FREE BANKING: A REASSESSMENT USING BANK-LEVEL DATA

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CHAPTER I

INTRODUCTION

Evidence from Sylla (1998), Rousseau and Sylla (2005), and Wright (2002) has shown that the connection between finance and growth has been present in the United States since its inception. However, high entry barriers initially restricted capital to developed parts of the county and those banks that could be established were prone to default and instability. The nation's first evolutionary step towards the modern banking sector was a series of state "free banking" laws starting in 1837. These laws standardized entry requirements within a state and helped spread banking throughout the developing nation.

Despite doubling the number of banks within a quarter of a decade, free banking was infamous for its instability. Fewer than half of all free banks remained in operation by 1863 and the majority of closed banks were not able to repay the full value of their notes. Whether true or not, politicians and the proponents of the National Banking System (1863-1913) took this instability as evidence of lax regulations and "wildcat banks", i.e. unsound banks operating outside of populated areas. Also focusing on legal restrictions and anecdotal evidence, early studies of antebellum banking such as Knox (1900), Hammond (1957), and Cagan (1963) did little to disprove or test these assertions.

Recent studies such as Rockoff (1972, 1974) and Rolnick and Weber (1983, 1984, 1985) have pushed back against the wildcat interpretation, but the lack of data has prevented a complete view of the period. Instead, studies draw conclusions from small sets of banks (Economopoulos 1988), years (Dwyer and Hasan 2007), and variables (Rolnick and Weber 1984). Building on the wave of empirical studies, this dissertation provides a comprehensive reassessment of free banking by assembling a bank-level database. The database includes an annual balance sheet and quarterly note discount for almost every antebellum bank, as well as an estimate of their note redemption cost and bond portfolio value.

Following the "new financial history" literature, the unique compositional and environmental data allows me to unpack free banking's most controversial aspects. This introductory chapter starts with a brief summary of free banking, providing the background material for the rest of the dissertation. The second chapter addresses the causes of free banking's systematic (or regulatory) instability and idiosyncratic (or bank-level) instability. After determining why free banks were unstable, the third chapter examines whether private brokers were able to efficiently price the default risk of each bank and thus mitigate note holder losses. Finally, the fourth chapter illustrates the results of the legislative "solution" to free banking's instability: the National Banking Acts of 1863 and 1864. On the surface, the legislation nationalized free banking, but their additional restrictions ultimately broke its spirit, leaving fewer than 56 free banks in operation in 1869.

The dissertation might focus on a historical period, but its conclusions have ramifications for modern bank regulations. First, it highlights the unintended consequences associated with reactionary regulations, and shows that the most successful regulations are those that are gradually amended as problems occurred. Second, it shows that the individuals are able to adjust to changes in risk and regulation even when there is no federal oversight or modern security exchanges. The Free Banking System is thus an important study of the complications and unexpected consequences of bank regulations, as well as, the market's ability to adjust to those regulations.

Introduction to Free Banking (1837-1862)

The U.S. banking system before 1837 was governed by a loose collection of rules with few standards even within states. Each bank petitioned for a unique charter from its state legislature, and approval depended as much on political influence as personal resources.[1] A series of "free banking" laws changed this by replacing the need for legislative approval with a well-defined set of capital, reserve, and note requirements. Therefore contrary to its name, free banking was far from laissez-faire; rather, the term "free" refers to the idea that any person who met the state's requirements was "free" to open a bank.[2]

The sample of free banking laws in Table 1-1 illustrates that requirement levels varied by state but each contained a bond-secured note requirement.[3] Unlike charter banks, the requirement stipulated that free banks purchase state or federal debt (or other specified assets) as security for each note. The bank then deposited those bonds with a state representative and received an equal value of bank notes in return. The state representative held the bonds as note collateral and only relinquished them when the bank returned an equal number of notes. If even a single request for note redemption was unmet by a bank, the state representative would close the bank and liquidate the collateral bonds to redeem any outstanding notes.

Table 1-2 shows that 18 of the 32 states passed a free banking law and 872 free banks were established before 1861. However, despite the large number of banks established, free banks seemed to be unnecessary in Northeast (with the exception of New York) given the high

[1] For convenience, I define "charter banks" to be any institution established by direct order of the state legislature. This distinction is necessary because charter banks continued to operate even after free bank laws were passed. Hammond (1957) and Bodenhorn (2003) provide detailed summaries of the political and economic forces behind free banking.

[2] The laws typically stated that any single or group of residents who met the requirements was allowed to found a bank. By the letter of the law, they do not explicitly exclude women, children, or slaves.

[3] Most laws specified that the government debt used for note backing had to be paying full interest. When allowed, other assets typically included real estate (Michigan, New Jersey), but some states also allowed unique assets such as slaves in Georgia.

Table 1-1: Sample of Free Bank Requirements By State

	Capital Stock	Assets Allowed For Note Security*	Accepted Bond Value	Additional Note Security	Note Reserve Requirements	Damages for Non-payment	Stockholder Liability
Alabama (1849)	$100,000 to $500,000	U.S. bonds	Par value	-	-	15%	-
Illinois (1851)	Over $50,000	Any public bonds	Not over par or market value	-	-	12%	Double
Indiana (1852)	Over $50,000	Any public bonds	Not over par or market value	-	12.5% of notes outstanding	-	Single
Michigan (1837)	$50,000 to $300,000	Any public bonds, MI mortgages, other personal bonds	-	0.5% of capital paid into security fund	Notes, loans and discounts under 2.5x capital stock	20%	Single
Minnesota (1858)	Over $25,000	Any public bonds	Not over par or market	25% of notes or 10% in Public stock	-	-	Double
New Jersey (1850)	$50,000 to $500,000	U.S., NJ, & MA bonds or mortgages	Not over par or market value	-	-	12%	Single
New York (1838)	Over $100,000	Any public bonds or NY mortgages	Not over par value	-	12.5% of notes outstanding in specie	14%	Not personally liable
Ohio (1851)	$25,000 to $500,000	US or OH bonds	Not over par or market value	Notes cannot be 3x capital or less than third of liabilities	30% of notes outstanding;	15%	Single
Wisconsin (1852)	-	Any public bonds & Wisconsin railroad bonds	Not over par or market	1/4th of notes	Security for notes over $25,000	5%	Single

Notes: Sample comes from original state law requirements. Any additions or changes to the laws were not added. "-" denotes non-specified values.
*Almost all state laws required that any bond used was currently paying full interest. "Public bonds" are defined as any state or national bond paying full interest.

Table 1-2: Summary of Antebellum Banking Systems (1790-1862)

Free Bank States	**Free Bank Law Passed**	**Charter Banks**	**Free Banks**
Alabama	1849	11	1
Connecticut	1852	83	14
Florida	1853	14	0
Georgia	1838	53	0
Illinois	1851	8	132
Indiana	1852	4	96
Iowa	1858	2	0
Louisiana	1853	25	0
Massachusetts	1851	225	4
Michigan	1837	33	46
Minnesota	1858	0	16
New Jersey	1850	70	26
New York*	1838	109	377
Ohio	1851	110	14
Pennsylvania	1860	114	0
Tennessee	1852	42	2
Vermont	1851	50	1
Wisconsin	1852	3	143
States With Bond Secured Note Issues			
Kentucky	1850	28	0
Missouri	1858	12	0
Virginia	1851	30	0
States Without Free Banks			
Arkansas	-	2	0
Delaware	-	11	0
Kansas	-	1	0
Maine	-	124	0
Maryland	-	55	0
Mississippi	-	27	0
Nebraska	-	8	0
New Hampshire	-	69	0
North Carolina	-	16	0
Rhode Island	-	104	0
South Carolina	-	20	0
Total		**1,463**	**872**

Notes: Year passed was taken from Rockoff (1974, pp. 3, 125-130). Number of banks was obtained from Weber (2005b). State with "Bond secured note issues" did not have other free bank requirements. *New York charter banks which eventually operated as free banks are counted as charter banks.

population and large number of pre-existing charter banks and unwanted in the South as the region set high bank requirements relative to its rural population. Excluding New York, only 42 free banks were established in those two regions compared to 1,107 charter banks. Therefore, the New York and Midwest free banking laws saw the most use. Midwest laws seem to be successful because their requirements were low and their low population prevented charter bank entry, whereas New York's requirements fit their growing population.

The impact of the new legislation on the country's bank distribution is seen in Figure 1-1. Before free banking, banks were concentrated in Northeast, particularly along the Atlantic Ocean and Great Lakes. As railroads and population expanded westward, so did the banking system. However, the expansion consisted primarily of free banks as charter banks remained concentrated in the Northeast. In 1860, 46.5 percent of free banks were located in the Midwest, compared to 8.5 percent of charter banks. Free banks seem to be attracted to communities that were beginning their development, whereas, larger charter banks were primarily in developed areas.

Free Bank Compositions & Instability

The first step to understanding of free banking is to examine an individual bank's balance sheet. For the sake of illustration, let us assume that a potential banker with $50,000 in capital wished to start a free bank. The banker would use the capital to buy $50,000 worth of government bonds.[4] The bonds were then deposited with the state representative in exchange for $50,000 worth of bank notes. As the bank's primary source of liquidity, these notes were then used to make investments and carry out day-to-day operations.

[4] While this example bank invested the full amount of capital in notes, it is not an unrealistic generalization as free banks heavily relied on circulation for liquidity.

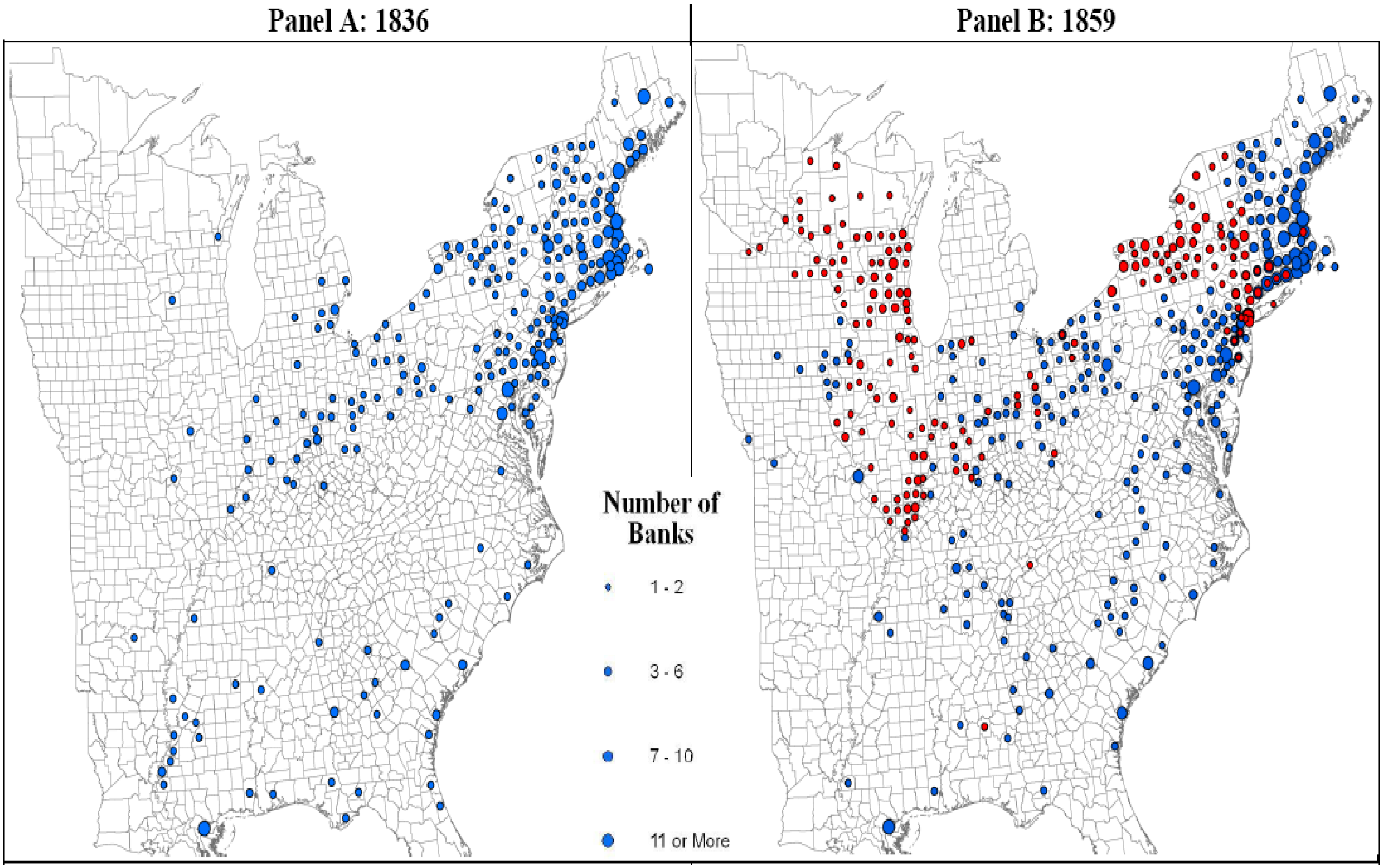

Figure 1-1: Distribution of Free and Charter Banks

Notes: The figure maps the location of each charter and free bank in 1836 and 1859. The blue dots represent charter banks and red dots represent free banks. The size of the dot denotes the number of banks in the county. Due to the few banks west of the Mississippi River, I have censored the map at that point.

Table 1-3: Sample Balance Sheets

	Bank A: Safe Bank		
Specie	25,000	Circulation	50,000
Loans	25,000	Deposits	0
Government Bonds	50,000	Capital	50,000
Total Assets	100,000	Total Liabilities	100,000
	Bank B: Risky Bank		
Specie	25,000	Circulation	100,000
Loans	25,000	Deposits	0
Government Bonds	100,000	Capital	50,000
Total Assets	150,000	Total Liabilities	150,000

Notes: This table provides two possible portfolios that could be achieved from an initial capital level of $50,000. The safe/risky labels are derived from the bank's ability to meet its note obligations during negative shocks to bonds and loans.

Table 1-3 illustrates two possible portfolios a bank could achieve. Bank A used its notes to make loans and purchase specie, whereas Bank B leveraged its notes to purchase additional bonds and deposited them with the state representative for more notes.[5] Bank B still used its additional notes to purchase specie and make loans, but the additional notes and bonds make it more risky. For example, if bonds and loans depreciated by 50 percent, Bank A would still have enough assets ($50,000) to meet its outstanding circulation ($50,000). Yet under the same shock, better equipped to handle negative shocks than the Bank B.

As seen in the example, free banking's unique note requirements meant that the security of a note was tied to the government bond price level. When bond prices fell, the value of the bank's note backing declined while its notes maintained the same face value. Moreover, a free bank could not have quickly sold its bonds to generate liquidity because they were held by a state representative. Even if a bank had available bonds to sell, any effort to sell them quickly would further depress their price and increase capital losses. The bond-secured note issue thus exposed

[5] This second bank would traditionally be labeled as a wildcat bank.

free banks to negative bond shocks and prevented them from redeeming notes when shocks did occur.

Free banks could avoid bond price declines and remain solvent in several ways. First, they could decide invest some of their capital into loans or specie, rather than fully investing in bonds for notes. This restraint would limit the amount of redemption required during a bank run. Second, they could diversify their liabilities with non-demandable deposits and their assets with short-term loans and specie.[6] Deposits would provide extra liquidity that was not subject to bank runs, whereas short-term loans and specie would provide assets that were not susceptible to bond price declines.[7]

Table 1-4 shows that stable free banks achieved this type of diversification. On the asset-side of the balance sheet, the average failed bank invested 44.8 percent of its assets in bonds, compared to the average stable bank had only 5.5 percent. Stable banks, however, did not invest in more specie, as the level of specie to assets was approximately the same across bank types. Instead, they invested in loans, potentially replacing one interest-earning asset with another. On the liabilities-side, failed banks issued roughly the same number of notes as stable banks but had only half the assets in which to reimburse note holders. To put it another way, the average failed free bank had to liquidate half of its assets to meet its outstanding circulation compared to stable banks that only had to liquidate a sixth.

The dissertation's second and third chapters build upon these balance sheet comparisons by addressing why free banks were instable and whether the market responded in the short-term. Lending support to Rolnick and Weber (1984), the second chapter confirms that the new note

[6] This type of diversification was studied by Economopoulos (1990).

[7] As argued by Rolnick and Weber (1984) and Dwyer and Hafer (2004), free banks could also diversify their bond portfolio with less risky bonds, such as New York or US bonds.

Table 1-4: Comparison of Average Free Bank Balance Sheet Positions

Assets			Liabilities		
	Non-Failed	Failed		Non-Failed	Failed
Specie	73,383	28,277	Circulation	72,319	80,401
Due from Other Banks	25,106	17,017	Deposits	123,467	12,785
Other Banks Bills	7,514	3,231	Due to Other Banks	37,426	3,081
Bonds	23,051	76,540	Other Liabilities	14,519	4,945
Loans	231,468	31,884			
Real Estate	8,710	1,015			
Expenses	2,767	864	Capital	165,778	77,998
Other Assets	45,569	12,021	Profit/Loss	12,290	779
Total Assets	417,568	170,850	Total Liabilities	425,799	179,988
Specie/Assets	17.6%	16.6%	Circulation/Assets	17.3%	47.1%
Bonds/Assets	5.5%	44.8%	Deposits/Assets	29.6%	7.5%
Loans/Assets	55.4%	18.7%	Capital/Assets	38.9%	43.3%

Notes: Table presents the average balance sheet of free banks. Banks are equally weighted. Measurement error prevents assets from equaling liabilities. “Failed” denote banks that did not fully redeem their notes upon closure.

requirements seem to be the underlying cause of the free banking system’s high failure rate relative to the charter banking system. However, as discussed by Economopoulos (1990), solvent free banks seemed to diversify their assets away from bonds with loans and reduced their note circulation. Regulation therefore seems to be responsible for the high free bank failure rate, but banks could have decreased their probability of failure through diversification.

The third chapter tests whether the market was able to effective monitor the risky behavior of free banks. It shows that the market priced bank notes according to their systematic risk (specie suspensions) and idiosyncratic risk (falling bond prices and a bank’s proportion of loans). Moreover, the discounts after a bank closed changed to reflect the market’s value of a bank’s debt (circulation) and assets (bond prices and a bank’s asset size). In this way, note discounts before closure corresponded to the probability that a bank would default, whereas after closure, they corresponded to its ability to pay off its debt. The market thus mitigated the real value of losses and allowed free bank notes to circulate throughout the country.

The Decline of Free Banking

Shrinking from 513 to 56 banks during the 1860's, the nation's experiment with free banking came to a virtual end with the Civil War and the National Banking Acts of 1863 and 1864. The new legislation attempted to reform the free banking system on the national level. The goal was to replace risky free and charter banks (i.e. state-chartered banks) with safe nationally-chartered free banks; however, the new "safer" regulations came with a high cost that not every bank was able to pay.

First, national banks avoided free bank's attachment to risky state debt by only allowing federal debt to back notes. Second, a ceiling was placed on aggregate circulation of national bank notes encouraging banks to restrict their note issues and pursue deposits. Third, New York's already high capital requirement was increased for densely populated areas. Fourth, a reserve was required on both reserves and deposits. Finally, a prohibitive 10 percent tax was passed on state bank notes meant to eliminate the free (and charter) bank notes.

The dissertation's fourth chapter show that the decline of free banks was not simply due to a switch to national charters. Rather, a third of state banks closed permanently between 1863 and 1869 and half of national banks were created from new capital. The chapter goes on to show that the high capital requirements of national banks prevented existing banks from converting to a national charter, whereas the state bank note tax destroyed many of the small banks which remains. Overall, the legislation created large banks in developed areas and destroyed the access to capital in rural areas, effectively breaking the spirit of free banking.

CHAPTER II

FREE BANK FAILURES: RISKY BONDS VS. UNDIVERSIFIED PORTFOLIOS

The Free Banking System (1837-1862) was the United States' first step towards a uniform banking system, but instead of adding stability to the existing system, the new laws led to even greater problems. By the time the National Banking Acts were passed, almost a third of all free banks were considered failures, unable to reimburse note holders for the full value of their bank notes upon closure. However, despite the infamous reputation, there is no general consensus on the cause of the failures. Because most samples have been limited to groups of banks or years, papers written on the topic have typically focused on one of two general explanations for their failure. Either banks were subject to poorly designed regulation or did not sufficiently diversify their asset and liability portfolios. Using almost the entire population of antebellum banks, this chapter attempts to draw clearer conclusions about the system's collapse by testing both theories within a single hazard model.

Rolnick and Weber (1984, 1985) believe that free banks were as much victims as villains, done in by sudden exogenous bond price depreciations and counter-productive bank regulations. Without exception, banks are more likely to fail when their assets depreciate. Rolnick and Weber argue that free bank laws further exposed banks to bond price depreciations by forcing them to back notes with government debt. Under this falling asset price hypothesis, low bond prices should correspond to a higher degree of free bank failures than charter bank failures.

Instead of focusing on specific regulations, Economopoulos (1990) addresses the operational choices made by free banks. He argues that individual free banks could have limited their exposure to bond prices through diversification. Free banks which sufficiently diversified their assets with loans and their liabilities with deposits would have been more likely to survive bond market declines than other free banks. The undiversified portfolio hypothesis therefore asserts that free banks needed to hold more loans and deposits but fewer bonds and circulation to remain solvent.[1]

The two hypotheses are straight-forward, but testing them separately is unlikely to provide conclusive results. A comparison of bank failures and collateral bond prices would identify the negative correlation between the two, but not prove that properly diversified banks also failed. To account for relationships between explanatory variables, I employ the multivariate proportional-hazard model with time varying covariates developed by Cox (1972). The model uses both a bank's financial (cross-sectional) and environmental (time series) information to estimate the roles that nature (bank structure) and nurture (market fluctuations) had in bank failure. Although similar to a panel logit or probit, the model gains additional efficiency from the use of imbedded duration information such as the bank's time-to-failure.

Recent studies such as Modlina (2002) and Wheelock and Wilson (1995, 2000) have shown the hazard model's usefulness in modeling bank failures, but the lack of consistent micro-level bank information has prevented its application in free banking studies. Without large panel samples, previous studies have examined smaller sets of banks (Economopoulos, 1990), years (Hasan and Dwyer, 1994), or variables (Rolnick and Weber, 1984). Only Dwyer and Hafer (2004) and Dwyer and Hasan (2007) have incorporated bank portfolios and bond market information within a single model.

[1] It is also helpful to note that this hypothesis is a more general version of Rockoff's (1972, 1974) wildcat banking hypothesis, namely that failed free banks issued more notes than they could conceivably redeem.

To overcome this deficiency, I have assembled the necessary panel by merging and expanding the two antebellum bank databases collected by Warren Weber (2005b, 2008). The later database is a set of over 20,000 bank balance sheets stretching from 1790 to 1861. The balance sheets were then matched with Weber's separate listing of banks to add each bank's type, location, operation dates, and whether it failed.[2] The merged database was then extended using *Hunts' Merchants' Magazine* and *Banker's Magazine* to document the over 120 banks that failed after Weber's listing ends in 1860 and construct a quarterly price database for 14 state bonds and a U.S. Treasury bond. The extended database provides the annual financial structure and failure date of almost every bank in operation before the Civil War, in addition to an indicator of relevant market fluctuations.

I use this micro-database to examine two questions: (1) what made a free bank more likely to fail than a charter bank (systematic risk) and (2) what made one free bank more likely to fail than another free bank (idiosyncratic risk). My results suggest that free banking's systematic risk was due almost entirely to its bond-secured note issue. On the other hand, individual free banks seemed to avoid failure by diversifying their assets with loans and reducing their circulation.

The Cause of Free Bank Failures

As discussed in the previous chapter, free banking's requirement that notes be fully backed by government debt (or other specified assets) was often insufficient to fully cover their note circulation. Consequently, bank notes were redeemed at cents on the dollar. Some losses were minimal (most Indiana banks, for example, redeemed at 95 cents on the dollar) whereas other losses were nearly total (Minnesota "railroad" banks repaid less than 35 cents of each

[2] I owe a great deal to Weber who made an expanded version of his databases available.

dollar).[3] Following Rolnick and Weber (1984), "failed banks" are defined as those institutions that did not reimburse the full value of their notes, whereas "closed banks" ceased operation but repaid their notes at par.[4] Based on this distinction, 29 percent of the 872 free banks failed. In comparison, only 19 percent of the 1,463 charter banks failed, even though they were allowed to back their notes with any type of asset.[5]

The high failure rate of free bank is traditionally attributed to either inefficient regulatory design or improper banking practices. In the following section, I discuss each of these theories individually drawing attention to their empirical strengths and weaknesses before moving to a more rigorous empirical test.

Falling Asset Price Hypothesis

The falling asset hypothesis in Rolnick and Weber (1984, 1985) argues that free bank failures were a natural reaction to exogenous bond price declines.[6] Because bond prices were published weekly or monthly, a bond price decline might trigger a bank note run.[7] Knowing that their note security portfolio was worth less in the short run than their notes in circulation in the short-run, banks could either (1) redeem their notes at par taking capital losses or (2) refuse their notes, close their doors, and forfeit their security portfolio. At some bond price, the losses on redemption would exceed the value of the security, and the bank would voluntarily cease operation rather than experience additional losses.

[3] Rolnick and Weber (1983)
[4] Due to lack of data this definition does not include losses on deposits.
[5] These failure rates were taken from Weber (2005b) which is described in the Data section.
[6] Although the hypothesis clearly applies all assets, the literature has focused on the bonds deposited with the state as they experienced the largest fluctuations during the period and were the primary source of note backing.
[7] Many newspapers published the bond prices of states such as New York, Pennsylvania, and Ohio every week. Less traded bonds were published monthly in *Hunts' Merchants' Magazine* or *Banker's Magazine.*

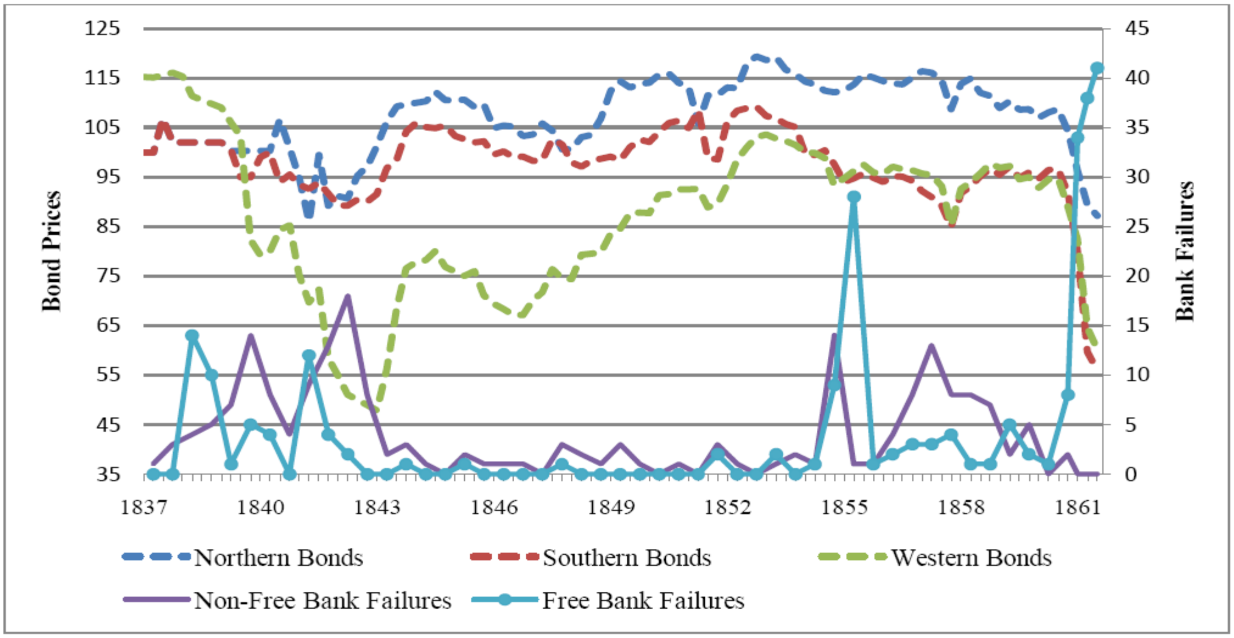

Figure 2-1: Bank Failures And Bond Prices (1837-1861)

Notes: Bond prices are listed by quarter. Failures are listed by half year. Dates of failures were obtained from Weber (2005b). Because fail dates are not approximate during 1861, they have been spread over the period. A description of the bond price indices is in the Appendix A. Northern bond prices include Maryland, New York, Ohio, and Pennsylvania. Western bond prices include Kentucky, Indiana, Illinois, Missouri, Tennessee, and Virginia. Southern bond prices include Georgia, Kentucky, Louisiana, North Carolina, South Carolina, and Tennessee. The few initial years when Southern bonds were unavailable the average was filled with the Northern bond price. It is also helpful to note that the decline in western bond prices during the early 1840's was the result of the collapse of state building projects and was reasonably exogenous to banking activity.

Rolnick and Weber test the hypothesis by illustrating the negative correlation between free bank failures and bond prices. As seen in Figure 2-1, 158 of 242 free bank failures (or 65 percent) occurred when bond prices were low.[8] Moreover, free banks that failed during the 1839 western bond crisis and the 1861 southern bond crisis held a larger proportion of their portfolio in these depressed bonds than banks that survived. For example, failed free banks in New York during the early 1840’s held 95 percent of their note security portfolios in defaulted bonds whereas solvent banks held only 75.2 percent.[9] The evidence therefore suggests that free banks were susceptible to bond price depressions.

[8] Bond periods were defined using the prices of Indiana 5% bonds and Missouri 6% bonds. These bonds were chosen for their large variation. The conclusions are robust to slight changes in the periods.
[9] Rolnick and Weber (1985, Table 3 and 4). Economopoulos (1988) finds similar results in Illinois.

This falling asset price hypothesis has not gone unchallenged. Hasan and Dwyer (1994) question the exogeneity of bond prices. During a bank run, solvent banks sold assets to obtain liquidity, and state representatives liquidated the assets of closed banks. Even if bond prices were not already declining, they could fall in response to the sudden liquidation of bonds. Although this represents an important criticism, the average bond portfolio of a bank was small compared to the total amount of state debt. For instance, the total amount of state debt in 1841 was $189,910,399 but the average free bank only held $74,737 with the state representative to cover its circulation.[10] Thus individual bond prices might have been endogenous, but it would take a large number of failures to dramatically affect the entire bond market.

Undiversified Portfolio Hypothesis

Economopoulos (1990) argues that free banks which diversified their asset and liability portfolios were better equipped to remain in operation during bond price depressions. Because free banks started in an unstable financial position, tied to a single asset (government bonds) and a single liability (note circulation), the undiversified portfolio hypothesis argues that free banks needed to hold a larger proportion of loans and specie in order to offset bond price declines, whereas deposits were needed to offset large circulations. The theory can potentially explain the 84 free bank failures that occurred during periods of stable or rising prices, as well as those during bond price depressions.[11]

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[10] Total state debt was obtained from Wallis (2005, Table 1). Average free bank circulation was calculated from the bank database described in Data section.

[11] It is worth noting the undiversified portfolio hypothesis typically focuses on comparing the probability of failure amongst free banks. It assumes that banks needed to diversify away from risky bonds and circulation because of the bond-secured note regulations. On the other hand, the falling asset price hypothesis explains the failure rate among free banks and between free and charter banks.

The undiversified portfolio hypothesis encompasses Rockoff's wildcat bank definition. Rockoff (1974, p. 142) defines wildcat banks as those with "note issues of far greater volume than they could hope to continuously redeem". A wildcat bank's portfolio should thus have had a large note circulation and little specie or other assets with which to redeem them.

Economopoulos tests the undiversified hypothesis by comparing the balance sheets of solvent and closed free banks in New York and Wisconsin. He shows that the more deposits, loans, or bonds a bank had, the more likely the bank would be solvent. While the positive relationship between solvency and bonds seems to challenge his hypothesis, Economopoulos argues that bond holdings were less risky when supported by other earning assets.

Data

Whereas most studies rely on samples containing a handful of banks or years, I have constructed a new dataset that provides financial and biographical information for almost every bank in operation before 1861.[12] The dataset is built upon the two antebellum databases collected by Warren Weber (2005b, 2008).

Weber's earlier database contains a complete census of the approximately 2,450 banks created before 1861. Constructed from published balance sheets and note reporters, the census provides each bank's location and dates of operation, as well as, its type (i.e. free or charter) and whether it failed or closed before 1861. The census matches well with contemporaneous accounts in periodicals in 1861, as well as previous bank estimates.

In order to extend the census through 1862, I used *Hunts' Merchants' Magazine* and *Banker's Magazine* to document which banks failed after Weber's listing ends in 1860. The extension is necessary because over 120 free banks closed between 1860 and 1863. If these

[12] The databases have been conveniently published on Weber's webpage and summarized in Weber (2006a, 2006b).

failures are excluded, then the failure rate of free banks is halved, making free banks appear much more stable. I determine which banks failed by comparing the reported list of banks in operation. A bank that was included in the list in the beginning of 1861 but not the beginning of 1863 is considered to be failed. The list was also reexamined in 1864 to correct for any missing banks that quickly reappeared.

Weber's second database contains almost 26,000 individual bank balance sheets from 1790 to 1861. Data before 1835 is less frequently available, but after 1837 the database contains annual account most banks. In total, balance sheets are available for 2,056 individual banks. Missing banks generally closed before they published their first annual balance sheet making this sample slightly biased toward stable and nonfraudlent banks. For the sake of the statistical analysis, I restrict the sample to bank observations after 1834 to avoid measurement error from missing bank entries. The balance sheets were then merged with the census to provide the bank type and when the bank failed or closed.

I also constructed a quarterly price database consisting of 14 state bonds and a U.S. Treasury bond. Prices of the more traded notes were collected from quarterly publications in *Hunt's Merchant Magazine and Commercial Review* or *Banker's Magazine*, but I have relied on large amounts of data collected by Dwyer, Hafer, and Weber (1999) to fill gaps after 1850 and Sylla, Wilson, and Wright's *Price Quotations* to fill gaps before 1845. Due to the low number of observations of some states, weekly and monthly prices were averaged to give a quarterly market price for each bond. Seen in Table 2-1 the database does not contain every state bond issued during the period, but it does provide the most comprehensive collection of bond available.

Table 2-1: Bond Prices Used in Average

State of Issue	Coupon Rate	Beginning Year	Beginning Quarter
US*	6	1834	1
NY	6	1834	1
OH	6	1834	1
PA	5	1834	1
MD	6	1834	3
IL	6	1838	2
SC	6	1839	3
IN	5	1839	4
KY	6	1840	3
VA	6	1842	1
TN	6	1843	4
GA	6	1854	3
MO	6	1854	3
NC	6	1854	3
LA	6	1855	1

Notes: This table lists the state bonds that were used to make up the bond price average. * denotes U.S. Treasury bond rather than a state bond.

Because the balance sheets do not contain the types of bonds held by each bank, I assigned each bank a portfolio of bonds defined by its state law. [13] Recalling Table 1-1, most states allowed any type of state or national debt that was paying full interest to back debt, whereas Alabama, New Jersey, New York, and Ohio only allowed banks to use certain state bonds. Banks not subject to a bond constraint are assumed to hold equal proportions of the 14 state bonds, Alabama and New Jersey banks hold U.S. Treasury bonds, and Ohio holds its own state bond. [14] Based on the change in its free banking law, New York observations hold equal proportions of the 14 state bonds before 1842 but only New York bonds afterward. The average

[13] The results are robust when I weight the portfolio by state debt in 1880 or assign portfolios by region. On the other hand, the bond price variables are insignificant when I ignore state requirements or weight the portfolio in by state debt in 1840.

[14] I use the price of NY bonds to fill the missing US bond prices before 1841 because they closely match fluctuations in US bond price during the rest of the period. However, bond prices remain significant when I use the full 14 bond price average instead.

price of each bank's portfolio is then defined as the average of price its bonds over the following year, in order to cover the period of potential failure.

Without information on a bank's composition of assets, management quality, or profitability, I am unable to estimate a full set of CAMELS measures used by modern regulators in assessing banks, but I have constructed as many as possible.[15] As described below, the variables can be separated both by their modern interpretations and their connection to the hypotheses summarized in the previous section.

The falling asset price hypothesis or a bank's "Sensitivity to market risk" is captured by two variables: *Average Bond Price* and *Cumulative Bond Value*.[16] The *Average Bond Price* is the average bond price of the bank's constructed portfolio over the year following the publication of the balance sheet. The measure captures that degree that the nominal price of bonds mattered. For instance, a 10 percent decline from par would most likely be less problematic than the same decline from a bond that was already selling at 70 percent of its par value. While the forward-looking average for a single bond could be endogenous to a large number of failures, it is unlikely that any bank or group of banks possessed a sufficient bond portfolio to influence all 14 allowable bonds. The assumption that a bank holds an equal amount of all available bonds suppresses the possible endogeneity of future bond prices.

The *Cumulative Bond Value* is total appreciation or depreciation of a bond portfolio since the bank was in operation.[17] Because bonds were deposited with the state comptroller at some fixed initial value, this variable measures the degree that bond prices have moved against or in

[15] The CAMELS ratings are a modern measure of a bank's quality. Each letter stands for a factor in rating: C for capital adequacy, A for asset quality, M for management quality, E for earnings, L for liquidity, and S for sensitivity to market risk.
[16] Note I explicitly assume that circulation was backed primarily with bonds. As most states did not allow other assets, this is not a significantly biased assumption. An examination of balance sheets also shows that free bank circulation is strongly correlated (0.69) with bonds.
[17] Lacking information on specific bank portfolios, I assume that a bank's bond portfolio did not change over time.

favor of the bank's portfolio over time. The variable is calculated by subtracting the bond price average when the bank entered from the average over the next year.

I test the undiversified portfolio hypothesis using five different variables.[18] The *log(Assets)* captures size differences among banks. *Capital* (defined as the ratio of Capital to Total Assets) measures "Capital adequacy". *Specie* (defined as Specie divided by Total Circulation) is an index of bank "Liquidity", measuring the bank's capacity to meet bank runs in specie. *Deposits* (defined as the ratio of Deposits to Total Assets) measures the bank's liability diversity, whereas asset diversity is measured by *Loans* (defined as the ratio of Loans and Discounts to Total Assets) and *Bonds* (defined as the ratio of state and U.S. government assets on the bank's balance sheet to total Assets). Contrary to modern studies where government debt is safe, *Loans* can also be thought of as a crude measure of "Asset quality" due to their high return and short maturity compared to bonds during the period. Finally, the level of potential future redemption is measured by the *Circulation* (defined as the ratio of Circulation to Total Assets).

Based on the previously hypotheses, we would expect the variables to have the following relationships with the probability of failure in the data:

$$Prob(Failure) = G\left\{\begin{matrix} Capital\ (-);\ Assets(-);\ Specie\ (-);\ Loans\ (-);\ Bonds\ (+); \\ Circulation\ (+);\ Deposits\ (-);\ Bond\ Prices\ (-) \end{matrix}\right\} \quad (1)$$

where (-)/(+) denotes the expected sign of the variable's correlation with the probability of failure. The rest of the chapter describes and estimates this probability using a hazard function.

[18] The balance sheet variables have been averaged across all years the bank was in operation in order to avoid sudden endogenous changes just prior to failure.

Empirical Analysis

I employ the multivariate proportional-hazard model with time varying covariates proposed by Cox (1972, 1974). This approach models the probability of failure of bank i given survival to the period t as:

$$\lambda(t, X_i, \beta, \lambda_0) = \lim_{h \to 0} \frac{P(t \leq T < t + h \mid T \geq t)}{h} = \lambda_0 exp\big(X_i(t_{Ji})\beta\big) \qquad (2)$$

where T is the failure date, λ_0 is the baseline hazard function common to all banks, and the exponential function captures the effects of the explanatory variables X_i. All explanatory variables enter the exponential function linearly with β, a vector of coefficients that are interpreted as the variable's effect on the instantaneous probability of failure. [19] Standard errors are clustered by state to account for possible within group correlation of errors.[20]

In addition to variables discussed above, X_i contains several other explanatory variables. The first is a free bank dummy which takes the value "1" if the observation came from a free bank and "0" otherwise. The dummy variable captures the differential failure rate between the bank types, or in other words, the intercept difference in terms of the hazard function itself. Each explanatory variable is also interacted with the free bank dummy to provide approximate slope differences. X_i also contains state effects to account for constant heterogeneity across states, such as regulation enforcement, and year dummies to account for financial panics and specie suspensions.[21]

As detailed in Appendix B, Cox's method is a semi-parametric "partial likelihood" approach which requires the specification of the scale function (exponential) but not the baseline

[19] To calculate the marginal effect of each variable, one would need to make additional assumptions on the initial hazard function. Rather than introducing more uncertainty, I only report the raw coefficients.
[20] According to Petersen (2009), the existence of residual correlation across groups and time can be corrected for by adding a time fixed effects and clustering the standard error by groups.
[21] Note that state effects limit the sample to states with more than a few observations. However, the few observations that are dropped do not largely influence the results.

hazard function. Like a panel probit or logit, the hazard treats each year a balance sheet was published (t) as a unique observation linked to the individual bank. Each bank enters the hazard at the date of its first balance sheet and exits when it ceased operation. In this way, the model examines the lifespan of each bank rather than just the point at which it failed, identifying the βs from variation across starting and failure dates.[22] This method gains further efficiency over other binary choice models by explicitly taking into account survival time.

The imprecise timing of observations relative to failure dates is a common problem for studies using the hazard model. The model makes use of the definition of a derivative by assuming that the observation periods are very small. Therefore if possible, the model needs to observe the bank immediately prior to its failure; however, a bank's final balance sheet was often published several quarters before its failure. Following other studies, I define failure to occur at the date of the last balance sheet publication. The definition assumes that there are no changes in-between the observed date and failure but does not results in any significant way because I use a forward-looking bond price and only use the average balance sheet of each bank.

Even though the undiversified portfolio hypothesis focuses on a narrow set of balance sheet variables, there is still a possibility of multicollinearity.[23] A correlation matrix shows that no pair of variables has more than a 0.65 correlation, but I tested the precision of the hazard coefficients in two additional ways.[24] First, I followed Mitra and Golder (2002) and Poel and Lariviere (2004) and looked for any large coefficient changes when variables are sequentially subtracted from the model. Second, I computed the variance inflation factors (VIFs) on a simple

[22] The model treats banks which were solvent at the end of 1862 or which closed during the period as censored observations.
[23] While most hazard models are sensitive to time-varying correlations (see Leeflang et al., 2000), the use of balance sheet averages eliminates this problem. The model therefore only needs to be tested for cross-sectional correlations.
[24] As long as correlations are not perfect, standard estimators remain consistent in most cases.

linear panel. Both tests indicate that the model's precision is not significantly affected by multicollinearity and therefore I proceed to estimate the fully-specified hazard models.

Results – Systematic Failure Risk

The falling asset and undiversified portfolio hypothesis have typically focused on what made a free bank more likely to fail than another free bank (idiosyncratic risk), but it is helpful to start by determining what made a free bank more likely to fail than a charter bank (systematic risk). This comparison is achieved by examining the free bank interaction terms. If the coefficient of the free bank interaction term is significant, it suggests that free banks were more or less likely to fail than a charter bank given an equal level of that variable. Alternatively, an insignificant interaction term does not imply that the variable is an insignificant indicator of idiosyncratic failure risk, only that the slope coefficient cannot be statistically distinguished between the two bank types.

Column (1) of Table 2-2 provides a comparison point by estimating the model with only a free bank dummy. As expected, free banks are more likely to fail than chartered banks. The coefficient is not statistically significant, but still provides some indication of relative insolvency of free banks. Starting at 0.332, the coefficient falls to 0.131 and 0.0973 when the explanatory variables enter the model without interaction terms. This decline suggests that the high failure rate of free banks relative to charter banks might be caused by the explanatory variables.

Forcing the coefficients to be equal across both bank types provides some information, but the interaction terms help determine whether free bank failures differed from charter banks. Immediately evident is that free banks seem to be much more likely to fail when bond prices were low. The coefficients on the level of each bond price variable are positive and insignificant,

Table 2-2: Determinants of Bank Failure (1835-1861)

	(1)	(2)	(3)	(4)	(5)
Free Bank Dummy	0.332	0.131	3.373	0.0973	-3.736
	[0.281]	[0.294]	[3.358]	[0.282]	[2.410]
Average Bond Price		-0.023	0.012		
		[0.015]	[0.020]		
Cumulative Bond Value				-0.004	0.006
				[0.012]	[0.014]
Bonds/Assets		0.243	-0.271	0.256	-0.561
		[0.955]	[1.684]	[0.962]	[1.491]
Circulation/Assets		0.686***	0.966	0.719***	1.205
		[0.215]	[1.152]	[0.221]	[1.060]
ln(Assets)		-0.355***	-0.411***	-0.356***	-0.387***
		[0.100]	[0.149]	[0.098]	[0.135]
Capital/Assets		0.372	0.148	0.438	0.157
		[0.652]	[1.152]	[0.628]	[1.010]
Specie/Assets		-1.024	-6.805***	-1.095	-6.623***
		[1.395]	[2.450]	[1.433]	[2.321]
Loans/Assets		-0.003	0.061	0.003	0.201
		[0.328]	[0.748]	[0.332]	[0.686]
Deposits/Assets		-3.910**	-7.036**	-3.852**	-6.683**
		[1.586]	[2.983]	[1.542]	[2.676]
Average Bond Price*Free			-0.071***		
			[0.020]		
Cumulative Bond Value*Free					-0.062***
					[0.016]
Bonds/Assets*Free			0.505		0.996
			[1.654]		[1.352]
Circulation/Assets*Free			-0.362		-0.519
			[1.083]		[0.985]
ln(Assets)*Free			0.262		0.250
			[0.202]		[0.167]
Capital/Assets*Free			0.300		0.570
			[1.926]		[1.792]
Specie/Assets*Free			6.976***		6.289***
			[2.498]		[2.436]
Loans/Assets*Free			-0.466		-0.721
			[0.780]		[0.726]
Deposits/Assets*Free			4.529		4.332
			[4.533]		[4.083]
Observations	20,073	20,073	20,073	20,073	20,073
Pseudo R-squared	0.154	0.175	0.183	0.175	0.181

Notes: The model is a proportional-hazard partial likelihood model. The dependent variable is the whether the bank failed during the next year. The model treats each year's balance sheet as a unique observation but links them under the individual bank. Balance sheet variables have been averaged across years to prevent endogeneity. Fixed effects for state and year have been added to all specifications. Standard errors have been clustered by state and are listed below the coefficients in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

whereas the coefficients on the interaction terms are negative, large, and significant. These stark results lend weight to the falling asset price hypothesis: free banks were more likely to fail in a given year because of their bond-secured debt issue.

Charter banks, on the other hand, are more likely to fail due to low specie levels than free banks. This result is shown when the significant interaction term (6.976) is added to the significant level (-6.805). As charter banks were generally located in developed and accessible locations, they might have needed to hold more specie to meet redemption demand. However, without an explicit model of charter bank regulations, I am unable to confirm this assertion.

The remaining interaction terms indicate that idiosyncratic free bank failures were more correlated with circulation and loans, whereas idiosyncratic charter bank failures were more correlated with assets, deposits, and specie. However, because bond prices are the only statistically significant cause of free bank failures over charter bank failures, the results suggest that the free banking system's bond-secured note issue was the only factor responsible for its high systematic failure risk.

Results – Idiosyncratic Failure Risk

The previous section showed that free banking's high failure rate relative to charter banking was most likely the result of the bond-secured note issue. This result lends weight to the falling asset hypothesis at the aggregate level, but does not shed light on why only certain free banks failed during the bond price depressions. As idiosyncratic risk is at the center of the undiversified portfolio hypothesis, this section addresses the free-bank-specific coefficients. Rather than estimating the model using only free bank observations, I calculate the free bank coefficients by adding each variable's level and interaction term from the hazard models in

Columns (3) and (5) of Table 2-2.[25] This process keeps state and year fixed effects constant across both bank types and allows for a clear reference to the charter bank coefficients.

The free-bank-specific coefficients in Table 2-3 confirm the previous results. A low average bond price or cumulative bond value is associated with a higher probability of failure for free banks. This correlation is not surprising given that the majority of free banks failed during periods of bond declines. Even so, the sizes of the bond price coefficients are not large enough to completely nullify the balance sheet effects for free banks. To put it another way, a free bank could counter the increased probability of failure associated with a bond price decline by increasing the relative quantity of loans and reducing circulation. These results suggest that the falling asset price hypothesis holds, but free banks are not helpless.

Not all balance sheet items are significantly correlated with the probability of failure. Asset size, for example, has little to do with failure. If anything, large free banks are more likely to fail. A bank's ratio of capital to assets is also insignificant. As previously described, a large proportion of free bank capital is typically invested in bonds, and thus a large capitalization leads to an even more undiversified portfolio. The ratios of deposits and bonds to assets have their expected signs but no significant statistical effect on the probability of failure.

The coefficient on circulation is positive and statistically significant. The more notes, the more likely a bank would fail. On the other hand, it does not seem like specie reserves helped to stabilize a free bank. This does not imply that wildcat banking (i.e. too much circulation to consistently redeem) was widespread, but does provide evidence that note over-issues are empirically important.

[25] Note that like the coefficients in the previous table, these coefficients are not the marginal effects, but rather the coefficients within the scale function.

Table 2-3: Determinants of Free Bank Failure (1835-1861)

	(3)	(5)
Average Bond Price	-0.059***	
	[0.020]	
Cumulative Bond Value		-0.055***
		[0.017]
Bonds/Assets	0.234	0.435
	[1.280]	[1.179]
Circulation/Assets	0.604**	0.685***
	[0.301]	[0.270]
ln(Assets)	-0.149	-0.137
	[0.141]	[0.107]
Capital/Assets	0.448	0.727
	[1.209]	[1.125]
Specie/Assets	0.171	-0.333
	[0.514]	[0.786]
Loans/Assets	-0.404*	-0.520*
	[0.227]	[0.287]
Deposits/Assets	-2.507	-2.350
	[2.518]	[2.229]
Observations	20,073	20,073
Pseudo R-squared	0.183	0.181

Notes: This table displays the free bank coefficients implied by Columns (3) and (5) of Table 2-2. The model is a proportional-hazard partial likelihood model. The dependent variable is the whether the bank failed during the next year. Balance sheet variables have been averaged across years to prevent endogeneity. The model treats each year's balance sheet as a unique observation but links them under the individual bank. Fixed effects for state and year have been added to all specifications. Standard errors have been clustered by state and are listed in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

The proportion of loans is also a significant indicator of whether a free bank would fail. The larger a bank's loan portfolio, the more likely it would remain solvent. The fact that loans seem to be free bank's most stabilizing asset should not be surprising. Although of highest value to the current holder, loans were typically short-term with maturities of 3-6 months.[26] Temin (1975) finds that New York City banks adjusted their loan portfolios to meet anticipated demand. The short maturity combined with the fact that loan rates (6%) were slightly above bond yields (5%) suggests that loans would not only have offset the level of bonds but also would have brought in needed revenue.[27]

A comparison of charter bank coefficients in Table 2-2 to the free bank coefficients in Table 2-3 shows that idiosyncratic risk is very different for each bank type.[28] Whereas individual free bank failures were correlated with circulation and loans, individual charter bank failures were correlated with asset size, specie, and deposits. This difference provides evidence for the undiversified portfolio hypothesis. Free banks needed to diversify their portfolio to respond to the bond-secured note issue whereas charter banks did not.

Based upon the coefficients of the hazard model in Column (3) of Table 2-3, we can determine which free banks are more or less likely to fail. As a demonstration, Table 2-4 provides the balance sheets of four Wisconsin banks with differing probabilities of failure.[29] The first bank (Marine Bank) is the solvent bank which the model labeled as the least likely to fail, whereas the last bank (Portage County Bank) is the failed bank which was most likely to fail. The other two columns provide the balance sheets of a solvent bank (Corn Exchange Bank) with an average probability of failure amongst solvent banks and a failed bank (Manitouwoc County

[26] Bodenhorn (2003) studies the loan portfolios of a small sample of banks across the nation. He first finds that there was an average maturity of about 85 days, but the number varied from 58 (Black River Bank in NY) to 116.9 (Branch & Sons in VA). Next he shows that many banks renewed loans over time, but several such as Branch & Sons in Virginia renewed very few. He concludes by illustrating that banks usually held diversified loan portfolios, representing the underlying industrial distribution of the surrounding area. For instance, the Memphis Branch of the Bank of Tennessee issued more loans to Merchant and Service sectors, while the Branch & Sons Bank issued more loans to the Manufacturing sector. Putting the results together, loans were short-term, often not renewed, and diversified against some idiosyncratic risk.

[27] Bodenhorn (2003) and Homer and Sylla (2005).

[28] The charter bank coefficients are simply the coefficients on each variable's level in Table 2-2.

[29] Selection of banks was limited to Wisconsin to keep state effects constant.

Table 2-4: Average Balance Sheets of Banks With Differing Probabilities of Failure

	Non-Failed Free Banks		Failed Free Banks	
	Lowest Probability	Avg. Probability	Avg. Probability	Highest Probability
Bank	Marine Bank	Corn Exchange Bank	Manitouwoc County Bank	Portage County Bank
County	Milwaukee	Waupun	Two Rivers	Jordan
State	WI	WI	WI	WI
Specie	5,294	4,891	2,736	1,142
Real Estate	2,073	4,649	300	0
Loans	133,183	50,336	15,653	0
Circulation	19,555	39,735	36,551	48,372
Capital	50,000	50,000	50,000	50,000
Deposits	51,736	40,076	2,138	0
Total Assets	181,695	141,265	88,689	106,109
Specie/Assets	2.9%	3.5%	3.1%	1.1%
Real Estate/Assets	1.1%	3.3%	0.3%	0.0%
Loans/Assets	73.7%	34.3%	17.3%	0.0%
Circulation/Assets	10.8%	28.1%	41.2%	45.6%
Deposits/Assets	28.5%	28.4%	2.4%	0.0%

Notes: Banks of each type have been sorted using the predictions of the proportional-hazard partial likelihood model in Table 2-3, Column (5). Only banks in Wisconsin have been used. All balance sheet items are averages over the bank's years in operation.

Bank) with an average probability of failure amongst failed banks. By reading from left to right, the table starts with the “best” bank and ends with the “worst”.

Immediately, loans stand out as the important asset for stable banks, falling from 73 to 0 percent as the probability of failure increases, whereas circulation stands out as the important liability rises from 11 to 45 percent. Next, we see that all the banks have the same capital level, suggesting that many held only the state requirement. Finally, we see there is non-linear relationship between specie reserves and probability of failure, as the “average” banks both held greater reserves than the “best” bank.

In summary, bond prices and the ratio of loans to assets are negatively and significantly correlated with the probability of free bank failure, whereas the ratio of circulation to assets is positively and significantly correlated. The rest of the balance sheet variables generally have their expected sign but are never significant. The results suggest that the note requirements of free banks were a significant source of instability but individual free banks could eliminate at least some of the idiosyncratic risk by diversifying their portfolios.

Robustness Checks Using Alternate Bank Samples

The approach in Table 2-3 does not rule out the possibility of bias due to outliers or fraud. This section examines these possibilities by restricting the bank panel in various ways. Once again, the full interaction model is estimated using the sample of charter and free banks, but only the free bank coefficients are reported in Table 2-5.

The first outlier is the larger number of failures in Illinois and Wisconsin in 1861 and 1862. While Dwyer and Hafer (2004) and Dwyer and Hasan (2007) show that these failures were the result of depressed bond prices, it is possible that they are driving the results in some other way. I correct for this by dropping all observations after 1860 and re-estimating the hazard model. After removing these observations, the average bond price remains statistically significant at the 5 percent level but the cumulative bond value losses its significance. The rise in standard errors is expected when treating so many failed banks as stable banks, but the lack of any large coefficient changes provides some support for the previous conclusions. The coefficients therefore suggest that large number of failures in Illinois and Wisconsin reinforce the falling asset price theory's explanatory power but the underlying relationship seems intact.

The previous hazard specifications also do not account for the possibility that fraudulent, short-lived banks had large reserves and few loans. If a banker wanted to defraud his customers, he would not loan them money; instead, he would buy liquid assets that he could carry with him

Table 2-5: Robustness Checks Using Specified Samples of Banks

	Sample of Banks Used							
	Before 1861		Banks Lasting More than Two Years		Non-NY Banks		Only NY Banks	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average Bond Price	-0.054**		-0.055**		-0.074**		-3.202***	
	[0.024]		[0.040]		[0.029]		[0.053]	
Cumulative Bond Value		-0.033		-0.089***		-0.071***		0.037
		[0.024]		[0.031]		[0.023]		[0.060]
Bonds/Assets	0.060	0.197	-1.045	-0.648	-1.070	-0.645		
	[1.128]	[1.052]	[1.315]	[1.138]	[0.970]	[0.942]		
Circulation/Assets	0.553**	0.647**	2.974**	1.977	1.840*	1.445*	-1.232*	-1.254*
	[0.274]	[0.261]	[1.383]	[1.410]	[1.059]	[0.845]	[0.757]	[0.751]
ln(Assets)	-0.148	-0.124	-0.358	-0.334	-0.054	-0.106	-0.866	-0.852**
	[0.148]	[0.125]	[0.286]	[0.265]	[0.112]	[0.104]	[0.435]	[0.432]
Capital/Assets	0.457	0.760	1.366	0.868	0.416	0.243	2.728	2.520
	[1.152]	[1.048]	[1.127]	[1.072]	[1.014]	[0.966]	[2.520]	[2.492]
Specie/Assets	0.205	-0.188	-12.334**	-12.964**	0.644	0.072	8.125	8.341
	[0.495]	[0.657]	[5.717]	[5.578]	[0.444]	[0.440]	[7.296]	[7.192]
Loans/Assets	-0.568	-0.622	-1.150*	-1.489*	-0.272	-0.327*	-0.232	-0.292
	[0.424]	[0.474]	[0.613]	[0.808]	[0.205]	[0.206]	[1.952]	[1.937]
Deposits/Assets	-1.667	-1.630	-2.395	-3.254	-4.202**	-4.407**	0.386	0.339
	[1.760]	[1.558]	[3.528]	[3.368]	[2.085]	[1.929]	[0.523]	[0.513]
Observations	19,174	19,174	19,539	19,539	15,048	15,048	5,025	5,025
Pseudo R-squared	0.183	0.182	0.194	0.195	0.186	0.184	0.341	0.340

Notes: The model is a proportional-hazard partial likelihood model. Both charter and free bank observations are used in the full-specification model of Table 2-2, but only the free bank coefficients are reported. The dependent variable is a dummy denoting whether the bank failed during the next year. Fixed effects for state and year have been added to all regressions except "Only NY Banks" where no location effects are included. Standard errors have been clustered by state for all samples but New York where they are clustered by county. Standard errors are listed in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

when bond prices declined. This type of behavior could lead to the significant coefficient on loans and the insignificant coefficient on specie. Because short lived-banks often did not remain open long enough to publish their first annual report, the original sample is already biased towards safe banks; however, I take selection a step further and drop any bank that was in operation less than two years. This selection should purge the sample of fraudulent banks, greatly leaving only stable banks in the sample. Once short-lived banks are removed, specie gains statistical significance, but the bond price variables, loans, and circulation remain generally significant.

The large number of New York banks could also bias the hazard's results. Because New York had a strong financial system and the most restrictive bank requirements, it is possible that its free banks operated differently from "frontier" banks. For instance, Sylla (1969) argues that country banks operated as virtual monopolies extracting high interest rates on loans, whereas, competition in cities drove down interest rates. I examine this possibility by regressing New York banks separately from the banks of all other states. If a country and city interest rate dichotomy exists, loans should be more correlated with solvency in non-NY banks reflecting their high return while specie should be more correlated with NY bank solvency. While the probability of failure in all free banks is correlated with circulation and bond prices, failures in New York are more correlated with low asset sizes and failures in other states are more correlated with small loans portfolios.

The comparison of New York and frontier free banks also suggests that bank balance sheet solvency depended on a state's bond requirement. While frontier banks could use any type of public debt to back their note circulation, New York banks could only use New York bonds after the early 1840's. Due to price variability of other state's bonds relative to New York's, frontier banks with risky bonds might need more loans to offset them, while at the same time, additional loans might be inefficient in a bank with stable bonds. Therefore, banks could also lower their risk of failure through their bond choice. This result is confirmed by Dwyer and Hafer (2004). They show that Illinois, Indiana, and Wisconsin free banks with risky portfolios (defined as those with high standard deviations and low returns) were more likely to fail during the 1861 bond price decline. I conclude that diversification seems to be important not just across asset classes but within them as well.

Conclusion

Free banking laws created competitive state banking systems by standardizing the requirements of banks; unfortunately, the laws were characterized by instability. Economic historians have typically blamed the instability on the laws themselves or inefficient bank management. By requiring notes to be backed with government securities, the laws left new free banks intimately tied to the price of a single type of asset (bonds). At the same time, however, banks could have diversified their portfolios in such a way as to avoid bond price declines. I test both of these hypotheses using the annual balance sheets of almost every antebellum bank.

First, I find that the new note requirements seem to be the underlying cause of the free banking system's high failure rate relative to the charter banking system. While bond prices declines were significantly correlated with free bank failures, they were not correlated with the failure rate of charter banks. Therefore, those banks that did not have to back notes with bonds did not fail because of depressed bond prices. Furthermore, the statistical relationship was not the result of general declines in bond prices. Banks were sensitive only to those bond prices that they could purchase for note backing, instead of the market price of all bonds. For example, New

York banks that could only use New York bonds avoided the failures associated with the price declines of Kentucky and Missouri bonds. In this way, some states limited the exposure of their banks to more risky bonds, at least ex post.

Second, solvent free banks seemed to diversify their assets away from bonds and liabilities away from note circulation. Although the addition of balance sheet variables to the hazard model does not reduce the statistical significance of the bond price effect, their combined effect would have been sufficient to a least partially shield banks from bond price declines. Free banks therefore were not helpless and could have decreased their probability of failure.

Solvent free banks also seemed to respond to the specific risks of their state regulations. Frontier free banks which could hold a range of risky bonds needed a larger proportion of loans to fully diversify their assets, whereas, more loans would have been inefficient for New York bank which had less risky bonds. As such, frontier free bank failures were correlated with loans and circulation while New York failures were correlated with specie and asset size.

Putting these results into a broader perspective, the National Banking Acts of 1863 and 1864 focused on the specific weaknesses of the free banking system. The legislation reformed the bond-secured note issue by requiring U.S. Treasury bonds instead of state debt. Federal bonds were still subject to default and inflation risk, but their prices were generally less variable than state bonds before (and after) 1860. On the other hand, a ceiling on the aggregate circulation of national bank notes encouraged banks to restrict their note issues, and a reserve requirement on both circulation and deposits encouraged banks to hold safer portfolios. The legislation thus took free banking's structure but put requirements in place to avoid its systematic and idiosyncratic risk.

Appendix A. The Proportional-Hazard Model

Although I use a proportional-hazard model in the chapter, it is helpful to first describe a typical hazard model. The standard hazard model measures the probability that a bank would fail within a short time period. Each bank (i) is observed for j periods (with $j = 1 \ldots J_i$). Because I have only used data before 1862, J_i is defined by either the last observed period of bank *i* before failure or the bank's 1861 balance sheet. The failure time for each bank is then defined as t_{i,J_i}.

Before we construct the hazard function itself, we must define a cumulative distribution function for the duration T. The CDF is given by $F(t) = Prob(T < t)$, with the corresponding density function $f(t) = \frac{dF(t)}{dt}$. The survivor function gives the probability that a bank will survive the period, and is defined as $\mathrm{S(t)} = 1 - \mathrm{F(t)}$. The hazard function for T is then:

$$\lambda(t) = \lim_{h \to 0} \frac{P(t \le T < t + h \mid T \ge t)}{h} = \frac{\frac{dF(t)}{dt}}{1 - F(t)} = \frac{f(t)}{S(t)} = \frac{d(\ln S(t))}{dt} \qquad (3)$$

The hazard is then the probability of failure within the interval $[t, t + h)$ conditional on the bank surviving to time *t*. This probability is often called the instantaneous rate of failure per unit of time.

In order to measure the impact of explanatory variables upon the hazard, we multiple the initial hazard function λ_0 by some function $g(X_i(t), \beta)$. This function scales up or down the initial hazard rate, leading us to the proportional hazard function:

$$\lambda(t, X_i, \beta, \lambda_0) = \lambda_0(t) g(X_i(t), \beta) \qquad (4)$$

The initial or baseline hazard is common to all banks, but the scale function brings in the variation across banks and time. Typically, an exponential function with linear arguments is used, the baseline hazard however is usually carefully specified. Using the semi-parametric "partial likelihood" approach proposed by Cox (1972, 1974), I can estimate the β's without having to specify either the baseline hazard or density function. Compared to full parametric techniques, there are some efficiency losses, but most studies have found it to be minimal.[30]

Cox's approach starts by ranking the duration by time, $t_1 < t_2 < \cdots < t_n$, and defining a "risk set" for each bank *i* as $R_i = \{k: t_{k,Jk} \geq t_{i,Ji}\}$. We consider this set to be all the banks which did not fail before bank i's failure. The collection of all failures and censoring is defined as $H(t_{i,Ji})$. Using these definitions, the conditional probability of bank *i* failing at $t_{i,Ji}$, given the history is:

$$Prob\left(\frac{i}{H(t_{i,Ji})}\right) = \frac{\lambda(t, X_i, \beta, \lambda_0)}{\sum_{k \epsilon R_i} \lambda(t, X_i, \beta, \lambda_0)} \qquad (5)$$

This equation relates the contribution of each observation to the likelihood function. However it can be simplified if we take account of the censored data. To this extent, we create a dummy variable, d_i, taking the value "1" if the bank failed and "0" otherwise. By using this in the numerator, non-failed banks do not contribute to the numerator. We can also drop out the baseline hazard function to give:

$$LF = \prod_{i=1}^{n} \frac{\exp\left(X_i(t_{Ji})\beta\right)^{d_i}}{\sum_{k \epsilon R_i} exp\left(X_i(t_{Ji})\beta\right)} \qquad (6)$$

By taking a log and substituting, we eventually obtain a log-likelihood function of the form

$$\ln(LF) = \sum_{j=1}^{n} \left\{ d_j X_i(t_{Ji})\beta - ln\left[\sum_{k \epsilon R_i} \exp\,(X_i(t_{Ji})\beta)\right]\right\} \qquad (7)$$

From this equation, we can estimate the β coefficients. Z-values can be obtained because the distribution is asymptotically pivotal.

[30] For a more in-depth discussion, consult Cox and Oakes (1984). Efron (1977) and Oakes (1977) are two studies that argue the efficiency losses are small.

CHAPTER III

BANK-SPECIFIC DEFAULT RISK IN THE PRICING OF BANK NOTE DISCOUNTS

Bank notes played a controversial role in the antebellum economy. On one hand, the asset-backed liabilities satisfied the public's need for portable, non-metallic money and quickly became the largest component of the domestic money supply. While on the other, estimates of aggregate note holder losses range from 2 to 5 percent per year and the losses on an individual note issue could be as high as 60 percent.[1] If note issues were so variable, then why were they so readily accepted? I propose that the market reduced the real value losses ex ante by pricing bank notes based upon the issuer's default risk. Whereas previous studies have shown a connection between discounts and systematic risk, I test whether discounts accurately represented the default risk of individual notes.

Starting with the savings and loan crisis and continuing through the subprime mortgage crisis, the past two decades have seen a renewed interest in determining whether the market monitors individual bank behavior. Studies such as Whalen (1991), Wheelock and Wilson (1995), and Bongini, Claessens and Ferri (2001) show that riskiness can be monitored through balance sheet indicators such as return on equity, whereas Avery, Belton, and Goldberg (1988), Gorton and Santomero (1990), and Flannery and Sorescu (1996) show that prices do respond to these indicators.[2] Because these studies focus on banks after the development of modern

[1] Estimates vary by author. Knox's (1900) puts losses at 5 percent per year; King (1983) puts New York's losses at 4 percent or more before 1842 but finds that that new banking laws limited losses later in the period; Rockoff (1974) is only able to justify a 2 percent annual loss rate across the available data. Rockoff (1974) and Rolnick and Weber (1988) find that individual note losses could be over 60 percent.
[2] These are just a sample of the large literature on monitoring bank risk. Older examples include, Meyer and Pifer (1970), Sinkey (1978), and Pettaway and Sinkey (1980).

regulations, the Free Banking Period (1837-1862) offers a unique testing environment. Not only were there no federal bank regulations during the period, but over 2,500 individual bank notes were priced by small local brokers and not by large exchanges. This chapter therefore considers the open historical question of whether the market efficiently price bank risk without federal oversight and modern security exchanges.

Examining the timing of bank closure and note discounts, Bodenhorn (1998) provides evidence that note discounts adjusted to changes in risk. Not only did discounts increase up to two years before a bank defaulted, but temporary increases were also seen for solvent banks. Bodenhorn argues that the increased note discount signaled that a bank was at risk. Banks heeding the signal took action and the market rewarded them with lower discounts, whereas those that did not often defaulted. Drawing on studies of free bank default, I determine whether these patterns match the two most significant indicators of bank-specific risk: the market value of a bank’s collateral assets and the degree of diversity in its portfolio.

Rolnick and Weber (1984, 1985) use depressed government bond prices as indicators of default risk. By design, free bank capital was primary invested in government debt to back note issues. A drop in bond prices would depreciate the value of a bank’s capital stock and note backing, but leave the value of the notes outstanding unchanged. Consequently, banks were more likely to default and should have had higher note discounts during periods of bond price declines.

Economopoulos (1990) argues that free banks could have limited their exposure to falling bond prices through portfolio diversification. Additional empirical tests in the previous chapter show that free banks that diversified their assets with loans and limited the size of their note circulations were more likely to remain solvent regardless of bond price declines. The banks achieving this diversification required a lower risk premium, and therefore should have had a lower note discount.

To date, the lack of micro-level data has only allowed the study of systematic risk. Gorton (1996, 1999), for example, focuses on state regulations and note insurance programs, whereas Weber (2005a) examines specie suspensions. However, the recent publication of Weber's bank database (2008) removes this constraint by providing the annual balance sheet of almost every free bank.[3] By matching a bank's composition with its redemption cost and note discount in New York City (1817-1860) and Philadelphia (1830-1858), I construct a quarterly panel from which to measure the relationship between discounts and bank-specific default risk for 596 free banks.

The data indicate that the note discounts of banks that were in operation are strongly related to those factors that increased the probability of bank failure: specie suspensions, bond prices, and the share of loans to assets of the underlying bank. Alternatively, discounts after bank closure reflected the market value of a bank's assets and the relative size of its obligations. Even in the absence of modern regulations or reporting, the market-determined discounts seemed to shield note holders from default risk, thereby lessening the value of losses and increasing note demand.

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[3] Weber (2006a, 2006b) contains a detailed description of the database.

Figure 3-1: Sample Bank Notes

Notes: Pictures taken from Weber's "Images of Minnesota Money" on http://www.minneapolisfed.org/research/economists/wewproj.cfm.

Bank Notes in the Antebellum United States

Unlike today, deposits during the antebellum period were not demandable or a high debt priority. Therefore to obtain liquidity, states gave banks the right to monetize their assets.[4] By promising to pay the full value in specie whenever demanded, banks split large illiquid assets into smaller liquid ones. As seen in Figure 3-1, bank notes were denominated in dollars and resemble modern paper currency. The name and location of the issuing bank were prominently displayed alongside an image meant to differentiate the notes and protect against counterfeiting. Each note also described the type of assets used to back it. For instance, the Dayton Bank note

[4] While individual deposits were increasing in commercial centers throughout the period, more than two-thirds of free banks had more circulation then deposits in 1860.

was “secured by the pledge of public stocks and real estate”, whereas the People’s Bank was “secured by pledge of public stocks”. Each note thus provided the relevant information whether for its use in transactions or redemption at the originating bank.

The notes of early antebellum banks (called charter banks) were subject to few operational standards. Some northeastern states developed insurance programs (e.g. the Safety Fund) or banking coalitions (e.g. the Suffolk System) to limit charter note losses, but participation was often not part of a bank’s charter. Starting in 1837, a series of free banking laws altered this trend. Rather than subjecting free banks to indirect or informal note regulations, the new laws required the purchase of government debt (and occasionally other assets) as security for each note.[5] The bonds were then deposited with the state comptroller in exchange for an equal value of notes. If any request for note redemption went unmet, the state comptroller would close the bank and liquidate the collateral bonds to redeem outstanding notes.

With over 2,500 unique bank notes in circulation, it was difficult to decipher which notes should be accepted. A merchant had to determine that the note was legitimate and then trust that it would be redeemed at face value if presented for repayment. Private note brokers stepped in to alleviate these problems by identifying and purchasing notes at a percentage discount from their par or face value.[6] Similar to modern currency exchangers, brokers advertised the prices and notes that they were willing to buy and sell. Merchants could then quickly exchange out-of-town bank notes for local currency, leaving the broker to return the note to the issuer. Accepting the risk of default, brokers also had an incentive to monitor bank activity and quickly adjust prices.

As the number of brokers and traded notes grew, note reporters began to collect the prevailing note discounts in an area and sell them as a monthly or quarterly periodical. The

[5] Most laws specified that the government debt had to be paying full interest. When allowed, other assets typically included real estate (Michigan, New Jersey), but some states also allowed unique assets such as slaves in Georgia.
[6] Dillistin (1949) and Gorton (1989a) provide a more detailed description of note brokers and reporters.

reporters reduced transactions costs by providing all the information a merchant needed: each bank note's current discount, physical description, originating location, and a description of any similar counterfeit notes. Rather than consulting a broker directly, a merchant could thus confidently verify any note's provenance and discount by comparing it to its physical description in the reporter.

Because there were at least two paper dollars for every dollar of specie in the money supply after 1840, sudden bank failures posed a potential problem for the economy.[7] On an aggregate-level, losses were not excessive. King (1983) finds that the annual losses of New York free bank notes were 4 percent before 1842 but less after additional regulations were installed, whereas Rockoff (1974) finds annual losses of about 2 percent across the entire free banking system. On the bank-level, note holder loses were much more significant. Rockoff (1974) and Rolnick and Weber (1988) find that individual note losses could be over 60 percent. Cagan (1963) suggests that the liquidity benefits of bank notes simply outweighed the losses, but an efficient market would also have limited the real value of the losses by appropriately discounting the notes before default. The remainder of the chapter determines whether discounts were correlated with a bank's probably of default.

Stylized Bank Note Discount Facts

Figure 3-2 shows that discounts varied across states from approximately zero in New York to 17.5 percent in Michigan but display the same tendencies across note reporters.[8] Comparing reporters from Cincinnati, Cleveland, New York City, and Philadelphia, Ales,

[7] Temin (1969)

[8] As discussed in detail in the next section, the two samples contain different bank notes and thus the differences in discounts could be the result of sample selection.

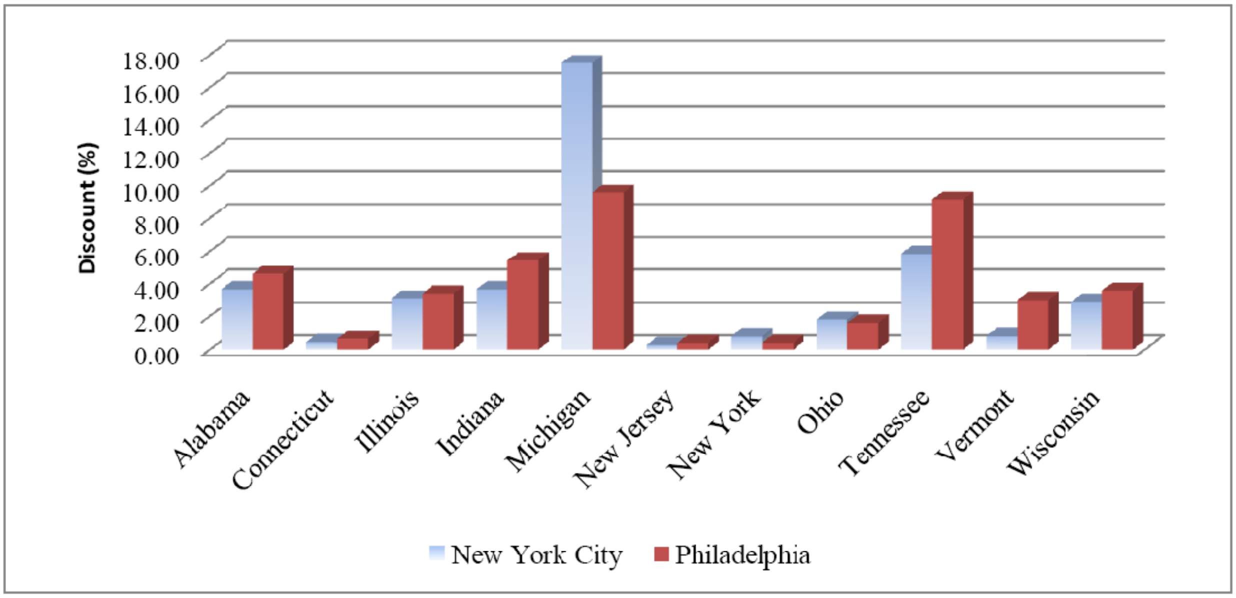

Figure 3-2: Average Bank Note Discounts By State (1837-1860)

Notes: Calcuated using note discount samples described in the Data Section. The state average is the average discount of all the bank notes from that state. Each bank note is only counted once. Note that bank samples contain different notes. Therefore the differences in discounts between the samples are just as likely to be caused by sample composition as by fundamental differences in prices.

Carapella, Maziero, and Weber (2008) highlight several stylized discount facts. The facts are as follows:

1) "Local" bank notes almost always traded at par, because note holders could easily demand payment from a local bank. As banks were required to redeem their notes at par, a local discount could only exist if the bank was closed or suspended. In the case of closed or suspended banks, the market value of the bank's assets and collateral should ultimately determine its discount.

2) Most, but not all, "foreign" notes circulated at a discount. For example, Indiana notes were discounted in New York City (NYC) and Philadelphia, whereas NYC notes were not discounted in Philadelphia. Furthermore, foreign discounts varied across redemption locations. In terms of the previous example, Indiana notes would have different discounts in NYC than Philadelphia.

3) Discounts were asymmetric across locations. If discounts were only a function of distance, then the discount of NYC notes in Cleveland should have been the same as the discount of Cleveland notes in NYC. However, this was not the case. Instead, NYC notes circulated around par in Cleveland, and Cleveland notes circulated at large discounts in NYC. As arbitrage did not eliminate these differentials, there must have been some asymmetry between bank notes.

Data

I examine the quarterly discount of bank notes traded in New York City (1817-1860) and Philadelphia (1830-1858). The data made public by Gorton and Weber are the longest and most inclusive sample of bank notes available.[9] Discounts in Philadelphia come from *Bicknell's Reporter, Counterfeit Detector, and General Prices Current* before 1839 and *Van Court's Counterfeit Detector and Bank Note List* thereafter. Whereas, discounts in New York City come primarily from the *Shipping & Commercial List*, *New York Price Current*, and to a lesser extent *Taylor's United States Money Reporter and Gold and Silver Coin Examiner* and *Thompson's Bank Note and Commercial Reporter*. Notes enter the sample around the date of first issue and exit when no longer traded. Discounts thus vary over time for a specific bank and from quarter to quarter between banks.

The discount samples contain charter bank notes, but I focus on free bank notes for two reasons. First, free banks within a state were subject to the same capital, reserve, and note requirements, whereas charter banks had unique requirements that often varied within a state.[10] This within-state variation makes balance sheet and note-security comparisons difficult as they

[9] Discounts from other cities such as Cleveland and Cincinnati contain few notes and periods in which to compare.
[10] Most importantly, almost every free bank backed its notes with some type of government debt, whereas charter banks could back their notes with any asset. Therefore I can estimate the value of a note's security in each period for free banks but not for charter banks.

were restricted in unobservable ways. Second, free banks were not generally subject to note insurance programs or bank coalitions. As described by Gorton (1996, 1999), the Safety Fund and the Suffolk Banking System virtually eliminated the note discounts of all member banks. While these institutions are important for note pricing, the absence of discounts leaves no variation to be explained. Therefore by focusing on free banks, I examine the underlying roles of redemption cost and default risk rather than the efficiency of external institutions.

The New York City sample consists of 495 unique free bank notes and the Philadelphia sample consists of 520 notes.[11] The size difference is the result of reporters not publishing local notes and Pennsylvania having no free banks until after 1860. The Philadelphia sample is therefore larger because it has more New York bank notes than the New York City sample. When New York free banks are excluded, the New York City sample has more notes than Philadelphia. Because of these differences, I regress the two samples separately but focus on the New York City sample's diversity and longer period. However, to provide a closer comparison of note reporters, I also report the regression results when New York City bank notes are dropped from the Philadelphia sample.

I obtain the annual balance sheet of almost every free bank in operation during the period from Weber (2008), but must make an assumption before matching them with the quarterly discounts. Namely, I assume that it would take note reporters two quarters to update their discounts in response to a new balance sheet examination.[12] Balance sheet examinations were required by law, but there was an initial delay between the time the bank examined its balance

[11] A sample selection regression shows that banks were selected into the sample by staying open. The longer a bank was is in operation, the more likely that it would be present in the reporters. The size of the bank is significant predictor for New York's sample but not Philadelphia.
[12] The assumption also allows me to extend the balance sheet data to fill missing balance sheet information.

sheet and the time it was published in a banking periodical.[13] For example, balance sheets examined at the end of the year were not published until the following March edition of *Merchant's Magazine*. Once publicly available, there was an additional delay as note reporters waited for reporters to update their prices using the new information. These delays would lead to the assumed two-quarter lag from the examination date until the note reporters were fully updated, but the results also hold with a one or three quarter lag.[14]

Because notes had to be physically returned to the issuing bank, I construct an annual passenger travel cost index to account for each bank note's redemption cost.[15] Described in detail in Appendix B, the index uses a hub-and-spoke network to estimate the travel cost from New York City and Philadelphia to each bank location. Each hub is a central city to which the travel costs from New York City and Philadelphia are known with reasonable certainty in 1836, 1849, 1856, or 1859, whereas the spokes are typically smaller locations to which the costs are unknown. A reasonable estimate of travel cost is then generated by minimizing the cost of traveling to the 376 free bank locations either directly or indirectly through a hub. Because the years represent major U.S. transportation waves, I am able to reasonable fill the missing years with a linear trend.

The combination of data provides 15,998 quarterly observations from 597 free banks located in 376 cities. Each observation contains a bank's lagged balance sheet, its quarterly note discount in New York City and Philadelphia and the travel cost to return its notes.

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[13] Note that the date of each balance sheet is the date of examination and not the date of publication.

[14] The delay also ensures that a bank's composition exogenous to changes in discounts.

[15] Compared to travel time and distance, cost is available for a large number of cities, varies over time, and does not depend on timetables or weather. As shown by Gorton (1989b), this choice should not significantly bias the results as travel costs are strongly correlated with travel time (0.94) and distance (0.89).

Examining the Determinants of Individual Note Discounts

Each period, a note holder could decide whether to use the note at a discount or exercise their option and return the note to the issuing bank for its full face value. Using this logic, Gorton (1996, 1999) constructs a cash-in-advance model, whereas Weber (2005a) models a note arbitrageur. The same basic implication emerges from either model: each bank note should be priced by its net expected redemption value. First, a note's discount should be positively correlated with the time (or cost) it takes to redeem, explaining the lack of local discounts and the existence of foreign ones. Second, a note's discount should be positively correlated with the probability that it will not be fully redeemed by the issuing bank, explaining why arbitrage did not lead to symmetric discounts across note reporter locations.

The systematic risk factors considered in the above studies, such as the specie suspensions and insurance programs, affect all banks involved equally. However, as stated by the models, efficient discounts must be bank-specific in order to match default risk. If after accounting for redemption cost, a risky bank's notes are priced at the state average, then discounts were not efficient and did not fully protect note holders. I therefore examine the correlation between discounts, travel costs, and default risk at the appropriate level.

Redemption Costs

Figure 3-3 maps the average discount of each bank note location. Each dot represents a bank location, whereas its size denotes the average discount of its notes in New York City or Philadelphia. Consisting of different banks, the figures cannot be compared against each other, but regardless of the note reporter city the same pattern emerges. Discounts increase with distance, but the relationship is not one-to-one or linear. For instance, NY notes circulated

Panel A: New York City (1837-1860) | Panel B: Philadelphia (1837-1858)

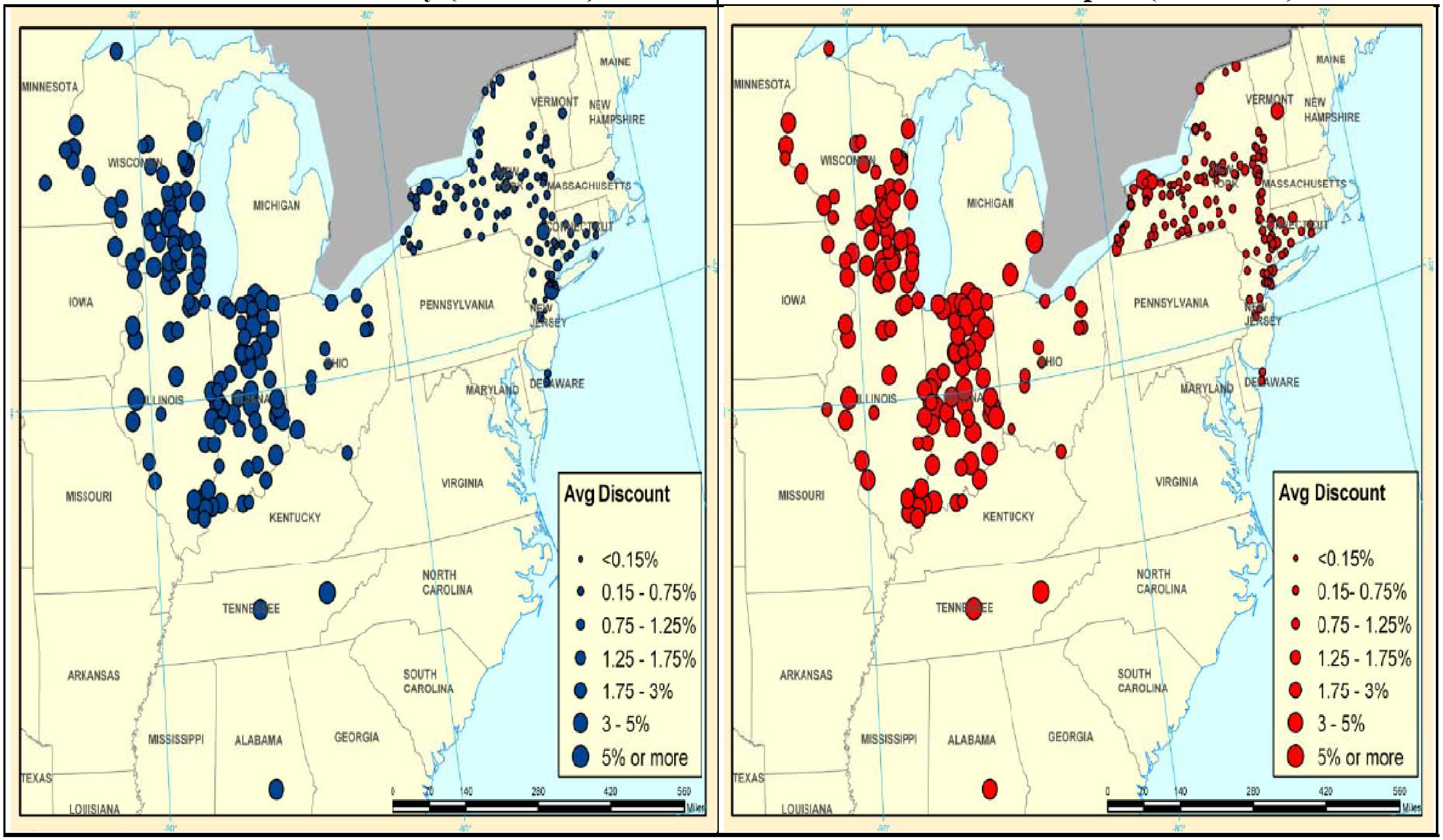

Figure 3-3: Average Discount in New York City and Philadelphia

Notes: Average discount is only on banks that were currently in operation. Note that the average over time actually biases the Midwest banks downward because most were not created until 1850 when travel costs were lower. On the other hand, many Northestern free banks were created in the 1840s when travel costs were much larger. See text for sources.

around par and Indiana notes did not, but some Indiana notes have greater discounts than those from Minnesota. Travel costs therefore seem to explain the general trends in discounts but not the volatility.

Default Risks

The data allow the examination of three types of default risk: systematic (specie suspensions), state-specific (falling bond prices), and bank-specific (undiversified balance sheets). With the exception of missing information on "Management quality" and "Earnings", these default risk measures correspond to the CAMELS ratings used to measure modern bank quality. The balance sheet variables measure "Capital adequacy" (Capital/Assets) and "Liquidity" (Specie/Assets), whereas specie suspensions and bond prices measure the note's "Sensitivity to market risk." Contrary to modern studies where government debt is very safe, loans can be thought of as a crude measure of "Asset quality", due to their high return and short maturity compared to bonds during the period.

Specie suspensions relieved banks of their redemption requirements without forcing closure and should have led to uniformly higher discounts. As seen in Figure 3-4, discounts double during each of the three shaded suspension periods: May 1837-Aug. 1838, Oct. 1839-June 1842, and late 1857.[16] The only exception comes in the Philadelphia sample during the early 1840's when the average discount decreases as a result of non-suspended New York bank notes trading at a premium.[17] When non-suspended notes are ignored, the average discount always increases during a suspension.

[16] New York banks did not suspend between October 1839 and June 1842.
[17] During specie suspensions, foreign bank notes were only traded for local notes. A premium does not suggest that paper was worth more than specie but instead that it was worth more than local bank notes.

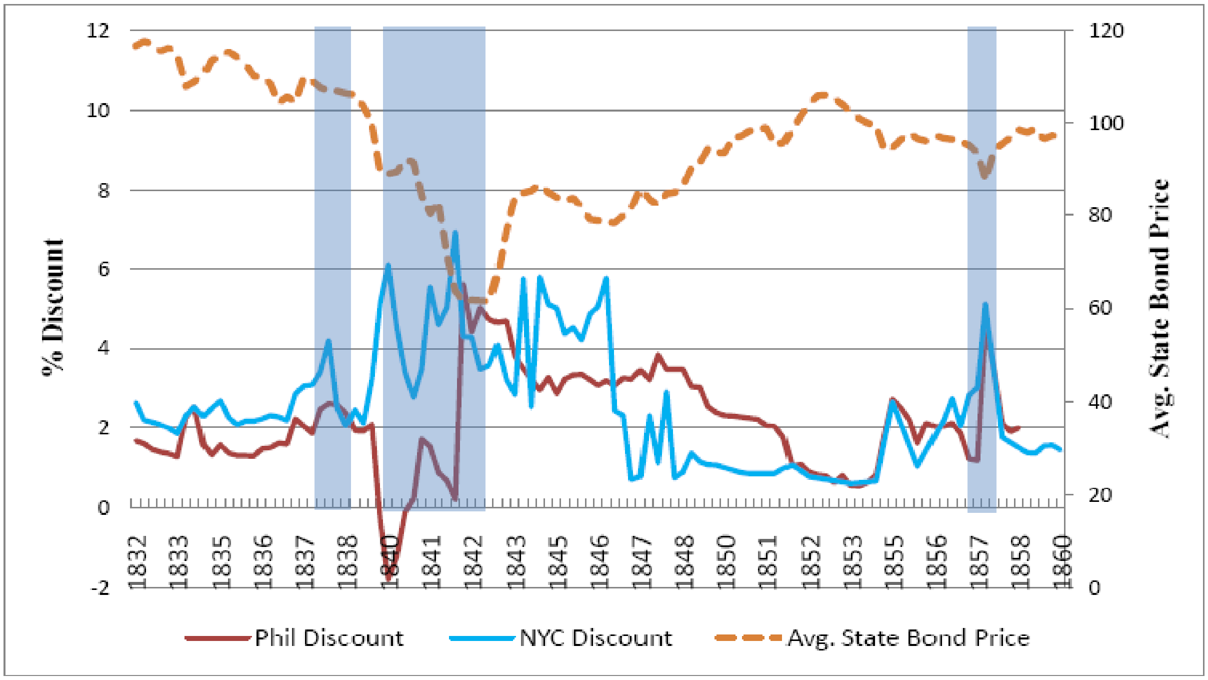

Figure 3-4: Note Discounts vs. Bond Prices (1832-1860)

Notes: Figure contains the average discount for open free and charter banks and the average price of the fourteen state bonds in Table 2-1. Shaded periods denote specie suspensions.

Rolnick and Weber's (1984, 1985) falling asset price hypothesis states that free banks were more likely to default during periods of low bond prices.[18] As notes were backed by government debt, a bond price decline signaled that a bank's collateral was insufficient to redeem its notes in the short run. This signal often resulted in a bank run. Knowing their collateral was worth less than their notes in circulation in the short-run, banks could either: (1) redeem their notes at par and take capital losses or (2) refuse their notes and forfeit their security portfolio. Discounts therefore needed to be higher during periods of low bond prices to compensate for the depreciated note backing and increased probability of failure. Figure 3-4 illustrates this negative correlation: bond prices are at their lowest when note discounts are at their highest.

[18] While not directly addressing the backing requirements, Gorton (1996, 1999) argues that bank regulations or lack thereof led to different levels of default risk. Using both free and charter bank notes, Gorton finds that insurance programs and branch banking regulations dramatically affected discounts. Because free banks were not subject to these regulations, I focus on the other balance sheet and note restrictions present in the laws.

While bond depressions were events outside of their immediate control, Economopoulos (1990) argues that banks could have diversified their asset and liability portfolios in order to remain solvent during negative shocks. Found in Chapter II, free banks with large proportions of bank notes (Circulation/Assets) and small proportions of loans (Loans/Assets) were more likely to default during the antebellum period. Because diversified banks are less likely to default, they should have had lower note discounts. Table 3-1 shows that a bank's proportion of specie, loans, and circulation are significantly correlated with discounts, whereas its asset size and leverage are insignificantly correlated. Discounts thus seem to reflect the bank-level factors associated with default.

Empirical Analysis

Similar to studies of modern bank subordinated debt, I estimate the note discount panel within a linear model.[19] Each observation is a single bank-quarter allowing identification across differences between banks and over time. The dependant variable ($Discount_{i,t}$) is the percentage discount on a note from bank *i* in period *t*, and the explanatory variables enter the regression equation linearly with a vector of coefficients. In keeping with the previous section, I measure redemption costs with the logarithm of travel cost from bank i's to the redemption city at time *t*

[19] Among others, Avery, Belton, and Goldberg (1988) assume a linear relationship between a bank's default risk and its market spread (i.e. discount). Despite criticism by Gorton and Santomero (1990), if one accounts for a bank's leverage, even the market spread of the standard non-linear Black and Cox model (1979) is either monotonically increasing or decreasing with risk. Using this fact, Flannery and Sorescu (1996) argue that a linear model could lead to better results as it does not rely on the strong assumptions necessary for traditional non-linear finance models. I therefore test the linear assumption's robustness using a non-linear specification in the appendix.

Table 3-1: Comparison of Free Bank Balance Sheets and Discounts

	New York City							
State	# of Banks	Avg. Discount	Avg. Distance	Total Assets	Capital/ Assets	Circulation/ Assets	Specie/ Assets	Loans/ Assets
Massachusetts	3	0.17	5.00	1,375,440	50.2%	12.3%	5.6%	86.8%
New Jersey	16	0.27	2.70	206,834	57.0%	42.4%	3.7%	47.5%
Connecticut	14	0.45	2.85	433,132	56.4%	24.1%	2.8%	73.0%
Vermont	1	0.78	9.20	192,139	42.0%	47.2%	1.7%	44.8%
New York	138	0.81	7.44	431,607	42.2%	36.4%	1.7%	47.5%
Ohio	14	1.80	18.65	272,671	27.0%	28.5%	5.6%	35.9%
Minnesota	4	2.20	43.23	85,879	45.2%	34.8%	3.6%	39.0%
Wisconsin	124	2.89	33.07	144,693	42.9%	31.6%	3.9%	38.0%
Illinois	94	3.09	29.20	227,608	38.9%	50.9%	4.4%	4.1%
Indiana	70	3.67	25.20	211,816	41.7%	39.3%	6.7%	26.3%
Alabama	1	3.67	43.90	598,979	16.7%	14.1%	3.4%	55.3%
Tennessee	2	5.85	31.28	257,572	52.0%	45.6%	5.4%	32.5%
Michigan	1	17.50	38.38	62,563	40.5%	38.7%	14.2%	61.9%
Correlation with Discount		1	0.613	-0.287	-0.044	0.060	0.254	-0.352

	Philadelphia							
State	# of Banks	Avg. Discount	Avg. Distance	Total Assets	Capital/ Assets	Circulation/ Assets	Specie/ Assets	Loans/ Assets
New Jersey	17	0.40	2.01	202,946	55.7%	43.6%	3.5%	46.4%
New York	189	0.40	8.36	730,655	51.2%	30.9%	3.0%	50.1%
Connecticut	14	0.64	5.45	433,132	56.4%	24.1%	2.8%	73.0%
Ohio	14	1.59	16.30	272,671	27.0%	28.5%	5.6%	35.9%
Vermont	1	3.00	12.34	192,139	42.0%	47.2%	1.7%	44.8%
Wisconsin	113	3.39	30.12	150,104	43.1%	30.6%	4.0%	39.2%
Illinois	72	3.59	26.55	242,286	40.6%	46.9%	5.7%	5.0%
Alabama	1	4.60	43.15	598,979	16.7%	14.1%	3.4%	55.3%
Indiana	70	5.43	22.19	211,816	41.7%	39.3%	6.7%	26.3%
Tennessee	2	9.14	29.75	257,572	52.0%	45.6%	5.4%	32.5%
Michigan	3	9.58	32.96	88,508	35.8%	51.0%	12.9%	61.9%
Correlation with Discount		1	0.626	-0.013	-0.074	0.077	0.108	-0.269

Notes: Entries contain the balance sheet of the average bank for each state. For the sake of the average and correlation, each bank was only counted once. The average discount of each state is only calculated when the underlying bank was open.

($LnCost_{i,t}$)[20], the effects of specie suspensions using a dummy variable ($Suspend_{i,t}$), the falling asset price hypothesis with the average quarterly bond price ($BPrice_{i,t}$) [21], bank size using the logarithm of $Assets_i$, capital adequacy and leverage using Capital/Assets ($CAPAS_{i,t}$), asset quality using Loans/Assets ($LOAS_{i,t}$), liquidity using Specie/Assets ($SPECAS_{i,t}$), and note overissues using Circulation/Assets ($CIRAS_{i,t}$).The general model is as follows:

$$Discount_{i,t} = a + \beta_1 LnCost_{i,t} + \beta_2 Suspend_t + \beta_3 BPrice_t + \beta_4 \mathrm{Assets_i} \quad (1)$$

$$+ \beta_5 CAPAS_i + \beta_6 CIRAS_i + \beta_7 SPECAS_i + \beta_8 LOAS_i + X_{i,t} + u_i + e_{i,t}$$

where u_i denotes the random effects by bank[22], $e_{i,t}$ denotes the error term, and $X_{i,t}$ is a vector of control variables. The control variables included but not reported are the number of years a bank has been in operation (reputation effects), Davis' (2004) annual industrial production index (business cycles), and year-quarter dummies. Standard errors are clustered by state to account for the possibility that errors are serially correlated within each state and across time.[23]

I estimate all regressions with and without state fixed effects. When included, these effects account for constant heterogeneity across states, such as relative population or regulatory enforcement. The state effects are also particularly useful for comparing balance sheets but do substantially reduce travel cost variation. The presence of state effects does not preclude travel costs from being significant, but must be kept in mind when interpreting the results of the model.

[20] The logarithm of travel costs accounts for the non-linear relationship between distance and discounts.
[21] The bond price variable was constructed from the 14 different state bonds outlined in Table 2-1. The bond price variable is defined as the average quarterly price of equally-weighted bonds allowed by each state's law. Most states allowed any type of state or national debt that was paying full interest to back notes, whereas Alabama, New Jersey, New York, and Ohio only allowed banks to the use of certain state bonds. Banks not subject to a bond constraint take the average price of all 14 state bonds, Alabama and New Jersey take the price of a US Treasury bond, and Ohio takes its own state bond price. The price of NY bonds fills missing US bond prices before 1841. Due to a law change, New York takes the average price of all 14 state bonds before 1842 but only its own bond price afterward.
[22] A Hausman test fails to reject the random effects assumption for the full model. I therefore use random effects because the database does not contain sufficient observations to cluster standard errors under fixed effects.
[23] Petersen (2009) shows that the existence of residual correlation across groups and time can be corrected for by adding a time fixed effects and clustering the standard error by groups.

I separate the note discounts of banks that were in operation during the quarter (referred to as "open banks") from those that had ceased operation (referred to as "closed banks").[24] Theoretically, the nature of default risk changes when a bank closed, as the market value of assets becomes more important and predictors of closure become less. For instance, the high return on loans decreases the probability of a bank closing, but once closed, sudden loan liquidation would lead to large note holder losses. Empirically, a bank's note discount often substantially increased when it ceased operation, rising from 2 to 15 percent on average. If this increase was the result of asset value or bankruptcy information, a combined regression would bias the model's coefficients. I therefore separate the two discount types to make the coefficients easier to interpret, but the results are equivalent when using a series of interaction terms.

Determinants of Note Discounts When Open

Table 3-2 presents the estimated model of discounts when banks were open. The table is divided into four sets of three regression specifications. Each set is based on the note reporter sample used and whether state fixed effects are included. The first specification of each set isolates the effect of travel costs and specie suspensions, the second isolates default risk, and the third combines the explanatory variables into a single model.

It is helpful to step back and compare the first two regression specifications before elaborating on the individual variables. As shown by the R-squared values, the default risk factors explain roughly the same amount of time-series variation in discounts than the travel

[24] Weber (2005b) is used to determine the quarter of closing.

Table 3-2: Determinants of Note Discounts While Free Bank Was Open

	Note Discounts of Open Banks												
	New York City (1837-1860)						Philadelphia (1837-1858)						
													Without NYC Notes
ln(Travel Cost)	0.490***		0.078**	0.039***		0.030***	1.251***		0.050	0.060		-0.102	-0.112
	[0.154]		[0.039]	[0.008]		[0.010]	[0.200]		[0.340]	[0.069]		[0.309]	[0.288]
Suspended	6.337***		4.527*	6.165***		5.353***	4.636		5.745*	3.280		4.549*	3.128
	[2.428]		[2.347]	[2.368]		[1.999]	[3.338]		[3.371]	[2.615]		[2.637]	[2.345]
Avg. Bond Price		-0.184***	-0.174***		-0.101*	-0.101*		-0.246***	-0.242***		-0.228***	-0.228***	-0.235***
		[0.013]	[0.016]		[0.055]	[0.055]		[0.028]	[0.046]		[0.052]	[0.054]	[0.059]
ln(Assets)		-0.019	-0.002		-0.044	-0.037		-0.015	-0.004		0.012	-0.006	-0.011
		[0.043]	[0.042]		[0.048]	[0.048]		[0.176]	[0.241]		[0.188]	[0.239]	[0.285]
Capital/Assets		0.589*	0.629**		0.491	0.495		1.162***	1.170***		0.918***	0.902***	0.385
		[0.319]	[0.307]		[0.346]	[0.343]		[0.269]	[0.250]		[0.243]	[0.227]	[0.465]
Circulation/Assets		-0.052	-0.008		-0.209	-0.202		1.152	1.146		0.838*	0.865	0.926
		[0.423]	[0.399]		[0.347]	[0.336]		[0.708]	[0.738]		[0.487]	[0.558]	[0.653]
Specie/Assets		-0.133	0.0217		-2.177*	-2.154*		1.477	1.512		0.225	0.115	0.507
		[1.595]	[1.657]		[1.169]	[1.156]		[1.710]	[1.711]		[1.368]	[1.128]	[1.291]
Loans/Assets		-0.655**	-0.612**		-0.528**	-0.520**		-0.450*	-0.451*		-0.689***	-0.672***	-0.623***
		[0.298]	[0.289]		[0.252]	[0.248]		[0.238]	[0.241]		[0.252]	[0.232]	[0.240]
State Effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Observations	4,641	4,641	4,641	4,641	4,641	4,641	8,762	8,762	8,762	8,762	8,762	8,762	7,656
R-squared :													
Within	0.3314	0.3342	0.3347	0.3378	0.3415	0.3415	0.1800	0.1955	0.1955	0.1824	0.1960	0.1960	0.2146
Between	0.3557	0.6259	0.6254	0.6765	0.6923	0.6925	0.3814	0.4952	0.4946	0.5641	0.5833	0.5837	0.3834
Combined	0.3667	0.4423	0.4431	0.4572	0.4619	0.4620	0.2673	0.3251	0.3253	0.3513	0.3635	0.3631	0.3065

Notes: Linear panel regression with random effects taking the bank's note discount as the dependent variable. Only discounts of banks that were currently in operation were used. Different columns represent the present of state fixed effects of discount sample used. All regressions include quarter-year effects, a index of industrial production, and the cumulative number of years a bank was open. Standard errors are provided in brackets and clustered by state. * denotes significance at 10%; ** at 5% level and *** at 1% level.

costs or specie suspensions, but a much larger portion of the cross-sectional variation. While these values do not prove that travel costs and suspensions are unimportant, they suggest that default factors play a more significant role in pricing note discounts.

Redemption costs are generally positively correlated with discounts; however, the relationship is greatly reduced when bank characteristics are included in the regression. For every 10 percent decrease in the cost of travel from NYC, a note's discount would decline by 0.049 percent without accounting for the default risk factors or state effects but only by 0.003 percent when both are in the model. The coefficient for the Philadelphia sample also changes its sign when default risk and state effects are present in the model. Therefore, travel costs are a determinant of note discounts, but the size of initial travel cost coefficient seems to be the result of risky frontier banks.

As found by Weber (2005a), specie suspensions have large coefficients which are always statistically significant. According to the model, a suspension would cause every bank note's discount to increase by about 5 percent. The effect is large relative to the average note discount (2 percent), and matches the results in Figure 3-4.

The bond price coefficient is always negative and significantly correlated with discounts. For a 10 percent decrease in the average bond price, discounts would rise by 0.14 percent in New York City and 0.23 percent in Philadelphia. Remaining statistically significant when regressed alongside the suspension dummy and time fixed effects, the bond price coefficient does not seem to be solely the result of financial panics.

Typically considered a modern stabilizing influence, a bank's leverage is positively but not always significantly correlated with discounts.[25] The insignificance and sign of the leverage coefficient is a direct cause of free bank's capital being invested in bonds for circulation. A

[25] This same result is found in the previous section.

larger capitalization rate implies a larger bond portfolio and therefore a higher probability of default.

While circulation is strongly correlated with the probability of default, a bank's circulation is also insignificantly correlated with discounts. The insignificance seems to be the result of large circulations being more readily available to be shipped together. Weber (2005a) suggests that the presence of economies of scale in note return lowers the redemption cost per note or per dollar and compensates note brokers for some risk. Unfortunately, the lack of redemption data prevents me from confirming this suggestion.

The coefficient on loans is always significant, negative, and large. Although of highest value to the current holder, loans were typically short-term with maturities of 3-6 months.[26] Temin (1975) also finds that New York City banks adjusted their loan portfolios to meet anticipated demand. The short maturity combined with the fact that loan rates (6 percent) were equivalent to bond yields (5 percent) suggests that loans helped to avoid bank runs without sacrificing revenue.[27] Loans therefore might have been a way for brokers to identify the profitability and diversity of a free bank.

In summary, discounts on the notes of open banks are closely related to travel costs and default risk, but not the other balance sheet variables. The effect of travel costs, however, significantly declines when controlling for default risk. In other words, brokers seem to price notes based on the issuing bank's fundamentals rather than its location.

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[26] Bodenhorn (2003, pp. 96-110)
[27] Homer and Sylla (2005) and Bodenhorn (2003, Table 4.2 and 4.3).

Determinants of Note Discounts When Closed

I regress the note discounts of closed banks in Table 3-3.[28] Not only does this examine what factors mattered to discounters after a bank closed, but it also implicitly measures which factors allowed a bank to fulfill their note obligations upon closure.

Travel costs and specie suspensions are no longer robustly correlated with note discounts. The fact that the coefficient on travel costs is negative or insignificantly positive is likely because a note holder only had to redeem the note at the state representative's office and usually had a year or two to do so. On the other hand, the statistical insignificance of the suspension coefficient is understandable given that closed banks were not required to redeem notes on demand.

Upon closure, a bank liquidated both the bonds used to back notes and those held on its balance sheet. The current market price of bonds therefore would determine the losses associated with bond liquidation. The signs reflect that this relationship, but it is only statistically significant when state effects are not included.

The coefficients on assets, circulation, and leverage are large and statically significant, whereas those on loans are insignificant. In the sense that a bank's circulation represents the size of its redemption obligations and its assets represents the potential size of sudden liquidation losses, the note discounts of closed banks reflect the ability of the bank to repay its note obligations. The results differ significantly from the pricing of the note discounts of open free banks, seeming to capture the changing nature of risk.

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[28] Because notes were removed from the reporters when they no longer circulated, the discount samples only contain about 170 unique notes.

Table 3-3: Determinants of Note Discounts While Free Bank Was Closed

	Note Discounts of Closed Banks				
	New York City (1837-1860)		Philadelphia (1837-1858)		
					Without NYC Notes
ln(Travel Cost)	-3.832***	-2.285***	-0.002	0.651	-1.726
	[1.263]	[0.695]	[1.116]	[0.647]	[5.450]
Suspended	10.780	11.060*	-19.512***	-19.501***	-21.765***
	[7.079]	[6.020]	[4.913]	[4.342]	[4.669]
Avg. Bond Price	-0.867***	-1.145	-0.367*	-0.142	-0.056
	[0.311]	[0.736]	[0.210]	[0.171]	[0.179]
ln(Assets)	6.853***	6.611***	2.512***	2.411***	2.758***
	[2.208]	[2.558]	[0.815]	[0.907]	[0.748]
Capital/Assets	22.310*	27.060*	15.886*	17.299**	21.937***
	[12.490]	[15.770]	[8.114]	[8.748]	[5.744]
Circulation/Assets	32.950*	29.460**	12.009	6.550	9.796
	[18.65]	[14.85]	[16.210]	[14.383]	[11.134]
Specie/Assets	21.880	30.980	4.170	5.406	14.178
	[36.030]	[42.770]	[16.487]	[16.842]	[19.853]
Loans/Assets	-2.913	-5.918**	-5.313	-11.232**	-8.702
	[4.912]	[2.930]	[5.739]	[4.799]	[7.154]
State Effects	No	Yes	No	Yes	Yes
Observations	908	908	1,684	1,684	1,494
R-squared :					
Within	0.2704	0.2755	0.177	0.1783	0.2146
Between	0.3467	0.4799	0.1997	0.3714	0.3834
Combined	0.2761	0.3651	0.1888	0.2907	0.3065

Notes: Linear panel regression with random effects taking the bank's note discount as the dependent variable. Only discounts of banks that were currently closed were used. Different columns represent the present of state fixed effects of discount sample used. All regressions include time (quarter-year) effects, a index of industrial production, and the cumulative number of years a bank was open. Standard errors are provided in brackets and clustered by state. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Conclusion

This chapter shows that the market effectively monitored the risky behavior of antebellum banks despite significant travel costs, informational asymmetries, and limited government involvement. Specifically, the market priced bank notes according to their redemption costs and default risk. While travel costs were able to separate note discounts across different states, they were highly correlated with a bank's default risk. The results suggest that systematic risk (specie suspensions) and idiosyncratic risk (falling bond prices and a bank's proportion of loans) were the primary determinants of discounts.

I also show that the market discounted the notes of open and closed banks differently. While open bank discounts were sensitive to default risk, closed bank discounts reflected the current market value of a bank's debt (circulation) and assets (bond prices and a bank's asset size). In this way, note discounts before closure corresponded to the probability that a bank would default, but after closure, they corresponded to its ability to pay off its debt.

The analysis provides a reason why risky bank notes circulated in the antebellum economy. It was not only that the benefits of bank notes simply outweighed the nominal losses, but that market discounts also mitigated the value of those losses. Combined with the fact that specie and other types of money during the period were also highly variable, the discounting process might have made bank notes the safest and most liquid currency.[29]

[29] Discussed in Bodenhorn (1998, p. 21), most coins in circulation were worn and not denominated in dollars thus making it hard to immediately exchange or decipher their value.

Appendix B. Construction of Passenger Cost Index

Over 30,000 miles of railroad and 4,000 miles of canals were constructed in the United States between 1815 and 1861. This "transportation revolution" greatly lowered the cost of passenger travel and facilitated the nation's westward migration.[30] The lack of antebellum travel records, however, has prevented studies from examining the impact of these changes on most locations. Historical studies such as Dunbar (1937) and Taylor (1951) illustrate the travel costs, times, and distances between major cities such as New York City or Philadelphia, but not subsidiary or developing cities such as Cleveland or Louisville. Even the most comprehensive study to date, Gorton (1989), is limited to 30 major cities. This appendix enables the study of antebellum travel improvements by constructing a hub-and-spoke network that is capable of estimating the cost of passenger travel to any US city in 1836, 1849, 1856, or 1859.

Historical Sources

I take the historical passenger costs from New York City and Philadelphia to a large number of "hub" cities from two travel guides.[31] Each guide assembled maps, schedules, costs, and distances for major transportation routes. Data for 1836 and 1849 come from Gorton's (1989) summary of *Disturnell's A Guide Between Washington, Philadelphia, etc.*, whereas 1856 and 1859 come directly from *Appletons' Railway and Steam Navigation Guide*.[32] These particular years were chosen both for their availability and association with the major antebellum transportation waves. As the majority of canals were not finished and railroads had not yet truly

[30] The term "transportation revolution" was first popularized by Taylor (1951).

[31] While travel costs, times, and distances are highly correlated, costs are the most comprehensive and available measure of transportation advances. Costs are exact, whereas reported times are approximate guesses and actual times would vary depending on weather conditions and other factors. Moreover, costs reflect technological improvements in both speed and efficiency, whereas times reflect only the former and distances reflect neither.

[32] Some additional hubs were taken from Weber (2005a) in the late 1840s. Similar in nature, *Disturnell's* guide focuses on the chief routes of travel, while *Appletons'* provides most available options. Despite the different approaches, a comparison of *Disturnell's* 1862 and *Appleton's* 1859 yields only minimal differences.

begun, roads and rivers were the most common avenue of travel before 1837. The 1840's saw a distinct rise in canals and the beginning of railroads. Finally, the spread of railroads through the Midwest and South surpassed water travel during the 1850's. In this way, the network provides an estimate of travel costs during each transportation wave and lowers the size of cost changes between observations.[33]

The problem with obtaining a complete summary of passenger costs from the guides is their general lack of stagecoach and minor water routes. Consequently, most cities unconnected to major rail or water transportation (referred to as a "spokes") are not present in the guides.[34] To reach these spokes from New York City or Philadelphia, one would have to travel by rail or water to a nearby location and then take a road or minor waterway the remaining distance. Obtaining the most efficient route to each spoke would therefore require additional knowledge of every water and road route between the several thousand spoke-hub pairs. The lack of information currently rules out such a detailed approach and forces the use of a simplifying assumption, namely that travel between each hub and spoke was by stagecoach on straight roads.

This assumption admittedly ignores available water transportation as well as any mountains, rivers, or other obstacles that roads would avoid. The choice of roads over rivers can be partially defended using historical evidence. Taylor (1951, p. 71-72) highlights some of the drawbacks of river transport:

> But even more important, especially in the West, was the directness of rail as again river routes…But the meandering western rives greatly handicapped water transportation…While railroads operated the year round, the lakes and rivers of the North were closed by ice from two to five month during the winter season and in the West frequently for long periods during the rest of the year by low water…Finally, river position was predetermined, where rails might be laid over the most convenience routes for commerce…irregularity of sailing and the lack of interline agreements made [non-direct travel] arrangements unusual for river trips…

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[33] This later result allows a linear trend to reasonably fill the intervening years.
[34] In the cases where stagecoach or wagon routes are listed, they generally lack consistent cost and time estimates.

Even though Taylor is comparing river travel to railroads, similar principles also apply to stagecoach travel. Relative to steamboats, stagecoaches were less reliant on weather (could travel year round), more direct (major roads were straight compared to rivers), and costs did not depend on direction of travel (upstream vs. downstream). The increased mileage and seasonality of river travel mitigates some of the per-mile cost advantage, and therefore, the stagecoach assumption might not greatly bias my cost estimate especially for travel in winter and summer months.

Assuming that stagecoaches were used to travel between every hub and spoke pair, the final piece of necessary historical information is an estimate of stagecoach costs. Seen in Table B1, stagecoach costs varied across locations, as the diffusion of road, bridge, and stagecoach improvements took time. The costs of stagecoaches within the developed Northeast were therefore generally inexpensive after 1840, but still expensive and declining everywhere else. Summarized in Table B2, I have chosen to use the median estimates of stagecoach costs proposed by Gorton (1989).[35] The estimates are expensive for developed areas such as the Northeast, but because the average travel distance between Northeast hubs and spokes are also small, the choice minimizes measurement error across the entire country.

Method of Construction

The hub-and-spoke network minimizes the travel cost based on available transportation options. Seen in Figure B1, if an individual from New York City was traveling to a city on a railroad (e.g. Indianapolis or Richmond), they would simply take a train. However, if the destination was not on a railroad (e.g. Nashville), the individual would first travel as far as possible by rail and then take a stagecoach the rest of the way.

[35] The network can also be adjusted to incorporate another set of cost estimates when necessary.

Table B1: Comparison of Historical Stagecoach Fares

Year		Passenger-Mile Rate ($)	Mileage
1812	Philadelphia to Pittsburg	0.09	297
1832	Philadelphia to New York	0.067	90*
1846	Montgomery to Mobile	0.05	200
1848	Tuscaloosa to Mobile	0.018	676
	Philadelphia to Baltimore	0.023	128
	Baltimore to Richmond	0.026	378
	Baltimore to Wheeling	0.044	271
	Indianapolis to Madison	0.047	86
	Philadelphia to Pittsburg	0.05	300
	Lexington to Louisville	0.056	75
	Louisville to St. Louis	0.056	75
	Wheeling to Columbus	0.057	140
	St. Augustine to New Orleans	0.058	600
	Columbus to Cincinnati	0.059	110
	Columbus to Cleveland	0.06	177
	Augusta to Montgomery	0.062	300
	Richmond to Knoxville	0.064	444
	Louisville to Nashville	0.067	180
	Montgomery to Mobile	0.067	180
	Nashville to Memphis	0.067	224
	Pittsburg to Wheeling	0.068	59
	Mobile to New Orleans	0.075	160

Notes: From Warren (1849) and Dunbar (1937). Partially reprinted in Fishlow (1965, Table 8) and Gorton (1989, Tables 5 and 6) . *in snow, on sleigh

Table B2: Estimates of Passenger Fares on Various Modes of Transportation

	Passenger-Mile Cost ($)			
	1839	1849	1856	1859
Stagecoach	0.07	0.06	0.06	0.06
Steamboat	0.043	0.04	0.03	0.03
Railroad	0.03	0.03	0.03	0.03

Notes: These estimates were first proposed by Gorton (1989). Railroad costs have been averaged between North and South.

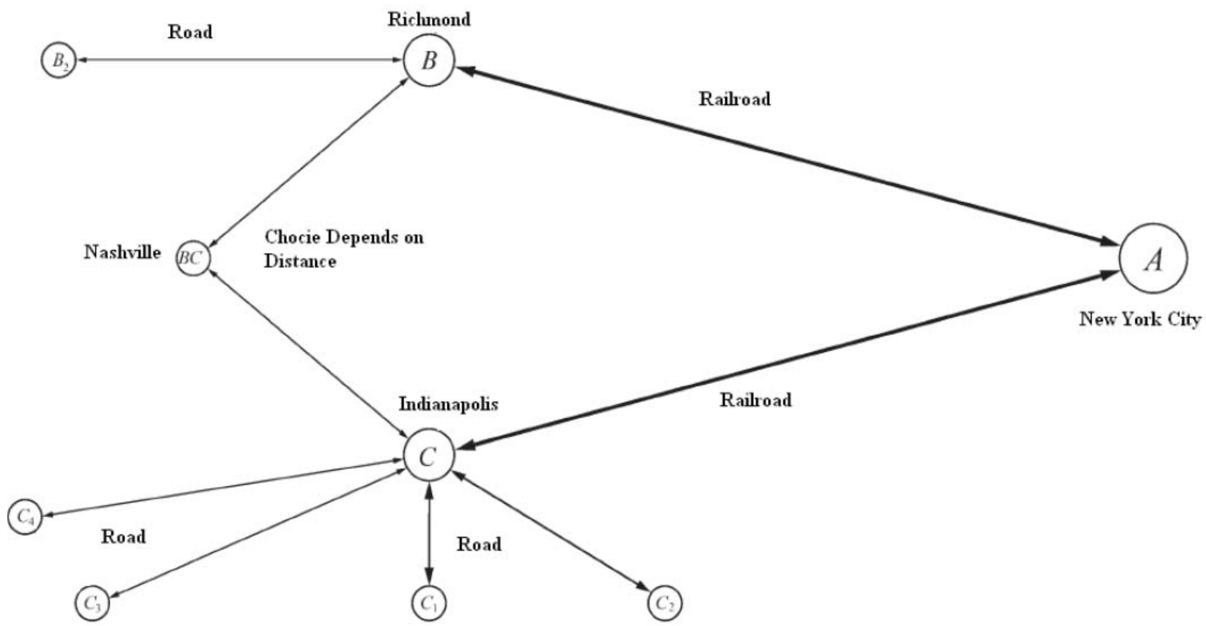

Figure B1: Sample Hub-and-Spoke Network

Notes: The figure describes the process by which a hub is matched with a spoke. Capital letters denote cities attached to a rail (i.e. hubs), whereas the lower case letters with numbers denote cities off of major travel routes (i.e. spokes). This diagram was first discussed in Redenius (2009) and I have adjusted it to fit the approach taken in the paper.

For the sake of explanation, the optimization problem can be described in four steps. First, the network obtains the passenger costs to known transportation hubs from the travel guides described above. Second, the network calculates the distance in miles between each hub-spoke pair. Third, the network calculates the total direct and indirect travel costs to Philadelphia and New York City. Finally, the network compares all routes to a city and selects the lowest cost.

The foundation of the hub-and-spoke network is a historical database containing the passenger costs from New York City and Philadelphia to a large number of cities in 1836, 1849, 1856, and 1859. Although railroads were generally more direct than rivers and less expensive than stagecoaches, I selected the shortest and least costly route of all available methods of travel.

Corresponding to the expansion of canals and railroads, Figure B2 illustrates how the number of hubs increased over time: 44 in 1836, 52 in 1849, 124 in 1856, and 132 in 1859.[36]

Putting the hub travel information aside temporarily, I create a separate spoke database. Each row is a single city's global position system (GPS) coordinates, whereas the columns correspond to each hub's coordinates. In this way, each cell pairs one spoke with one hub. I then use the Haversine Formula to calculate the distance in miles on a sphere between each hub-spoke pair. Assuming the coordinates of the two locations are (long1, lat1) and (long2, lat2), the Haversine Formula is:[37]

$$\begin{aligned} &\text{dlong} = \text{long2} - \text{long1} \\ &\text{dlat} = \text{lat2} - \text{lat1} \\ &X = [\sin(\text{dlat}/2)]^{\wedge}2 + \cos(\text{lat1}) * \cos(\text{lat2}) * [\sin(\text{dlong}/2)]^{\wedge}2 \\ &\text{Distance (in miles)} = \{2 * \text{atan2}[\text{sqrt}(X), \text{sqrt}(1-X)]\} * 3956 \end{aligned} \qquad (2)$$

I convert the distance into passenger costs by multiplying it by the median per mile stagecoach cost estimates in Table B2.

I combine the hub and spoke databases to minimize the total cost of travel to each city. The total cost of each route is simply the sum of the cost from Philadelphia and New York City to a hub and the cost from that hub to the spoke. Because the origin cities are hubs with a zero travel cost, this process calculates the direct travel to a city as well as every possible indirect path through a hub. By comparing all routes, I select the minimum total cost of travel to each city in each year.[38]

[36] Care was given to select the same hubs across time, but they do vary based on availability. The increase in hubs substantially reduces the distance between hubs and spokes which in turn reduces the estimation error over time.
[37] See Sinnott (1984) for more details.
[38] For simplicity, I assume that costs could not increase over time and replace any which do with their previous value.

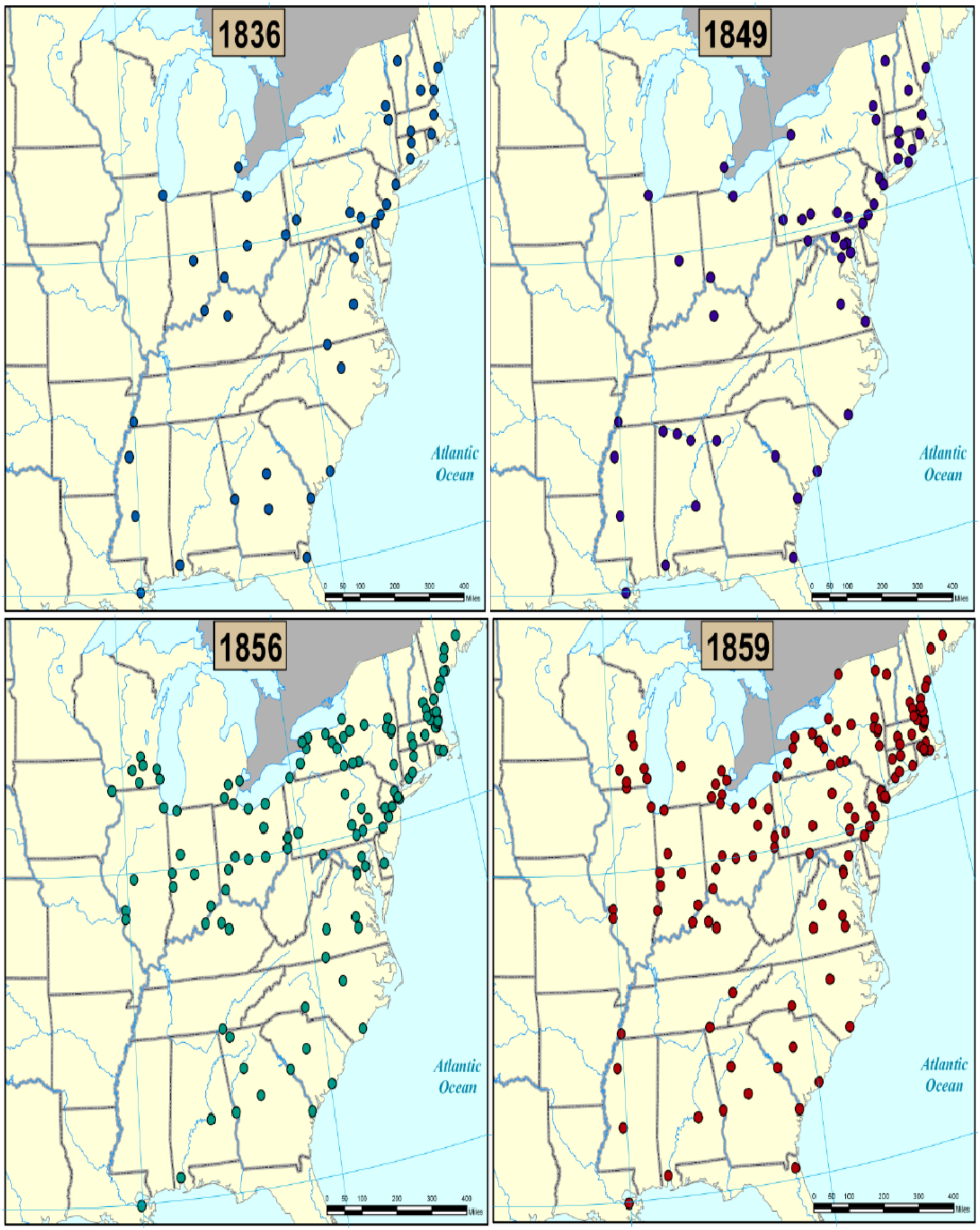

Figure B2: Transportation Hubs Used In Each Year

Notes: The figure presents the transportation hub underlying the hub-and-spoke network.

Appendix C. Non-linear Model of Note Discounts

The chapter used a simple linear panel approach to approximate the determinants of discounts. Responding to Gorton and Santomero's (1999) criticism that the relationship between risk and discounts (or market spread) is non-linear in leverage, this section estimates an alternative non-linear model suggested by Flannery and Sorescu (1996). Keeping the control variables, a bank's size, and the travel cost the same, this model differs from the last in that the risk variables are interacted with the sum of the leverage variable ($CAPAS_i$) and its square. The interaction creates a non-linear relationship between risk, leverage, and discounts similar to that argued by Gorton and Santomero (1999). Keeping the previously defined variables, the model is:

$$\begin{aligned} Discount_{i,t} &= \beta_1 LnCost_{i,t} + \beta_2 \text{Assets}_{\text{i,t}} \\ &+ \left(\beta_3 Suspend_{i,t} + \beta_4 BPrice_{i,t} + \beta_5 CIRAS_{i,t} + \beta_6 SPECAS_{i,t} + \beta_7 LOAS_{i,t}\right) \\ &* (CAPAS_{i,t} + \beta_8 CAPAS_{i,t}^2) + X_{i,t} + e_{i,t} \end{aligned} \tag{3}$$

With this model there are two things to note. First, the level coefficient on leverage must be constrained to unity in order to identify the other coefficients. Second, the raw coefficients are not the standard marginal effects. Instead, the marginal effect of each variable depends on at least one other variable. For example, the marginal effect of each risk variable is of the form:

$$\frac{\partial Discount_{i,t}}{\partial Suspend_{i,t}} = \beta_3 (CAPAS_{i,t} + \beta_8 CAPAS_{i,t}^2) \tag{4}$$

while the marginal effect of leverage is:

$$\begin{aligned} \frac{\partial Discount_{i,t}}{\partial CAPAS_{i,t}} &= \left(\beta_3 Suspend_{i,t} + \beta_4 BPrice_{i,t} + \beta_5 CIRAS_{i,t} + \beta_6 SPECAS_{i,t} \right. \\ &\left. + \beta_7 LOAS_{i,t}\right) * (1 + 2\beta_8 CAPAS_{i,t}) \end{aligned} \tag{5}$$

To make results comparable, I only report these marginal effects evaluated at the mean.

Table C1: Nonlinear Determinants of Note Discounts When Bank was Open

	Note Discounts of Open Banks			
	NYC		Philadelphia	
ln(Travel Cost)	0.375**	0.031***	1.085***	-0.089
	[0.148]	[0.010]	[0.094]	[0.230]
Suspended	4.779	4.593	-0.791	-1.237
	[2.825]	[2.726]	[1.333]	[1.191]
Avg. Bond Price	-0.013*	-0.005	0.013**	0.009**
	[0.006]	[0.006]	[0.005]	[0.004]
ln(Assets)	0.016	-0.038	-0.197	-0.386
	[0.110]	[0.053]	[0.224]	[0.233]
Capital/Assets	0.435	-0.066	-5.748	-1.416
	[1.228]	[0.274]	[6.628]	[1.469]
Circulation/Assets	1.115	0.007	-1.121	-0.855
	[0.669]	[0.519]	[0.765]	[0.542]
Specie/Assets	6.845	-1.922	10.050	-1.873
	[5.619]	[1.539]	[8.085]	[1.661]
Loans/Assets	-1.263*	-0.332	-2.023***	-0.703**
	[0.658]	[0.223]	[0.611]	[0.260]
State Effects	No	Yes	No	Yes
Observations	4,641	4,641	8,868	8,868
Adj. R-squared	0.3264	0.4015	0.2197	0.2936

Notes: This non-linear model interacts a bank's leverage with its balance sheet risk factors. Different columns represent the present of state fixed effects of discount sample used. All regressions include time (quarter-year) effects, a index of industrial production, and the cumulative number of years a bank was open. Standard errors are provided in brackets and clustered by state. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table C1 reports the regressions using the note discounts of open banks. Although it is not a rigorous comparison, the adjusted R-squared terms suggest that the non-linear panel actually fits discounts roughly the same if not worse than the linear model. The non-linear model produces the same basic marginal effects with lower significance levels, further suggesting that the non-linearity is less important for antebellum bank notes.[39] The proportions of loans remains negatively correlated with discounts. Suspensions and travel costs generally remain positive, whereas the average bond price changes sign in Philadelphia. Leverage is now generally negative, while Asset size and circulation remain insignificant. I conclude that the linear model's results are generally robust to this non-linearity, particularly in the New York City sample.

[39]The increased standard errors are largely due to the insignificance of leverage.

CHAPTER IV

STATE BANKS AND THE NATIONAL BANKING ACTS: A TALE OF CREATIVE DESTRUCTION

Bank regulators walk a delicate tightrope. On the one hand, they must stabilize the financial system and prevent future crises; while on the other, they must keep banking incentives in place to facilitate future growth. The National Banking Acts of 1863 and 1864 failed to achieve either of these goals. The legislation attempted to reform the free banking system, but its methods have been heavily criticized. Cagan (1963), West (1974), and Livingston (1986) argue that it created an inelastic money supply and a risky reserve structure. Whereas, Davis (1965), Sylla (1969), and James (1978) argue that the high requirements prevented liquidity from reaching rural areas. Using a new bank-level census, this chapter examines how the legislation changed the antebellum distribution of banking services through the destruction of state banks and creation of national banks.

There were over 1,650 state-chartered banks (i.e. free and charter banks) in 1859. However, only 235 remained a decade later, whereas 1,630 nationally-chartered banks had been established. The sudden decline in state banks and rise in national banks have been illustrated in many studies, but the limited amount of data has forced key studies of the National Banking Period such as Barnett (1911), James (1978), and White (1983) to focus on growth after 1876. A few recent studies have began to analyze bank level data for Georgia and Indiana (Redenius 2002) and New York City (Weiman and James 2006), but have yet to provide an examination of the entire geographic and economic distribution of banks.

I overcome these data gaps by constructing a census of banks from 1860 to 1869. Specifically, I use the annual editions of *Merchants and Bankers' Directory* to determine the name, dates of operation, location, and capital level of every bank in operation during the decade, as well as whether they converted to a national charter. I then link the census to Warren Weber's antebellum databases (2005b, 2008) to provide the beginning date and balance sheet of banks in operation before 1860. The combined data enable the comparison of state banks that continued to operate with those that closed or converted to a national bank, as well as, new national banks that opened during the period.

The data show that the decline of state banks was not simply due to their adoption of national charters. Rather, many could meet the high national bank requirements, and nearly a third closed permanently between 1863 and 1869. The legislation therefore not only changed the distribution of the country's banking services, but had a differential effect on banks based on composition and location. A set of bank-level regressions similar to White (1983) and Carlson and Mitchener (2009) indicate the legislation stripped bank capital from rural areas and redistributed it to developed areas. In particular, the high national bank capital requirements prevented existing state banks from converting and new national banks from opening in rural areas, whereas the state bank note tax drove many of the small banks operating in rural areas out of business.

State and National Banking

The total number of banks displays steady but slow growth over time, but charter, free, and national banks all experienced a unique growth pattern. Separated for the first time in Figure 1, the number of free banks experienced an early decline in 1861 and stayed flat until a second

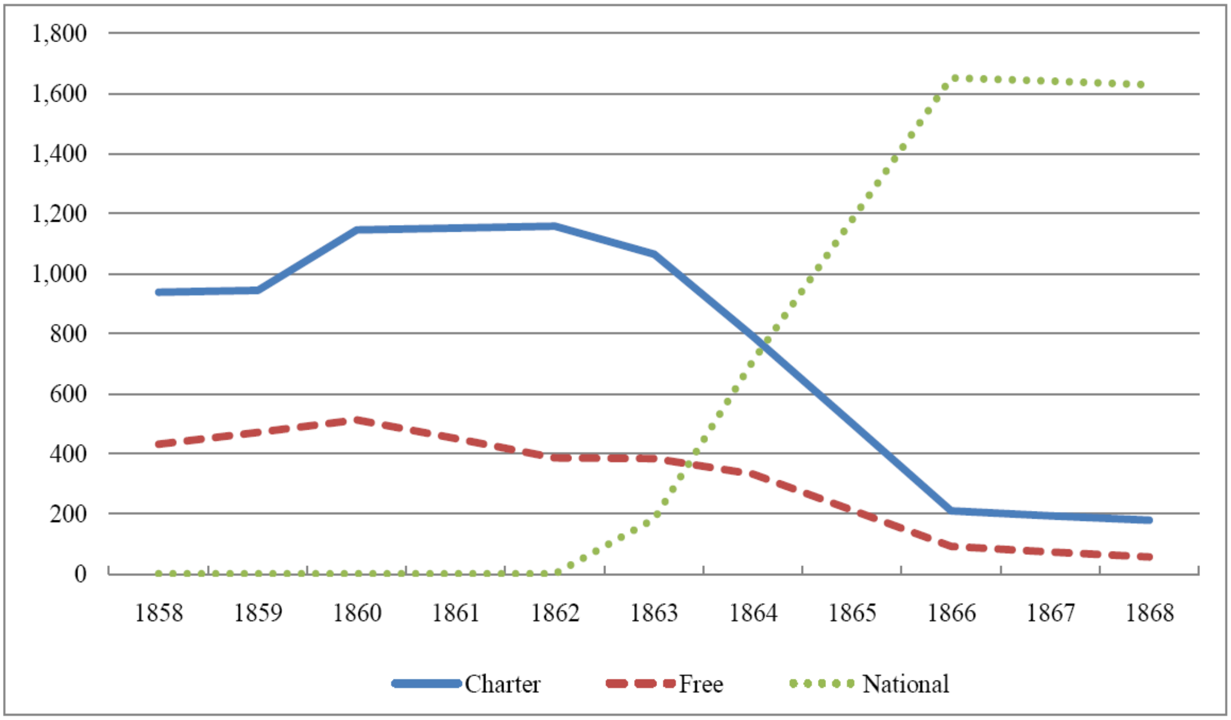

Figure 4-1: # Of Banks By Type (1858-1868)

Notes: Number of banks open at end of each year. Bank operation dates before 1861 come from Weber (2005b) and from *Merchants and Bankers' Directory*. Due to lack of data, 1861, 1865, and 1867 are filled with a linear trend.

decline in 1865; charter banks grew until 1862 and then began to quickly decline; and national banks grew slowly in 1863 and then fast until 1866.[1] Underlying these patterns were three major periods of legislation: 1863, 1864, and post-1864. The earliest periods correspond with the two National Banking Acts and the third period is when a state bank note tax was implemented. This section proceeds with a detailed description of the bank legislation and regional growth during each period, followed by subsequent sections that examine bank-level factors responsible for the growth.

[1] This figure, as well as the others in this section, comes from the new census of banks discussed in Section 3.

National Banking Act of 1863

Secretary of the Treasury Salmon Chase was given the task of financing the war under Lincoln. Chase, a Jeffersonian democrat, was skeptical of the state banking systems, but did not take action until after the Midwest free banking defaults and the specie suspension of 1861.[2] Seeking to secure bank notes and create a market for national debt, Chase pushed for a federally-controlled banking system. The resulting National Banking Act of 1863 (also known as the National Currency Act) adopted the language and approach of New York's relatively stable free banking law, but it also homogenized bank notes and took explicit steps to prevent the note holder losses seen during the Civil War.[3]

First, it avoided free banking's attachment to risky state debt by only allowing the use of federal debt. Second, it only allowed notes to be issued up to 90 percent of a bank's total bond value.[4] Third, it forced banks to restrict their circulations by placing a $300 million ceiling on the aggregate number of national notes. Fourth, it placed a 25 percent reserve requirement on both circulation and deposits.

The reserve requirements were structured in such a way as to reduce the burden on banks. Specially, only banks in nine large "reserve cities"[5] were required to hold the full 25 percent reserve in vault cash. The remaining banks (called country banks) were allowed to deposit up to three-fifths of the reserves in a reserve city national bank. In this way, country banks received interest on their reserves and reserve city banks received additional deposits.

Despite never being subjected to a deposit reserve, an examination of bank balance sheets shows that the tiered-reserve requirements enabled existing banks to continue keep their

[2] Davis (1910) discusses the anti-bank statements made by Chase during his time as governor of Ohio.
[3] Chapter II discusses the targeted nature of the National Banking Acts in more detail.
[4] This requirement had the addition benefit of creating a demand for federal debt.
[5] The original redemption cities were Baltimore, Boston, Chicago, Cincinnati, New Orleans, New York City, Philadelphia, Providence, and St. Louis.

allocation of funds when they converted to a national charter. In 1860, the average ratio of specie to circulation and deposits was 5 percent for free banks and 11 percent for charter banks, but was 20 and 25 percent respectively when interbank deposits were included. The new requirements therefore would not have been an entry barrier for state banks as long as they held their funds in a national bank.

The Act also forbade national banks from issuing real estate loans. The intention was to prevent the losses due to land speculation seen during the antebellum period; however, it would also have the unintended consequence of preventing lending in communities where wealth was concentrated in land. As few states explicitly prevented real estate loans before 1863, Barnett (1911) argues that the constraint discouraged rural and agricultural banks from adopting a national charter.

New York's high capital requirement was lowered for rural areas, but was kept high for densely populated areas. Specifically, banks in a city with over 10,000 people had to maintain a capital level of at least $100,000, whereas those in less populated cities had a $50,000 minimum.[6] Recalling the sample of free bank laws in Table 1-1, very few banks required $100,000.[7] The capital requirements therefore fell most heavily on high population areas and western states such as Minnesota and Wisconsin which had low capital requirements.

Senator Harris of New York added a last-minute amendment when the Act stalled in Congress. The amendment allowed state banks that held 50 percent or more of their capital in federal bonds to issue national notes without converting to a national charter. State banks could only issue notes up to 80 percent of their bonds' market value, i.e. 10 percent less than national

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[6] To provide additional demand for national debt, the Act required much of the capital to be submitted in US bonds.
[7] White (1984) illustrates that states lowered their requirements over time to further increase the differences between state and national banking requirements.

banks, but the loophole still gave them the primary benefit of a national charter, homogenous bank notes, without subjecting them to the costly requirements.

The response to national banking was less than enthusiastic by any metric: number, location, or capital. During the year, 182 national banks were established and only 7 were former state banks.[8] Moreover, the national banks that were established typically did not locate in the country's financial centers. For example, there was one national bank in Philadelphia and three in New York City, but at least three in both Cincinnati and Syracuse. The lack of national banks in urban areas also corresponded to the lowest average capital level ($125,000) of any bank type.

The aggregate number of state banks declined by 95 in 1863; however, the National Banking Act does not seem to be responsible. First, as seen in Figure 4-2, the closures were almost entirely in the Confederate South. During 1863 and 1864, 179 of 277 southern banks closed, compared to 27 of 1,173 non-southern banks.[9] The fact that 22 new state banks were created also suggests that state banking was still a viable option in other areas. Second, southern banks that survived the Civil War were located in areas quickly retaken by the Union, i.e. Louisiana, Tennessee, and Virginia.[10] Third, contemporary accounts such as the *Merchants and Bankers' Directory* (1864, p. 19; 1865, p. 21) illustrates that the war interrupted southern banking, stating "The Bank of Tennessee is in the hands of the rebels, and removed South". The

[8] Weiman and James (2006, p. 4) argue that most of the new banks were founded by private bankers that believed they might lose part of their note broker business.
[9] 1863 corresponds to the Battle of Gettysburg and the Surrender of Vicksburg, whereas, 1864 corresponds to Sherman's march to the sea.
[10] While it is possible that southern banks simply did not report to the *Merchant and Bankers' Directory* during the war, it seems unlikely given that they did not begin to report again after the war.

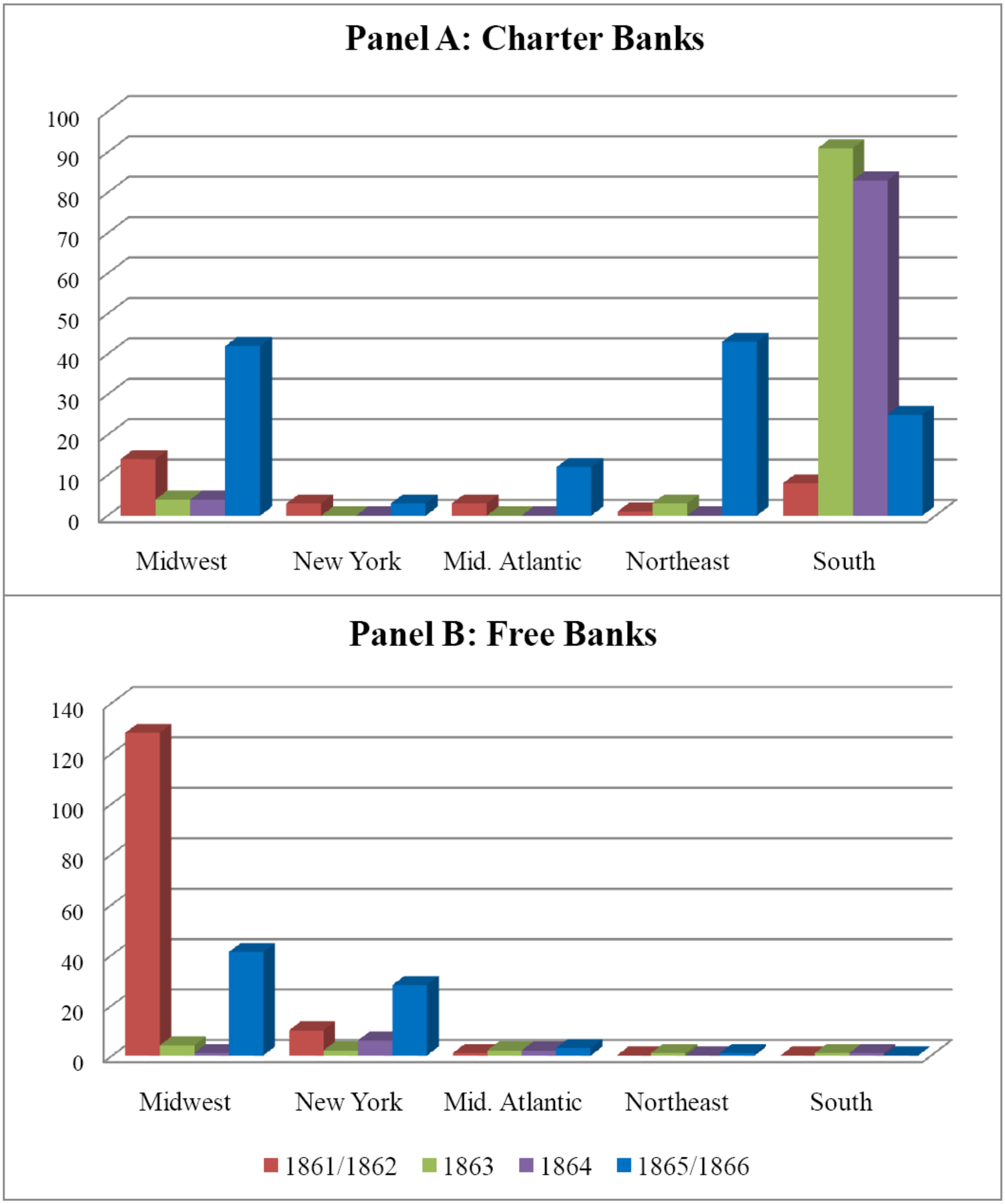

Figure 4-2: State Bank Closures By Region (1861 - 1866)

Notes: Contains the number of banks closed during each year. Closures are defined as those banks that closed and did not convert to a national charter. Dates of closure obtained from *Merchants and Bankers' Directory* .

evidence suggests that the Civil War was the primary cause of state bank closures in 1863, and the National Banking Act left the distribution of state banks roughly unchanged.[11]

National Banking Act of 1864

The lack of state bank conversions and large national banks in financial centers left Chase and his supporters troubled.[12] The primary cause of both problems was the lack of New York City bank conversions. New York City banks provided a safe place to earn interest on reserves. Over time, interior banks developed correspondent relationships in the city, and by 1860, almost 40 percent of all interbank deposits were in New York City banks.[13] However, because the Act did not count deposits placed in a state bank as reserves, interior banks that wanted to convert to a national charter would have to cancel their correspond relationships and move their deposits to another city. In this way, many banks were discouraged from becoming national banks.

The New York holdout also stemmed from the new reserves requirements. While the legislation encouraged country banks to place deposits in reserve city banks, it did not provide the same incentive for reserve city banks. In fact, reserve city banks might have to withdraw their deposits from other banks just to meet their reserve requirements. Rather than losing their main source of liquidity, New York City banks united in opposition to the new legislation, hoping to prevent the spread of national banking.[14]

To end the New York City holdout, the National Banking Act of 1864 restructured the reserve requirements. First, the reserve requirement of country banks was reduced to 15 percent.

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[11] I have not excluded these closures in the econometric analysis of Sections 4 and 5. When southern banks are excluded, the main results become stronger, suggesting that the bank closures were not the result of instability.

[12] Samuel Hooper, the Massachusetts congressman who introduced the first National Banking Act in the House, wrote to Chase in November of 1863, "I do not like having only small banks organized under the new law, and regret that no large banks are yet organized in the principle commercial cities to be made depositories of public money, as it seems to me very desirable". Quoted in Davis (1910, p. 168) and Gische (1979, p 45).

[13] For comparison, Boston had 15 percent and Philadelphia had 5 percent of the countries interbank deposits.

[14] Gische (1979) and Weiman and James (2006) describe the holdout in more detail.

Second, the number of reserve cities was raised to 16 and their banks were now allowed to hold up to half of their reserve in a New York City national bank.[15] Third, New York City was designated as the only central reserve city and its banks were required to hold their entire 25 percent reserve in vault cash. Finally, all non-central reserve city banks were required to redeem their notes at par in a larger city. The structure forced other banks to place reserves in other banks and established New York City as the official center of the banking world.[16]

Preventing state banks from enjoying the benefit of national banking without enduring its requirements, the Act revoked the ability of state banks to issue national bank notes. State banks could still issue their own unique notes, but they were, in many ways, inferior to the homogenous national notes. For the first time, banks had to decide between issuing state or national notes.

Capital requirements were also increased in an effort to establish banks capable of serving as depositories. National banks in a city with more than 50,000 people now needed $200,000 in capital, those with 6,000 to 49,999 people needed $100,000, and those in smaller cities still needed $50,000. As no state previously required a capital level of $200,000. the Act greatly raised entry barriers for new national banks and existing state banks.

The changes successfully broke New York City's holdout by converting its largest bank, Bank of Commerce ($10 million in capital), to a national charter.[17] By the end of 1864, 282 new national banks had been established and an additional 242 state banks converted. Seen in Figure 4-2, national bank expansion was still greatest in the Middle Atlantic and Northeast, but it was

[15] The reserve cities were St. Louis, Louisville, Chicago, Detroit, Milwaukee, New Orleans, Cincinnati, Cleveland, Pittsburgh, Baltimore, Philadelphia, Boston, Albany, Leavenworth, San Francisco, and Washington. Charleston and Richmond were added after the war.

[16] Weiman and James (2006) confirm that New York not only remained primary holder of interbank deposits but the size of those deposits also dramatically increased over time.

[17] The Bank of Commerce of New York was exempted (by name) from the double liability requirement.

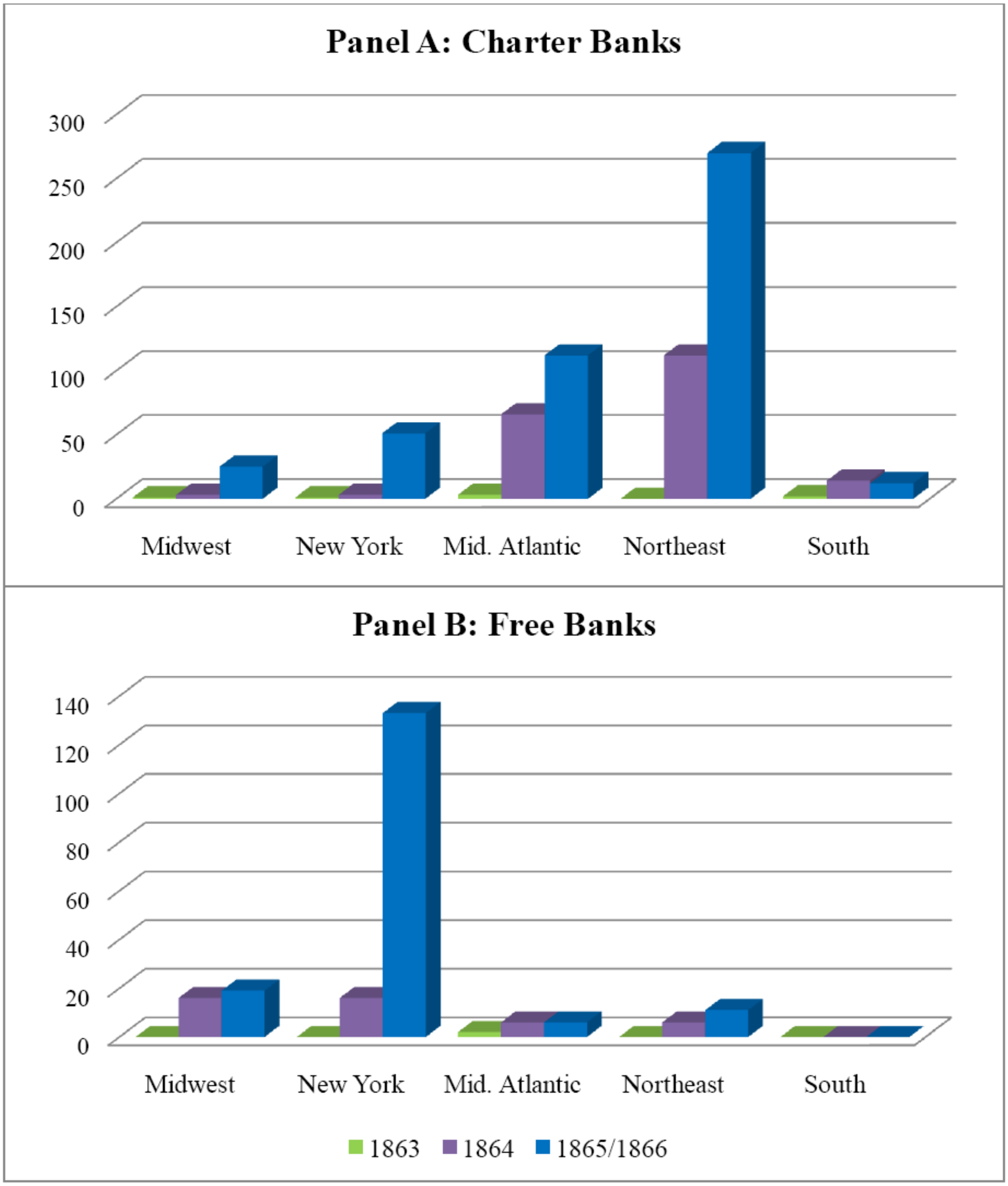

Figure 4-3: State Bank Conversions By Region (1863 - 1866)

Notes: Contains the number of state banks that converted to a national charter during each year. The matching criteria are described in the Data Section of the text. All dates are obtained from *Merchants and Bankers' Directory*.

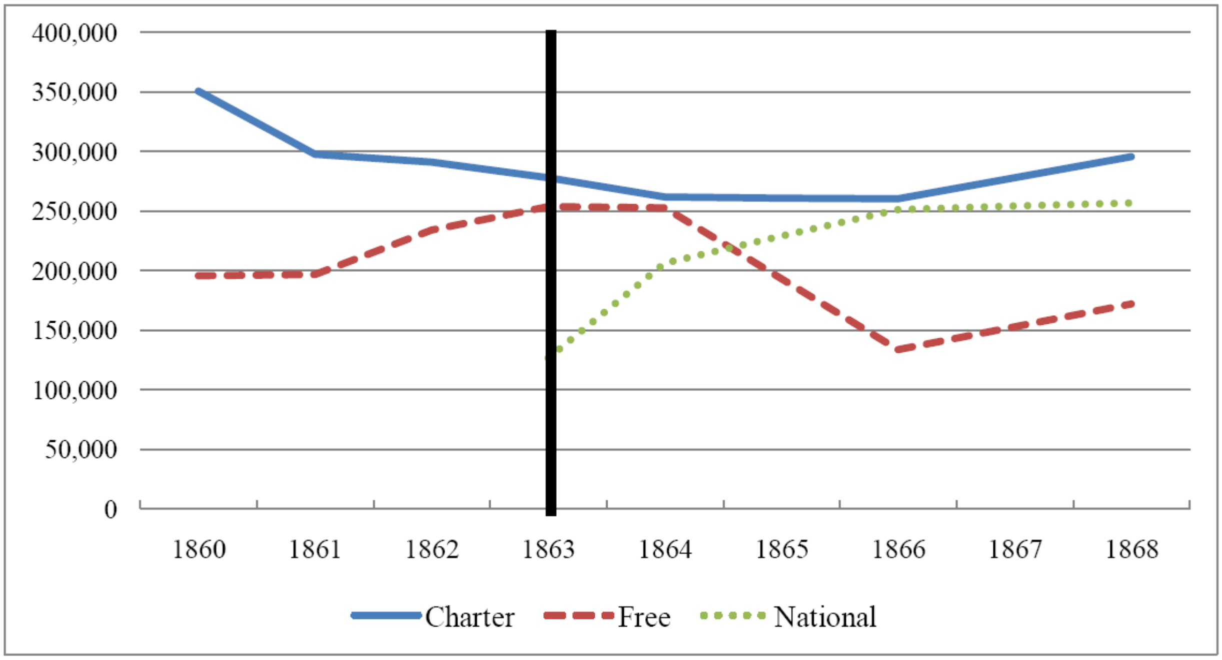

Figure 4-4: Average Capital By Bank Type (1860 - 1868)

Notes: Contains the average capital level of each bank type by year. Bank capital before 1861 are obtained from Weber (2008) and from the *Merchants and Bankers' Directory* after. The vertical line represents the National Banking Act of 1863. Due to lack of data, 1861, 1865, and 1867 are filled with a linear trend.

now concentrated in financial centers. For example, 36 banks were established in Boston, 14 in New York City, and 27 in Philadelphia. Seen in Figure 4-4, the average capital level of national banks also dramatically grew from $126,000 to $205,000. The capital growth, however, was due not to increased requirements, but rather to the conversion of state banks with an average capital level of $325,000.

State banks were beginning to convert at a high level, but 1,126 still remained at the end of the year. Corresponding to Sherman's march to the sea, the large number of closures in 1864 once again seems to be the result of the Civil War. Of the 97 closures, only 13 were outside of the South. State banks thus seemed capable of continuing under their state charter despite the National Banking Acts.

State Bank Note Tax (1865-1868)

While James (1978), Gische (1979), and Weiman and James (2006) argue that the wave of state bank conversions had only started to gain momentum, economic historians such as Hammond (1957) and White (1983) argue that the 10 percent state bank note tax passed in 1865 was responsible for the collapse of state banking. Instead of encouraging banks to convert to a more secured note issue, Gische (1979, p. 58) states, "The tax was seen by both its supporters and opponents as the final and conclusive blow to the circulation of state bank notes". The tax would not only drive state bank notes out of the market, but it would also force the majority of state banks to reevaluate their charter, as two-thirds still had more circulation than deposits.

The years after 1864 saw an explosion of national bank growth: 291 new national banks were established and 651 state banks converted. The average capital of national banks also grew to $255,000, making them comparable to charter banks and larger than free banks. By 1869, 1,650 national banks had been established and roughly half were former state banks. The national banking system was therefore constructed using a large amount of new capital.

The state bank note tax seems to be the only piece of legislation capable of closing state banks. Almost one-fourth of existing state banks closed between 1864 and 1869, leaving only 179 charter banks and 56 free banks in operation. Seen in Table 4-1, closures were concentrated in the Midwest where capital and reserve requirements were particularly low. On the other hand, free banks remained in New York and populated western cities such as Chicago and Madison, and surviving charter banks remained in the Northeast and populated southern cities such as Louisville and New Orleans. The data thus indicate that state banks stripped of note issue could only survive within densely populated areas where deposits were most likely prevalent.

Table 4-1: Outcomes of State Banks Present in 1863

	# of Banks in 1863	Converted	Closed	% Open in 1869
Midwest				
Charter Banks	100	28.0%	52.0%	20.0%
Free Banks	102	34.3%	48.0%	17.6%
New York				
Charter Banks	69	79.7%	8.7%	11.6%
Free Banks	240	63.8%	25.8%	10.4%
Middle Atlantic				
Charter Banks	230	78.7%	9.1%	12.2%
Free Banks	23	56.5%	34.8%	8.7%
Northeast				
Charter Banks	491	78.4%	10.6%	11.0%
Free Banks	19	89.5%	10.5%	0.0%
South				
Charter Banks	275	10.2%	75.3%	14.5%
Free Banks	2	0.0%	100.0%	0.0%
All				
Charter Banks	1,159	58.2%	28.8%	12.9%
Free Banks	386	56.5%	31.9%	11.7%

Notes: Percentages are based on the number of banks which were present at beginning of 1863. The definitions of closed and converted are discussed in the data section.

Data

The national bank restrictions focused on balance sheet requirements and locations, and therefore bank-level data are required to study the Acts' influence. However to date, bank-level data for the 1860's have only been examined for Georgia and Indiana (Redenius 2002), New York City (Weiman and James 2006), and Wisconsin (Krueger 1933; Keehn 1974). To expand on these studies, I created a complete census of banks from 1860 to 1869 using the *Merchants and Bankers' Directory*.[18]

[18] I cannot obtain the *Directory* from 1862, 1866, and 1868. Luckily, these years are not the focus of the chapter and can be merged into the following years data.

The annual directories provide the name and location of every bank in operation at the end of each year, as well as their president, cashier, and capital level. I determine when banks opened and closed by comparing the directories in successive years. The bank's characteristics then allow me to determine whether a state bank converted to a national charter when it did close.[19] I define a state bank as "converted" if its closing year, location, and at least two of four other characteristics (name, president, cashier, and capital level) match those of an opening national bank.[20] Finally, the census is linked to Weber's antebellum databases (2005b, 2008) to determine each existing bank's balance sheet, establishment date, and type (i.e. charter or free).

Consequences of National Banking Legislation

The National Banking Acts and state bank note tax had two opposite effects on the banking system. On the one hand, they converted or closed existing state banks, while on the other, they established new national banks. This section examines the pattern of creation and destruction at the bank-level to determine how and why the distribution of banks changed over time.

Determinants of State Bank Decline

I begin by modeling the destruction of the existing state banking system using a multinomial logit function. The dependent variable denotes a bank's outcome (survived, closed, converted) by a certain date, and the model identifies the conditional probability of each outcome through cross-sectional balance sheet variation across banks. I have chosen to use survival as the

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[19] Because the National Banking Act of 1863 required banks to adopt a name based on their entry order (e.g. First National Bank of Buffalo), the name and location of a closing state bank are often not sufficient to determine whether it converted to a national charter. While the requirement was repealed by the National Banking Act of 1864, there were still 634 First National Banks (about 33 percent of all national banks) in 1869.

[20] A match is generally made on three of the other characteristics. Looser restrictions lead to few additional matches.

base outcome, as the raw coefficients measure the probability of moving from the steady-state, but the choice does not affect the main results.[21] However, rather than reporting the raw coefficients which measure relative risk, I report the explanatory variables' marginal effect on the probability of each outcome to make the interpretation clearer.

Because banks would alter their behavior in response to new standards, I compare each state bank's composition in 1860.[22] The explanatory variables are thus observed prior to the Civil War and National Banking Acts, making them at least weakly exogenous to the events. Fitting the multinomial approach, the explanatory variables match both a bank's probability of closure and its ability to convert to a national charter.[23] The logarithm of capital measures the bank's size and ability to meet the national capital requirements. Reserves (defined as specie and due from other banks divided by circulation and deposits) measures the bank's ability to redeem notes and meet the national reserve requirements.[24] The ratio of circulation to circulation and deposits determines the bank's primary source of liquidity and the extent that the bank note tax would have affected it. The ratio of loans to assets measures whether loans were the bank's primary source of revenue and the extent that the prohibition of real estate loans would have affected it.

The regressions contain several independent variables in addition to the balance sheet items. The first is a free bank dummy which takes the value "1" if the observation came from a free bank and "0" otherwise. The dummy variable captures the differential outcome rate between the bank types. The interaction between the other independent variables and the dummy provides

[21] A Hausman test also fails to reject the independence of irrelevance alternatives.
[22] The resulting database contains about 80 percent of banks open in 1860. The missing banks generally had recently opened or were in the process of closing.
[23] I do not deflate capital and reserves based on population because I am jointly addressing closures and conversions. Such a deflation would help identify conversion coefficients, but bias those of closure.
[24] Deposits are composed of individual deposits and interbank deposits.

approximate slope differences. The number of years a bank had been in operation (controlling for a bank's reputation) and state dummies (controlling for the original state regulations and population) are also included in all regressions.

Whereas Chapter II illustrated a bank's probability of closure before 1863, Table 4-2 illustrates the probability of closure, survival, and conversion during the rest of the period.[25] Each regression is reported in three columns, one for each outcome. The first two regressions examine the outcomes for banks present in 1863, whereas the third isolates the effect of the state bank note tax by regressing only the outcomes of banks present in 1865.

Before looking at individual coefficients, a key result is visible by looking at the regression as a whole. State banks which survived the period seem very different than those that closed or converted. In every case but circulation, the absolute values of the closed and converted coefficients are almost indistinguishable. This stark result illustrates the birth of savings banks. While some savings banks existed in the Northeast before 1860, it was not until after the state bank note tax that they began to see widespread use. In fact, several of the surviving state banks changed their name to reflect their roles as savings or deposit institutions, and there were several hundred savings banks in operation across the country by 1875. The state bank note tax seemed to force the evolution of state banking by destroying those banks which could not survive as savings banks.

The free bank coefficient is statistically significant across all regressions. In a given state, a free bank is about 8 percent more likely to close and less likely to convert then charter banks, but not more or less likely to survive. The significance of the free bank coefficient for conversion is most likely due to the fact that free banks had more state debt than national debt.[26] A free bank

[25] The results are very similar when closures before 1863 are included or when southern states are excluded.
[26] See Rolnick and Weber (1984) for a breakdown of bond portfolios.

Table 4-2: Multinomial Determinants of State Bank Outcomes (1863-1868)

	Banks Present in 1863						Banks Present in 1865		
	(1)			(2)			(3)		
	Closed	**Survived**	**Converted**	**Closed**	**Survived**	**Converted**	**Closed**	**Survived**	**Converted**
Free Bank Dummy	0.082**	-0.001	-0.081**	0.893***	-0.001	-0.892***	0.936***	-0.001	-0.935***
	[0.039]	[0.001]	[0.039]	[0.259]	[0.004]	[0.257]	[0.230]	[0.040]	[0.201]
ln(Capital)	-0.099***	-0.001***	0.100***	-0.085***	-0.001	0.085***	-0.074***	-0.005	0.079***
	[0.023]	[0.000]	[0.023]	[0.024]	[0.001]	[0.024]	[0.026]	[0.004]	[0.029]
Reserves	-0.264**	-0.002	0.266**	-0.215	-0.001	0.215	-0.082	-0.003	0.084
	[0.120]	[0.002]	[0.120]	[0.164]	[0.003]	[0.164]	[0.137]	[0.023]	[0.143]
Circulation/(Circulation+Deposits)	0.148*	-0.005***	-0.144*	0.258**	-0.006***	-0.252**	0.258**	-0.050**	-0.208
	[0.079]	[0.002]	[0.080]	[0.102]	[0.002]	[0.102]	[0.117]	[0.025]	[0.138]
Loans/Assets	0.092	-0.001	-0.091	0.131	0.001	-0.132	0.137	-0.004	-0.133
	[0.079]	[0.002]	[0.079]	[0.140]	[0.004]	[0.141]	[0.172]	[0.028]	[0.182]
Free Bank Interactions									
ln(Capital)				-0.026	-0.001	0.026	-0.035	-0.007	0.042
				[0.045]	[0.001]	[0.045]	[0.050]	[0.008]	[0.049]
Reserves				-0.200	-0.002	0.203	-0.286*	-0.016	0.302*
				[0.194]	[0.003]	[0.194]	[0.150]	[0.035]	[0.157]
Circulation/(Circulation+Deposits)				-0.231*	0.003	0.228*	-0.307*	0.014	0.293
				[0.127]	[0.004]	[0.129]	[0.158]	[0.040]	[0.188]
Loans/Assets				-0.171	0.001	0.170	-0.086	0.028	0.058
				[0.165]	[0.004]	[0.165]	[0.189]	[0.037]	[0.170]
Location Dummies?		State			State			State	
Observations		1,191			1,191			896	
Pseudo R-squared		0.266			0.271			0.207	

Notes: The multinomial logit regression models the probability that a bank would be closed, converted, or open in 1869. All regressions include state dummies and the cumulative number of years a bank was open. Coefficients are calculated marginal effects. Standard errors are provided in brackets and clustered by state. * denotes significance at 10%; ** at 5% level and *** at 1% level. The probability of closed, survived, and converted after 1863 are 19, 11, and 70 percent respectively.

would therefore have to sell less expensive state bonds and purchase national bonds before converting to a national charter.

The circulation variable is a significant determinant of all three outcomes. The more circulation a bank had relative to its deposits, the more likely that it would close and the less likely that it would convert to a national charter or remain open. However, the coefficient on survival is slightly reduced and loses statistical significance for outcomes of banks present in 1865. The reduction of the coefficient suggests that the state bank note tax might have encouraged a small number of banks to convert but the number was insignificant compared to the number of banks that it closed. The pattern indicates that the state bank note tax's primary effect was bank destruction not conversion.

An increase in circulation relative to deposits seems to have larger effect on the probability of closure (or conversion) for a charter bank than a free bank, but the effect is only marginally significant. The sum of the level and interaction coefficients retains its sign for outcomes of banks present in 1863, but loses it for banks present in 1865. Circulation, therefore, increases a free bank's probability of closure at a reduced rate for the full period, but has little effect on free banks after 1865.

Reserves and loans are not robustly correlated with any bank outcome. The insignificant coefficient on reserves provides evidence that banks already had sufficient interbank deposits, whereas the high standard errors on the loan coefficients are not surprising given that I cannot isolate real estate loans. The signs on the loan coefficients at least suggest that the prohibition on real estate lending was not an entry barrier for conversion.

Banks with a large amount of capital seem the most likely to convert. A state bank's capital level is negatively correlated with closure and positively correlated with conversion. On the other hand, large capital levels are not correlated with survival. The coefficients are also economically significant. Increasing a bank's capital from $50,000 to $100,000 would decrease the probability of closure and increase the probability of conversion by 8 percentage points. Because the coefficients on the other two national bank requirements, loans and reserves, are statistically insignificant, the high capital requirements seem to be the primary entry barrier for state bank conversion.

These results lend weight to the arguments of James (1978), Gische (1979), and Weiman and James (2006). Converted banks are associated with high capital levels, closed banks with high circulations, and surviving banks with large amounts of deposits. In this way, the capital requirements of the National Banking Acts prevented small state banks from converting, whereas the state bank note tax prevented the remaining banks of circulation from operating under their original charter. The note tax also seems to be primarily associated with bank closure and could have reduced the number of banks unnecessarily.

Figure 4-5 displays these conclusions from a geographic perspective. Panel A shows that the majority of closed banks were located in the Midwest or South. On the other hand, Panel B shows that bank conversions were almost entirely in the Northeast. Matching the regression results, areas with high circulation and low capital requirements (Midwest and South) lost a large number of state banks, and areas with high capital requirements (Northeast) saw a large number of conversions.

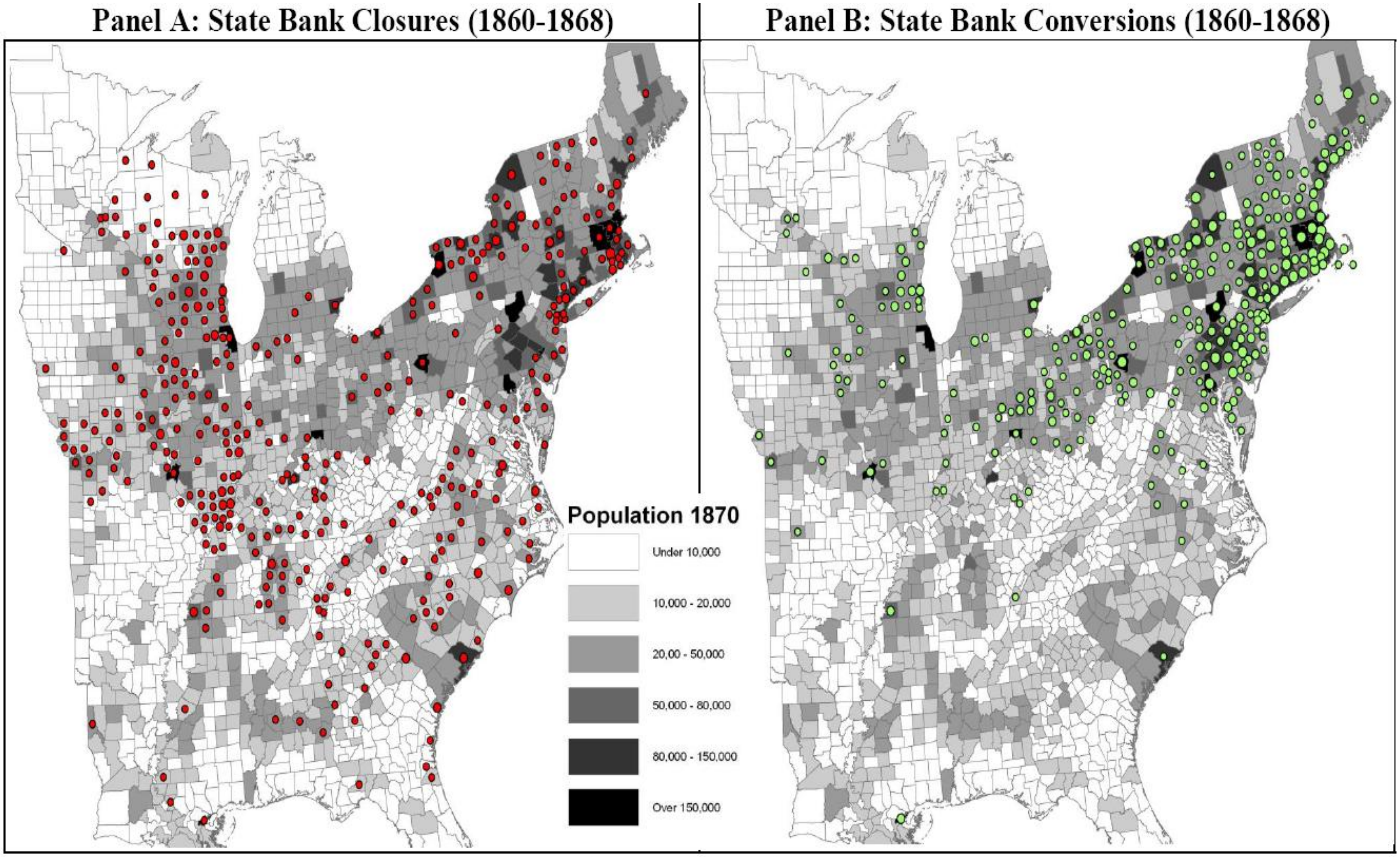

Figure 4-5: Locations of State Bank Closures and Conversions

Notes: The figures map the location of each state bank that closed or converted between 1860 and 1868. The size of the dot denotes the number of banks in the county, whereas the underlying shading displays the population of that county in 1870. County-level population was taken from Haines (2004). Due to the few banks west of the Mississippi River, I have censored the map at that point.

Determinants of New National Banks

The National Banking Acts created 784 new banks by 1869. However, unlike the previous section, the compositions of these new banks are endogenous to its entry decision and cannot be compared. Therefore to study the creation of new banks, I model the number of new national banks that enter county *i* in year *t* as a linear function of the composition of each county.[27]

The size of a county is measured by the logarithm of population in 1860 and the change in the log of population between 1850 and 1860 to avoid any endogenous changes caused by bank entry.[28] The county's industrial composition is measured by the share of its population in manufacturing in 1860,[29] and its banking composition is measured by the number of state banks in year *t*, the number of closed state banks since 1860, and the number of national banks in year *t-1*. Presented in Table 4-3, the regression is estimated separately for 1863, 1864, and 1865/1866 to allow each piece of legislation to affect entry decisions differently.

The coefficients on population are always positive and statistically significant. New national banks were attracted to populated areas, but not necessarily the fastest growing areas. Matching the conclusions of Sylla (1969), national bank capital requirements seemed to need the support of a large population and prevented banks from entering areas which had not yet reached some threshold. In fact, only 24 national banks were located in counties with fewer than 10,000 people in 1869 even though almost half of the country had fewer.

[27] This approach is similar to that found in Carlson and Mitchener (2009). All non-bank information comes from Haines (2004). State dummies are included in all regressions.
[28] Using the urban population instead of total population leads to the same results only larger coefficients.
[29] When I account for agricultural production, land, or value instead of manufacturing, the results remain the same with a changed sign.

Table 4-3: Determinants of New National Banks (1863-1866)

	# of New National Banks Entering County in Year		
	1863	1864	1865/1866
	(1)	(2)	(3)
# of State Banks In Current Year	0.032***	0.090***	0.142***
	[0.009]	[0.032]	[0.028]
# of Closed Banks Since 1860	-0.011	-0.073***	0.141***
	[0.021]	[0.022]	[0.048]
# of National Banks In Previous Year		0.010	0.002
		[0.113]	[0.016]
Ln(Population)	0.113***	0.153**	0.142***
	[0.035]	[0.074]	[0.046]
Change in Population (1850-1860)	-0.018	0.042	-0.011
	[0.018]	[0.028]	[0.030]
Labor Share of Manufacturing	1.289*	2.427	1.997**
	[0.745]	[1.970]	[0.918]
Location Dummies?	State	State	State
Observations	1,613	1,613	1,613
R-squared	0.277	0.395	0.286

Notes: The table presents the results of an ordinary least squares regression. The dependent variable is the number of new national banks that opened in the county. Each column represents a different year of entry. All regressions include state dummies. Standard errors are provided in brackets and clustered by state. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Counties with large manufacturing labor shares also attracted new national banks. The more individuals employed in manufacturing the more likely a national bank would be established in the area.[30] A 10 percentage point increase in manufacturing share would lead to 0.13 to 0.24 additional national banks in an area. Because the average number of national banks in a county was only .711, the effect of manufacturing on bank growth is both statistically and economically significant.

[30] A similar result is found when manufacturing capital or firms per capita is used instead of labor share.

The banking coefficients show no evidence of crowding out. In fact, the coefficient on state banks is positive and significant, suggesting that national banks were attracted to counties with state banks. The complementary is most likely the result of a bank's demand for depositors. As seen in the previous section, surviving state banks were located in large deposit areas, a trait also desired by national banks.[31] National banks also had an incentive to replace the circulation lost when state banks were stripped of their note issue capability. In this way, state banks evolved into savings banks whereas national banks filled the need for banks of circulation.

Alternatively, the coefficients on closed state banks are all significantly below 1 suggesting that national banks did not fully replace state banks. In fact, they seem to avoid those places with closed banks before 1865. Even in 1865/1866, at most 1 national bank would be established for every 7 closed state banks. Because the capital of new national banks was roughly the same as closing state banks, one national bank could not replace the capital of several state banks.

These results indicate that new national banks located in densely populated counties with large manufacturing sectors. Confirmed in Figure 4-6, there was a large number of new national banks in the Midwest and South, but very few in low population areas. Instead, new bank growth primarily occurred in counties with the largest populations (e.g. Chicago and St. Louis). The maps also indicate that the National Banking Acts concentrated new capital in previously developed areas, particularly along what would come to be known as the "Manufacturing Belt".

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[31] James (1979) discusses the growth in the importance of deposits during the National Banking Era. Krueger (1944) shows that national banks had a large number of deposits relative to state banks in Wisconsin.

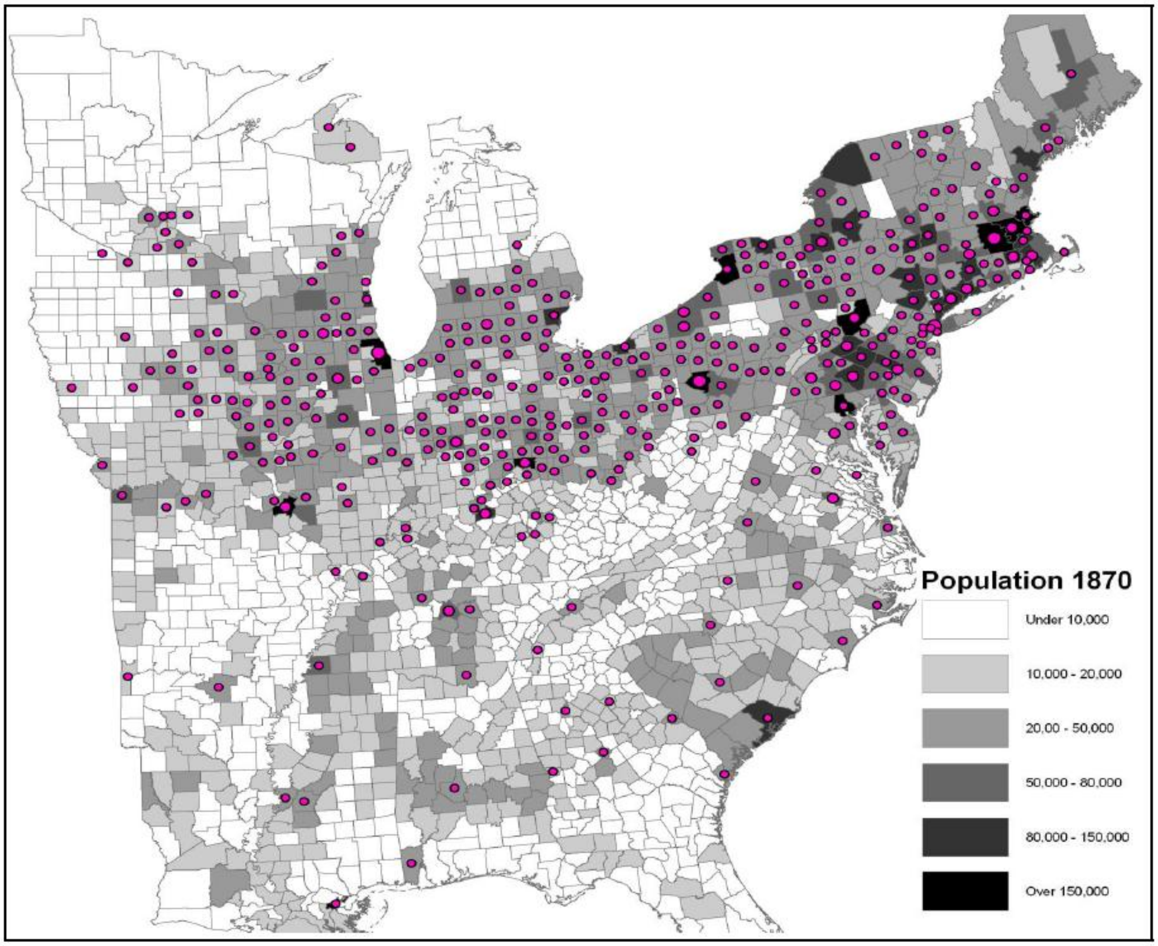

Figure 4-6: Locations of New National Banks (1863-1868)

Notes: The figure maps the location of each new national bank that opened between 1863 and 1868. The size of the dot denotes the number of banks in the county, whereas the underlying shading displays the population of that county in 1870. County-level population was taken from Haines (2004). Due to the few banks west of the Mississippi River, I have censored the map at that point.

Counterfactual Analysis

The conclusions from the previous sections have implied that the state bank tax might have unnecessarily reduced the number of banks. This section attempts to determine the full effect of the tax by describing the distribution of banks if the state bank note tax was not passed. Specifically, I assume that the closures during 1865 and 1866 did not occur. This choice purposely keeps the new national banks that opened in response to state bank closures for two reasons. First, the number of banks that entered in response to the closures was small, about 28

Table 4-4: Counterfactual Distribution of Banks Without State Bank Note Tax

	Actual # of Banks in 1868	# of Banks If No State Bank Note Tax	% Difference
All Counties	1,865	2,067	10.8%
Region			
Midwest	367	453	23.4%
South	146	171	17.1%
New York	342	373	9.1%
Northeast	547	591	8.0%
Middle Atlantic	463	479	3.5%
Population			
Less than 10,000	24	37	54.2%
10,000 to 49,999	946	1,063	12.4%
50,000 to 99,999	328	361	10.1%
100,000 to 299,999	410	443	8.0%
More than 300,000	157	163	3.8%
Avg. Capital Level			
Less than 50,000	32	94	193.8%
$50,000 to 99,999	398	450	13.1%
$100,000 to 199,999	766	816	6.5%
$200,000 to 999,999	576	608	5.6%
More than $1,000,000	93	99	6.5%

Notes: Table presents the counterfactual distribution of banks if there had been no closures during 1855 and 1856. When examining the population results it is helpful to note that 48 percent of counties had less than 10,000 people, 47 percent had 10,000 to 49,999, leaving about 1.5 percent in the remaining population categories. The 5 banks without capital records are listed as "Less than 50,000".

new banks. Second, national banks that did respond would have done so in high population areas therefore only biasing the numbers against finding a large difference between rural and urban regions.

Table 4-4 shows that the tax had the greatest effect on the Midwest, but most regions were affected. However, to view the full impact of the tax, the counterfactual must be broken down county population. In this case, the results are much clearer: the state bank note tax primarily stripped capital from rural areas. If the tax was not imposed, there would have been over 50 percent more banks in areas with less than 10,000 people, around 11 percent more for areas with 10,000 to 99,999, and less than 10 percent more for more populated counties. Therefore most geographic regions were affected by the state bank note tax, but the loss of banks was concentrated in the rural counties of those regions.

Another important result is seen when the counterfactual is displayed relative to bank capital levels: only the smallest banks were destroyed. The note tax destroyed roughly two-thirds of all banks with capital levels of less than $50,000, but only 6.5 percent of banks with more than $100,000. As suggested by the multinomial coefficients, the state bank note tax greatly shifted the distribution towards large banks.

Conclusion

The National Banking Acts of 1863 and 1864 and the state bank note tax of 1865 were conceived as a way to secure the banking sector, but they ultimately caused a dramatic redistribution of bank capital. Over the course of the decade, 589 state banks closed and 879 converted to a national charter, whereas 752 new national banks were established. Using a newly created bank census, this chapter isolates the bank-level causes behind these radical changes.

Figure 4-7 illustrates how the geographic distribution of banks changed. In 1860, banks do not seem to be restricted to high population areas and many were located in less populated counties. However, over the course of the decade, there was a shift towards high population areas. Densely populated areas such as Southern Michigan gained a large number of banks, whereas rural areas such as Alabama, Missouri, and Wisconsin lost a large number of banks. The legislation thus created bank capital around the Midwest’s “Manufacturing Belt” and destroyed it in other areas. The question for future studies is whether this redistribution benefited or harmed the country’s development.

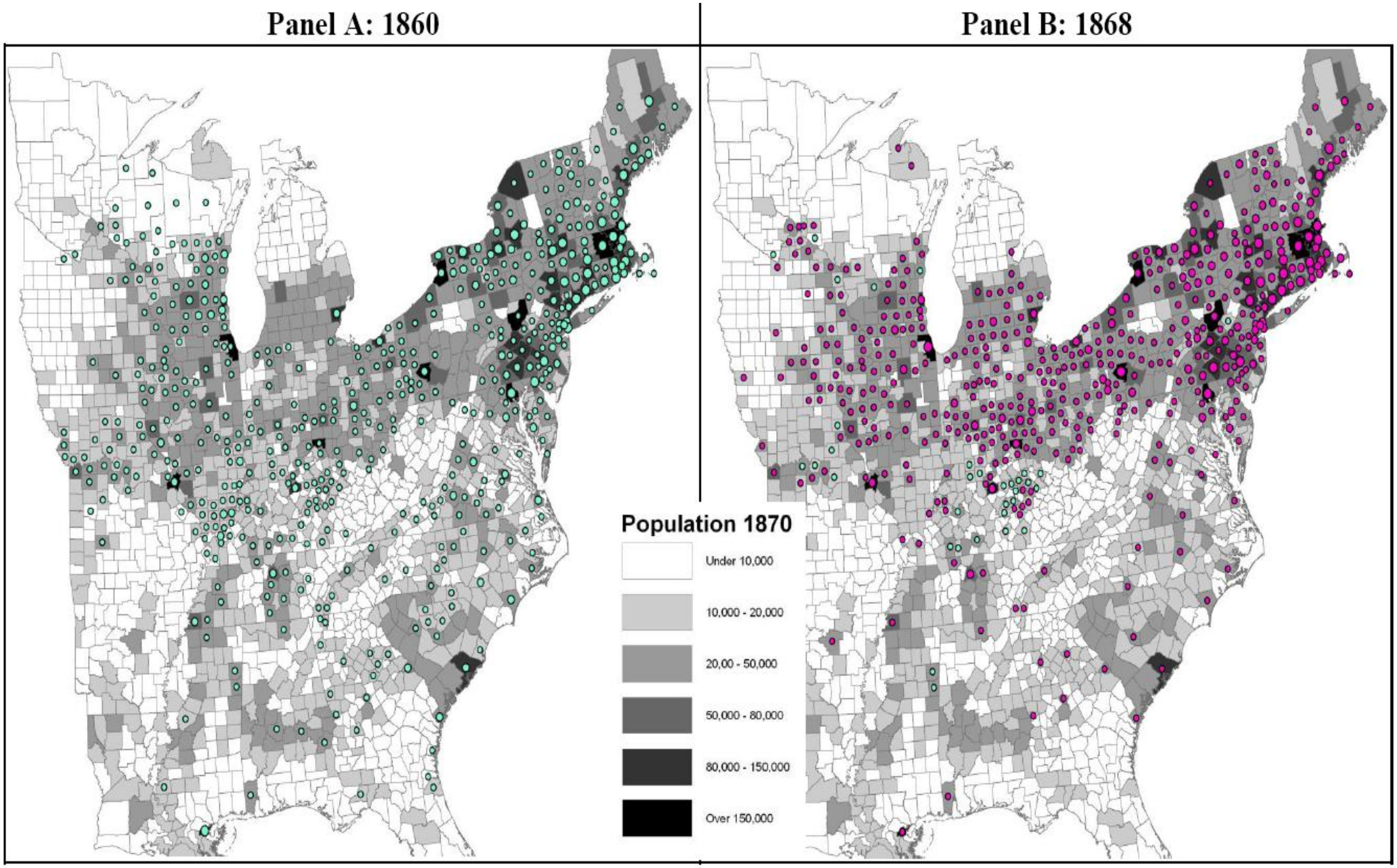

Figure 4-7: Distribution of Banks

Notes: The figures map the location of each bank in 1860 and 1868. The size of the dot denotes the number of banks in the county. Dark dots correspond to national banks, whereas lighter dots correspond to state banks. The underlying shading displays the population of that county in 1870 from Haines (2004). Due to the few banks west of the Mississippi River, I have censored the map at that point.

A comparison of existing state banks shows that the National Banking Acts' capital restrictions prevented small state banks from converting, whereas the state bank note tax prevented them from continuing to operate under their original charter. On the other hand, new national banks did not simply replace closing state banks, locating instead in densely populated counties with large manufacturing sectors. Even though the legislation attempted to emulate the free banking spirit, the results show that it ultimately destroyed the small banks in rural areas that free banking had established.

State banks that survived the period were fundamentally different from those that converted or closed in one respect: they held large numbers of deposits. The note tax thus seems to have the unintended benefit of forcing state banks to evolve into savings bank. Savings banks existed within the Northeast before 1860, but it was not until the decade after the note tax that savings and deposits banks spread throughout the country.

CHAPTER V

CONCLUSION

Through a unique collection of compositional (e.g. balance sheets and note discounts) and environmental (e.g. bond portfolio values and passenger travel costs) data for almost every antebellum bank, this dissertation provides the first bank-level view of the U.S. Free Banking System. The depth of the data not only augments previous descriptive studies, but also enables a modern econometric reassessment of free banking's most controversial topics. Following the "new financial history" literature, the dissertation conclusions transcend the historical context and shed light on many continuing problems in finance.

The lessons most clearly learned from free banking are the problems associated with reactionary and near-sighted bank regulations. States believing their banking capital was insufficient sought to lower entry barriers and encourage growth. In the rush to liberalize, however, states did not take proper precautions to create stable banks. Instead the underlying security requirement of the entire banking system failed to take the variability of state debt into account. On the other hand, the "solution" to free banking, the National Banking Acts, raised requirements too far, preventing even stable banks from operating in rural areas. Therefore, despite radically different goals, both regulations over-reacted and by doing so limited the benefits of the entire system. This type of oscillation between strict (e.g. Glass-Steagall Act of 1933) and loose (e.g. Gramm-Leach-Bliley Act of 1999) regulations continues to create unforeseen problems even in the modern system.

On the other hand, the period's most successful regulations were those that gradually amended problems as they occurred and adapted to changing market risk. For instance, New York and Indiana free banks experienced few failures after they adjusted their bond requirements, whereas the lowering of national bank capital requirements in 1900 led to tremendous bank growth. Attentive and flexible legislatures were able to create stable financial systems and encourage growth by adjusting regulations as needed, rather than waiting until an entire new set of rules was seen as the only option. The outcomes of small careful adjustments are much easier to predict, and therefore seem to avoid the unexpected consequences that accompany large changes in regulations.

The dissertation's final lesson is that individuals and banks are able to adjust quickly to changes in risk and regulation. During the antebellum period, private note brokers were able to efficiently price over 2,500 unique bank notes without federal regulators or modern security exchanges. Through their efforts, the secondary note market protected individuals from losses and potentially allowed bank notes to circulate around the country. Similarly, stable banks diversified their portfolios around the free banking's bond-secure note issue. Even stripped of their note issue capacity, some free banks were able to evolve into savings banks. In this light, it is even more important for legislatures to continuously adapt bank regulations over time to match current market conditions and the bank behavior, rather than allow regulations to become out of date.

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