290**	-1.393**	-1.033*	-1.317**	-1.391**	-1.102*
	[0.547]	[0.556]	[0.602]	[0.544]	[0.556]	[0.595]
$\beta_{1886\text{-}1890}$	-1.113**	-1.236**	-0.869	-1.172**	-1.236**	-0.933*
	[0.496]	[0.499]	[0.526]	[0.500]	[0.499]	[0.527]
$\beta_{1891\text{-}1895}$	-1.079**	-1.203**	-0.847	-1.107**	-1.203**	-0.906*
	[0.490]	[0.503]	[0.538]	[0.491]	[0.504]	[0.535]
$\beta_{1896\text{-}1900}$	-1.154***	-1.269***	-0.905*	-1.223***	-1.269***	-0.961**
	[0.423]	[0.429]	[0.468]	[0.425]	[0.432]	[0.466]
$\beta_{1901\text{-}1905}$	-0.789	-0.888*	-0.587	-0.859*	-0.885*	-0.645
	[0.505]	[0.509]	[0.569]	[0.498]	[0.512]	[0.566]
$\beta_{1906\text{-}1910}$	-0.640	-0.735	-0.437	-0.724	-0.738	-0.493
	[0.505]	[0.503]	[0.549]	[0.503]	[0.504]	[0.551]
$\beta_{1911\text{-}1914}$	-0.842	-0.893	-0.610	-0.939	-0.900	-0.669
	[0.568]	[0.554]	[0.597]	[0.572]	[0.553]	[0.601]
Common language	1.102***					
	[0.157]					
Common border		0.854***				
		[0.212]				
Common empire			1.741***			
			[0.162]			
Controls	Y	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y	Y
Common language $\times$ t				Y		
Common border $\times$ t					Y	
Common empire $\times$ t						Y
I(Brit bank_o) $\times$ t	Y	Y	Y	Y	Y	Y
$\text{Country}_{\text{dt}}$	Y	Y	Y	Y	Y	Y
N	67378	67378	67378	67378	67378	67378
Clusters	129	129	129	129	129	129
Adj. R^2	0.547	0.534	0.557	0.547	0.533	0.557

Notes: Table A9 reports the coefficients every five years. The control variables are time-invariant and time-varying measures of distance standard to gravity estimations, such as common language. Standard errors in brackets are clustered by the origin country. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

Table A10: *Long-term effects: robustness to monetary standard and conflict*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\beta_{1850\text{-}1855}$	-0.114	-0.280	-0.249	-0.260	-0.261	-0.243	-0.245
	[0.430]	[0.321]	[0.377]	[0.432]	[0.336]	[0.331]	[0.342]
$\beta_{1856\text{-}1860}$	-0.308	-0.177	-0.110	0.0321	-0.0357	-0.141	-0.139
	[0.280]	[0.228]	[0.267]	[0.283]	[0.197]	[0.232]	[0.219]
$\beta_{1866\text{-}1870}$	-1.527***	-1.581***	-1.693***	-1.488***	-1.368***	-1.472***	-1.460***
	[0.426]	[0.382]	[0.384]	[0.410]	[0.427]	[0.369]	[0.373]
$\beta_{1871\text{-}1875}$	-1.865***	-1.887***	-1.992***	-1.745***	-1.553***	-1.735***	-1.726***
	[0.626]	[0.510]	[0.486]	[0.535]	[0.579]	[0.523]	[0.524]
$\beta_{1876\text{-}1880}$	-1.966***	-1.875***	-1.992***	-1.739***	-1.550**	-1.738***	-1.727***
	[0.690]	[0.562]	[0.555]	[0.615]	[0.594]	[0.572]	[0.569]
$\beta_{1881\text{-}1885}$	-1.520**	-1.472***	-1.595***	-1.341**	-1.152**	-1.344**	-1.330**
	[0.680]	[0.548]	[0.608]	[0.651]	[0.556]	[0.551]	[0.547]
$\beta_{1886\text{-}1890}$	-1.337**	-1.226**	-1.444**	-1.190*	-1.005*	-1.193**	-1.182**
	[0.663]	[0.538]	[0.592]	[0.614]	[0.514]	[0.511]	[0.503]
$\beta_{1891\text{-}1895}$	-1.342*	-1.142**	-1.407**	-1.164*	-0.956*	-1.141**	-1.130**
	[0.684]	[0.545]	[0.582]	[0.625]	[0.534]	[0.521]	[0.512]
$\beta_{1896\text{-}1900}$	-1.386**	-1.196**	-1.448***	-1.200**	-1.019**	-1.202**	-1.193***
	[0.629]	[0.466]	[0.530]	[0.558]	[0.483]	[0.461]	[0.453]
$\beta_{1901\text{-}1905}$	-0.998	-0.789	-1.048*	-0.839	-0.683	-0.842	-0.831
	[0.736]	[0.549]	[0.590]	[0.637]	[0.531]	[0.545]	[0.537]
$\beta_{1906\text{-}1910}$	-0.840	-0.651	-0.924	-0.671	-0.521	-0.701	-0.686
	[0.717]	[0.541]	[0.615]	[0.622]	[0.525]	[0.528]	[0.523]
$\beta_{1911\text{-}1914}$	-0.958	-0.795	-1.126*	-0.875	-0.668	-0.863	-0.853
	[0.741]	[0.596]	[0.658]	[0.665]	[0.564]	[0.577]	[0.573]
Controls	Y	Y	Y	Y	Y	Y	Y
Country$_o$ FE	Y	Y	Y	Y	Y	Y	Y
Gold standard$_o$ × t	Y						
Silver standard$_o$ × t		Y					
Conflict (any)$_o$ × t			Y				
Conflict (interstate)$_o$ × t				Y			
Conflict (other)$_o$ × t					Y		
Country$_{ot}$ war						Y	
Country-pair$_{odt}$ war							Y
I(Brit bank$_o$) × t	Y	Y	Y	Y	Y	Y	Y
Country$_{dt}$	Y	Y	Y	Y	Y	Y	Y
N	56937	56937	67378	67378	67378	67378	67378
Clusters	55	55	129	129	129	129	129
Adj. R^2	0.543	0.543	0.530	0.530	0.530	0.530	0.530

Notes: Table A10 reports the coefficients every five years. The monetary and conflict variables are binary variables taking a value of 1 if the exporting country had that characteristic in 1865 or 1866 and are interacted with year dummies. Column 6 controls for war in the origin country (including civil war) in any year, and Column 7 controls for war between dyadic pairs of countries in any year. Standard errors in brackets are clustered by the origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A11: *Long-term effects: robustness to industry composition of exports*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{1850\text{-}1855}$	-0.292	-0.341	-0.231	-0.327	-0.379	-0.349
	[0.314]	[0.402]	[0.344]	[0.398]	[0.386]	[0.319]
$\beta_{1856\text{-}1860}$	-0.141	-0.362	-0.103	-0.335	-0.207	-0.256
	[0.226]	[0.249]	[0.233]	[0.250]	[0.233]	[0.229]
$\beta_{1866\text{-}1870}$	-1.381***	-1.632***	-1.620***	-1.501***	-1.736***	-1.469***
	[0.360]	[0.441]	[0.388]	[0.478]	[0.426]	[0.445]
$\beta_{1871\text{-}1875}$	-1.518***	-2.030***	-1.789***	-1.752***	-2.024***	-1.814***
	[0.476]	[0.604]	[0.515]	[0.642]	[0.557]	[0.511]
$\beta_{1876\text{-}1880}$	-1.551***	-2.155***	-1.760***	-1.751**	-2.038***	-1.800***
	[0.531]	[0.667]	[0.536]	[0.701]	[0.589]	[0.547]
$\beta_{1881\text{-}1885}$	-1.185**	-1.798***	-1.393**	-1.390**	-1.676***	-1.421***
	[0.529]	[0.684]	[0.557]	[0.678]	[0.602]	[0.525]
$\beta_{1886\text{-}1890}$	-1.097**	-1.688**	-1.306***	-1.314**	-1.561***	-1.212**
	[0.518]	[0.673]	[0.499]	[0.620]	[0.573]	[0.479]
$\beta_{1891\text{-}1895}$	-1.066**	-1.639**	-1.210**	-1.239*	-1.444**	-1.184**
	[0.519]	[0.683]	[0.479]	[0.630]	[0.578]	[0.495]
$\beta_{1896\text{-}1900}$	-1.168**	-1.696***	-1.146***	-1.207**	-1.480***	-1.294***
	[0.453]	[0.620]	[0.438]	[0.562]	[0.526]	[0.420]
$\beta_{1901\text{-}1905}$	-0.841	-1.422**	-0.702	-0.706	-1.011*	-0.880
	[0.524]	[0.695]	[0.486]	[0.615]	[0.546]	[0.544]
$\beta_{1906\text{-}1910}$	-0.820	-1.292*	-0.537	-0.545	-0.871	-0.835
	[0.508]	[0.673]	[0.499]	[0.633]	[0.600]	[0.515]
$\beta_{1911\text{-}1914}$	-0.964*	-1.442**	-0.670	-0.665	-1.051	-0.937
	[0.532]	[0.698]	[0.558]	[0.700]	[0.679]	[0.587]
Controls	Y	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y	Y
$\ln(\text{coffee}_\text{o}) \times \text{t}$	Y					
$\ln(\text{grains}_\text{o}) \times \text{t}$		Y				
$\ln(\text{bullion}_\text{o}) \times \text{t}$			Y			
$\ln(\text{alcohol}_\text{o}) \times \text{t}$				Y		
$\ln(\text{tobacco}_\text{o}) \times \text{t}$					Y	
Commodities $\text{share}_\text{o} \times \text{t}$						Y
$\text{I(Brit bank}_\text{o}) \times \text{t}$	Y	Y	Y	Y	Y	Y
Country_dt	Y	Y	Y	Y	Y	Y
N	67378	67378	67378	67378	67378	62109
Clusters	129	129	129	129	129	81
Adj. R^2	0.531	0.531	0.531	0.531	0.532	0.538

Notes: Table A11 reports the coefficients every five years. The industry-level exports are calculated in 1865 and interacted with the 5-year dummies. Countries that did not export a commodity are given ln values of zero. The Commodities share of exports is the fraction of goods exported in 1865 that are categorized as raw or primary products. Standard errors in brackets are clustered by the origin country. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

Table A12: *Long-term effects: robustness to excluding cotton exporting countries*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{1850\text{-}1855}$	0.0141	-0.281	0.0470	-0.231	0.0783	-0.167
	[0.234]	[0.358]	[0.221]	[0.328]	[0.201]	[0.311]
$\beta_{1856\text{-}1860}$	-0.0175	0.0118	-0.0715	-0.162	-0.0354	-0.104
	[0.153]	[0.214]	[0.148]	[0.227]	[0.143]	[0.216]
$\beta_{1866\text{-}1870}$	-1.590***	-1.498***	-1.501***	-1.469***	-1.453***	-1.373***
	[0.347]	[0.439]	[0.326]	[0.377]	[0.294]	[0.371]
$\beta_{1871\text{-}1875}$	-1.715***	-1.550**	-1.744***	-1.737***	-1.710***	-1.656***
	[0.498]	[0.606]	[0.468]	[0.524]	[0.426]	[0.505]
$\beta_{1876\text{-}1880}$	-1.789***	-1.439**	-1.889***	-1.758***	-1.843***	-1.654***
	[0.556]	[0.609]	[0.529]	[0.571]	[0.488]	[0.550]
$\beta_{1881\text{-}1885}$	-1.374***	-1.068*	-1.498***	-1.374**	-1.434***	-1.260**
	[0.483]	[0.588]	[0.456]	[0.551]	[0.435]	[0.534]
$\beta_{1886\text{-}1890}$	-1.330***	-0.940*	-1.398***	-1.218**	-1.342***	-1.117**
	[0.427]	[0.561]	[0.395]	[0.510]	[0.387]	[0.497]
$\beta_{1891\text{-}1895}$	-1.233***	-0.881	-1.325***	-1.174**	-1.270***	-1.067**
	[0.429]	[0.573]	[0.390]	[0.515]	[0.373]	[0.502]
$\beta_{1896\text{-}1900}$	-1.319***	-0.966*	-1.393***	-1.227***	-1.334***	-1.121**
	[0.363]	[0.530]	[0.332]	[0.456]	[0.325]	[0.444]
$\beta_{1901\text{-}1905}$	-0.903**	-0.481	-1.038**	-0.860	-0.971**	-0.745
	[0.420]	[0.559]	[0.412]	[0.541]	[0.400]	[0.527]
$\beta_{1906\text{-}1910}$	-0.750*	-0.366	-0.863**	-0.711	-0.796*	-0.592
	[0.437]	[0.552]	[0.429]	[0.528]	[0.425]	[0.508]
$\beta_{1911\text{-}1914}$	-0.883*	-0.535	-1.041**	-0.928	-0.917*	-0.745
	[0.528]	[0.592]	[0.526]	[0.574]	[0.523]	[0.555]
Controls	Y	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y	Y
excluding USA	Y	Y				
excluding Brazil			Y	Y		
excluding Egypt					Y	Y
$\text{I(Brit bank}_o) \times \text{t}$	Y	Y	Y	Y	Y	Y
Country_d	Y		Y		Y	
Country_{dt}		Y		Y		Y
N	63851	63851	66381	66381	66570	66570
Clusters	128	128	128	128	128	128
Adj. R^2	0.524	0.524	0.531	0.531	0.530	0.530

Notes: Table A12 reports the coefficients every five years. Exports from the USA, Brazil, and Egypt are excluded in columns 1–2, 3–4, and 5–6, respectively. Standard errors in brackets are clustered by the origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A13: *Long-term effects: robustness to contemporaneous financial crises*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_{1850\text{-}1855}$	-0.298	-0.288	-0.247	-0.297	-0.288	-0.291	-0.288	-0.270
	[0.333]	[0.342]	[0.324]	[0.336]	[0.335]	[0.336]	[0.332]	[0.327]
$\beta_{1856\text{-}1860}$	-0.152	-0.134	-0.118	-0.153	-0.140	-0.140	-0.115	-0.103
	[0.228]	[0.219]	[0.212]	[0.228]	[0.227]	[0.227]	[0.227]	[0.226]
$\beta_{1866\text{-}1870}$	-1.410***	-1.397***	-1.437***	-1.411***	-1.428***	-1.422***	-1.419***	-1.443***
	[0.401]	[0.405]	[0.397]	[0.401]	[0.404]	[0.404]	[0.407]	[0.397]
$\beta_{1871\text{-}1875}$	-1.724***	-1.701***	-1.757***	-1.741***	-1.761***	-1.725***	-1.724***	-1.707***
	[0.538]	[0.537]	[0.545]	[0.540]	[0.546]	[0.541]	[0.542]	[0.549]
$\beta_{1876\text{-}1880}$	-1.713***	-1.697***	-1.717***	-1.739***	-1.732***	-1.685***	-1.712***	-1.683***
	[0.581]	[0.574]	[0.574]	[0.587]	[0.595]	[0.580]	[0.583]	[0.589]
$\beta_{1881\text{-}1885}$	-1.242**	-1.217**	-1.278**	-1.256**	-1.260**	-1.231**	-1.260**	-1.262**
	[0.553]	[0.548]	[0.542]	[0.553]	[0.554]	[0.549]	[0.553]	[0.551]
$\beta_{1886\text{-}1890}$	-1.126**	-1.102**	-1.188**	-1.129**	-1.161**	-1.147**	-1.127**	-1.127**
	[0.521]	[0.515]	[0.507]	[0.520]	[0.515]	[0.516]	[0.521]	[0.518]
$\beta_{1891\text{-}1895}$	-1.084**	-1.058**	-1.140**	-1.086**	-1.109**	-1.097**	-1.060**	-1.044*
	[0.534]	[0.525]	[0.530]	[0.531]	[0.524]	[0.526]	[0.529]	[0.533]
$\beta_{1896\text{-}1900}$	-1.229**	-1.210**	-1.248***	-1.232**	-1.243***	-1.234**	-1.234**	-1.229**
	[0.469]	[0.464]	[0.462]	[0.468]	[0.462]	[0.464]	[0.471]	[0.474]
$\beta_{1901\text{-}1905}$	-1.038*	-1.014*	-0.971*	-1.042*	-1.057*	-1.046*	-1.033*	-1.031*
	[0.549]	[0.540]	[0.549]	[0.548]	[0.538]	[0.540]	[0.550]	[0.552]
$\beta_{1906\text{-}1910}$	-0.832	-0.806	-0.748	-0.836	-0.868	-0.853	-0.836	-0.825
	[0.552]	[0.542]	[0.527]	[0.551]	[0.538]	[0.539]	[0.553]	[0.551]
$\beta_{1911\text{-}1914}$	-0.920	-0.898	-0.839	-0.923	-0.956	-0.941	-0.926	-0.915
	[0.594]	[0.585]	[0.560]	[0.593]	[0.578]	[0.580]	[0.591]	[0.589]
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y	Y	Y	Y
Currency crisis_ot	Y							
Inflation crisis_ot		Y						
Stock mkt crisis_ot			Y					
Sovereign debt $(\text{domestic})_\text{ot}$				Y				
Sovereign debt $(\text{external})_\text{ot}$					Y			
Sovereign debt $(\text{any})_\text{ot}$						Y		
Banking crisis_ot							Y	
Any crisis_ot								Y
$\text{I(Brit bank}_\text{o}) \times \text{t}$	Y	Y	Y	Y	Y	Y	Y	Y
Country_dt	Y	Y	Y	Y	Y	Y	Y	Y
N	57305	57305	52480	57305	57305	57305	57305	57305
Clusters	62	62	44	62	62	62	62	62
Adj. R^2	0.543	0.544	0.545	0.543	0.544	0.544	0.544	0.544

Notes: Table A13 reports the coefficients every five years. Different types of financial crises are binary variables, which take the value of 1 if the exporting country is experiencing it in any given year. These are contemporaneous measures taken from Reinhart and Rogoff (2009b). Data limitations reduce the number of observations. Standard errors in brackets are clustered by the origin country. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

Table A14: *Long-term effects: robustness to financial crises in 1865*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)
$\beta_{1850\text{-}1855}$	-0.202	-0.314	-0.264	-0.306	-0.187
	[0.325]	[0.359]	[0.330]	[0.342]	[0.356]
$\beta_{1856\text{-}1860}$	-0.0976	-0.203	-0.226	-0.234	-0.257
	[0.214]	[0.264]	[0.240]	[0.229]	[0.245]
$\beta_{1866\text{-}1870}$	-1.352***	-1.541***	-1.248***	-1.419***	-1.340***
	[0.431]	[0.399]	[0.417]	[0.406]	[0.399]
$\beta_{1871\text{-}1875}$	-1.621***	-1.941***	-1.634***	-1.769***	-1.657***
	[0.538]	[0.432]	[0.548]	[0.524]	[0.504]
$\beta_{1876\text{-}1880}$	-1.608***	-1.958***	-1.701***	-1.754***	-1.642***
	[0.566]	[0.446]	[0.588]	[0.572]	[0.535]
$\beta_{1881\text{-}1885}$	-1.179**	-1.465***	-1.260**	-1.253**	-1.178**
	[0.546]	[0.522]	[0.551]	[0.553]	[0.547]
$\beta_{1886\text{-}1890}$	-1.063**	-1.320**	-1.111**	-1.120**	-1.074*
	[0.526]	[0.505]	[0.531]	[0.523]	[0.538]
$\beta_{1891\text{-}1895}$	-0.958*	-1.281**	-1.125**	-1.069*	-1.024*
	[0.527]	[0.502]	[0.524]	[0.535]	[0.535]
$\beta_{1896\text{-}1900}$	-1.110**	-1.386***	-1.247**	-1.229**	-1.178**
	[0.473]	[0.436]	[0.474]	[0.471]	[0.482]
$\beta_{1901\text{-}1905}$	-0.883	-1.129**	-1.140**	-1.030*	-0.969*
	[0.542]	[0.522]	[0.544]	[0.549]	[0.537]
$\beta_{1906\text{-}1910}$	-0.640	-0.909*	-0.933	-0.827	-0.756
	[0.540]	[0.526]	[0.565]	[0.553]	[0.557]
$\beta_{1911\text{-}1914}$	-0.726	-0.987*	-0.990	-0.922	-0.852
	[0.583]	[0.582]	[0.607]	[0.592]	[0.604]
Controls	Y	Y	Y	Y	Y
Country_o FE	Y	Y	Y	Y	Y
Inflation $\text{crisis}_\text{o} \times$ t	Y				
Stock mkt $\text{crisis}_\text{o} \times$ t		Y			
Sovereign debt $\text{crisis}_\text{o} \times$ t			Y		
Banking $\text{crisis}_\text{o} \times$ t				Y	
Any $\text{crisis}_\text{o} \times$ t					Y
I(Brit bank_o) $\times$ t	Y	Y	Y	Y	Y
Country_dt	Y	Y	Y	Y	Y
N	57305	52483	57305	57305	57305
Clusters	62	44	62	62	62
Adj. R^2	0.544	0.545	0.544	0.543	0.543

Notes: Table A14 reports the coefficients every five years. Different types of financial crises are binary variables, which take the value of 1 if the exporting country is experiencing it in 1865, taken from Reinhart and Rogoff (2009b), and interacted with year dummies. No country experienced a currency crisis or domestic sovereign debt crisis in 1865 so these are not reported. Standard errors in brackets are clustered by the origin country. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A15: *Long-term effects: robustness to borrowing from London Stock Exchange*

$$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{1850\text{-}1855}$	-0.249	-0.251	-0.251	-0.247	-0.248	-0.255
	[0.329]	[0.330]	[0.331]	[0.330]	[0.331]	[0.331]
$\beta_{1856\text{-}1860}$	-0.152	-0.150	-0.155	-0.152	-0.150	-0.151
	[0.225]	[0.224]	[0.225]	[0.224]	[0.220]	[0.224]
$\beta_{1866\text{-}1870}$	-1.495***	-1.470***	-1.415***	-1.385***	-1.433***	-1.457***
	[0.391]	[0.384]	[0.382]	[0.395]	[0.374]	[0.372]
$\beta_{1871\text{-}1875}$	-1.775***	-1.785***	-1.712***	-1.671***	-1.751***	-1.723***
	[0.548]	[0.546]	[0.538]	[0.541]	[0.532]	[0.526]
$\beta_{1876\text{-}1880}$	-1.808***	-1.817***	-1.752***	-1.715***	-1.744***	-1.792***
	[0.586]	[0.583]	[0.567]	[0.577]	[0.573]	[0.571]
$\beta_{1881\text{-}1885}$	-1.376**	-1.469***	-1.334**	-1.373**	-1.321**	-1.375**
	[0.547]	[0.549]	[0.532]	[0.538]	[0.564]	[0.545]
$\beta_{1886\text{-}1890}$	-1.231**	-1.229**	-1.168**	-1.193**	-1.192**	-1.220**
	[0.503]	[0.508]	[0.500]	[0.506]	[0.512]	[0.503]
$\beta_{1891\text{-}1895}$	-1.180**	-1.117**	-1.133**	-1.138**	-1.135**	-1.161**
	[0.510]	[0.509]	[0.510]	[0.513]	[0.511]	[0.508]
$\beta_{1896\text{-}1900}$	-1.119**	-1.127**	-1.172***	-1.219***	-1.206***	-1.257***
	[0.465]	[0.445]	[0.439]	[0.439]	[0.451]	[0.447]
$\beta_{1901\text{-}1905}$	-0.596	-0.714	-0.839	-0.934*	-0.846	-0.914*
	[0.536]	[0.513]	[0.537]	[0.552]	[0.558]	[0.532]
$\beta_{1906\text{-}1910}$	-0.564	-0.789	-0.718	-0.727	-0.722	-0.748
	[0.569]	[0.524]	[0.516]	[0.532]	[0.549]	[0.520]
$\beta_{1911\text{-}1914}$	-0.811	-1.000*	-0.921*	-0.904	-0.915	-0.916
	[0.616]	[0.573]	[0.547]	[0.569]	[0.578]	[0.569]
Controls	Y	Y	Y	Y	Y	Y
$\text{Country}_{\text{o}}$ FE	Y	Y	Y	Y	Y	Y
Sovereign debt_{ot}	Y					
Any $\text{equity}_{\text{ot}}$		Y				
Corporate debt_{ot}			Y			
Railway $\text{issuance}_{\text{ot}}$				Y		
Bank $\text{issuance}_{\text{ot}}$					Y	
Any industry $\text{issuance}_{\text{ot}}$						Y
I(Brit bank_{o}) $\times$ t	Y	Y	Y	Y	Y	Y
$\text{Country}_{\text{dt}}$	Y	Y	Y	Y	Y	Y
N	67378	67378	67378	67378	67378	67378
Clusters	129	129	129	129	129	129
Adj. R^2	0.531	0.531	0.530	0.530	0.530	0.530

Notes: Table A15 reports the coefficients every five years. Variables denoting borrowing on the London Stock Exchange are binary variables which take the value of 1 if the exporting country issued a given type of debt or equity each year. These data are taken from the Investor's Manual Monthly, discussed in Appendix 3.3. Standard errors in brackets are clustered by the origin country. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

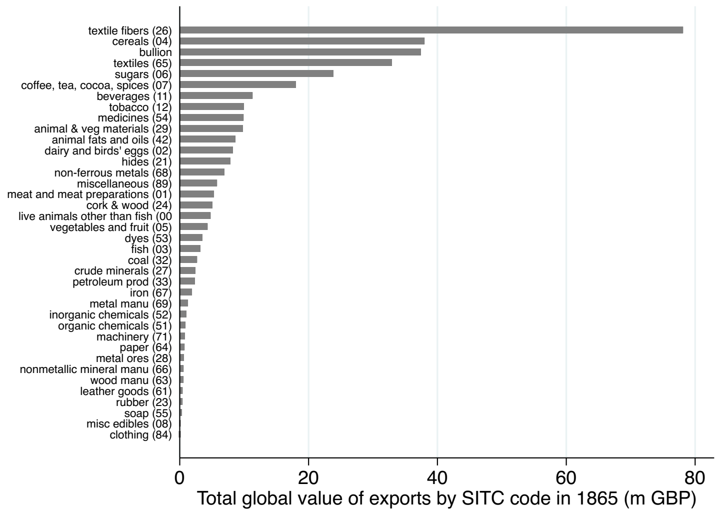
Table A16: *Long-term effects: robustness to composition of banks*

$\ln(\text{Ex}_{odt}) = \beta_t \text{F}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\beta_{1850\text{-}1855}$	-0.141	-0.271	-0.173	-0.258	-0.159	-0.129	-0.215
	[0.350]	[0.335]	[0.341]	[0.327]	[0.349]	[0.321]	[0.322]
$\beta_{1856\text{-}1860}$	-0.0169	-0.0179	-0.0488	-0.136	-0.0133	0.0231	0.121
	[0.250]	[0.259]	[0.221]	[0.220]	[0.261]	[0.209]	[0.234]
$\beta_{1866\text{-}1870}$	-1.361***	-1.739***	-1.575***	-1.604***	-1.448***	-1.669***	-1.762***
	[0.421]	[0.435]	[0.403]	[0.414]	[0.398]	[0.421]	[0.437]
$\beta_{1871\text{-}1875}$	-1.554**	-2.026***	-1.851***	-1.900***	-1.544***	-1.962***	-2.005***
	[0.636]	[0.541]	[0.550]	[0.570]	[0.573]	[0.567]	[0.549]
$\beta_{1876\text{-}1880}$	-1.641***	-2.159***	-1.963***	-2.018***	-1.530***	-2.105***	-2.169***
	[0.582]	[0.602]	[0.631]	[0.594]	[0.555]	[0.600]	[0.593]
$\beta_{1881\text{-}1885}$	-1.253**	-1.722***	-1.616**	-1.640***	-1.191**	-1.763***	-1.790***
	[0.558]	[0.627]	[0.632]	[0.587]	[0.534]	[0.614]	[0.629]
$\beta_{1886\text{-}1890}$	-1.154**	-1.589***	-1.491**	-1.482**	-0.995**	-1.632***	-1.686***
	[0.497]	[0.602]	[0.618]	[0.574]	[0.493]	[0.609]	[0.606]
$\beta_{1891\text{-}1895}$	-1.091**	-1.501**	-1.450**	-1.370**	-0.934*	-1.561**	-1.565***
	[0.506]	[0.588]	[0.641]	[0.553]	[0.504]	[0.603]	[0.596]
$\beta_{1896\text{-}1900}$	-1.155***	-1.540***	-1.510**	-1.392***	-0.942**	-1.568***	-1.635***
	[0.440]	[0.527]	[0.583]	[0.483]	[0.460]	[0.536]	[0.537]
$\beta_{1901\text{-}1905}$	-0.783	-1.308**	-1.166*	-1.055*	-0.644	-1.252**	-1.406**
	[0.514]	[0.548]	[0.675]	[0.537]	[0.494]	[0.600]	[0.555]
$\beta_{1906\text{-}1910}$	-0.634	-1.190**	-1.028	-0.904	-0.519	-1.072*	-1.278**
	[0.503]	[0.563]	[0.661]	[0.550]	[0.512]	[0.599]	[0.572]
$\beta_{1911\text{-}1914}$	-0.788	-1.348**	-1.207*	-1.070*	-0.690	-1.261*	-1.448**
	[0.554]	[0.620]	[0.716]	[0.605]	[0.543]	[0.657]	[0.637]
Controls	Y	Y	Y	Y	Y	Y	Y
Country$_\text{o}$ FE	Y	Y	Y	Y	Y	Y	Y
British banks$_\text{ot}$	Y						
Local banks$_\text{ot}$		Y					
French banks$_\text{ot}$			Y				
German banks$_\text{ot}$				Y			
US banks$_\text{ot}$					Y		
European (non-Brit) banks$_\text{ot}$						Y	
Total banks$_\text{ot}$							Y
I(Brit bank$_\text{o}$) $\times$ t	Y	Y	Y	Y	Y	Y	Y
Country$_\text{dt}$	Y	Y	Y	Y	Y	Y	Y
N	67378	67378	67378	67378	67378	67378	67378
Clusters	129	129	129	129	129	129	129
Adj. R^2	0.530	0.532	0.530	0.530	0.531	0.531	0.531

Notes: Table A16 reports the coefficients every five years. The composition of banks is given by the log of the total number of each type of bank, calculated every 5 years. Countries that did not have any of a type of bank are given ln values of zero. Standard errors in brackets are clustered by the origin country. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

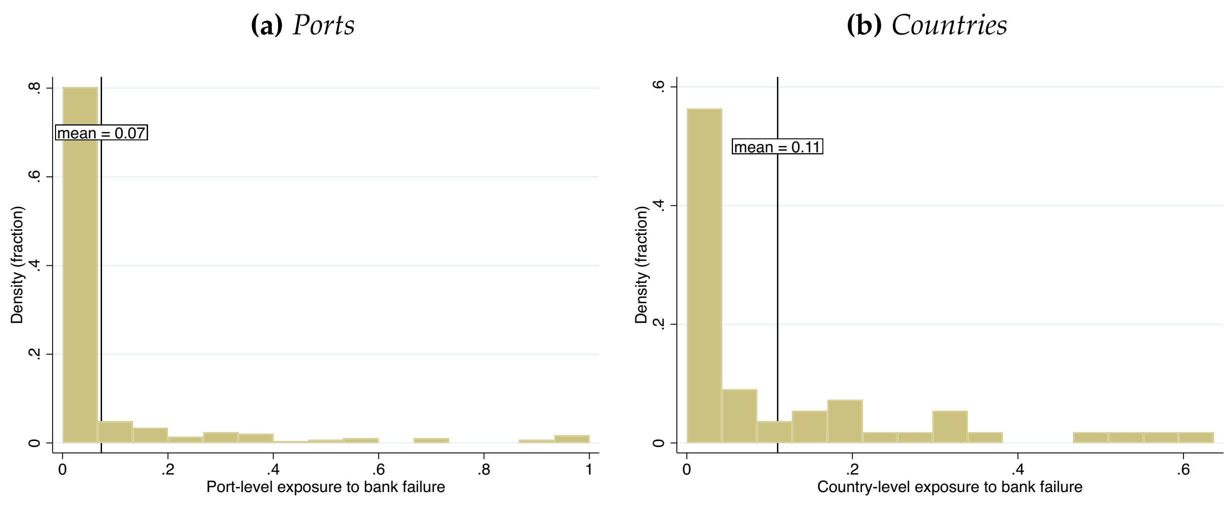
A.2 Additional figures

Figure A1: *Industry composition of global exports in 1865*



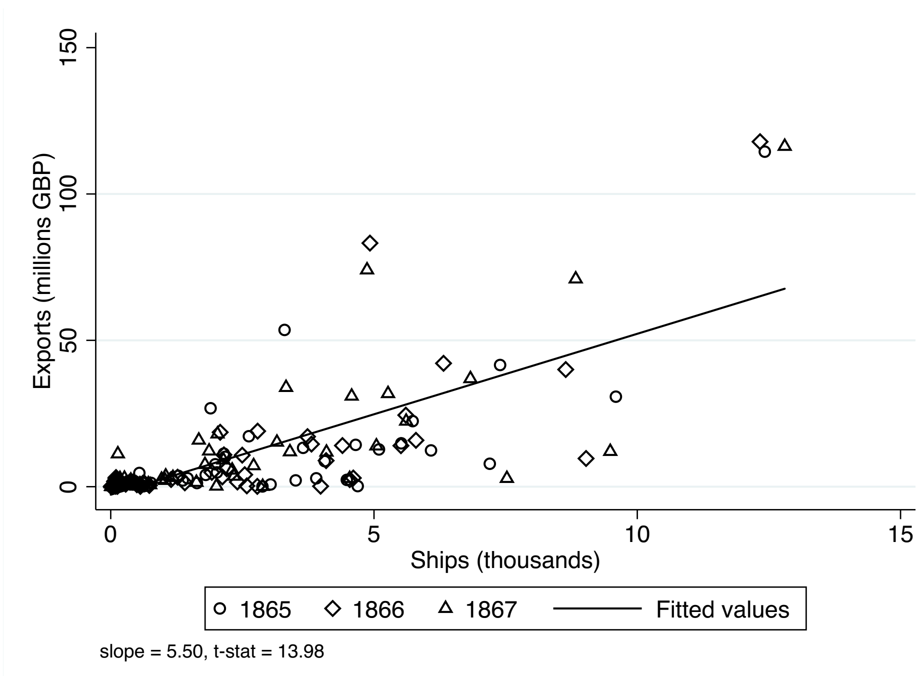
Notes: Figure A1 shows the total value of world exports across all countries by two-digit SITC categorization. The handcoded SITC category is given in parentheses next to the category name. Units are millions of pounds sterling in 1865. Sources: *Statistical Tables relating to Foreign Countries* and *Statistical Tables relating to the Colonial and Other Possessions of the United Kingdom* published in 1866.

Figure A2: *Distribution of exposure to bank failure*



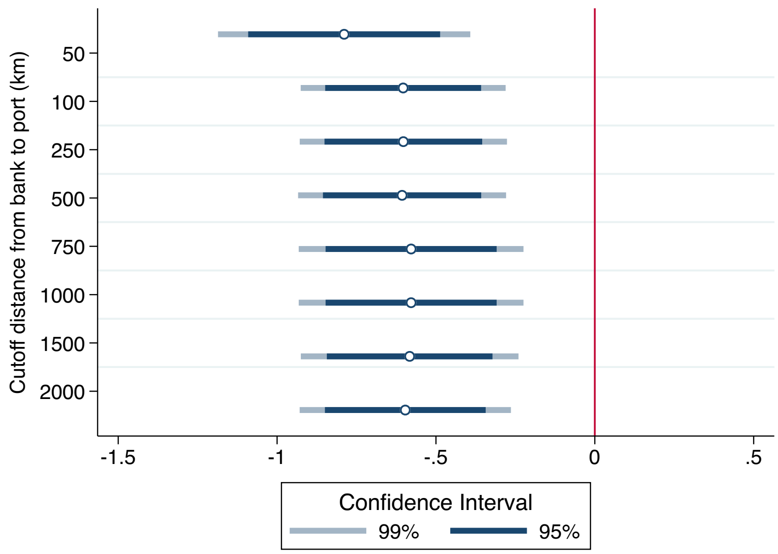
Notes: Figure A2 plots the histogram of port (n = 289) and country (n = 55) exposure to bank failures for the sample of ports and countries that were active in the pre-crisis year.

Figure A3: *Positive correlation between country-level number of ships and exports values*



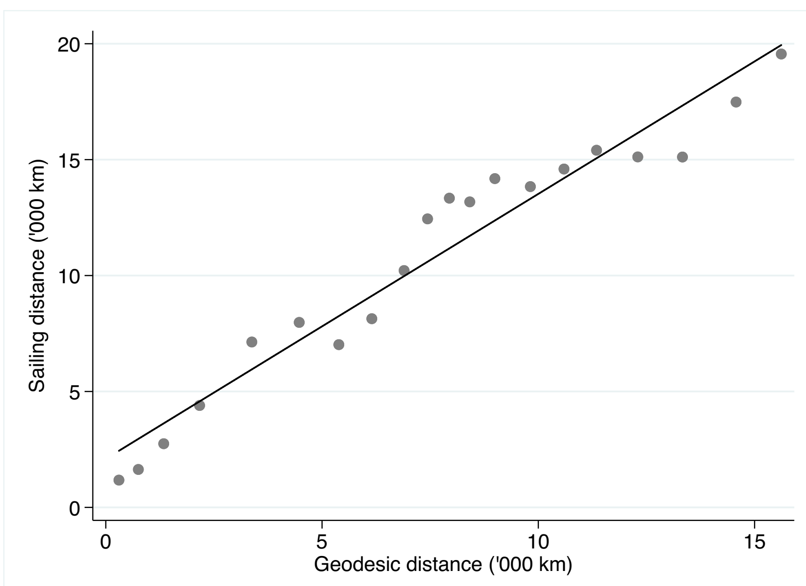
Notes: Figure A3 shows the positive linear relationship between the number of ships leaving a country in a given calendar year (from the *Lloyd's List* and the values of exports from that country. Three years around the crisis year are plotted. The line is fitted to the pooled sample of all years.

Figure A4: *Port-level effect of bank failures on exports: robustness to distance cutoffs*



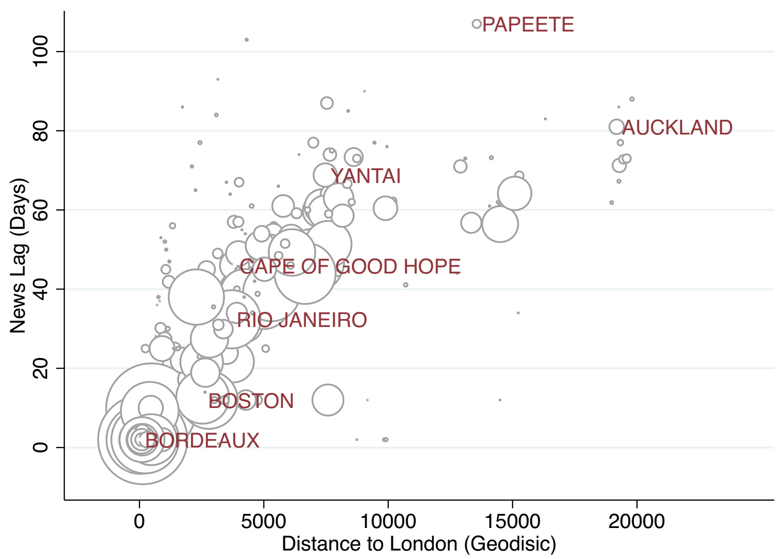
Notes: Figure A4 plots the estimated coefficients for β for the specification below, where the control group of completely unexposed ports is based on the distance between the port and the nearest city of financing. The baseline specification in the paper uses a cut-off of 500 km. $\ln(S_{pot}) = \beta \text{Fail}_{po} \times \text{Post}_t + \alpha_p + \gamma_{ot} + \varepsilon_{pot}$

Figure A5: *Positive correlation between sailing distance and geodesic distance*



Notes: Figure A5 plots the binscatter relationship between ports' distance to each other measured geodesically in kilometers and sailing distance measured in kilometers. The data for sailing distance come from *Philips' Centenary Mercantile Marine Atlas II* published in 1935. Sailing distances are calculated without the Suez Canal route, which only opened in 1869. See appendix A.6 for a full discussion of the data source. Geodesic distances are calculated based on the port's longitude and latitude coordinates.

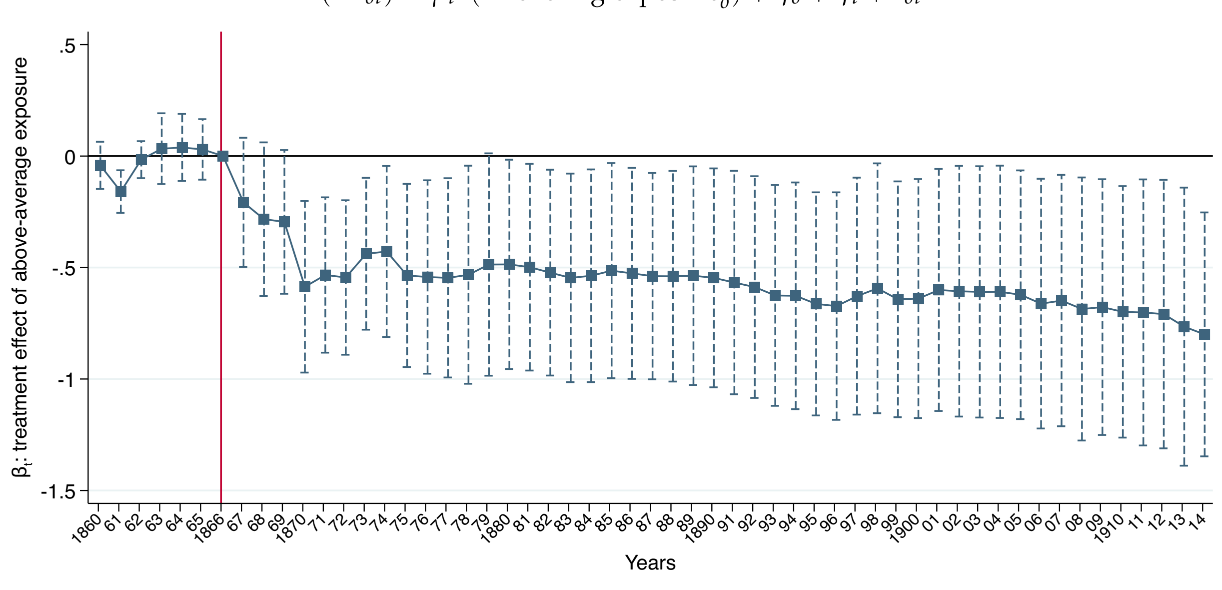
Figure A6: *Positive correlation between news lag and geodesic distance to London*



Notes: Figure A6 plots the relationship between the ports' physical distance to London (measured geodesically in kilometers) and the news lag in days that the ports received news of the banking crisis. The circles convey the pre-crisis size of the port. Select ports from each continent are named.

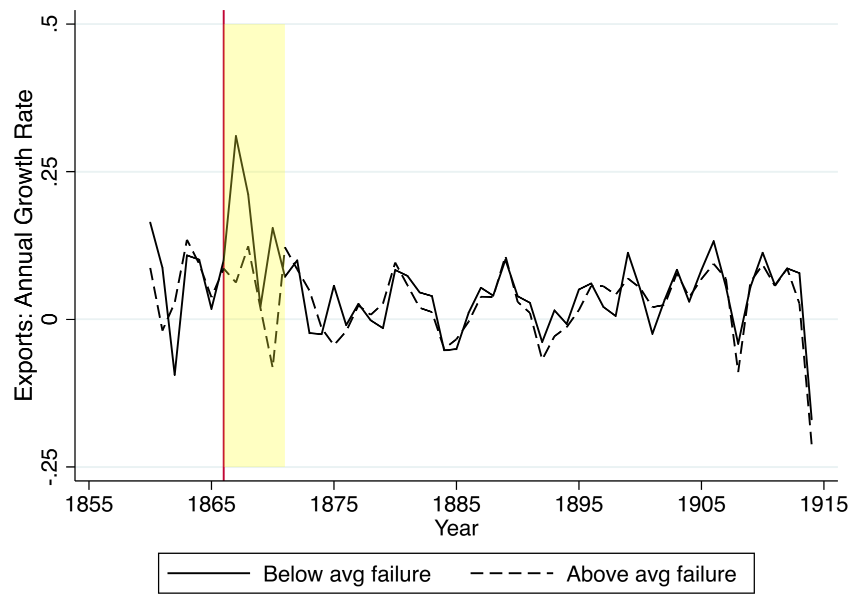
Figure A7: *Effect of above average exposure to bank failure on total exports*

$$\ln(\text{EX}_{ot}) = \beta_t \mathbb{I}(\text{Above avg exposure}_o) + \gamma_o + \gamma_t + \varepsilon_{ot}$$



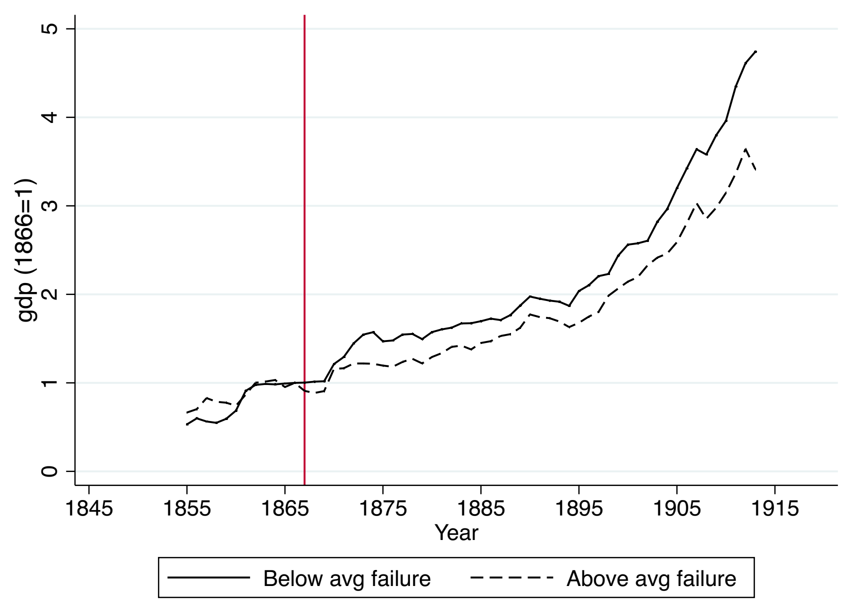
Notes: Figure A7 plots β_t from 1860–1914 for the specification above. The dependent variable is the ln of the total value of exports for origin country o in year t. γ_o and γ_t are country and year fixed effects, respectively. The regressions are weighted by the total value of exports in order to most closely mirror Figure 1.4. N = 5,799.

Figure A8: *Annual country-level growth rates of total exports*



Notes: Figure A8 plots the annual growth rates for the two groups of countries for the years before and after the crisis. Calculated from the aggregate data presented in Figure 1.4. The vertical line marks 1866.

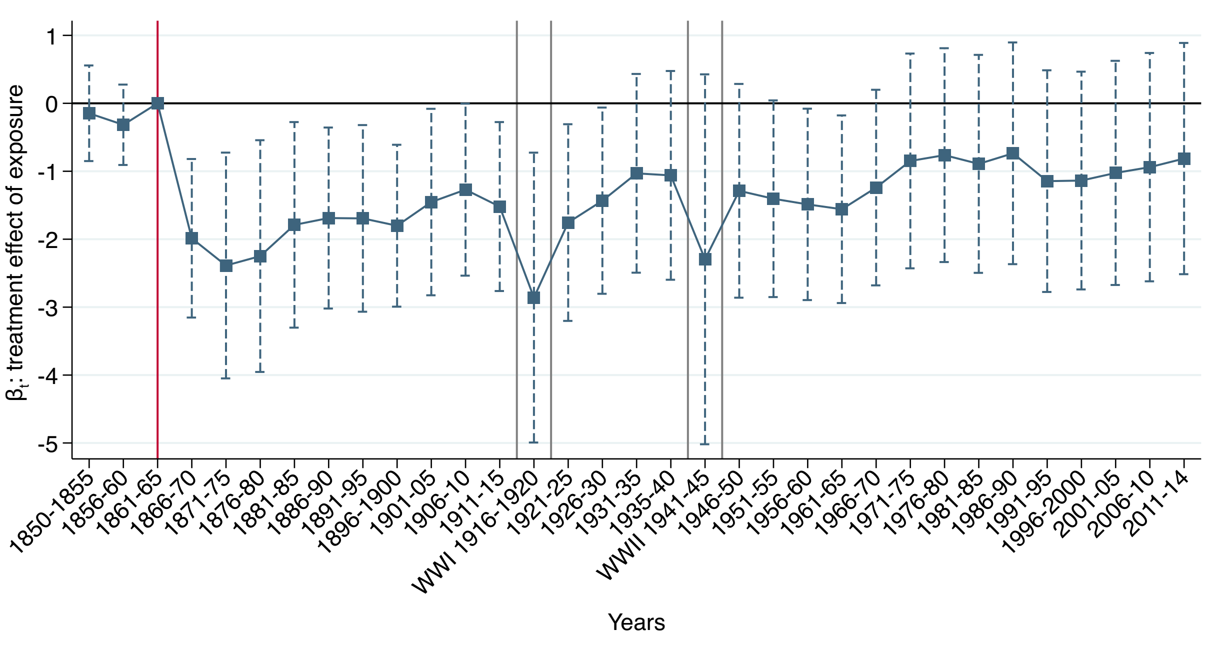
Figure A9: *Aggregate GDP, grouped by above and below average exposure to bank failures*



Notes: Figure A9 plots the raw data for the total value of GDP by groups of countries, binned by above and below average exposure to failure. GDP is normalized to equal 1 in 1866. The vertical line marks 1866.

Figure A10: *Effect of bank failures from 1850–2014*

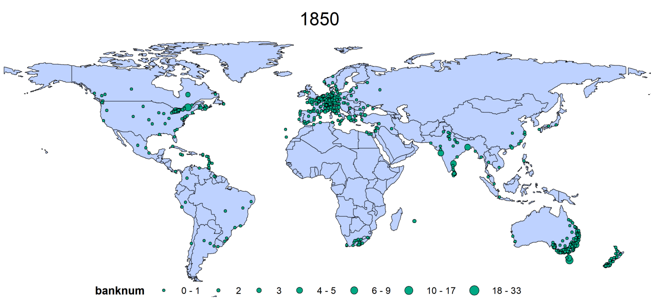
$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$



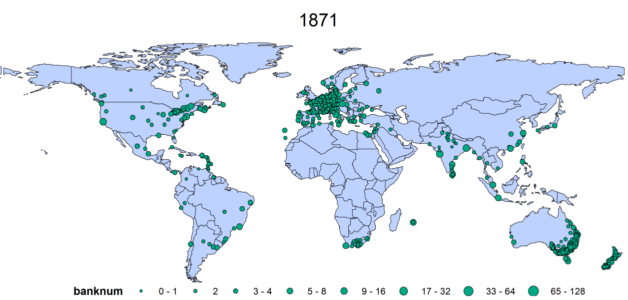
Notes: Figure A10 plots the point estimates and 95 percent confidence intervals for the specification given above estimated on the country-level panel of trade from 1850–2014. The dependent variable is the ln value of exports. The specification includes origin country o FE, destination country-year dt FE, and time-varying controls for the bilateral distance between countries. β_t is the treatment coefficient on the effect of exposure to failed banks on exports in each group of years. The coefficients most closely corresponding to WWI and WWII are marked separately. Standard errors are clustered by the origin country. N = 665,866. Table A8 reports the coefficients.

Figure A11: *Growth of multinational banks, 1850-1913*

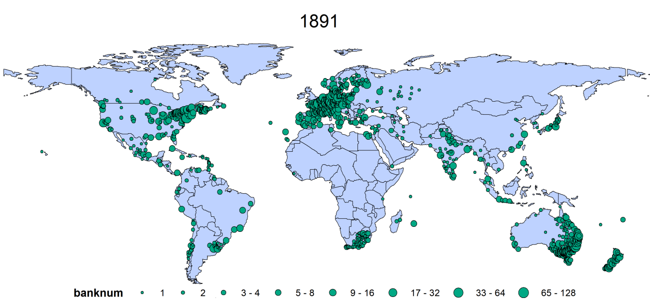
(a) *1850*



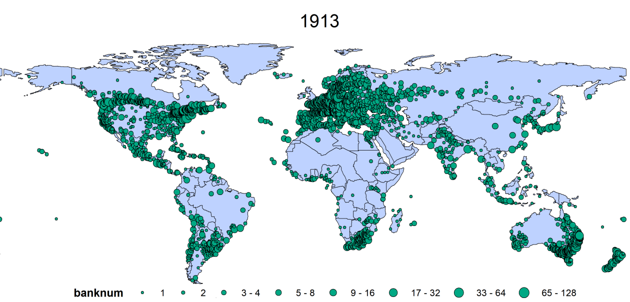
(b) *1871*



(c) *1891*



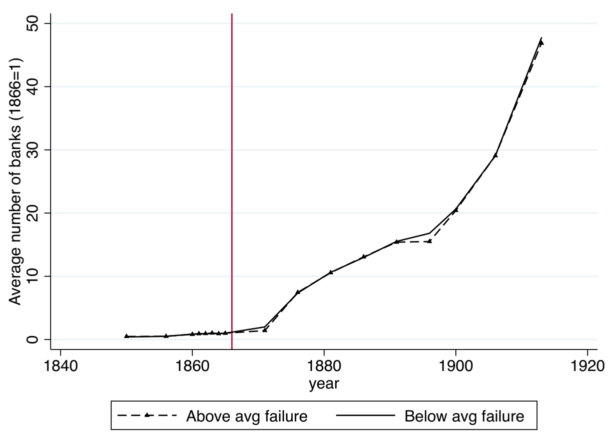
(d) *1913*



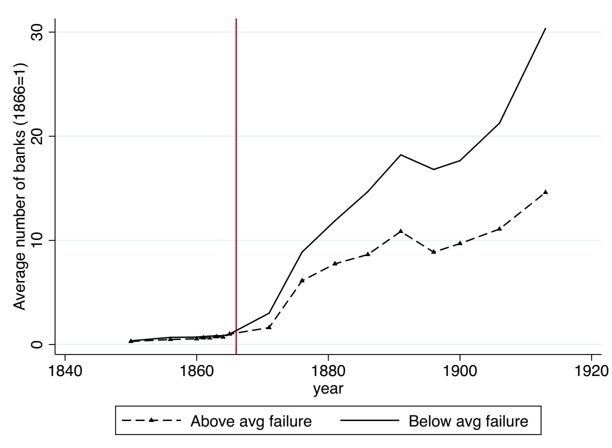
Notes: Figure A11 maps the total number of multinational banks (of all nationalities) from the *Banking Almanac* for various years.

Figure A12: *Banking sector recovery*

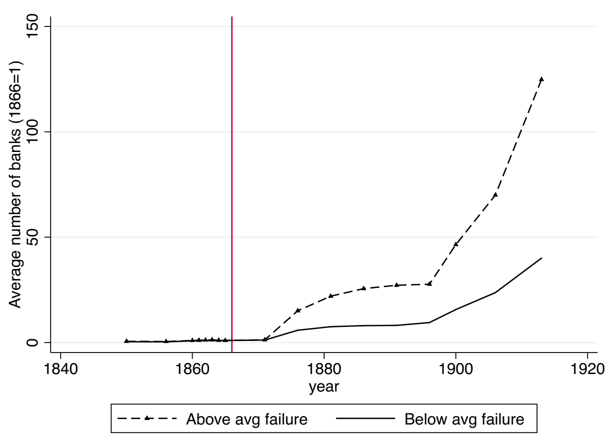
(a) *All banks*



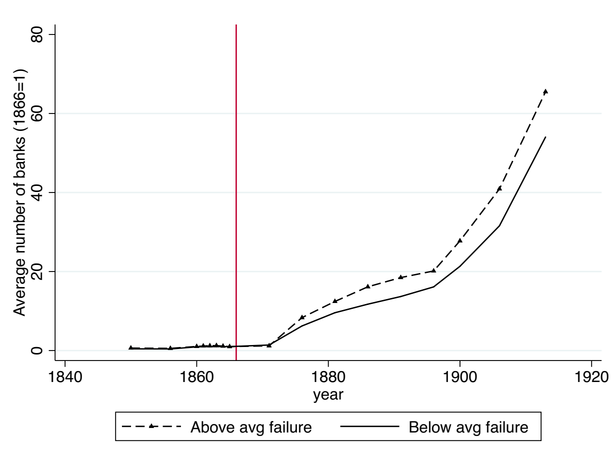
(b) *British banks*



(c) *French banks*

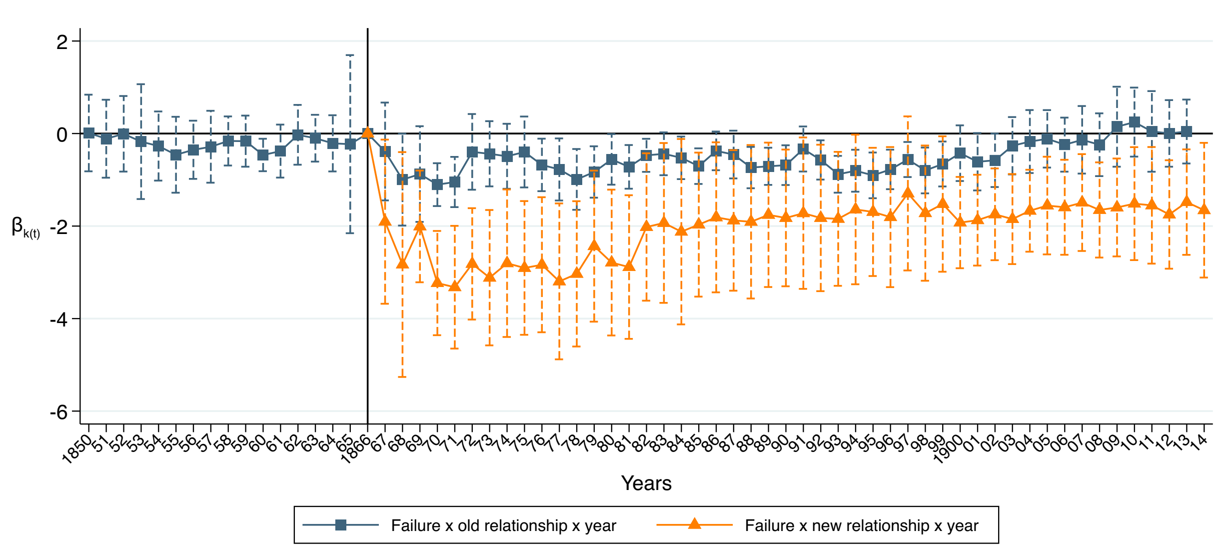


(d) *Domestic banks*



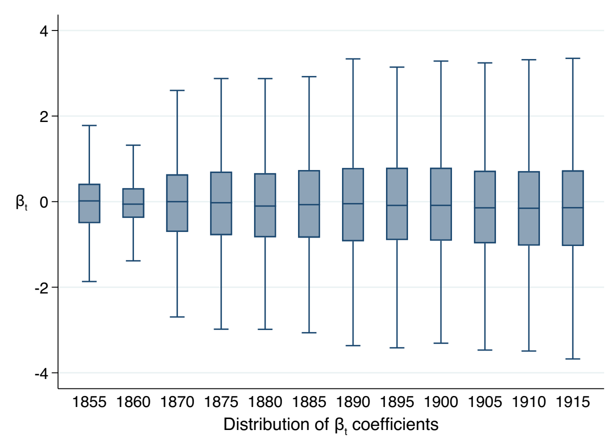
Notes: Figure A12 plots the raw data of the average number of banks in cities exposed to above and below average British bank failure. The data come from 5 year intervals of the *Banking Almanac*. Subfigure (a) plots all the average for all banks. Subfigures (b), (c), and (d) split the total by nationalities. "Local banks" refers to banks of the same nationality as the country it is located in. Each series is normalized to equal 1 in 1866. The vertical line marks 1866.

Figure A13: *Effect of exposure to bank failure on new vs pre-existing trade relationships*



Notes: Figure A13 plots the point estimates and 95 percent confidence intervals from the country-level panel of trade in the specification given below. "Failure × old relationships x year" is the treatment coefficient on the effect of exposure to failed banks on exports for bilateral trade relationships that existed prior to 1866. "Failure × new relationships x year" is the treatment coefficient on the effect of exposure to failed banks on exports for bilateral trade relationships that were newly formed after 1866. The dependent variable is the ln value of exports. The specification includes origin country *o* FE, destination country-year *dt* FE, time-varying controls for the bilateral distance between countries. Standard errors are clustered by the origin country: $\ln(\text{EX}_{odt}) = \beta_{t,old}\text{Fail}_o \times \mathbb{I}(\text{Old}_{od}) + \beta_{t,new}\text{Fail}_o \times \mathbb{I}(\text{New}_{od}) + \gamma_o + \gamma_{dt} + \varepsilon_{odt}$

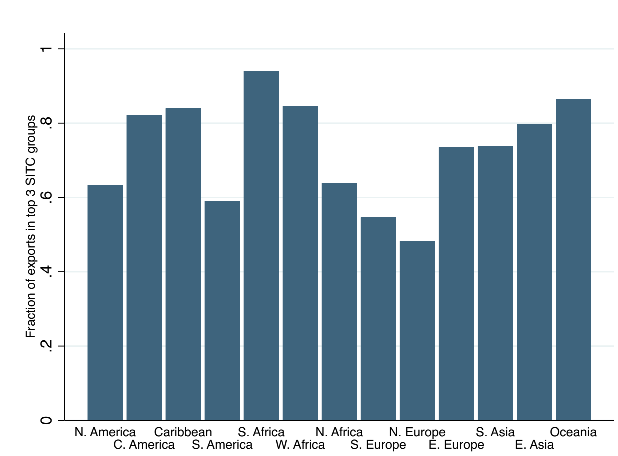
Figure A14: *Treatment placebo*



$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' X_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

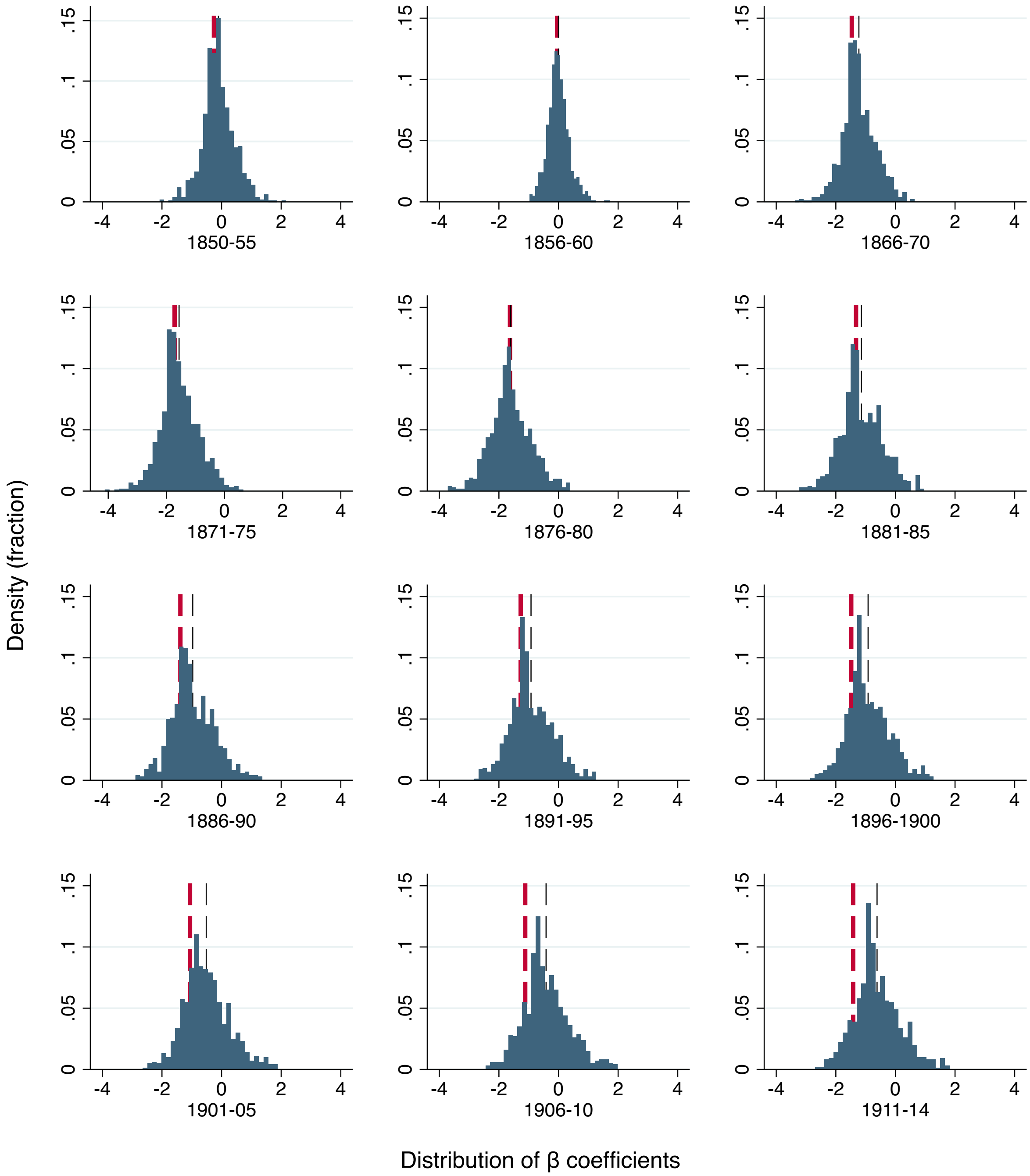
Notes: Figure A14 plots the median, 25th and 75th percentile (edges of the box), and lower and upper adjacent values for the frequency distribution of estimates of β_t from running 1,000 regressions on simulated data corresponding to equation 1.8 (above). The simulated data are generated from randomly replacing the the country-level exposure to failure Fail_o with the exposure from another country. The end year for each β's range of year is given on the x-axis (for instance, 1855 refers to $\beta_{1850-1855}$).

Figure A15: *Exports correlation within country regions*



Notes: Figure A15 plots the fraction of exports in the top 3 SITC groups for each region. Exports values are calculated from 1865. The full list of countries and their geographic regions are given in appendix A.5.4. Regions are listed by geographic proximity, beginning in North America and traveling south and east.

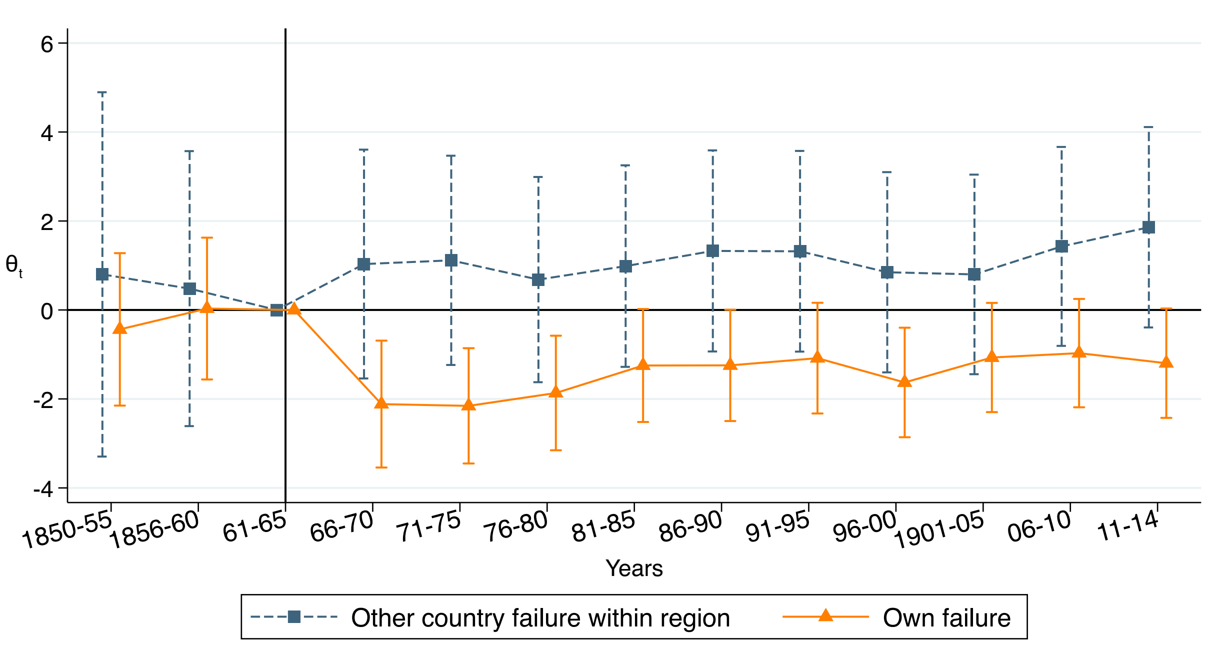
Figure A16: *Country region placebo*



$$\ln(\text{EX}_{odt}) = \beta_t \text{Fail}_o + \Gamma' \text{Region}_{ot} + \gamma_o + \gamma_{dt} + \theta_t \ln(\text{dist})_{od} + \varepsilon_{odt}$$

Notes: Figure A16 plots the frequency distribution of estimates of β_t from running 1,000 regressions corresponding to equation 1.8 (above) including origin-country region-year fixed effects, where the origin-country is randomly assigned to a geographic region. The x-axis of each subfigure plots the magnitude of the estimates for each group of years. The baseline impact of exposure to bank failures on exports, estimated in column (8) of Appendix Table A7, is plotted as the thicker red dashed line, while the mean placebo estimate (averaging across the 1,000 estimates) is plotted as the thin black dashed line.

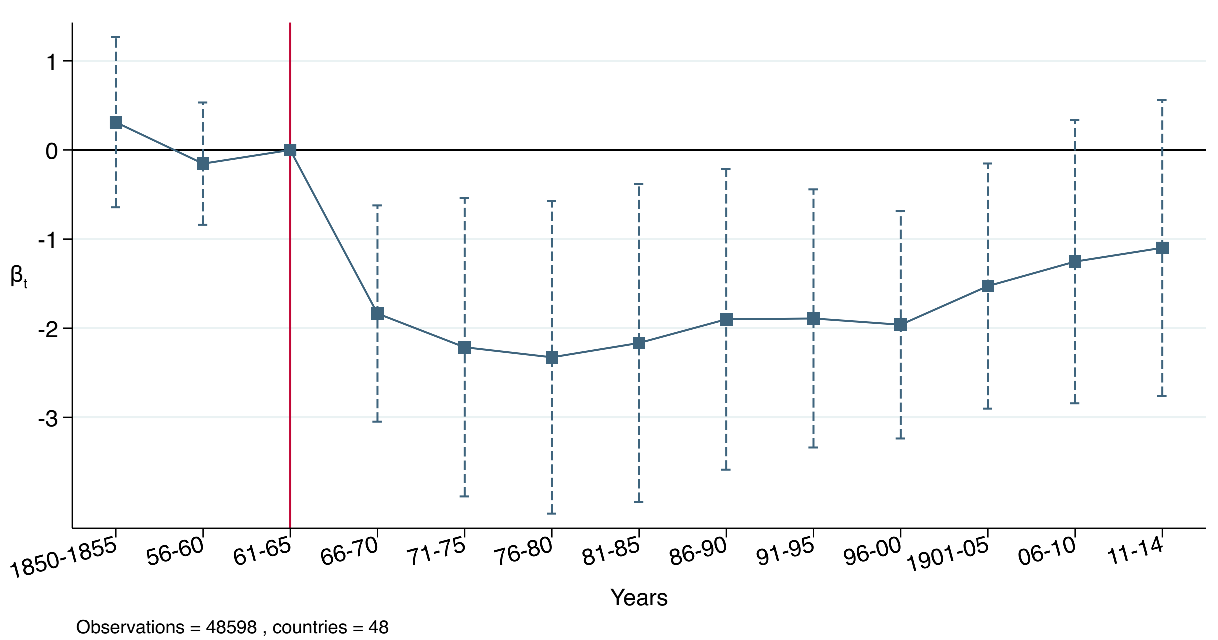
Figure A17: *Effect of other-country exposure within region on own country*



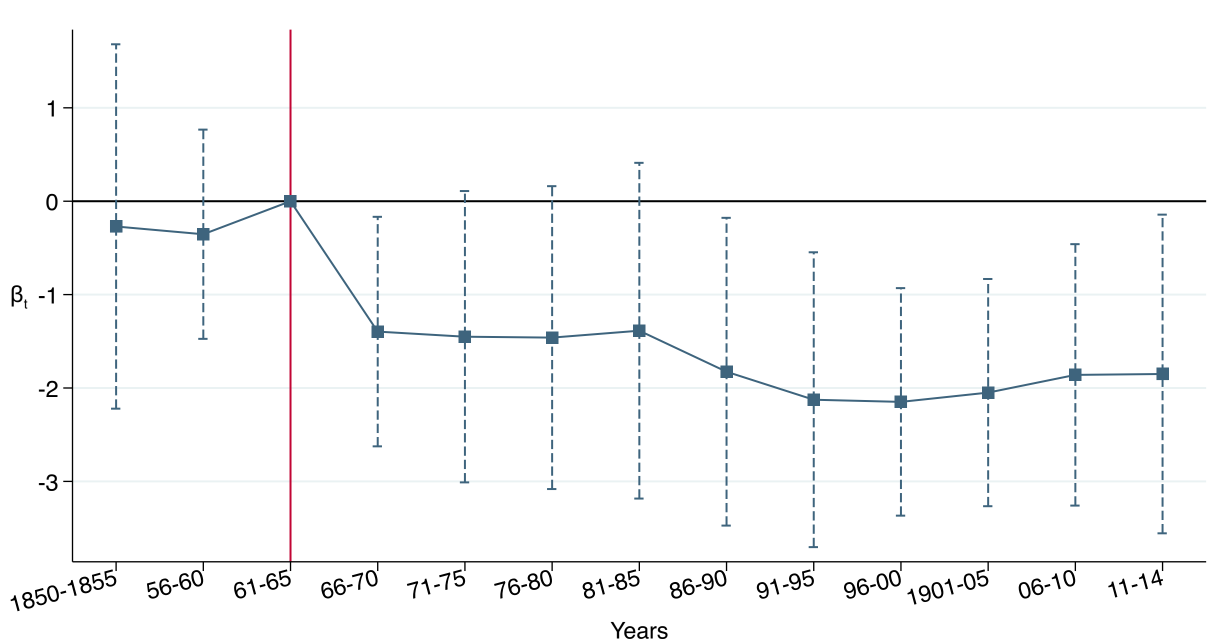
Notes: Figure A17 plots the estimated coefficients from the regression specification below. "Own failure" refers to the country-level exposure to failure Fail_o. "Other country failure within region" is the average exposure to bank failure experienced by all other countries in the same geographic region. The dependent variable is the ln value of exports. The specification includes origin country o FE, destination country-year dt FE, time-varying controls for the bilateral distance between countries. Standard errors are clustered by origin country: $\ln(\text{EX}_{odt}) = \theta_t \text{Fail}_o \times \text{Fail}_{o,other} + \beta_t \text{Fail}_o + \gamma_o + \gamma_{dt} + \varepsilon_{odt}$

Figure A18: *Recovery within country groups*

(a) *Within SITC groups*



(b) *Within regions using the same countries*



Notes: Figure A18 plots the estimated coefficients from the regression specification below, which is the main specification in equation 1.8 including SITC-year fixed effects (Figure A18a) and region-year fixed effects (Figure A18b). Figure A18b is estimated on the same sample of countries as in Figure A18a, the countries for which data on exports composition in 1865 is available.

A.3 Instrument validity

The empirical setting focuses on the effect of British credit contractions without observing the share of British credit in total credit. This section shows that under certain assumptions, the instrument for British bank failures will recover the effects on credit contractions from all banks.

Assume that the true model of the world is the following where Credit_l^{total} denotes the total change in credit available in location l:

$$\Delta \ln(Y_l) = \beta_0 + \delta_1(\Delta \text{Credit}_l^{total}) + \varepsilon_l \tag{A.1}$$

$\Delta\text{Credit}_l^{total}$ can be rewritten in terms of the share of total credit from British banks α_b and the share from non-British banks $1 - \alpha_b$:

$$\Delta \text{Credit}_l^{total} = \alpha_b \Delta \text{Credit}_l^{Brit} + (1 - \alpha_b)\Delta \text{Credit}_l^{non-Brit}$$

This allows us to rewrite Equation A.1 in the following way where $\beta_1 = \alpha_b * \delta_1$ and $\beta_2 = (1 - \alpha_b) * \delta_1$:

$$\Delta \ln(Y_l) = \beta_0 + \beta_1 \Delta \text{Credit}_l^{Brit} + \beta_2 \Delta \text{Credit}_l^{non-Brit} + \varepsilon_l \tag{A.2}$$

Instrumenting for total credit loss using British bank failures:

$$\Delta \text{Credit}_l^{total} = \gamma_0 + \gamma_B \text{Fail}_{l,B} + \nu_l$$

$$\varepsilon_p \perp 1, \text{Fail}_{l,B} \text{ and } \nu_l \perp 1, \text{Fail}_{l,B}$$

The 2SLS estimator is:

$$\hat{\delta}_1^{IV} \longrightarrow \frac{\text{Cov}[\Delta \ln(Y_l), \text{Fail}_{l,B}]}{\text{Cov}[\Delta \text{Credit}_l^{total}, \text{Fail}_{l,B}]} = \frac{\beta_1 \text{Cov}[\Delta \text{Credit}_l^{Brit}, \text{Fail}_{l,B}] + \beta_2 \text{Cov}[\Delta \text{Credit}_l^{non-Brit}, \text{Fail}_{l,B}]}{\alpha_b \text{Cov}[\Delta \text{Credit}_l^{Brit}, \text{Fail}_{l,B}] + (1 - \alpha_b)\text{Cov}[\Delta \text{Credit}_l^{non-Brit}, \text{Fail}_{l,B}]}$$

I use $\Delta\text{Credit}_l^{Brit}$ to proxy for $\Delta\text{Credit}_l^{total}$.

1. $\delta_1 = \beta_1$ when $\alpha_b = 1$, so $\beta_2 = 0$: non-British credit does not matter for trade

2. $\hat{\delta}_1^{IV} \longrightarrow \beta_1$ when: $\text{Cov}[\Delta\text{Credit}_l^{non-Brit}, \text{Fail}_{l,B}] = 0$: the failure rates of British banks in ports is not related to the change in non-British credit

A.4 Additional evidence on long-term effects

A.4.1 Lower-cost financing for shorter routes

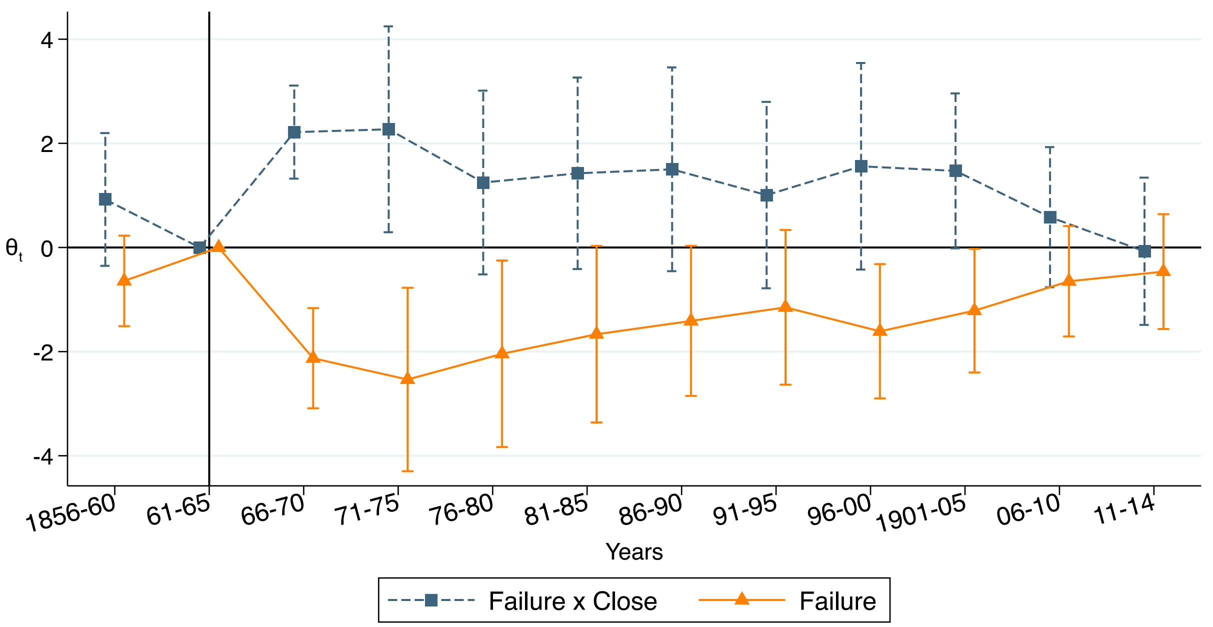
Shorter routes are less expensive to finance because goods spend less time in transit. An externally financed loan has shorter maturity, and it is easier for exporters to internally finance out of working capital. Since financing costs increase with the distance between trading partners, the key prediction is that trade between more distant partners will decline after the bank failures.

I test this prediction using the panel of country-level values of trade by allowing for the exposure to failure to differentially affect trading partners that are physically closer. I construct a binary variable "Close" to indicate country-pairs that are less than the average distance between countries trading in 1865. The results are robust to constructing the variable over all years or at the end of the sample in 1914. Formally, I estimate the following:

$$\begin{aligned} \ln(\text{EX}_{odt}) = {} & \theta_{t,close}\text{Fail}_o \times \mathbb{1}(\text{Close}_{od}) + \beta_t \text{Fail}_o + \lambda_t \mathbb{1}(\text{Close}_{od}) \\ & + \Psi' X_{od} + \gamma_o + \gamma_{dt} + \varepsilon_{odt} \end{aligned} \tag{A.3}$$

Figure A19 plots $\theta_{t,close}$ in blue and β_t in orange. β_t, the effect of exposure to bank failure, is very similar to the baseline effect in previous estimations. $\theta_{t,close} > 0$ indicates that conditional on exposure to bank failures, exports to closer destinations are positively affected. The main effect for exports to close destinations is given by $\theta_{t,close} + \beta_t$, which is close to zero. The qualitative interpretation is that a country's exports losses are borne by more distant trading partners, and that exporters are diverting their goods to destinations with lower trade costs.

Figure A19: *Exports are not affected for closer destinations*



Notes: Figure A19 plots the plots the θ_t and β_t point estimates and 95% confidence intervals from the country-level panel of trade in the specification given in equation A.3. The dependent variable is the ln value of exports. The specification includes origin country o FE, destination country-year dt FE, and time-varying indicators for common land border, common European colony, and common language. "Failure × Close" is the treatment coefficient on the effect of exposure to failed banks on exports to countries that are less than the average distance away from the destination country, where the average is measured by 1865 bilateral trade flows. Standard errors are clustered by the origin country. N = 66,791.

A.5 Additional historical context

A.5.1 Trade finance

The mechanics of trade finance in the 19th century were conducted through bills of exchange traded among the networks of banks and interbank lenders centered on London. Bills were short-term loans that became contractual obligations when the creditor "accepted" it by signing across it. In their simplest form, bills of exchange allowed for debts between two parties. They were orders written by the "drawer" (lender) that the "drawee" (borrower) would pay the face value of the bill (to the drawer, someone else, or the bearer) at some point in the future. A check is simply a bill of exchange in the case when the drawee is the drawer's bank. A promissory note is a promise to pay between the drawer and payee, where there is no drawee responsible for making the payment. Bills usually had a maturity of 3-6 months (Cassis, 2016, p.93). The Treasury Bill was proposed by Walter Bagehot in 1877 and modeled after the commercial bill of exchange to allow the government to borrow at short maturities just as commercial interests were able to.

British banks lent to their customers by "accepting" the customer's bills of exchange. British commercial law stipulated that the acceptor in turn became liable for the bill, such that if the original borrower defaulted, the acceptor was responsible for payment. This liability meant that acceptors transformed the idiosyncratic risk of individual borrowers into their own credit risk. Bankers' acceptances therefore bore the credit risk of the bank, with the banks absorbing their customers' credit risk. This guarantee made it easier to re-sell the bills because the credit risk was easily observable. The acceptor would then re-sell the bill to another individual or financial institution by "discounting" it on the money market in London (Jones, 2000, p.23). The London money market's liquidity came from the size of the foreign bills market, and banks almost never held their own bills until maturity (King, 1936). Discounts most resemble a modern-day repurchase agreement: the seller received the face value minus the discount rate (haircut) at the initiation of the transaction, and he paid the full face value in return for the security at its maturity. At maturity, the bill was presented to the original borrower via his accepting bank for repayment, and the debt terminated.

The term Discount Window in reference to the central bank comes from the fact that bills of exchange were "discounted" there. Banks obtained emergency liquidity by entering into a repurchase agreement with the Bank fo England on the short-term liquid assets that it held. These assets were predominantly the bills of exchange that had been extended by other banks abroad, reflecting the lending activity of those banks.

British multinational banks had accounts at the Bank of England, which in practice meant that any security originated by one of these multinational banks was considered high enough quality to be discounted at the Bank of England. The features of repo agreements and joint liability protected the London money market from issues stemming from asymmetric information where acceptors knowingly passed on bad bills. Those features made their quality easily ascertainable, and bills were flexible and customizable, so they became useful debt and investment instruments around the world, analogous to commercial paper today. Although bills could be used for any purpose, those that originated outside of the United Kingdom primarily financed trade and were collateralized by shipments.[1]

British multinational banks began being established in the 1830s both within and beyond the British Empire to facilitate international capital flows, with the specific purpose of increasing trade abroad. These banks were headquartered and raised capital

[1]Cassis (2016) writes: “Finance required by the growth of international trade was supplied by private bankers, increasingly by a small group of largely London-based merchant bankers who specialized in trade credit by accepting bills of exchange and thus guaranteeing by their undoubted standing the payment of the bills involved. The merchant banks’ backing was made clear by their acceptance on presentation of the international trade bills with which they were individually connected. These providers of commercial finance became known in the City as ‘acceptance houses’, and the paper involved as ‘acceptances’. The bills were readily traded on the London market and so were liquid over the period, normally 60-90 days, between their acceptance and maturity.” (p. 93)

in London by issuing deposits and shares, but they operated outside of Britain through subsidiaries in cities around the world. The fact that they raised shares, issued deposits, and invested abroad signaled a new movement in banking. These were the first "universal banks" which then spread to Continental Europe in the subsequent decades (Cassis, 2016, p.96). They most often funded the British merchants already established in foreign ports. The lack of infrastructure in most countries was such that those merchants had to arrange for their own financing and insurance if they wanted it. Their local knowledge was invaluable to business, and the multinational bank subsidiary offices maintained close contact with these exporters (Jones, 2000, p.27). See Table A17 for examples of these banks and their operating regions.

Table A17: *Examples of banks and operating regions*

Bank	**Founding Year**	**Operational Region**
Anglo-Egyptian Bank	1864	Egypt, Mediterranean
Anglo-Italian Bank	1864	Italy, France
Bank of Australasia	1835	Australia, New Zealand
Bank of British North America	1836	Canada, USA
Chartered Mercantile Bank of India, London & China	1853	India, China, Canada, Australia, Indonesia, USA
Colonial Bank	1837	Caribbean
Imperial Bank	1862	Europe, Egypt, North America
Ionian Bank	1839	Greece
London Bank of Mexico & South America	1864	Mexico, Peru
Union Bank of London	1839	Australia, New Zealand, South America, Asia, North America

Notes: This is a sample of the banks providing trade credit. The operational region is given as countries although city-level variation is used in all the empirics. Sources: Bank of England Archives C24/1, *Banker's Magazine*, select bank histories listed in Appendix A.6.

A.5.2 Overend & Gurney

Transcript of the prospectus published on July 13, 1865

THE COMPANY is formed for the purpose of carrying into effect an arrangement which has been made for the purchase from Messrs. Overend Gurney and Co., of their long established business as bill brokers and money dealers, and of the premises in which the business is conducted, the consideration for the goodwill being £500,000, one half being paid in cash and the remainder in shares of the company with £15 per share credited thereon – terms which, in the opinion of the directors, cannot fail to ensure a highly remunerative return to the shareholders.

The business will be handed over to the new company on the 1st of August next, the vendors guaranteeing the company against any loss on the assets and liabilities transferred.

Three of the members of the present firm have consented to join the board of the new company, in which they will also retain a large pecuniary interest. Two of them (Mr. Henry Edmund Gurney and Mr. Robert Birkbeck) will also occupy the position of managing directors and undertake the general conduct of the business.

The ordinary business of the company will, under this arrangement, be carried on as heretofore, with the advantage of the co-operation of the board of directors, who also propose to retain the valuable services of the existing staff of the present establishment.

The directors will give their zealous attention to the cultivation of business of a first-class character only, it being their conviction that they will thus most effectually promote the prosperity of the company and the permanent interests of the shareholders. Copies of the company's Memorandum and Articles of Association, as well as the Deed of Covenant in relation to the transfer of the business, can be inspected at the offices of the solicitors of the company.

LONDON, July 12, 1865.

A.5.3 London banking crisis

Previous scholarship

Banker's Magazine wrote the following about Overend & Gurney's share issuance:

> The transformation of Overend, Gurney and Co.'s far famed discount establishment into a joint stock company, marks another era in the history of limited liability...we may confidently anticipate that the position of the new company will be relatively as high as the standing of the house to whose business it succeeds.

Walter Bagehot's account of Overend and Gurney's demise in *Lombard Street* blames the entirety of the failure on the directors:

> In six years [from 1860-1866], the immensely rich partners lost all their own wealth, sold the business to the company, and then lost a large part of the company's capital. And these losses were made in a manner so reckless and so foolish that one would think a child who had lent money in the City of London would have lent it better. (p. 19)

Anna Schwartz writes the following:

> Overend, Gurney in earlier years had been a solid conservative partnership, one of the pillars of the City. About 1860, a younger generation then in charge of the business became less circumspect in its lending operations, accepting equity interests for unrepayable loans extended to ironworks and shipping companies. Losses led to a decision to incorporate with the possibility of turning over a new leaf. The new company was launched in 1865 just after the conclusion of the US Civil War, when there was every reason to anticipate a strong revival of demand for British exports, but the new company did not live long enough to benefit from it.[...] when on 10 May Overend, Gurney shut down, the market was shaken. The next day panic broke loose. (p.273)

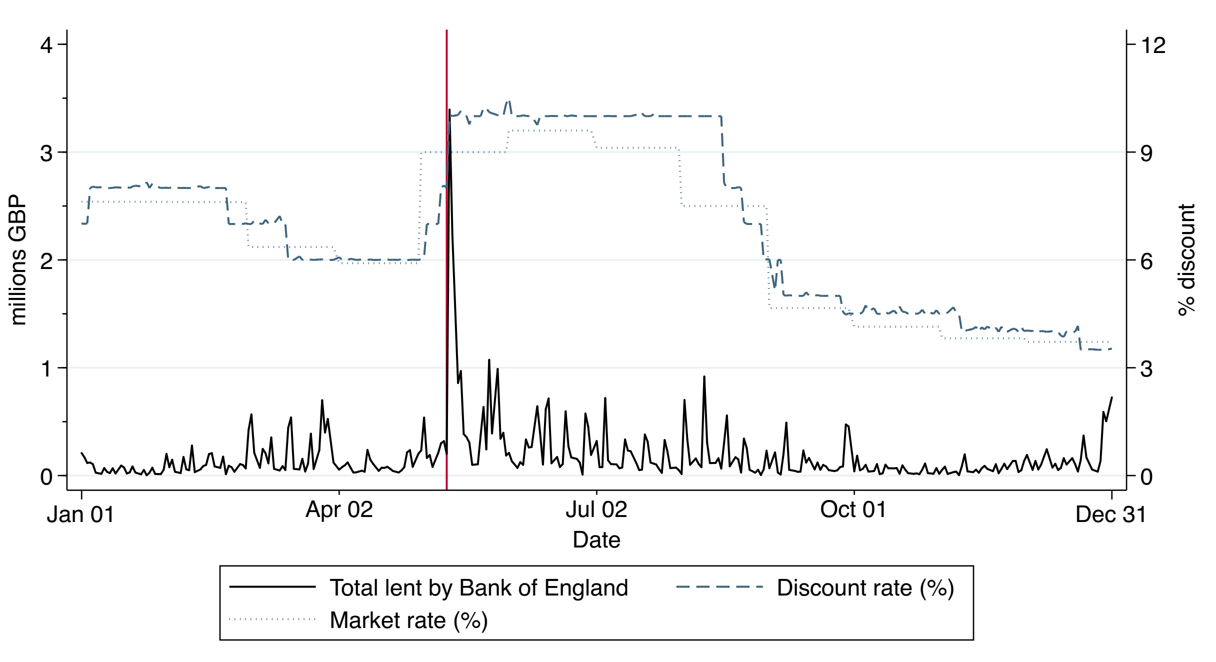
Bank of England response

In order to calm the London market, the Governor of the Bank of England appealed to the Chancellor of the Exchequer to suspend the Banking Act of 1844. The Banking Act of 1844 was the foundation of the gold standard in Britain and required that the Bank of England's currency supply was tied to the gold supply. This would allow the Bank of England to accommodate the demands for liquidity by issuing currency beyond the gold reserve at the Bank of England and effectively suspend the gold standard. The government gave its permission, and this was sufficient to calm the markets so that the gold standard remained in place. £5.6 million was lent to banks in just the first two days of the crisis, collateralized on the short-term securities that reflected London's lending relationships. Although £5.6 million almost drained the Bank of England of its gold reserves, it was small compared to the size of the banking sector, whose balance sheets were almost £5 million each. Although the Bank of England was praised for averting a deeper crisis, the size of the intervention was small relative to the size of the market, and 12% of banks failed.

The Overend & Gurney failure has been written about extensively by historians and has been credited as the one that cemented the Bank of England's role as Lender of Last Resort. It was the event which led Walter Bagehot, the editor of *The Economist* at the time, to argue that the monetary authority should, in times of crisis, discount bills of good quality in the amount demanded to creditable borrowers (Bagehot, 1873). Domestically, the 1866 banking crisis is attributed with causing the failure of over 200 firms. The shock on manufacturing led to protests and riots that ultimately contributed to the passing of the Reform Act of 1867, which greatly expanded the franchise. This was also known as the Second Reform Act (the first was in 1832) and roughly doubled the franchise among adult males in England and Wales.

First, worse quality banks could still approach the Bank of England Discount Window for funds as long as they held bills that they could post as collateral. A bill's riskiness was determined by the bank that underwrote the debt, not the bank that brought in the bill for discount. It is apparent from the ledgers that banks discounted the bills originally accepted by other institutions, not themselves. This pattern is consistent with the historical accounts that banks did not usually hold their own bills to maturity but rather immediately discounted them on the London money market. Second, it is unlikely that worse banks held lower quality bills because all banker's acceptances of the same maturity were discounted at the same market rate in normal times. Third, the average rejection rate at the Bank of England did not change during the crisis, indicating the Bank did not appear to change its policy during the crisis. These characteristics help to address the main concern that worse banks would not have been able to obtain liquidity from the Bank of England.

Figure A20: *Bank of England Discount Window lending in 1866*



Notes: Figure A20 shows the total amount of lending by the Bank of England at its Discount Window. The red vertical line marks May 11, 1866. Sources: Bank of England Archives C24/1

Transcript of the Minutes of the Bank of England Court of Directors, Saturday May 12, 1866:[2]

A Court of Directors at the Bank on Saturday, the 12 May 1866

[2]The archived minutes are available at: http://www.bankofengland.co.uk/archive/Documents/archivedocs/codm/18111911/codm041866111866b1.pdf

Present: Henry Lancelot Holland, Esquire Governor; Thomas Newman Hunt, Esquire Deputy Governor [...]

The Governor laid before the Court the following correspondence:

Bank of England, 11 May 1866.

To: The Right Honourable, The Chancellor of the Exchequer, M. P.

Sir,

We consider it to be our duty to lay before the Government the facts relating to the extraordinary demands for assistance which have been made upon the Bank of England today in consequence to the failure of Messrs Overend Gurney & Co. We have advanced to the Bankers, Bill Brokers and Merchants in London during the day upwards of four million Sterling upon the Security of the Government Stock and Bills of Exchange – an unprecedented sum to lend in one day, and which,therefore, we suppose, would be sufficient to meet all their requirements; although the proportion of this sum which may have been sent to the Country must materially affect the question.

We commenced this morning with a Reserve of £5,727,000—which has been drawn upon so largely that we cannot calculate upon having so much as £3,000,000 —this evening, making a fair allowance for what may be remaining at the Branches.

We have not refused any legitimate application for assistance, and, unless the money taken from the Bank is entirely withdrawn from circulation, there is no reason to suppose that this Reserve is insufficient.

We have honor to be, Sir, your obedient servants.

H.L. Holland, Governor and T.M. Newman Hunt, Deputy Governor.

The Chancellor of the Exchequer's response:

Downing Street, 11 May 1866.
To: The Governor and the Deputy Governor of the Bank of England

Gentlemen,

We have the honour to acknowledge the receipt of your letter of this day to the Chancellor of the Exchequer, in which you state the course of action at the Bank of England under the circumstances of sudden anxiety which have arisen since the stoppages of Messrs Overend Gurney & Company (Limited) yesterday.

We learn with regret that the Bank reserve, which stood, so recently as last night, at a sum of about five millions and three quarters, has been reduced in a single day, by the liberal answer of the Bank to the demands of commerce during the hours of business, and by its just anxiety to avert disaster, to little more than one half of that amount, or sum (actual for London and estimated for Branches) not greatly exceeding three millions.

The accounts and representations, which have reached Her Majesty's Government during the day, exhibit the state of things in the City as one of extraordinary distress and apprehension. Indeed deputations composed of persons of the greatest weight and influence, and representing alike the private and the Joint Stock Banks of London, have presented themselves in Downing Street, and have urged with unanimity and with earnestness the necessity of some intervention on the part of the State, to allay the anxiety which prevails, and which appears to have amounted through great part of the day to absolute panic.

There are some important points in which the present crisis differs from those of 1847 and 1857. Those periods were periods of mercantile distress, but the vital consideration of banking credit does not appear to have been involved in them, as it is in the present crisis. Again, the course of affairs was then comparatively slow and measured, whereas the shock has in this instance arrived with intense rapidity and the opportunity for deliberation is narrowed in proportion. Lastly, the Reserve of the Bank of England has suffered a diminution without precedent relatively to the time in which it has been brought about, and, in view especially of this circumstance, Her Majesty's Government cannot doubt that it is their duty to adopt without delay the measures which seem to them best calculated to compose the public mind, and to avert the calamities which may threaten trade and industry.

Of them, the Directors of the Bank of England, proceeding upon the prudent rules of action by which their administration is usually governed, shall find that, in order to meet the wants of legitimate commerce, it is requisite to extend their discounts and advances upon approved securities so as to require issues of Notes beyond the limit fixed by law, Her Majesty's Government recommend that this necessity should be met immediately upon its occurrence, and in that event they will not fail to make application to Parliament for its sanction.

No such discount or advance, however, should be granted at a rate of interest less than ten per cent, and Her Majesty's Government reserve it to themselves to recommend, if they should see fit, the imposition of a higher rate. After deduction by the Bank of whatever it may consider to be fair charge for its risk, influences and trouble, the profits of these advances will accrue to the public.

We have the honor to be, Gentlemen, your obedient servants.

Russell Gladstone, Chancellor of the Exchequer

Resolved that the Governors be requested to inform the First Lord of the Treasury, and the Chancellor of the Exchequer that the Court is prepared to act in conformity with the letter addressed to them yesterday.

Resolved that the minimum rate of discount on Bills not having more than 95 days to run, be raised from 9 to 10%.

A.5.4 Country characteristics

Table A18: *Countries by region and British empire status*

Country	ISO code	Region	British Empire
Australia	AUS	OCEA	1
Austria-Hungary	AUTHUN	ESTEUR	0
Azores	AZORES	STHEUR	0
Belgium	BEL	NWEUR	0
Brazil	BRA	STHAM	0
British Guiana	GUY	STHAM	1
British West Indies	GBRWINDIES	CARIB	1
Canada	CAN	NORAM	1
Cape of Good Hope	ZAF	STHAFR	1
Ceylon	LKA	STHASI	1
Chile	CHL	STHAM	0

China	CHN	ESTASI	0
Colombia	COL	STHAM	0
Cuba	CUB	CARIB	0
Curacao	ANT	CARIB	0
Danish West Indies	VIR	CARIB	0
Denmark	DNK	SCANDI	0
Egypt	EGY	NORAFR	0
France	FRA	NWEUR	0
Germany	DEU	NWEUR	0
Gibraltar	GIB	STHEUR	1
Greece	GRC	STHEUR	0
Guatemala	GTM	CTRAM	0
Hong Kong	HKG	ESTASI	1
India - British Possessions	GBRIND	STHASI	1
Italy	ITA	STHEUR	0
Jamaica	JAM	CARIB	1
Japan	JPN	ESTASI	0
Java	IDN	STHASI	0
Malta	MLT	STHEUR	1
Mauritius	MUS	STHAFR	1
Mexico	MEX	CTRAM	0
Netherlands	NLD	NWEUR	0
New Zealand	NZL	OCEA	1
Norway Sweden	SWENOR	SCANDI	0
Panama	PAN	CTRAM	0
Persia	IRN	MIDEST	0
Peru	PER	STHAM	0
Philippines	PHL	STHASI	0
Poland	POL	ESTEUR	0
Portugal	PRT	STHEUR	0
Puerto Rico	PRI	CARIB	0
Romania	ROU	ESTEUR	0
Russia	RUS	ESTEUR	0
Siam	THA	STHASI	0
Sierra Leone	SLE	WSTAFR	1
Spain	ESP	STHEUR	0
St Helena	SHN	STHAFR	1
Straits Settlements	STRAITS	STHASI	1
Trinidad and Tobago	TTO	CARIB	1
Turkey	OTTO	MIDEST	0
USA	USA	NORAM	0
Uruguay	URY	STHAM	0
Venezuela	VEN	STHAM	0

A.6 Historical data sources

A.6.1 Data constructed

Bank characteristics

I gathered the banks' 1865 and 1866 balance sheets and histories from annual reports published in *Banker's Magazine*, *Banking Almanac and Directory*, and *The Economist*. These data include their age, capital (equity financing), leverage ratio, and reserve ratio. Publicly traded banks did not consistently publish balance sheets until 1890, and even then only half the private banks did so (Michie, 2016). Prior to that legislation, banks had complete freedom over whether they publicly disseminated their balance sheets, so this information is not available for all banks.

Port-level panel of trade

The source for the port-level is the daily publications of the *Lloyd's List* newspaper. *Lloyd's* employed agents in ports around the world to gather information on international shipping activity to send back to London. The primary consumers of this newspaper were insurance agents, merchants, and family members of ship crews. The reporting in *Lloyd's List* is organized by port, based on the distance to London spiraling outwards. Under each port, ships are listed individually with their name, their captain's name, type of ship, whether they arrived to the port or sailed from it, the destination of their movements, and the date of the event. Coastal (i.e. domestic) trade was omitted from the records for non-British ports. *Lloyd's* also usually listed the date the intelligence was sent, as there was often a lag between then and when it would have been received for publication.

Processing the scans of the original prints required a labor-intensive combination of OCR (Optical Character Recognition), python word processing, and manual data entry. Almost 420,000 unique shipping events were processed. *Lloyd's List* is very geographically precise, so ports located within 10 kilometers of each other are aggregated into one port unit. An example is that Cape of Good Hope is distinguished from Cape of Good Hope Point, which are in the same bay. Ports that were aggregated into the same geographic unit are matched to the same city for banking services.

Country-level panel of trade

The country-level panel of bilateral trade includes over 68,000 observations for 130 countries from 1850-1914. The sources are Pascali (2017), Dedinger and Girard (2017), Fouquin and Hugot (2016), and Mitchener and Weidenmier (2008), along with the *Statistical Tables* published by the United Kingdom and United States. Measures of bilateral resistance between countries, such as common language, land border, and common colonial background were taken from Fouquin and Hugot (2016). I recalculate geodesic distance based on the center of the standardized pre-WWI country borders. Measures of GDP and population from Fouquin and Hugot (2016) were also recalculated to reflect those borders.

Industry composition of exports

I collected the composition of exports by country pre-crisis from the *Statistical Tables relating to Foreign Countries* and *Statistical Tables relating to the Colonial and Other Possessions of the United Kingdom* published in 1866. Values of exports by types of goods were converted from various currencies into nominal pounds sterling as necessary. The types of goods were manually standardized according to Standard International Trade Classification (SITC) codes version 4. Appendix figure A1 lists the value of exports by SITC category.

Sailing distances between ports

The sailing distance between ports is reported in nautical miles in the *Philips' Centenary Mercantile Marine Atlas II* published in 1935. Distances for different sailing routes are given, but I exclude the Suez Canal route because it was not open until 1869. The routes that are allowed include the Kiel Canal, Cape of Good Hope, Strait of Magellan, Cape Horn, and Torres Strait.

City-level panel of banks

I gathered the names and city-level locations of all banks operating around the world from 1850-1913 using the annual editions of the *Banking Almanac*. The data from 1861-1867 are annual; for the rest of the period I digitized almanacs at 5-year intervals. These records make it possible to observe the operations of non-British banks throughout the entire period. Nationalities are not given in the original source, so I assign bank nationalities based on the locations of their headquarter offices (when known), the source of their capital (usually given in their individual histories), and their names and areas of operation. This dataset contains over 55,000 unique bank-location observations.

A.6.2 Data collected

Conflicts

I use Sarkees and Wayman (2010) from the Correlates of War project for data on inter-state, intra-state, and extra-state conflicts from 1850–2014 to document conflicts within the exporter-country and between country-pairs. For inter-state wars, I standardize country borders to coincide with pre-WWI borders, the same way as in the panel of trade data. Wars that occurred within one country's borders (for instance, the Second Italian War of Independence in which regions of Italy fought each other) are included as a conflict for the exporting country, but is not included in the dyadic war variable because the outcomes do not include own-country trade. Intra-state conflicts are recorded as a war within the state where it is occurring (for instance the United States for the US Civil War). Extra-state conflicts are recorded as a war for the official state and are not included in the dyadic calculations of conflict.

In the pre-period balance checks in Table 2.3, I include all conflicts that occurred or were ongoing in 1865 and 1866. There are 11 countries involved in inter-state conflicts, 3 in intra-state conflicts, and 2 in extra-state conflicts. These include the Paraguayan War (Paraguay, Argentina, Brazil, Uruguay), Austro-Prussian War (Austria-Hungary, Germany), Chincha Islands War (Spain, Peru, Chile), Second French intervention in Mexico (France, Mexico), Third Italian War of Independence (Italy, Austria-Hungary), Taiping Rebellion (China), Cretan Revolt (Ottoman Empire), United States Civil War (USA), Polish Rebellion in Siberia (Russia), Bhutan War (United Kingdom).

Monetary standard

I gathered the data on the monetary standard of each country in 1866 using published monetary histories or the wikipedia article for each country's historical currency. In cases, like in the British West Indies, when the official currency (pegged to the pound in gold) circulated alongside unofficial currencies (like the Spanish pieces of eight in silver), I categorized the country as being "bimetallic." The results are not sensitive to being categorized by the official currency (gold in this case).

B | Appendix to Chapter 2

B.1 Additional tables

Table B1: *Alternative sample periods for first stage regressions*

	1(National Bank)	
	(1)	(2)
1(pop<6k)	0.185**	0.274***
	(0.0904)	(0.0848)
Δ Pop(1870:1880)	0.000109***	0.000116***
	(0.0000330)	(0.0000299)
State FE	Y	Y
Start Year	1873	1877
End Year	1883	1887
N	155	147

Notes: B1 presents first stage results with alternative sample periods. The first column shows national bank entry likelihood between 1873 and 1883, and the second between 1877 and 1887. In both samples, town population was below 6,000 in 1870, and between 4,000 and 8,000 in 1880. Additionally, there was no national bank as of the start year (1873 and 1877, respectively).

Table B2: *Alternative samples for first stage regressions*

Panel A: National Bank Entries and Town Population (2,000 to 10,000)

	1(National Bank)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1(pop<6k)			0.134	0.342***	0.331***	0.356***	0.240***
			(0.0831)	(0.0795)	(0.0708)	(0.0736)	(0.0669)
Population in 1880	0.0000365***		0.0000476***	0.000179***		0.000137***	
	(0.00000979)		(0.0000120)	(0.0000161)		(0.0000168)	
Population in 1870				-0.000175***		-0.0000947***	
				(0.0000155)		(0.0000171)	
Δ Pop(1870:1880)		0.000146***			0.000177***		0.000117***
		(0.0000132)			(0.0000146)		(0.0000160)
State FE						Y	Y
N	826	826	826	826	826	826	826

Panel B: National Bank Entries and Town Population (3,000 to 9,000)

	1(National Bank)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1(pop<6k)			0.0571	0.229**	0.298***	0.361***	0.294***
			(0.115)	(0.108)	(0.0861)	(0.106)	(0.0835)
Population in 1880	0.0000141		0.0000234	0.000147***		0.000156***	
	(0.0000196)		(0.0000271)	(0.0000294)		(0.0000309)	
Population in 1870				-0.000174***		-0.000130***	
				(0.0000220)		(0.0000254)	
Δ Pop(1870:1880)		0.000135***			0.000168***		0.000136***
		(0.0000193)			(0.0000214)		(0.0000246)
State FE						Y	Y
N	333	333	333	333	333	333	333

Panel C: Population Cutoff and Presence of National Banks

	1(National Bank in 1875)		1(National Bank)	
	(1)	(2)	(3)	(4)
1(pop<6k)	-0.194*	-0.186***	-0.0747	-0.0629
	(0.105)	(0.0662)	(0.108)	(0.0681)
Population in 1880	-0.0000903**		-0.00000662	
	(0.0000449)		(0.0000462)	
Population in 1870	0.0000860***		0.000000177	
	(0.0000264)		(0.0000271)	
Δ Pop(1870:1880)		-0.0000867***		-0.00000126
		(0.0000252)		(0.0000260)
State FE	Y	Y	Y	Y
Adj. R^2	0.311	0.314	0.243	0.245
N	341	341	341	341

Notes: Panel A and B of Table B2 presents first stage results with alternative population ranges around the 6,000 cutoff. Panel A uses the sample where 1880 population $\in [2,000, 10,000]$ and Panel B uses the sample where 1880 population $\in [3,000, 9,000]$ Panel C expands the main sample (population in 1880 $\in [4,000, 8,000]$ and population in 1870 $< 6{,}000$) by adding towns already had national banks as of 1875.

Table B3: *Placebo: National Banks and local business (county-level)*

Panel A: Percentage changes in share of doctors

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-0.0113	0.0147			0.0654	0.0872
	(0.0323)	(0.0329)			(0.0899)	(0.0918)
1(pop<6k)			0.0229	0.0290		
			(0.0338)	(0.0330)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	-0.132	-0.132	-0.132	-0.132	-0.132	-0.132
Std. Dev. of Dep. Var.	0.154	0.154	0.154	0.154	0.154	0.154
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Percentage changes in share of teachers

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	0.0305	-0.0278			-0.0400	-0.0835
	(0.0795)	(0.0816)			(0.217)	(0.224)
1(pop<6k)			-0.0140	-0.0278		
			(0.0832)	(0.0820)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	-0.0513	-0.0513	-0.0513	-0.0513	-0.0513	-0.0513
Std. Dev. of Dep. Var.	0.417	0.417	0.417	0.417	0.417	0.417
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Notes: Table B3 presents results from the IV estimates as well as reduced form estimates. Dependent variables in Panel A and B are percentage changes in shares of doctors and teachers among males above 21 years old from 1880 census to 1900 census, respectively. Regressions are weighted by share of town population in the sample in 1880. * p<0.1, ** p<0.05, *** p<0.01.

Table B4: *Robustness: National Banks and growth in manufacturing production*

Panel A: Scaling production by male labor between 18-44 in age

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	63.12	89.92*			375.2***	509.7**
	(45.77)	(50.25)			(145.4)	(200.3)
1(pop<6k)			164.8***	172.2***		
			(58.27)	(58.34)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	108.0	108.0	108.0	108.0	108.0	108.0
Std. Dev. of Dep. Var.	320.1	320.1	320.1	320.1	320.1	320.1
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

Panel B: Inflation-adjusted manufacturing production per capita

	OLS	RF	IV	OLS	RF	IV
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	52.66		254.9**	81.31*		421.4**
	(35.57)		(127.1)	(48.69)		(183.1)
1(pop<6k)		86.14**			142.4**	
		(41.86)			(56.98)	
State FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Scaled by Males above 21yrs	Y	Y	Y			
Scaled by Males between 18-44yrs				Y	Y	Y
Mean of Dep. Var.	151.0	151.0	151.0	201.5	201.5	201.5
Std. Dev. of Dep. Var.	252.9	252.9	252.9	318.1	318.1	318.1
N	148	148	148	148	148	148
KP F-stat			10.68			10.68

Notes: Table B5 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is changes in manufacturing production per capita between 1880 and 1890. Control variables include number of state banks in a town as of 1876, as well as number of railroads in 1880. Regressions are weighted by share of town population in the sample in 1880. * p<0.1, ** p<0.05, *** p<0.01.

Table B5: *Placebo: National Banks and local manufacturing sector (1870-1880)*

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-48.69	-32.18			-61.85	-51.20
	(39.71)	(41.69)			(140.4)	(148.9)
1(pop<6k)			-18.97	-14.69		
			(47.49)	(47.37)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	-36.30	-36.30	-36.30	-36.30	-36.30	-36.30
Std. Dev. of Dep. Var.	217.9	217.9	217.9	217.9	217.9	217.9
N	147	147	147	147	147	147
KP F-stat					8.686	8.215

Notes: Table B5 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is changes in manufacturing production per capita between 1870 and 1880. Control variables include number of state banks in a town as of 1876, as well as number of railroads in 1880. Regressions are weighted by share of town population in the sample in 1870. * p<0.1, ** p<0.05, *** p<0.01.

Table B6: *Placebo: National Banks and local innovation activity (1870-1880)*

	OLS		RF		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
1(National Bank)	-0.781	-1.094**			-0.502	-0.849
	(0.489)	(0.548)			(1.325)	(1.743)
1(pop<6k)			-0.220	-0.287		
			(0.644)	(0.661)		
State FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of Dep. Var.	0.793	0.793	0.793	0.793	0.793	0.793
Std. Dev. of Dep. Var.	1.982	1.982	1.982	1.982	1.982	1.982
N	148	148	148	148	148	148
KP F-stat					15.74	10.68

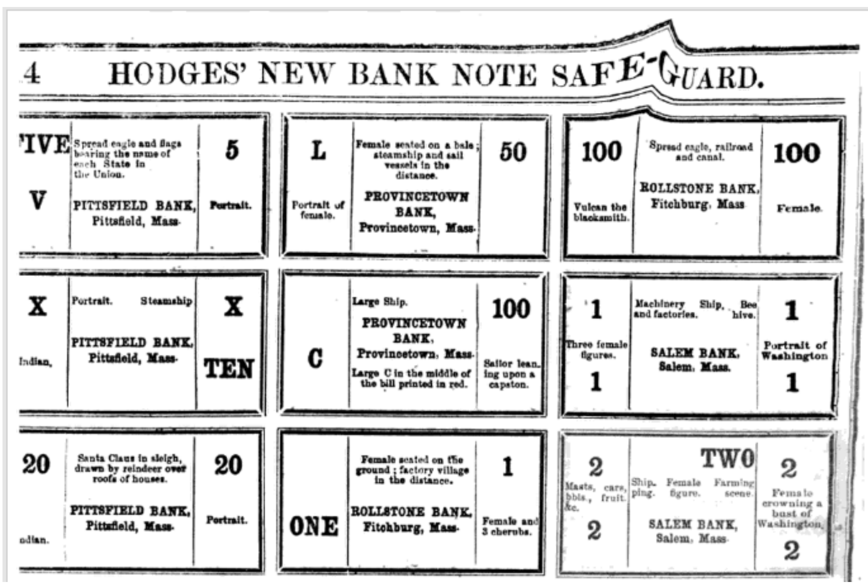
Notes: Table B6 presents results from OLS, reduced form, as well as IV estimates. Dependent variable is percentage change in total number of patents between 1860s(1861-1870) and 1870s(1871-1880). Control variables include number of state banks in a town as of 1876, as well as number of railroads in 1880. Regressions are weighted by share of town population in the sample in 1870. * p<0.1, ** p<0.05, *** p<0.01.

B.2 Additional figures

Figure B1: *Bank note from the Pittsfield Bank in Massachusetts*

(a) *Bank note from the Pittsfield Bank in Massachusetts*

(b) *Page from Hodges' New Bank Note Safe-Guard*

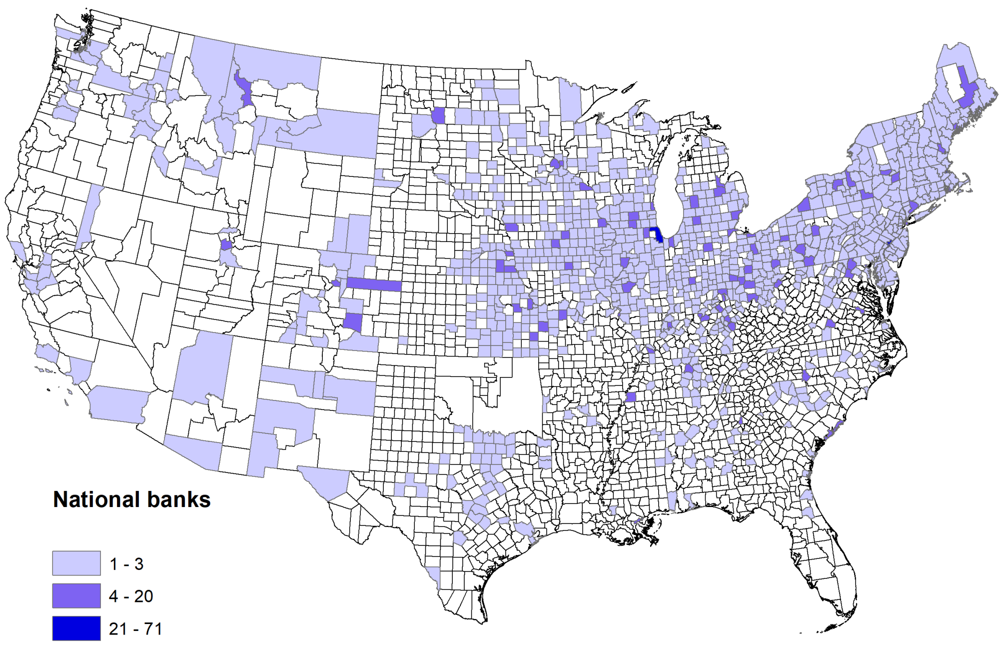


4 HODGES' NEW BANK NOTE SAFE-GUARD.

FIVE V	Spread eagle and flags bearing the name of each State in the Union. PITTSFIELD BANK, Pittsfield, Mass.	5 Portrait.	L Portrait of female.	Female seated on a bale; steamship and sail vessels in the distance. PROVINCETOWN BANK, Provincetown, Mass.	50	100 Vulcan the blacksmith.	Spread eagle, railroad and canal. ROLLSTONE BANK, Fitchburg, Mass.	100 Female.
X Indian.	Portrait. Steamship PITTSFIELD BANK, Pittsfield, Mass.	X TEN	C	Large Ship. PROVINCETOWN BANK, Provincetown, Mass. Large C in the middle of the bill printed in red.	100 Sailor leaning upon a capstan.	1 Three female figures. 1	Machinery and factories. Ship. Bee hive. SALEM BANK, Salem, Mass.	1 Portrait of Washington 1
20 Indian.	Santa Claus in sleigh, drawn by reindeer over roofs of houses. PITTSFIELD BANK, Pittsfield, Mass.	20 Portrait.	ONE	Female seated on the ground; factory village in the distance. ROLLSTONE BANK, Fitchburg, Mass.	1 Female and 3 cherubs.	2 Masts, oars, bbls., fruit, &c. 2	TWO Shipping. Female figure. Farming scene. SALEM BANK, Salem, Mass.	2 Female crowning a bust of Washington. 2

Notes: Figure B1(A) gives an example of a private banknote that was printed in 1853. The note is for twenty dollars, redeemable for specie at the Pittsfield bank. Figure B1(B) displays an page from the *Hodges' New Bank Note Safe-Guard*, first published in 1859. It is an example of one of the many publications dedicated in helping merchants and brokers to detect counterfeit bank notes. It describes the physical appearance of over 10,000 bank notes, "embracing every genuine note issued in the United States and Canada." The description for the Pittsfield bank $20 note from Figure B1(A) is shown in the bottom row of the first column and accurately describes the note.

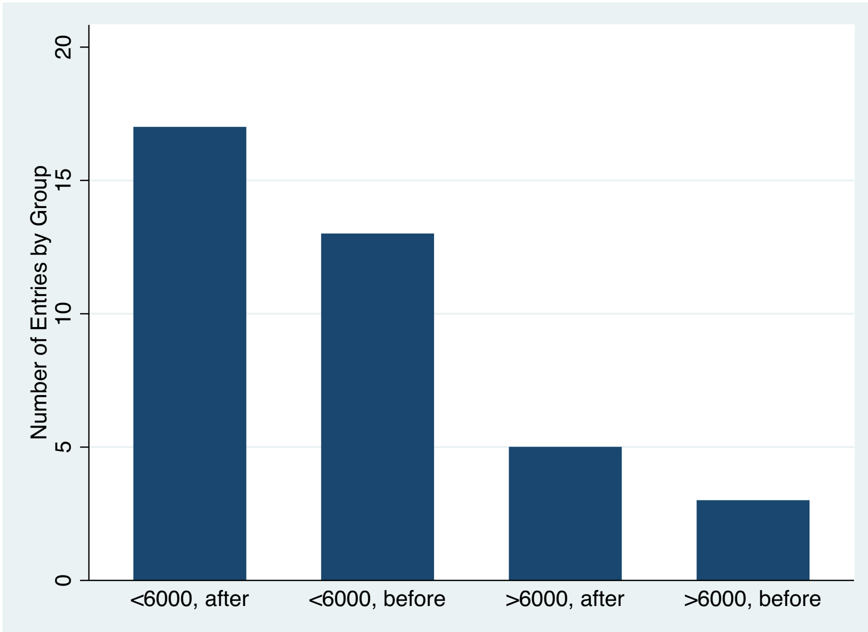
Figure B2: *Distribution of national banks in 1885*



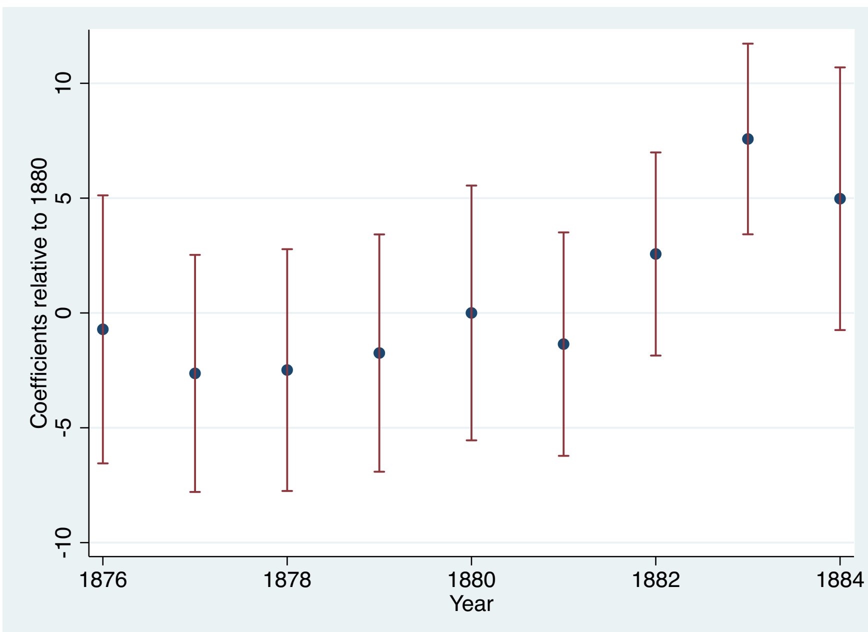
Notes: Figure B2 plots the location distribution of all national banks as of 1885. Each area represents a county. The white areas did not have a national bank as of 1885, and the lighter to darker shades represent 1-3, 4-20, and 21 or more national banks within the county.

Figure B3: *Timing of entry*

(a) *New National Banks in sample*



(b) *All new National Banks between 1876 and 1885*



Notes: Panel A of Figure B3 shows number of new national banks in our main sample before or after census publication year, and whether population in 1880 census crossed the 6,000 threshold. Panel B shows coefficients and standard error bars of coefficients on year dummy variables from the following regression: $NumberNewBanks_{s,y} = \beta_y * 1(year = y) + \gamma_s * 1(state = s) + \epsilon_{s,y}$.

B.3 Additional notes on the first stage

B.3.1 First stage regressions in alternative samples

We choose the 4,000 to 8,000 population range in order to obtain a sample of towns that are largely comparable and hence less likely to be subject to omitted variable bias. The first stage regressions are robust and more statistically significant with wider population ranges. In Panel A and B of Table B2, we present first stage regression results for 1880 population between 2,000 and 10,000, as well as between 3,000 and 9,000 in 1880, respectively. In both cases, having fewer than 6,000 population is strongly associated with the likelihood of obtaining a national bank once we control for population levels or changes.

In Panel C of Table B2, we expand our main sample to include all towns that already had a national bank as of 1875. The first two columns suggest that when all of these towns faced lower entry cost in the 1870s, smaller towns were less likely to obtain a national bank. Column (3) and (4) show that our 1880 population cutoff is not correlated with the *existence* of national bank in 1885. This is likely due to state bank conversions—larger towns were more likely to have state banks and subsequently more national banks converted from those state banks. This force operates in the opposite direction as the instrument. Although state banks usually had much lower capital requirements than $50,000, in reality they often operated with much larger capital (Knox, 1900), and the conversion to national bank charters was minimally constrained by the capital requirement defined in the National Banking Act. We therefore focus on the changes in access to national banks by studying the towns with no national bank as of 1875.

B.3.2 Timing of entry

National banks were allowed to maintain the capital levels as of the time of their charter, so one particular endogeneity concern is that banks could accurately forecast economic and population growth, and would rush to obtain a charter before the 1880 census was published. For example, a town with population below 6,000 in 1870 correctly anticipateed that it would cross the population threshold in 1880 and established a bank in 1879, before population in census was updated. This behavior of "racing the census" would bias the OLS estimates upward because the bank entry would be correlated with the outcomes. However, it would actually weaken the first stage and the reduced form relationship in the instrument.

In addition, we empirically correlate the new national bank entries to the years around the new census publication. First we compare new national bank entries right before the 1880 census in our sample of towns, and then we look at the towns in the entire country. Figure B3 presents the results. In Panel A, we compare number of new national bank entries by population in 1880 census for the towns in our sample. The first and third bars shows the number of new entries right after the new census was published, and the second and fourth bars shows the number of new entries right before it. For towns below the threshold, there is more entry, which is consistent with our first stage results. For both population groups, more entry occurred *after* the new census was published rather than before.

In Panel B, we look at national bank entry in the entire country. We present coefficients on year dummy variables from the following equation:

$$NumberNewBanks_{s,y} = \beta_y * 1(year = y) + \gamma_s * 1(state = s) + \epsilon_{s,y}, \tag{B.1}$$

and compare the coefficients relative to 1880. The result also show that there was no spike in entry before the new census and that in fact, more new national banks established after 1881 than before. The empirical evidence suggests that there was no census racing behavior.

In fact, our first stage results are robust to selecting any year ranges that starts prior to the 1880 census and ends in the 1880s. We choose the range from 1875 to 1885 to capture a relatively stable time period in terms of economic activities and relative growth in national and state banks.

B.4 Additional historical context

B.4.1 Banking system before the National Banking Act

The idea of establishing a unified banking system across the United States was several decades earlier than the passage of the National Banking Act. The First Bank of the United States, charted for a term of twenty years by the Congress on February, 1791, operated in Philadelphia and was the nation's *de facto* central bank. Alexander Hamilton, the first Secretary of the Treasury, believed a national bank was necessary to stabilize and improve the nation's credit, and proposed federal mint as common currency. However, the bank faced widespread resistance due to concerns of expanding federal power, which was famously led by the Secretary of State Thomas Jefferson. The bank charter was not renewed and expired in 1811.

In 1816, the Second National Bank started operation with similar functions as the First Bank of the United States. As of 1832, the Second National Bank operated more than 30 branches nationwide. However, the political clashes over the power of a national bank system eventually led to failure of its charter renewal in 1836, which marked the beginning of the Free Banking Era.

B.4.2 Additional evidence of bank debt illiquidity in the Free Banking Era

The large number of floating exchange rates created inconvenience in economic activity. For example, a case record compilation of the United States supreme court between 1843 and 1846 (Stephen K. Williams, 1901) contains a case regarding the value of a loan, and how its value had changed over time:

> [...] the defendant did [...] receive the amount of said loans from the plaintiffs in the bank notes of Virginia and of other States, which, [...] were depreciated considerably below the current value of the bank notes of this district [...]

The frictions stemmed from state bank notes illiquidity was especially detrimental to interstate transactions. As a contemporary traveler illustrated the magnitude of the cost in his diary (Dewey, 1910):

> Started from Virginia with Virginia money; reached the Ohio River; exchanged $20 Virginia note for shinplasters and a $3 note of the Bank of West Union
>
> [...] At Maysville wanted Virginia money; couldn't get it.
>
> [...] reached Fredericktown; there neither Virginia nor Kentucky money current; paid a $5 Wheeling note for breakfast and dinner; received in change two $1 notes of some Pennsylvania bank, $1 Baltimore and Ohio Railroad, and balance in Good Intent shinplasters; 100 yards from the tavern door all notes refused. [...]