REPUTATION FORMATION IN EARLY BANK DEBT MARKETS

by

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Abstract

Two hypotheses concerning firms issuing debt for the first time are tested. The first is that new firms' debt will be discounted more heavily by lenders, compared to firms which have credit histories (but are otherwise identical), and that this excess discount declines over time as lenders observe defaults. The declining interest rate corresponds to the formation of a "reputation," a valuable asset which provides an incentive for firms to not choose risky projects. The second hypothesis is that prior to the establishment of a reputation new firms issuing debt are monitored more intensely. The sample studied consists of new banks issuing bank notes for the first time during the American Free Banking Era (1838-1860). The presence of a reputation effect in debt prices is confirmed: the debt of new banks is discounted more heavily than banks with credit histories. Note holders are then motivated to monitor new banks because the excess discount provides an incentive for notes of new banks to be redeemed. As lenders learn that new banks can redeem their notes, the discount declines as predicted for surviving banks. The precision of learning increases during the period due to technological improvements in information transmission, namely, the introduction of the telegraph and the railroad. The results explain why the pre-Civil War system of private money issuance by banks was not plagued by problems of overissuance ("wildcat banking").

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I. Introduction

This essay studies the formation of reputations in debt markets. The particular focus is on the market for bank notes during the American Free Banking Era (1838-1860) during which time large numbers of firms entered banking and issued debt in the form of perpetual, non-interest-bearing, risky debt claims, offering the right of redemption on demand at par in specie. The consensus of recent research holds that wildcat banking was not a pervasive problem during this period (see Rockoff 1974A, 1974B, 1975, 1985, 1989) and Rolnick and Weber (1982, 1983, 1984, 1988)), but there is no explanation of the mechanism that prevented wildcat banking.[1] The main question addressed in this paper is whether market mechanisms, monitoring and reputation formation, existed which provided incentives for banks to not engage in wildcat banking.

The theory of reputation formation in debt markets which is tested here is due to Diamond (1989). Diamond considers an observationally equivalent cohort of firms issuing debt for the first time. Some of the firms have high risk, negative net present value, projects; some have low risk, positive net present value, projects; and some may choose between the high and low risk projects. When these firms issue debt for the first time there is a lemons problem causing lenders to charge a premium to the new firms above the interest rate charged to firms that have credit histories but which are otherwise identical (hereafter called "seasoned" firms). The main result of Diamond concerns the dynamic behavior of this lemons premium. Over time, lenders observe defaults and, as a consequence, reduce the premium required on the remaining new firms' debt since, on average, firms with high risk projects will have defaulted. Since, for a given project, the lower interest rate increases the present value of the borrower's rents, the credit history of being a surviving firm is a valuable asset and corresponds to a "reputation." But, the lower interest rate has an additional effect as well since the firms which can choose between projects may find the safer project more attractive. The importance of reputation in Diamond's model is that it affects the actions of some borrowers since it is increasingly costly to default as time goes by. Insofar as some borrowers default over time this incentive becomes stronger.

The theory predicts that: (1) firms issuing debt for the first time should pay higher interest rates than otherwise identical firms; (2) over time lenders will lower the premium, conditional on having observed defaults until, eventually, the premium disappears. This study is concerned with testing these predictions. The predictions of the model are tested in an environment where the issues arise in a very clear way and which has the advantage of relative ease in testing the theory.

During the American Free Banking Era many states passed free banking laws that eased the

restrictions on entry into banking. (See Table 1.) Banks during this period issued debt primarily in the form of bank notes which were used as media of exchange. These notes circulated at discounts from face value at locations some distance from the issuing banks. An important issue concerning the period is whether or not some banks had an incentive to behave as "wildcat" banks, that is, banks that chose to inflate their currencies beyond the point where they could be continuously redeemed, absconding with the proceeds. More generally, the question concerns how well private money systems can function. In particular, does the notion of reputation provide an effective mechanism for private money-issuing firms to not behave as wildcat banks? Klein (1974) explicitly argues that competitively supplied private monies can exist because of the ability of issuers to establish reputations. The period is also interesting because of enormous technological change; both the railroad and the telegraph were introduced during this period and rapidly diffused across the country. Part of this study assesses the effects of this technological change on reputation formation.

A) Reputations and Debt Markets

It is not obvious that debt markets behave in the way Diamond hypothesized. It may be the case that there is enough information available initially to discriminate among different types of firms. In the modern era, corporate debt is typically rated before it is issued. Before firms issue debt publicly for the first time, they have credit histories based on experiences with banks and venture capitalists. Using these histories, and other publicly available information, ratings firms and market participants may be able to screen borrowers initially so that there is no initial premium charged on their debt and no subsequent learning. Even the category of "no rating" may be informative.[2]

A related issue concerns which firms choose to issue debt. In the model of Diamond (1989) firms do not have a choice concerning whether to issue debt publicly. The theory may hold if all firms had to issue debt publicly, but, in reality, it may be that firms only issue debt if their characteristics are sufficiently well-known that they do not have to pay a premium (relative to seasoned firms) on their initial debt issuance. Alternative sources of borrowing include privately placed debt, bank debt, and venture capitalists. Diamond (1991) considers the same model as in Diamond (1989) but where firms have a choice of financing their projects with bank loans or with publicly issued debt. The main result there is that firms will choose to be monitored by banks until their reputations are established and then issue public debt.

Empirically testing for the presence of reputation effects with modern data presents enormous difficulties. The main problem is that a counterfactual is posed: whether new firms are charged a premium which declines over time requires knowing what the interest rate would be if the same firm had a reputation. Such a comparison poses the difficult problem of finding a seasoned cohort of firms with the same asset risk. Note that this cannot easily be done on the basis of bond ratings. If the Diamond (1989) theory is correct, then new firms should have lower bond ratings than otherwise identical firms. Over time the ratings of the survivors should converge to the rating of the seasoned firms. But, in that case, the benchmark cohort cannot be formed using bond ratings. Since bond ratings are presumably formed using the available information, it is not clear how the researcher, using the same information, can separate risk due to lack of credit history from risk due to fundamentals. If Diamond (1991) is correct, then new firms borrow from banks and the interest rates on their loans must be compared to the benchmark cohort (but loan interest rate data are generally unavailable).

An additional empirical problem is that in Diamond's theory lenders learn by observing defaults, but these happen only over relatively long periods of time for most entering cohorts of firms. In a study of junk bonds, Asquith, Mullins and Wolff (1989) find that default rates are low immediately after issue and rise over time. The length of time required for a significant number of defaults to occur, and hence result in a lower premium for the remaining firms, would seem to make tracing the evolution of the premium especially hard since it is measured relative to the fundamentals of an otherwise identical firm. But, the longer the time it takes learning to occur, the more likely that the fundamentals of the new firms and those of the benchmark firms will diverge. Thus, practically, it seems impossible to determine an accurate benchmark interest rate to test for the presence of an initial premium.[3]

B) The Free Banking Era

In this paper a sample of firms which avoids many of the above difficulties is used to test the theory. The sample consists of pre-Civil War banks issuing debt for the first time. The debt consists of bank notes which were the distinct private monies of banks during this period (1838-1863). A bank note was a noninterest-bearing, risky, perpetual debt claim on the bank which could be redeemed at par on demand. This was effectively the only private debt that was publicly issued during this period.[4] Moreover, to operate as a bank required issuing bank notes. Thus, there can be no selection bias in which firms issued debt. All firms operating as banks issued bank notes. Section II provides some

background on bank notes during the Free Banking Era.

To address the issue of why this period was not characterized by widespread overissuance of private money I focus on four issues. First, I ask whether Diamond's dynamic lemons premium theory characterizes debt issuance during this period, i.e., were new banks charged higher premia (relative to otherwise identical seasoned peers) and did these premia decline over time? During the Free Banking Era bank notes were not rated and banks could not have prior histories without having issued bank notes. Nevertheless there may be prior information which is relevant, perhaps concerning the individuals in charge of the bank or information concerning the bank's capital ratio, ratio of notes to capital, amounts of reserves, and so on. The hypotheses are not mutually exclusive: lenders may be able to discriminate to some extent, but reputations may also be important.

The second issue concerns how note holders monitored banks. I show that the redemption option in the bank note contract provided a mechanism for note holders to monitor banks and that a higher discount (from face value) on the notes of new banks would give them an incentive to monitor. By redeeming the notes of new banks with high discounts and observing whether these banks can honor their obligations, note holders learn whether new banks are riskier than other banks at that location.

The third question concerns the effects of cross-section variation in public and private arrangements concerning banking in the various states. If there is sufficiently widespread adverse selection initially, then according to Diamond, reputation cannot serve to deter firms from choosing excessively risky projects which, in this case, might include banks "overissuing" monies, so-called wildcat banks. The degree of adverse selection may have varied across states, affecting the extent to which the notes of new banks may have been discounted (relative to seasoned peers). I test for the presence of such factors.

Finally, the ability of market participants to produce and receive information about new banks and their ability to exercise the redemption option by carrying the note back to the issuing bank are influenced by technology. In the 1840s the technology available to transmit information and the transportation technology were primitive. But, the technology rapidly improved over the period with the introduction of the telegraph and the diffusion of the railroad. I investigate whether technological changes affect reputation formation and monitoring using a measure of technological change constructed from pre-Civil War travellers' guides .

C) Outline of the Model and Tests

The basic empirical strategy of the paper is to compare the discounts (from face value) on the bank notes of new banks to the discounts on the notes of existing banks with credit histories (seasoned banks) at the same location. But this is reasonable only if the seasoned banks at the particular location are comparable in every way except that they have credit histories. Section III introduces a model, based on Gorton (1993), which has the limited goal of addressing this issue. The model shows that the notes of all (solvent) seasoned banks (at a given location) will trade at the same price. It is important to establish *a priori* that all the seasoned banks at a given location have the same risk so that the seasoned note prices can be used as benchmarks against which the prices of new banks' debt can be compared.

The model prices a bank note and shows that the value of the note declines as it is carried further and further away from the issuing bank. This decline in value is greater if the risk of the bank's portfolio is greater. A consequence is that consumers are not indifferent between the notes of two banks an equal distance away, but with different risks, even if those risks are priced. The reason is that the value of a claim on the riskier bank will be worth less in terms of consumption at a distant point. Consequently, consumers will send the notes of the higher risk bank back for redemption. Thus, an important conclusion of the model is that higher risk banks at a given location are monitored via more frequent note redemptions. The redeemability of notes means that bank type (asset risk) can be checked very quickly. It is shown that this monitoring mechanism supports the equilibrium in which all seasoned banks (at a given location) have the same risk.

The model predicts that banks the same distance away will have notes trading at the same discount. A bank with notes trading at a higher discount is either a seasoned bank which became insolvent or a new bank which must adjust its balance sheet to reduce its risk to be consistent with the risk taken on by its seasoned cohort. When the information about the ability of a new bank to honor notes is transmitted to distant locations, the price of its notes should adjust, contributing to the formation of the bank's reputation. The model, thus, addresses an apparent paradox in free bank note prices, namely, that all solvent, seasoned, banks at a given location have notes trading at the same price. The model explains that this is a result of the fact that bank notes functioned as a medium of exchange.

Section IV examines the predictions of the model as a prelude to using the prices of seasoned cohorts as a benchmark for the subsequent analysis. In particular, I examine whether the bank notes of seasoned solvent banks at particular locations do, in fact, trade at the same price. I also look for

evidence that higher risk new banks' notes tend to be sent for redemption.

In Section V the main hypothesis of interest is tested, namely, the question of whether the debt of new banks is discounted more heavily than is the debt of seasoned peer banks. In addition, I investigate whether the prices of new banks' notes are fair lemons premia.

If cross-section variation in public and private banking arrangements in different states affects the degree of adverse selection, then this should be reflected in the initial discounts on new banks' notes. This is examined in Section VI. Section VII examines whether the initial note prices differentiate between banks that subsequently go bankrupt and those that do not. Section VIII examines the issue of technological change. An index of technological progress is introduced and used to analyze the effects of technological change on the ability of market participants to discipline banks. Section IX concludes.

II. Pre-Civil War Bank Debt Markets

In pre-Civil War America banks could open by obtaining a charter from a state legislature, and satisfying state regulations concerning capital and reserves, or, if the state allowed free banking, by depositing specified (state) bonds with a state regulatory authority, allowing them to issue private money.[5] If a free banking law was passed, then free and chartered banks could coexist if free banks entered the industry. (See Table 1.)

All banks (free and chartered) issued distinct private monies, bank notes. Notes were issued in convenient denominations to facilitate use as media of exchange. Bank notes were pervasively used as a medium of exchange because there was no viable alternative medium. During this period the government did not print paper money and there were problems with the available coins. Not only was specie difficult to transport, but most coins were foreign so there was a confusing array of denominations. There was no domestic coin between the 50 cent piece and the $2.50 gold dollar. Moreover, the law did not provide for the reminting of underweight coins which meant that coins might have a negative rate of return.[6]

Banks issued notes to finance loans, mortgages, and stock purchases. The notes then circulated as a medium of exchange. At the bank's home location the notes circulated at par because of the redemption option. At the home location of the issuing bank any note price below par would result in the immediate exercise of the option allowing the note holder to obtain specie (if the bank was solvent). Consequently, all transactions using the notes of banks at that location would be conducted at par,

consistent with Fama (1983) who argued that this would be the case for non-interest-bearing private monies.

During this period, however, there were large interregional trade flows.[7] Such trade may have been conducted with bank notes. There is indirect evidence that the volume of circulating notes at distant locations was sizeable. For example, in 1864 one observer commented:

> There are no less than one thousand different kinds of bank notes, which every businessman in New York or New England is called upon to criticize and examine, and pay discount on, and suffer more or less, in the ordinary course of trade. (Shepard (1864)).

Alternatively, while notes may not have circulated as hand-to-hand currencies at great distances from the issuing bank, interregional trade net balances would still have to be settled, resulting in flows of notes of banks from different locations.

Whether notes circulated at distances far from the issuing or not, note prices represent a system of flexible exchange rates. For transactions at a distance away from the issuing bank the price of a note could be below par since arbitrage via the redemption option was costly because of the time it took to return to the issuing bank. Thus, note prices of distant banks were quoted at discounts. (An arbitrage bound is derived below.) These discounts reflected the risk of the bank's asset portfolio, leverage of the bank, and the time involved to take the note back to the issuing bank. (See Gorton (1993).)

A) Bank Note Price Data

Note brokers traded notes in informal secondary markets. Note prices in the secondary market were reported by newspapers, called bank note reporters, which were consulted when unfamiliar notes were used in a transaction or sold in the secondary market. Bank note reporters were competitive with several sometimes operating in larger cities. (See Dillistin (1949).)

The data used in this study are from Van Court's Counterfeit Detector and Bank Note List, a bank note reporter printed in Philadelphia, monthly, from February 1839 through December 1858.[8] Van Court was a small tabloid providing general business news together with the discounts from par on the notes of the banks of twenty nine states and territories and three provinces of Canada. In all, note prices of approximately 3,000 banks are provided. (Appendix Table A1 shows the coverage provided by Van Court.)

The prices reported by Van Court are in the form of discounts from par, i.e., the number "3" means a one dollar note of that bank is trading for 97 cents worth of gold (see Gorton (1989A)).[9] The

prices are not necessarily transactions prices and the volumes traded are not known. Nevertheless it seems reasonable to believe that they are fairly accurate since it is known that merchants relied on such reporters and that the bank note reporter market was competitive.

The prices in Van Court refer exclusively to the Philadelphia secondary note market. At a different location, say Chicago, prices would differ (even for a bank with the same asset risk and leverage), as we will see below, because the distance back to the issuing banks would differ.

B) Cross-Section Variation in State Banking Systems

The banking systems in the various states and territories differed in a number of important dimensions. Some states allowed entry into banking under free banking laws and some maintained exclusively chartered systems; some allowed branching; some provided insurance for circulating bank liabilities; some had private arrangements among banks that were important.

A traditional hypothesis is that banking systems which passed free banking laws experienced more bank failures and larger losses than did chartered banking systems. Rockoff (1974A, 1974B, 1975), while stressing the heterogeneity of free banking experiences, finds some support for this view. Rolnick and Weber (1982, 1983, 1984) find little evidence of pervasive wildcat banking, arguing that falling asset prices is a better explanation of failures in free banking states. Rockoff and Rolnick and Weber do not directly compared the experiences of free and chartered systems, however. Kahn (1985) compares the experiences of four free banking states with two chartered systems and with New Jersey which passed a free banking law midway through the period. He finds that free banking legislation "often resulted in very high failure rates in those states relative to failure rates in non-free-bank states," though Kahn stresses that this is based on *ex post* data.

It is important to stress that chartered banking states also had a variety of experiences. In particular, passage of free banking laws was not necessary for the rapid growth of banks. Kahn (1985) cites Maine and Maryland as examples. Other chartered states restricted entry; Rockoff (1974B) cites Pennsylvania, Tennessee, and Missouri as examples.

Together the evidence of Rockoff and Rolnick and Weber strongly suggests that the earlier view that free banking was synonymous with wildcat banking is incorrect, but it remains less clear how free banking systems performed relative to chartered systems.

Importantly, besides differing as to whether free banking was allowed or not, state banking

systems significantly varied in other ways as well. (See Table 1.) These other factors will subsequently be important in assessing whether initial note discounts priced the degree of adverse selection across different states. These other factors fall into two categories. First, some states allowed banks opportunities which seem to have raised their expected returns for the same risk. In particular, some states (Virginia, North Carolina, South Carolina, Georgia, and Tennessee) allowed branching which made these systems less risky. See Schweikart (1987), Calomiris (1989), and Calomiris and Schwiekart (1988). Also, some states had successful state insurance systems (Indiana, Iowa, and Ohio), while others had less successful systems (New York, Vermont, and Michigan). See Calomiris (1989).

A second factor concerns private bank monitoring arrangements. Banks in New England were part of the Suffolk System, a private coalition of banks centered around the Suffolk Bank of Boston, generally viewed as a quasi-central bank. New England banks were apparently less risky because of regulation of their activities by the Suffolk Bank. See Mullineaux (1987), Dewey (1910), and Whitney (1878).

Variation in characteristics of state banking systems suggests that the degree of adverse selection of new banks may vary, affecting the price of new banks' notes. Stricter entry requirements, whether formal (e.g., different capital and reserve requirements) or informal (as with the Suffolk System) might well have prevented "bad" banks from entering.

C) Defining "New" Banks

In this study the focus of attention is on new banks issuing notes for the first time. As there is no other extensive information available, a "new" bank must be defined using Van Court's published prices. In order to be useful to consumers a bank note reporter, such as Van Court, had to have exhaustive coverage. Every conceivable note that might be offered as payment in a transaction had to have a quoted discount or price. It is worth stressing that the bank note reporter market was competitive (see Dillistin (1949)). Thus, it does not seem unreasonable to take the initial discount reported by Van Court on a bank's note as essentially the primary issuance price in Philadelphia. A new bank is defined, for purposes of this study, to be a bank appearing for the first time in Van Court after the first six months of publication.[10]

The definition of a new bank results in a sample of 1673 banks which entered during the period. Figure 1 presents a bag graph of the number of new banks entering each year during the same period.

Entrants are, to some extent, clumped in the early period, when some states followed the lead of New York in adopting free banking, and in the early 1850s when a number of additional states adopted free banking. (See Table 1.)

III. A Model of Bank Notes

This section presents a very simple, stylized, model of bank notes, based on Svensson (1985) and Gorton (1993). The goal of the model is to demonstrate that the notes of banks at the same location will have identical discounts at given distant locations, corresponding to identical asset risk (assuming capital requirements are binding so banks have the same leverage). This prediction will be tested in the next section and will become the basis for using the note prices of seasoned banks as benchmarks against which the notes of new banks can be compared.

A) The Model Economy

Assume that agents are spatially separated. Let 'd' be a measure of the distance from an agent's home location to the distant market where the agent trades at time t. (In general, the time subscript on d will be omitted for ease of notation.) The representative agent (at a representative location) is assumed to prefer goods procured from locations further from home rather than nearer home. The agent's objective is to maximize:

$$E_t[\sum_{j=t}^{\infty} \beta^{j-t} U(C,d)] \qquad (1)$$

where C is consumption, $0<\beta<1$, $U_C'>0$, $U_{CC}''<0$, $U_d'>0$, $U_{dd}''<0$. The assumption that utility depends on distance is intended to capture the notion of a division of labor, motivating trade. The idea is that the "same" good purchased further away "tastes" better.

Each agent is endowed with a nontradeable project which returns a random amount at date t, $y_t(d)$, of a single nonstorable consumption good. Endowments are independently, identically, lognormally distributed at each date and location. The standard deviation of endowments at location d is $\sigma(d)$, assumed constant through time. Later, however, we will consider thought experiments where a single bank, a distance d away, has a higher $\sigma(d)$ than other banks at that location.

Since agents prefer goods from distant locations they will trade. Assume that agents face a cash-

in-advance constraint which can only be satisfied by issuing private money. The agent issues two types of claims against future endowments: debt and equity. The debt consists of noninterest-bearing debt claims which allow for conversion into consumption goods on demand at par at the location of the issuing agent. The debt is called bank notes. For simplicity the equity does not pay dividends. Each period the agent begins with a portfolio of equity claims, $\Sigma_d Q_{t-1}(d)$, and a portfolio of debt claims (notes), $\Sigma_d D_{t-1}(d)$ and has issued Q_{t-1} and D_{t-1}.

Each agent is to be thought of as a buyer-seller pair, as in Lucas (1980). The seller stays at home and sells the endowment to buyers from other locations, receiving bank notes of other agents in exchange. The buyer chooses a distance, d, to travel, and purchases goods at that distant location, paying for them with bank notes. Assume the buyer chooses the distance d, but that the direction is random, reflecting some uncertainty about which market should be visited. All expectations below are taken over this uncertainty and uncertainty concerning future endowments.[11] Only one (distant) market can be visited at each date t. Let $P_t(d)$ be the price (in terms of consumption units) of bank notes carried by the representative agent and traded at a location a distance d away at time t. The cash-in-advance constraint faced by the buyer is:

$$C_t \leq \sum_d P_t(d) D_{t-1}(d) \qquad (2)$$

Note that the buyer may carry a portfolio of bank notes from issuers at different locations, d, to the market chosen for transactions at date t.

The sequence of events in period t is as follows. First, households receive their endowments $y_t(d)$. For simplicity, assume that this information, $y_t(d)$ (each location d) is public information.[12] Second, the goods market opens. The buyer travels a distance d, carrying the portfolio of bank notes and purchases C_t consumption units from sellers at location d, using bank notes, and then returns home. Simultaneously, the household seller sells goods from the household endowment in the home market, receiving bank notes in exchange for consumption goods. Third, households go to the securities market, in which notes and shares are traded, opens at each home location. Households choose a portfolio of notes and shares and, in particular, may decide to redeem some notes. Finally, consumption occurs and period t ends.

In order to give meaning to the notion of distance assume that a note issued by an agent a distance

d away takes d periods to return for redemption. There is, thus, assumed to be an asymmetry between buyers and sellers. Buyers can carry a note a distance d in a single period, but a seller who receives the note requires d periods to receive the (risky) payoff to redeeming the note. This asymmetry is introduced for tractability. Let $D_t^R(d)$ be the amount of notes sent for redemption d periods ago. Then the amount the agent must currently honor is $D_t^R(0)$.[13]

For simplicity assume that no new equity is issued and that the face value of new debt issued always equals the face value of the amount redeemed, so long as the agent is solvent. Thus, leverage is constant.[14] When the seller sells the endowment the proceeds are $\Sigma_d P_t(d)D_t(d)=y_t$ which, since the debt does not bear interest, is the amount available to the agent.[15] Let $q_t(d)$ be the price of equity claims on the representative agent. Then the budget constraint is:

$$C_t \le \sum_d [P_t(d)D_{t-1}(d) - P_t(d)[D_t(d)+D_t^R(d)]] \quad + \qquad (3)$$

$$\sum_d q_t(d)[Q_{t-1} - Q_t(d)]$$

Note that the amount of notes redeemed is not subtracted because, by assumption, the same amount of new notes are issued.

B) Equilibrium

The representative agent chooses a distance to travel in period t, d, an amount of notes of each type (d) to be sent for redemption, $D_t^R(d)$, an amount of notes of each type, d, to be used to satisfy the cash-in-advance constraint, $D_t(d)$, and an amount of equity shares of each type $Q_t(d)$, to maximize (1), subject to (2) and (3). The respective first order conditions are:

$$U'_{dt} = -E_t\{U'_{dt}\sum_d \frac{\partial P_t(d)}{\partial d}[D_{t-1}(d) - [D_t(d)+D_t^R(d)] \qquad (4)$$

$$+\mu_t \sum_d \frac{\partial P_t(d)}{\partial d}[D_{t-1}(d)]\}$$

$$U'_{Ct} \geq \beta^d E_t[U'_{Ct+d}\frac{P_{t+d}(0)}{P_t(d)}], \text{ each } d \tag{5}$$

$$U'_{Ct} \geq \beta E_t\{U'_{Ct+1}[P_{t+1}(d)/P_t(d)+\mu_{t+1}[P_{t+1}(d)/P_t(d)]\}, \text{ each } d \tag{6}$$

$$U'_{Ct}=\beta E_t[U'_{Ct+1}q_{t+1}(d)/q_t(d)], \quad \text{each } d \tag{7}$$

where "E_t" indicates the expectation conditional on information available at time t, and μ is the Lagrange multiplier associated with the cash-in-advance constraint.

Equilibrium requires that: (1) the goods market clears at each location d, $C_t(d)=y_t(d)$; (2) the equity market clears at each location d, $Q_t(d)=Q_{t-1}(d)=1$; (3) the note market clears at each location d, $D_t(d)+D_t^R(d)=D_{t-1}(d)$.

In the securities market an agent faces a choice between holding a particular bank note for another period to satisfy the cash-in-advance constraint (equation (6)) and sending the note back to the issuing agent for redemption, resulting in a risky payoff in d periods (equation (5)). If (5) and (6) are satisfied with equality in equilibrium, the agent must be indifferent between these alternatives. Consequently, at the margin a note can be priced as a risky, pure-discount, bond with time to maturity d.[16] This is because equation (5) values the note as a risky debt claim on the issuing bank which matures in d periods. Because the redemption option can be exercised at any time, the agent faces this redemption opportunity each period.

If (5) holds as an equality, so that notes can be priced as risky pure-discount bonds and if, further, preferences display constant relative risk aversion, then a closed-form solution for note prices based on Black-Scholes (1973) and, in particular, Merton (1974), can be derived. See Gorton (1993). This pricing formula is useful because it shows that the value of a note, $P_t(d)$, varies inversely with time to maturity (d), risk (σ), and leverage. In particular, $\partial P_t(d)/\partial d < 0$, that is, notes decline in value as they travel further away from the issuer. Imposing the equilibrium condition, $D_t(d)+D_t^R(d)=D_{t-1}(d)$, on (4):

$$U'_{dt}=-\mu_t\sum_d E_t\{\frac{\partial P_t}{\partial d}D_{t-1}(d)\} \tag{8}$$

The interpretation of this condition is that the optimal distance to travel is chosen to equate the marginal benefit of increased distance (in terms of the goods tasting better) to the marginal cost which is the capital loss associated with carrying the notes further away from home and, hence, being able to purchase less. This trade-off determines the choice of d.

If no notes are sent for redemption, then (5) does not hold as an equality, but provides an arbitrage bound on the note price, i.e.,

$$P_t(d) \geq \beta^d E_t[\frac{U'_{Ct+d}}{U'_{Ct}} P_{t+d}(0)], \quad each \quad d$$

In this case, the notes can only be priced up to this bound. The remaining case occurs when many of the bank's notes are sent for redemption so that (5) holds with equality, but (6) does not. In this case the note is more valuable being redeemed then it is used being used as a means of exchange next period.

C. New Banks: Discounts and Monitoring

The above model considers a setting in which all banks at each location have access to the same project. Consequently, their notes would be priced the same at any particular location. In order to address the issue of new banks, without repeating the work of Diamond (1989), consider allowing a new bank to enter the market at a given location. I do not consider this bank's project choice, but simply assume that this new bank is perceived by other households to be of higher risk, $\sigma_N > \sigma_S$, where σ_S is the variance of the seasoned banks' project return (at location d). Assume that the new bank is the same as the seasoned banks at its location in every way except with respect to project risk. I will show that in equilibrium the notes of the new bank (N) will be redeemed, enforcing the equilibrium in which all banks have the risk of the seasoned banks (S).

The new bank will issue notes and the household buyer will carry them to a distant market and exchange them for goods. Because the new bank's notes are higher risk, it will face a higher discount in that market than will the notes of seasoned banks of the same location (this is a straightforward implication of Black-Scholes pricing). I will show that the new bank will be monitored via the redemption option. That is, the notes of the new bank will be sent for redemption. Of course, this will take d periods during which time the bank note reporter will quote the higher discount.

Given the result of Gorton (1993) that bank notes can be priced as risky pure discount debt with maturity equal to the time it takes to return to the issuing bank, we can state the following lemma which is a standard result from contingent claims.

Lemma: Consider two banks, Bank N (for new) and Bank S (for seasoned), which are the same distance away (d) and which have the same leverage, but have different risk. In particular, $\sigma_N > \sigma_S$, *so* $P_t^S(d) > P_t^N(d)$. *Then:*

$$\frac{\partial P_t^N(d)}{\partial d} < \frac{\partial P_t^S(d)}{\partial d}.$$

The lemma says that the value of Bank N's notes decay at a faster rate as the distance away from the bank is increased. Note that the optimal choice of distance using the new bank's notes, d_N, is lower than the optimal choice of distance using the seasoned banks notes, d_S, ($d_N < d_S$) because $\sigma_N > \sigma_S$.

We can now show how the higher discount on the new bank will cause it to be monitored:

Proposition 1: *If the notes of two banks at the same distant location (d), with identical amounts of notes outstanding and identical leverage, circulate to the same extent at a particular location, then they must be of identical risk, i.e., the two banks have the same* σ*'s.*

Proof: The proof is by contradiction. Consider two banks, Bank S and Bank N, identical except that $\sigma_N > \sigma_S$. We will show that the notes of Bank N will tend to be sent for redemption while those of Bank S will circulate (i.e., be used to satisfy the cash-in-advance constraint).

Let D_t^{Ri} be the amount of Bank i's notes being sent for redemption and let D_t^i be the amount of Bank i's notes being held for circulation, i=N or S. Suppose that both types of notes circulate to the same extent and that the household sends the same amount of each for redemption. We will show that this cannot be an equilibrium. If both types of notes circulate, then $D_t^i > 0$ for i=S,N and (6) holds with equality for each bank's notes. Also, by hypothesis (of an interior solution), (5) holds with equality for each for each note type, i.e., $D_t^{Ri} > 0$ for i=S,N.

To show that this cannot be an equilibrium consider the following rearrangement of the agent's portfolio. Reduce the amount of Bank S notes being sent for redemption by ΔD_t^{RS}, increasing the amount of Bank S notes being held for circulation by the same amount. Increase the amount of Bank N notes being sent for redemption by $(P_t^N/P_t^S)\Delta D_t^{RN}=\Delta D_t^{RS}$, so that the expected value of the total amount being sent for redemption is the same. Then, with respect to the expected value of future redemptions, the agent is no worse off.

But, the amount of Bank S notes being held for circulation is greater while the amount of Bank N notes being held for circulation is decreased. Now, using (8), consider the effect on the choice of distance:

$$U_d' = -E\{\mu_t[(\frac{\partial P_t^S}{\partial d})(D_t^S+\Delta D_t^{RS})+(\frac{\partial P_t^N}{\partial d})(D_t^N-(\frac{P_t^S}{P_t^N})(\Delta D_t^{RS}))]\}$$

$$= -E[\mu_t[(\frac{\partial P_t^S}{\partial d})(D_t^S)+(\frac{\partial P_t^N}{\partial d})(D_t^N)+\Delta D_t^{RS}[(\frac{\partial P_t^S}{\partial d})-(\frac{\partial P_t^N}{\partial d})]]]$$

Recall that $\partial P_t/\partial d<0$. By the lemma the difference in partial derivatives is negative. Since utility is strictly concave, the agent is better off, that is, next period the agent expects to be able to choose a higher d and hence increase consumption. ‖

The proposition says that if there is a riskier bank, with notes trading a higher discount than other banks at the same location, then more of its notes will be redeemed (assuming that its risk is perceived to be so high that the arbitrage bound, (5), is violated).[17] The reason is that the price of the riskier bank's notes decline at a faster rate as the agent moves further away from home, i.e., chooses a higher d. Consequently, a note of the riskier bank will purchase fewer consumption units at the distant location, so it will be sent for redemption.

The proposition says that the notes of the higher risk banks will be redeemed. Because the riskier banks will face more redemptions, they would have to hold more reserves or become insolvent. Thus, the initial difference in note prices induces a natural monitoring mechanism: note redemptions.

D) Monitoring Wildcat Banks

Seasoned banks' notes will not violate the arbitrage bound and consequently will circulate without being redeemed. But, privately each bank may have an incentive to increase risk. To show how monitoring works I will briefly consider a ("out-of-equilibrium") wildcat bank that increases asset risk above σ_S.

Consider a new bank issuing notes for the first time at date t. These notes, printed at date $t-1$, will be used to finance initial consumption so that $C_t \leq P_t(d)D_{t-1}$ is the initial budget constraint and, coincidentally, the cash-in-advance constraint; D_{t-1} is the initial amount of notes printed. Next period this household/bank will have none of its own notes (since they will have been spent at a distant location), but will have received other households' notes and will have its own bank equity which can be used to finance consumption. The first order condition for choice of risk, σ, is:

$$-U'_{Ct}\frac{\partial P_t}{\partial \sigma}D_{t-1} - \beta E_t\langle U'_{Ct+1}\frac{\partial q_{t+1}}{\partial \sigma}[Q_t - Q_{t+1}]\rangle$$

Since $\partial q_{t+1}/\partial\sigma > 0$, the increase in risk results in a higher value of the bank equity (i.e., equity is valued as a call option on the value of the bank in the standard way). Selling this equity next period will allow the wildcat bank to realize the benefits of increased risk.[18] But, the cost of the increase in risk is that $\partial P_t/\partial\sigma < 0$, that is, a smaller amount of consumption can be purchased when the notes are carried to a distant market initially to get them into circulation. In other words, market participants, recognizing the incentives of the bank will discount its notes appropriately, penalizing the bank when it first introduces the notes into the market. Consequently, this bank will not choose an infinite amount of risk.

A wildcat bank chooses a level of risk higher than σ_S. In that case, assuming the arbitrage bound is violated, all of its notes will be redeemed, say, next period.[19] Then the wildcat bank can only benefit if it does not go bankrupt and the choice of risk is given by:

$$-U'_{Ct}\frac{\partial P_t}{\partial \sigma}D_{t-1} - \beta\int_0^{y^*}\langle U'_{Ct+1}\frac{\partial q_{t+1}}{\partial \sigma}[Q_t - Q_{t+1}]\rangle f(y)dy \qquad (9)$$

where $y^* = D^R$, indicating the level of output at which the bank is bankrupt when D^R ($=D_{t-1}$) notes are redeemed. Thus, the equilibrium in which all banks choose σ_s is supported if adding more risk cannot satisfy the above first order condition. In that case, the threat of redemption prevents wildcat banking.

E) Summary

There are two results of the model. First, the notes of all banks at a given location will trade at the same price at distant locations (up to the arbitrage bound). Second, this result is supported by the threat of note redemptions. These results will be examined empirically in the next section as a prelude to studying reputation formation.

With respect to reputation formation, the situation to be studied is more complicated than the above scenario because the above model has not included multiple types of banks. The situation Diamond (1989) analyzed was one in which market participants learn the type of each borrower over time. While this could be incorporated into the above model, I do not repeat that analysis here. For the purposes at hand, studying reputation formation, the above model should be interpreted as follows. In the context of the Diamond setting, Proposition 1 says that the notes of new banks will be returned more frequently, that is, they will not circulate to the same extent. Redemptions serve the purpose of monitoring the new banks since if they are not good types, then they will become insolvent faster. Thus, while new banks' notes will have higher discounts initially, compared to seasoned peers, over time good banks and bad banks can be separated, and the type that can choose between a risky and a safe project will have an incentive to choose the low risk project.

IV. Empirical Examination of the Model

The model predicts that the notes of banks at a given location will trade at the same price (because, if they do not, the riskier banks will face redemptions until they adjust their asset risk or go bankrupt). Establishing that the notes of seasoned banks at a given location should trade at the same price is important so that the prices of the notes of these banks can be used as a benchmark against which to compare the prices of new entrants. (There is almost no additional prior information that can be brought to bear on the issue.) In this section these predictions of the model are examined empirically as a prelude to testing for the presence of reputation formation.

A) Do Seasoned Solvent Banks Face the Same Discount?

To examine the prediction of the model that seasoned solvent banks' notes (at a given location) trade at the same discount Table 2 provides the average of the monthly percentages of total banks, at representative selected locations, whose notes were trading at the modal discount for each year.[20] The states shown in Table 2 are representative geographically and with respect to type of banking system. At each date the bank notes of most banks at each particular location are trading at the same discount in the Philadelphia note market, the modal discount. It is clear from the table that at most locations the percentage of banks with notes trading at the same discount in Philadelphia is extraordinarily high.

In almost every case, the notes of other banks, not trading at the modal discount, are trading at higher discounts, usually much higher, suggesting that these notes are claims on insolvent banks (see Gorton (1989A)).[21] When a bank went bankrupt, state bank regulators liquidated the bank over a period of time, usually some years. During this time the bank's notes could continue to circulate, but they would be equity claims on the bank. Consequently, these notes would trade at "deep" discounts. To investigate this Table 3 provides the modal discounts, averaged over the months of each year, and the average nonmodal discount.[22] It can be seen that the nonmodal discounts are typically much larger than the modal discounts.[23] As expected, in Philadelphia, the modal discount is always zero indicating that bank notes trade at par at the home location.

The high percentages of banks with debt trading at the modal discount is consistent with Proposition 1. Banks not trading at the modal discount are insolvent.

B) Evidence of Monitoring

The model also predicts that the notes of a new bank which are trading at a discount higher than the modal discount of seasoned peers at their location will be redeemed more frequently. Facing such redemptions, we would expect "bad" banks, i.e., high risk banks, to be detected fairly fast. In fact, the model predicts that the notes of banks of higher perceived risk would not circulate as far. (With a higher σ, the optimal d which solves (8) is lower.) Consequently, learning by market participants should happen fairly fast. Moreover, as a consequence of redemptions all new banks should hold more reserves in anticipation of redemptions, a prediction examined in a subsequent section. While there are no data available on redemptions at individual banks, some evidence that this is the case can be adduced by examining how fast "bad" new banks are detected.

In order to examine this issue the sample of new banks must be split into "good" and "bad" banks. To define a "good" bank I will rely on the predictions of the above model, namely, that such a bank eventually has notes priced the same as seasoned peers. Therefore, a "good" bank is defined to be a bank whose note discount has converged to the modal discount (at that location) thirteen months after entry.[24] Other banks are deemed bad banks (their note discounts become increasingly larger than the modal discount as time goes by).

A bank which becomes insolvent is treated by Van Court in one of two ways. Either its notes continue to trade at high discounts, since they are essentially equity claims at that point, or the discount on the bank's notes are no longer reported.[25] A bank whose discount is initially in excess of the modal discount may eventually (after one year by the above definition) become a good bank. Suppose it is assumed that new banks which Van Court drops from newspaper coverage are bad banks which have been detected. In fact, just prior to being dropped these new banks have higher discounts than other new banks, suggesting that they did become insolvent. (See Figures 2 and 3.) The percentage of new bad banks which Van Court discontinues reporting provides a lower bound on the number of bad banks which have been detected.

Examining the percentage of new bad banks which Van Court discontinues reporting on provides some sense of the speed with which bad banks are detected. Table 4 presents some (representative) such evidence. As can be seen in the table, for many states over 50 percent of the bad banks are detected within the first year of their existence. The states where no bad banks have been detected within the first year are distant states with few banks, Alabama and Nebraska. In the case of Delaware there is only one bad bank. On the other hand, bad banks are detected very fast in states with large numbers of bad banks, such as New York or Indiana. The evidence in Table 4 is consistent with the notion that bad banks are forced into insolvency via redemptions since their assets typically would have maturities longer than one year.[26]

We now turn to testing the main prediction of the reputation theory, that banks issuing notes for the first time should face higher discounts on their notes than banks at the same location which have been in existence for some time.

V. Reputation and the Primary Note Market

We are now in a position to ask whether the notes of new banks are discounted more heavily than

seasoned peer banks at that location. We will examine the discounts on new banks' notes compared to the modal discount of banks at that location. Define the "excess entry discount" for new banks, entering the market at time t, at a particular location, to be:

$$\frac{Entry\ Discount_t - Modal\ Discount_t}{|\ 100 - Modal\ Discount_t\ |}$$

The excess entry discount is the difference between the discount on the notes of a new bank, entering at time t, and the modal discount for seasoned banks at that location at time t, normalized for the price of the seasoned banks' notes at time t (to facilitate comparison across time and location).

The advantage of this definition of the excess entry discount is that many observed factors are indirectly accounted for by their influence on the modal discount. For example, if a state changes its bank regulations, introduces free banking, or if there is a macroeconomic shock, the modal discount will change. Gorton (1993) argues that the modal discounts are accurate reflections of such risk factors. Thus, the benchmark is quite robust.

A) Discounts on the Debt of New Banks

The main prediction of Diamond's reputation theory is that the excess entry discounts should be significantly positive because the debt of new banks must offer a premium to note holders (over the rate offered on the debt of seasoned banks) to induce them to hold it since new banks are without credit histories. To examine this question the excess entry discount is computed for all new banks during the period; there are 1673 new banks. A finding of a significantly positive excess entry discount would be evidence in favor of the theory.

Panel A of Table 5 provides the average excess entry discount on the debt of all new banks which entered during the period. Also provided are the results of the test that the excess entry discount is significantly different than zero. As can be seen from the table, the average excess entry discount is significantly positive as predicted by the reputation model of Diamond. This is also true of subperiods, as shown in Panel B of Table 5.

B) Are the Excess Entry Discounts Fair Lemons Premia?

If new banks are, in fact, riskier, on average, than seasoned banks, and the higher discount accurately reflects this risk, then a market participant buying a portfolio of the notes of new banks at the date of entry should not earn a higher return compared to a portfolio of seasoned banks' notes purchased at the same dates and locations. That is, the discounts should be fair "lemons premia," since some of the new banks will fail and some will not. Thus, a portfolio of new banks' notes should include some notes which suffer capital losses (when the bank fails or when information that it is a 'bad' bank is revealed) and some notes which realize capital gains (when it is revealed to be a 'good' bank).

To examine this question I form a portfolio of each new bank's notes at the date the new bank enters and examine the return on this portfolio over the first year of the bank's existence. The return on this portfolio is compared to the return on a benchmark portfolio composed of seasoned peer banks' notes as follows. On each date that a new bank enters, the benchmark portfolio purchases the note of a seasoned peer from that location. The benchmark portfolio is then held for a year. We examine the difference in the returns on these portfolios. Thus, for a new bank entering at date t, the difference in returns is given by:

$$\left\langle \frac{P_{Nt+12} - P_{Nt}}{P_{Nt}} \right\rangle - \left\langle \frac{P_{St+12} - P_{St}}{P_{St}} \right\rangle \equiv R_N - R_S$$

where P_t is the price of the note at date t (100 minus the discount) and N and S refer to the new bank and the seasoned bank, respectively.

Table 6 reports the differences in returns between the two portfolios for the whole period and for subperiods. In each case the difference is insignificantly different from zero. The discounts on the notes of new banks appear to be fair since they provide the market rate of return on seasoned banks' notes. In particular, there is no underpricing of new banks' notes.

C) Counterfeiting

The fact that the excess entry discounts are significantly positive, on average, and that they represent fair lemons premia, does not, however, allow the immediate conclusion that the lack of a credit history is the explanation. A nonmutually exclusive alternative hypothesis concerns counterfeiting of bank

notes. Counterfeiting during the Free Banking Era was a serious problem. (See Dillistin (1949) and Glaser (1960).) Van Court reports descriptions of counterfeit notes for every bank with a reported note price, suggesting that counterfeiting was widespread.

The result that the notes of new banks are more heavily discounted than the notes of seasoned banks at the same location is consistent with the interpretation that new notes were more likely to be counterfeits. It may have taken time for note holders to learn to recognize counterfeits of new notes. If the probability of a new bank's note being counterfeit is higher, or if the public was less capable of recognizing counterfeits of new notes, then these notes would face higher discounts. As the public learns that the new notes are from legitimate banks and comes to recognize the counterfeits of new banks' notes, the excess entry discount would shrink. Learning about counterfeits is also tantamount to the acquisition of a reputation, but this reputation is conceptually distinct from the notion of a reputation proposed by Diamond.

There are several reasons why counterfeiting does not seem a persuasive explanation of the results in Tables 5 and 6. First, a difficulty with the counterfeiting explanation of the results is that it is not clear that the notes of new banks would be more likely to be counterfeited than the notes of seasoned banks. There are costs to counterfeiting the notes of new banks. The main problem is that many of these banks become insolvent fairly quickly (as shown in Table 4) making counterfeiting the notes of new banks very risky. Moreover, as we have seen in Table 5, new banks' notes were more heavily discounted, making it less profitable to counterfeit them. Contemporaries of the period repeatedly observe that almost all notes were counterfeited, but that notes of "better" banks were more likely to be counterfeited. The New York Times observed in 1862 that:

> Out of the thirteen hundred and eighty-nine banks in the United States, only two hundred and fifty-three have escaped the attempts at imitation by one or another of the many species of frauds. And out of these two hundred and fifty-three, at least one hundred and forty-three are not worth counterfeiting, so that in round numbers, out of 1,300 bank note issues, but one hundred are not counterfeited. The rule is, that the better the bank, the more the counterfeits. (Quoted in Glasner (1960, p. 85-86.)

A second point concerns how counterfeiting was actually accomplished. The dominant method was not actually engraving, printing, photographing, or otherwise creating replicas of real notes. These technologies were expensive and not widespread. The predominant method involved altering existing notes, rather than replicating notes.[27] A typical method was to raise the denomination of an existing note, for example, by turning a one dollar bill into a ten dollar bill by adding a zero. Another common

method was to alter a note of an insolvent bank (trading at a high discount) so that it appeared to be a note of a solvent bank, thereby capturing the difference in the discounts. One observer writes:

> There are now in circulation nearly four thousand counterfeit or fraudulent bills, descriptions of which are found in most Bank Note Lists. Of this number, a little over two hundred are engraved imitations--the residue being in point of general design entirely unlike the real issues of the banks whose names have been printed on them. These spurious notes--more properly altered--bills are generally notes of broken or exploded banks, which were originally engraved and printed by bank note engravers for institutions supposed to be regularly organized and solvent. (The Descriptive Register of Genuine Notes (1859), cited by Glasner (1960, p. 82.))

Basically, the available counterfeiting technology, altering existing notes rather than printing new notes, restricted the choices of counterfeiters. It was not possible to focus counterfeiting activity exclusively on new notes. Attention was focused on notes which were poorly designed or poorly printed, making alterations easier, or on notes which were more profitable to alter. Moreover, to the extent that activity could be focused, the available evidence suggests that it was the seasoned banks' notes which were more profitable to counterfeit. The conclusion is that counterfeiting cannot be the explanation for the results in Tables 5 and 6. In fact, new banks' notes were less likely to be counterfeit.

VI. Cross-Section Variation in State Institutions and the Degree of Adverse Selection

Variation of excess entry discounts across states is likely to depend, in part, on the ability of banks to engage in risk-taking, that is, the degree of adverse selection in an entering cohort may differ across states. As discussed above, the degree of adverse selection should depend on the public and private arrangements governing banking in the given state. This section examines these predictions.

A) Public and Private Banking Arrangements

Institutional factors which affect entry would be detectable in the excess entry discounts only if they affect the degree of adverse selection. It is important to keep in mind that these factors will affect the benchmark of the modal discount if seasoned bank risk is affected (see Gorton (1993)). So the excess entry discount will only be affected if these factors serve to deter bad banks from entering.

A state-run note insurance program may reduce the degree of adverse selection. New banks in states with successful state insurance programs should have lower excess entry discounts because these systems were mutual guarantee systems which including monitoring by other banks and state insurers (see Calomiris (1989)). If monitoring by state regulators or by other banks is more intense in states with

insurance programs, then fewer bad banks will enter the market. Calomiris (1989) divides these systems into successful insurance systems and unsuccessful insurance systems based on their design and experience. In what follows I adopt his classification.

Also, as mentioned above, some states allowed branch banking which evidence suggests reduced the bank failure rate, possibly due to diversification. The existence of branch banking would reduce the modal discount (a prediction confirmed by Gorton (1993)), but may also affect the excess entry discount. This would occur only if competition from incumbents via branches raises the required quality of entrants in order to achieve success.

Private bank coalitions, in particular the Suffolk System of New England, should reduce the degree of adverse selection because participation in this system was a prerequisite for success. The Suffolk Bank, generally viewed as a quasi-central bank, may have screened entrants. It appears that the Suffolk Bank was successful in reducing the risk of member banks. During the Panic of 1839 and its aftermath only four out of 277 banks in New England (outside of Rhode Island) failed. In other areas of the country the failure rate was much higher. In Ohio, Illinois and Michigan 13.4 percent of banks failed.

The above factors would be important to the extent that they operated to reduce the proportion of bad banks in any entering cohort. Free banking laws, however, were designed to ease entry rather than restrict entry. Consequently, the predictions about excess entry discounts with respect to whether the banking system is free or chartered are less clear. While a common conjecture is that since free banking made entry easier and that, consequently, the degree of adverse selection may well have been higher in free banking states, only Kahn (1985), who examined two chartered states, provides any evidence for this view, as discussed above.

When a free banking law was passed in a state it did not necessarily mean that free banks entered (see Table 1). In every case where free banks entered, they coexisted with chartered banks. In other words, there is no state in which chartered banks were forced out of the banking industry by competition from free banks. The model discussed above predicts that, when free banks enter under a new free banking law, either the new free banks' note prices will adjust to the price of the incumbent seasoned chartered banks or vice versa. It cannot be the case, in equilibrium, that free banks and chartered banks coexist with notes trading at different prices. Indeed, in all states that passed free banking laws, solvent free and chartered banks traded at the modal discount for that location. A good example of this is New

York which had insured chartered banks and free banks coexisting for the entire period. The free banks were not insured, but faced bond backing requirements for note issuance. Yet all these banks traded at the same discount when solvent.

Gorton (1993) found that the risk of banks trading at the modal discount (the asset value variance implied by the modal note price, which can be found be inverting the Black-Scholes formula) was not affected by passage of a free banking law. This suggests that free banks and chartered banks coexisted because free banks adjusted their balance sheets so as to have the same risk as the incumbent chartered banks. According to the model, it cannot be the case that seasoned chartered banks adjusted their risk levels to the anticipated level of risk that would prevail when free banks entered. That level of risk could have been achieved without entry by free banks (if it could not have been achieved, then chartered banks would be driven out of the market, but this never occurred). One explanation for why free banks did not enter in some states that passed free banking laws might be that bank regulations prevented them from achieving the same risk level as the incumbent chartered banks. This is a question for further research.

While free banks that entered would have to adjust to the risk level of the incumbent chartered banks, it might be the case that the degree of adverse selection would be worse in free banking states. In that case the excess entry discounts would be larger because of more bad banks entering. In the four free banking states examined by Rolnick and Weber (1984), however, they do not find large numbers of banks failing in the first year. While it is not clear what "large" means since there is no benchmark for chartered banking states, it does not appear that there was a high proportion of wildcat banks entering. Rational wildcat bankers would not enter in greater numbers if the threat of redemptions made it unprofitable, i.e., if condition (9) holds for entering banks. These observations suggest that the distinction between free and chartered banking systems may not help explain cross-section variation in excess entry discounts. Essentially, free banking laws while allowing entry may not necessarily result in large numbers of bad banks entering because of the threat of the redemption option when faced with competition from chartered banks.

B) Excess Entry Discounts and Institutional Factors: Tests

To examine whether the degree of adverse selection varies in the manner predicted, the excess entry discounts were regressed on the above independent variables, entered as dummy variables. If the banking systems is a chartered banking system the variable is set to one. If the state subsequently adopts

free banking, then the chartered dummy variable is set to zero and the free banking dummy is set to one.

Table 7 presents the regressions. The cross-section variation of excess entry discounts by state does reflect risk factors which *a priori* are expected to play a role: branching, membership in the Suffolk System, and insurance, reduce the excess entry discount. This is shown on the left-hand side of Table 7 which presents a simple, time series-cross-section regression of the excess entry discounts on new banks' notes on dummy variables for whether the state is a branching state, is a free or chartered banking state, has a successful or less successful insurance program, or is a state in the Suffolk System. Also, excess entry discounts are lower when the stock market goes up.[28] The excess entry discount is not significantly affected by whether the new bank entered during a period of suspension of convertibility (Suspension period).[29] (The variable Travel Time is discussed below.)

With respect to the whether the state allowed free banking or not, Table 7 shows that there is no significant difference with respect to the degree of adverse selection. These dummy variables are significant for the period as a whole and for the early period (prior to 1846), but are not significantly different from each other. For the later periods the variables are not significant. This is consistent with the results of Rolnick and Weber (1984) who argued that free banking did not appear to have resulted in significantly different performance than chartered banking systems. The *ex ante* evidence from note market prices is in agreement with their *ex post* evidence concerning failures.

VII. Good Banks and Bad Banks

The result that the notes of new banks were, on average, discounted more heavily than the notes of seasoned peer banks provides evidence in favor of the reputation hypothesis. But, it does not rule out the possibility that market participants could, at least to some extent, distinguish between "good" banks and "bad" banks. Perhaps there is enough prior information to allow such a distinction, even though there is not enough information to eliminate the significantly positive excess entry discount.

A "good" bank has been defined to be a bank whose note price eventually converges to the modal price (after thirteen months by the above definition), while a "bad" bank is a bank whose note price diverges from the modal discount. Using this definition we can ask whether the initial note discounts reflect the fact that the bank will subsequently turn out to be good or bad.

A) Market Distinctions Between New Banks At Entry

To address the question of whether the market can distinguish between good and bad banks at entry, I separately compute excess entry discounts for good banks and bad bank (that is, based on their *ex post* performance). The question is whether the excess entry discounts are significantly different for the two groups. Table 8 shows the average excess entry discounts for all bad new banks entering during the period (the first column) and all good new banks entering during the period (the second column). Also shown are the computations for three subperiods. For the whole period, as well as the subperiods, the excess entry discounts for the bad banks are significantly different than zero. For the good banks the mean excess entry discount, while significantly different from zero for the whole period, is not significantly different from zero after 1845. During the later period (1846-1858) entering good banks' debt is priced the same as (that is, insignificantly different from) seasoned peers' notes.

The tests in the bottom half of the table show that for the whole period, as well as subperiods, the mean excess entry discounts for the two groups are significantly different.[30] In other words, while the market significantly discounted the debt of new banks relative to seasoned peers, participants could distinguish good banks from bad banks and (relatively) priced them accordingly.

As illustrations Figures 2 and 3 plot the average excess entry discounts (for the whole period) over the first year for the good banks and the bad banks for Tennessee and New York. It is clear that the good banks' excess entry discounts are lower initially and converge to zero by one year (by definition). The excess entry discounts of the bad banks diverge from the modal discount.

B) The Informational Basis of Distinctions Between New Banks

What information could have led market participants to initially discriminate between entering new banks, more heavily discounting those that, in fact, did turn out to be insolvent? Part of the answer to this question is provided by Table 9. Table 9 shows some average balance sheet ratios for banks in New York State. The data are divided between country banks and city banks since these two groups have significantly different balance sheets. These data may have been available to market participants when the bank opened, and certainly were available by the end of the year which is when the state regulatory authorities collected and published the data. On the liability side of the balance sheet the mean ratios of notes to total assets, deposits to total assets, specie to total assets, and capital to total assets are computed. On the asset side, the ratios of real estate loans (mortgages) to total assets, loans and discounts to total

assets, and stock to total assets are computed. (Omitted are such categories as due from banks, due to banks, etc.) Note that there were no new good city banks during the period.[31]

In examining Table 9 there are several notable differences between the various groups of banks. With respect to city banks, bad banks have significantly more notes, stock, and capital while they have significantly less deposits, specie, and real estate. Since the capital is book capital this difference may reflect the fact that seasoned banks are older. Deposits and real estate require some time to acquire market share while stock can be easily purchased as an asset.

Comparing seasoned country banks to bad (new) country banks, bad banks have more deposits, stock, and capital while they have less specie, real estate, and loans. Good (new) country banks have more notes, specie, stock, and capital, than seasoned country banks and have less deposits, real estate and loans. Finally, comparing bad (new) country banks to good (new) country banks, bad banks have more deposits and stock and have less notes, specie, and real estate.

Recall that the model predicts that new banks can expect more notes to be redeemed since they are perceived as being riskier than seasoned banks; these redemptions must be honored to avoid bankruptcy. What is clear from the above comparisons is that bad banks, whether city or country, have less specie reserves than do seasoned banks or good banks. Since new bad banks' notes face significantly higher discounts, more of their notes would be redeemed than would notes of new good banks. But, their specie to total assets ratio is insignificantly lower than seasoned banks or new good banks. It appears that they are less able to honor redemptions. This is consistent with the redemption option allowing market participants to monitor banks and discover bank type quickly.

The same inference can be drawn if the excess entry discounts for new banks in New York State are regressed on the balance sheet ratios. This is shown in Table 10. It is clear that market participants demanded higher excess entry discounts for banks with low amounts of specie (to total assets) and high amounts of notes (to total assets). Moreover, the relation between low specie reserves (to total assets) and bank type is accurate.

VIII. Technological Change and Primary Note Prices

During the Free Banking period there was enormous technological change; the railroad and the telegraph were introduced and diffused across the United States. The railroad was introduced in England in the 1820s and spread to the U.S. shortly thereafter. Between 1838 and 1860 railroad mileage

increased from 3,000 miles to over 30,000 miles. (See Fogel (1964) and Fishlow (1965).) The first telegraph line was strung from Baltimore to Washington in 1846 and then from Philadelphia to New York. By 1860 there were 50,000 miles of telegraph lines. (The continent was spanned in 1861.) Five million messages per year were sent by telegraph in 1860. (See Duboff (1980, 1983, 1984) and Thompson (1947).) These improvements affect the time it takes to return notes to an issuing bank and may have allowed more accurate predictions of a bank's type. In this section I examine whether these technological changes affected the market for new banks' notes.

In order to examine the effects of these technological changes an index of technological change is required. The next subsection discusses the construction of such an index.

A) Measuring Technological Change

Indices of the time it took to get from Philadelphia to the largest city in each state or territory in the sample were constructed from pre-Civil War travellers' guides which provided the mostly commonly used routes and the means of transport (steamship, canal, stagecoach, or railroad) along each leg of the trip. The guides also provide the number of miles travelled on each particular leg. This information was combined with estimates of the rate of travel (miles per hour) for each mode of transport to construct the index.[32] (See Gorton (1989B) for details.) The index was constructed for three years: 1836, 1849, and 1862 (the only years for which the travel guides could be located). These years correspond roughly to three regimes: 1839 through 1845; 1846 through 1850; and 1850 through 1858. Prior to 1845 neither the railroad nor the telegraph had made much progress. Progress was made in the middle period and, by the last period, had become widespread.

The index does not explicitly account for the diffusion of the telegraph. However, since the telegraph tended to be strung alongside railroad tracks, and the main innovation reducing travel time was the railroad, the index roughly captures both the influence of the railroad and the telegraph. (See Thompson (1947).)

Improvements in travel times were dramatic during the two decades from 1839 to 1958. Figure 4 shows the percentage reductions in travel times, for representative locations. The solid lines show the percentage reductions from the first period to the second period; the shaded lines show the percentage reductions from the second period to the third period. Importantly, there is a good deal of cross-section variation, for some locations the largest gains came in the middle period while for others the largest gains

came in the last period.

B) Reputation Formation and Technological Change

The introduction of the telegraph and the railroad should affect the pricing of new bank debt initially. There are two affects. First, monitoring via note redemptions takes time. Since technological change reduces the amount of time it takes to redeem a note, monitoring via redemptions will improve *ceteris paribus*. Second, initial estimates of new banks' types may improve.

As travel time falls notes can be returned for redemption more quickly allowing new banks to be monitored faster. While this would affect the prices of all banks' notes and hence the modal discounts, it would have a greater affect on initial note prices. The reason is provided by the Lemma given above. Given that a bank note is isomorphic to a risky discount bond with maturity equal to the time it takes to return to the issuing bank, a reduction in redemption time corresponds to a decrease in maturity. By the Lemma this reduces the prices of bad banks' notes by more than for good banks' notes. Thus, there is a greater incentive to redeem the notes of bad banks and they would become insolvent faster *ceteris paribus*. If bad banks are detected faster, then the excess entry discount on the remaining banks' notes should be reduced (approaching the modal discount) faster.

The second affect concerns the possibility of improved information about bank type initially. The telegraph, in particular, would allow information about a new bank's ability to redeem notes to have reached distant locations before the new bank's notes had arrived there. Organizing a new bank took time because either a charter had to be granted by the state legislature or a free bank had to establish itself with the regulatory authorities by depositing state bonds. There was, thus, an interval between the time a bank was established and the time of its first note issuance. During this period information could flow to other parts of the country. With technological change, Van Court's initial note prices may have become more accurate.[33]

More accurate initial note prices should force the average quality of entering banks to improve. Average quality can improve if entering banks reduce their asset risk, or if they reduce leverage, or hold more reserves, for the same asset risk. Recall that in Diamond's model there are three types of borrowers (i.e., banks): good banks, bad banks, and banks that can choose between good and bad projects. As time goes by some borrowers default. On average these will be bad banks. But a consequence of such defaults is that the rate charged to the survivors goes down which can cause the

borrowers with a choice of projects to choose the safe project, further improving the average quality of the survivors. To the extent that market participants can detect bad types initially (and price them accordingly), the lower interest rate can be charged to the remaining banks on issue. But then the effect on those borrowers which can choose between projects is felt immediately, reducing the interest rate for the surviving banks. Thus, the prediction of Diamond's model would be that improved information should cause the excess entry discount to decline with technological change. The argument also implies that market participants should be better able to distinguish between good and bad banks with technological change. We now turn to examining these predictions.

C) Tests for Effects of Technological Change

The first prediction, that technological change should reduce the average excess entry discount, is examined in Panel B of Table 5. Panel B of Table 5 computes the excess entry discount by subperiod. As can be seen in Table 5 there is a marked decline in the mean excess entry discount, though it is still significantly positive in the last period.

Table 8 addresses the second prediction, that technological change should improve initial information sets to allow market participants to distinguish good banks from bad banks. In Table 8 the excess entry discount for good banks is insignificantly different from zero after 1845; market participants detect good banks at entry in the later two periods. These results suggest that the three periods are different, but do not make use of the cross-section variation in improvements in technology captured by the travel time index.

Table 7 uses the travel time index and provides further evidence of the importance of technological change. The left-hand side column of the table includes the variable Travel Time, which is the index of the time of a trip back to the issuing bank, discussed above. The index is measured in hours. In the regression the three years for which the index is constructed were assigned to the three regimes. If Travel Time falls, then as explained above, the excess entry discount should fall. Indeed, the positive correlation is detected in the regression, again confirming the first prediction.

To get some sense of the importance of the reduction in travel time consider the mean excess entry discount for the entire period, 0.0697. If this corresponds to an average travel time of three days (72 hours) and this time is reduced to one day, then they excess entry discount falls to 0.0216, a third of the initial excess entry discount. Thus, technological change is not only significant in the regression,

but is quite dramatic in practical terms.

The remaining, right-hand side, of Table 7 addresses the issue of whether the information possessed by market participants about new banks became finer over time. The right-hand-side of Table 7 presents a time series-cross-section Seemingly Unrelated Regression of the excess entry discounts on the *a priori* risk factors, for the three periods. Notably, the risk factors of state banking systems are priced in the early period, but in the last period are not priced. This result suggests that the information available became finer. In the early period market participants know the characteristics of state banking systems, and possibly little else about entering banks. But, in the last period excess entry discounts have fallen, though they are still significantly positive, and the market still distinguishes between good and bad banks, but the state characteristics are not priced. This would occur if market participants had finer information than state risk characteristics.

Technological change allowed market participants to have finer information about entering banks, imposing tougher discipline on entrants. Excess entry discounts declined as the time it took to transmit messages fell because of technological change. In fact, good banks' entry discounts were not insignificantly different from those of seasoned banks in the middle and late periods.

In the above analysis the degree of adverse selection was conceptually held constant. But, the degree of adverse selection might be correlated with technological change. Though not directly testable it seems plausible that this correlation would be causal, i.e., technological change reduced the degree if adverse selection.

IX. Conclusion

Diamond's (1989) theory of reputation formation appears to accurately describe bank note issuance during the American Free Banking Era. The notes of new banks were more heavily discounted than were the notes of banks with credit histories. This conclusion relies on the predictions of a model of free bank notes in which consumers, who use the bank notes as a medium of exchange, have an incentive to return the notes of higher risk banks for redemption. This mechanism allowed consumers to learn quickly whether new banks had the appropriate asset risk. Redemption and reputation, combined with public and private restrictions on risk-taking which limited the degree of adverse selection, explain the success of the free banking era (in the sense that wildcat banking was not widespread).

Footnotes

1. In general, a "wildcat" bank refers to a bank which inflated its currency to the point where it could not be continuously redeemed. A number of more precise definitions of wildcat banking have been proposed in the literature. Rockoff (1974B, 1975) provided the definition which seems to have become standard. According to Rockoff, a necessary condition for wildcat banking was the possibility that free banks could value the bonds backing their note issuance at par when, in fact, the market value was much lower than par. Then a wildcat bank, according to Rockoff (1975), was a bank which deposited backing securities which were valued at par by the state banking authorities, but, in fact, were worth less than par. Backing its note issue with overvalued securities then allowed this bank to issue notes which were insufficiently backed. The difference was earned as seigniorage and the bank left to fail. See Dillistin (1949) for a discussion of the origin of the term.

2. The existence of ratings per se is not evidence against the theory since ratings can be subsequently adjusted based on performance.

3. The problem may be compounded by the fact that firms issuing for the first time are usually young, smaller, firms--perhaps riskier. A decline in the interest rate may not reflect learning, but changes in the risk of the firm. Young firms have no natural comparison group.

4. In the latter part of the period railroads issued bonds.

5. "Free banking" refers to the passage of a general incorporation law for commercial banks. Free banking laws varied by state, but tended to incorporate some common features. Typically, banks had to back their note issuance with designated state bonds deposited with state regulatory authorities. Also, bank notes were printed and registered under the direction of the regulatory authorities. Further background can be found in Dewey (1910), Hammond (1957), Grant (1857), and Cleaveland (1857).

6. With a well-functioning government currency system bank notes would be dominated. But, during the *ante bellum* period the costs of using specie were sizeable. See Carothers (1930).

7. Interregional trade flows in *ante bellum* America were sizeable. See Mercer (1982) and Pred (1980). Fishlow (1964) presents quantitative evidence on the size of these flows and Lindstrom (1975) specifically discusses Philadelphia.

8. See Gorton (1989A) for a more detailed description of Van Court's Counterfeit Detector and Bank Note List.

9. All note denominations of a given bank were discounted from face value by the same amount and there were no "volume" discounts.

10. The first six months of publication are excluded because Van Court's first issues were not apparently exhaustive in covering the existing banks. Initially, Van Court appears to have been expanding coverage to include banks which were seasoned, but which he had not included previously. The prices of many banks are listed in the first six months at the modal discount for that location, suggesting that they are not new. Including the first six months shows large numbers of banks as "new" compared to subsequent

numbers of entering banks. Excluding the first six months eliminates 713 banks which would have otherwise been classified as new.

11. The direction travelled is thought of as random in order to introduce the notion that agents were not absolutely certain about what their purchases would be in each period. If the direction and distance are certain, then an agent will buy the notes of that distant location in his home market in order to carry them to their home location where they will trade at par. In this case the notes sold at the home location will be sold at discounts and the analysis will be similar. My assumption avoids this complication without changing the essential conclusions.

12. Each location, d, receives the same endowment suggesting the interpretation of the randomness as a geographical weather shock. Such information was widely reported in newspapers and by travelers.

13. Notes sent for redemption at time t will be in transit for d periods. Consequently, at any time t there may be notes sent for redemption in the past which have not been redeemed yet. This complication is dealt with by Gorton (1993) and, for simplicity, is ignored here.

14. This can be viewed as a binding capital requirement.

15. This holds with equality since it will never be optimal to sell less than the total endowment because the household receives no utility from its own endowment.

16. This assumes there are no notes currently in transit.

17. The proposition assumes that the leverage constraint, imposed by state regulatory authorities is binding and is, hence, the same for both banks. A slightly more complicated version of the proposition can be shown for variation in leverage.

18. Of course, in equilibrium the representative household must hold all the equity and could not benefit by selling it.

19. In other words, since other market participants understand the incentives of the wildcat bank, $d=1$, which means that all of the wildcat bank's notes will be redeemed next period.

20. Gorton (1989) contains the full set of results.

21. This was verified for a small sample of New York State banks.

22. The reader will note some negative entries in Table 3. These occurred during periods of suspension of convertibility (during the banking panics of 1839 and 1857). During a period of suspension it was not possible to obtain gold in exchange for notes. Van Court essentially changed the numeraire from gold to Philadelphia bank notes during these periods. Thus, a negative number indicates a premium in terms of Philadelphia banks' notes. See Gorton (1989A) for a more complete discussion.

23. In a few cases, such as Connecticut in 1851 and Georgia in 1850 a single bank's notes traded at a discount lower than the modal discount for a few months. In no case is the nonmodal discount systematically lower than the model discount.

24. The requirement is that the discount of the entrant be at the mode for three consecutive months, thirteen, fourteen, and fifteen months after entry. Results are not particularly sensitive to a variety of other definitions of "good" and "bad" banks.

25. State bank regulatory authorities sometimes liquidated insolvent banks over a period of years, during which time the bank's notes may continue to circulate at high discounts.

26. See Dewey (1910) for a discussion of the loans made by banks during this period.

27. Dillistin (1949) provides a discussion of the ways in which notes were altered and provides pictures of real and altered notes.

28. The monthly index of stock prices if from Smith and Cole (1935).

29. A suspension period occurs during a banking panic during which time all banks refuse to convert debt liabilities into specie on demand.

30. The tests in the bottom half of Table 8 and in Table 9 are tests of the equality of means assuming that the samples are independent and have different population standard deviations (which is consistent with bad banks and good banks having different degrees of risk). Consequently, instead of an ordinary t-statistic, the following statistic was calculated:

$$t' = (\overline{X}_1 - \overline{X}_2)/\sqrt{s_1^2/n_1 + s_2^2/n_2}$$

This quantity does not follow the Student's t distribution when $\mu_1 = \mu_2$, but the degrees of freedom can be adjusted so that standard t tables can be used. See Snedecor and Cochran (1980). In both Tables 8 and 9 the degrees of freedom shown are the adjusted degrees of freedom.

31. This may reflect the power of the New York Clearinghouse Association which made have made it hard for banks to enter in New York City and be "good" banks. The New York clearinghouse, however, began in 1853.

32. Gorton (1989B) also computes the cost of a trip to each particular location. This is highly correlated with the time it takes, so here only the time to return to issuing bank is analyzed.

33. The affects of improved estimates of σ on the note price are unclear: the option pricing formula is nonlinear in the variance so that an unbiased estimate of the variance does not produce an unbiased estimate of the note price. The sign of the bias cannot be unambiguously determined. See Boyle and Ananthanarayanan (1977).

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Table A1

Coverage of Van Court's Bank Note Reporter: States and Dates

States with Complete Coverage, February 1839-December 1858		States with Incomplete Coverage***		States Listed as "Uncertain" or not Listed
United States	Canada	United States	Canada	
Alabama	Canada**	Arkansas (1840-58)	New Brunswick (1840-48)	Iowa Territory
Connecticut	Nova Scotia	Florida (1842-58)		Minnesota
Delaware		Illinois (July 1856-58)		Missouri
District of Columbia		Indiana (1857)		Texas
Georgia		Michigan (1853)		
Kentucky		Mississippi (1839, 1841-43, 1852-58)		
Louisiana		Nebraska (1840-47)		
Maine		New Hampshire (1857-58)		
Maryland		Virginia (1846-47, 1853-54)		
Massachusetts		Wisconsin (1839-55)		
Montana*				
Pennsylvania				
New Jersey				
New York				
North Carolina				
Ohio				
Rhode Island				
South Carolina				
Tennessee				
Vermont				

* Montana became the 41st state in 1889.

** Canada includes banks located in provinces other than Nova Scotia or New Brunswick.

*** Incomplete coverage means that the *Van Court Bank Note Reporter* did not quote a price for banks in that state for that month. The state may have been listed, though, and the notes of the banks in that state described as "all uncertain." Dates in parentheses indicate periods for which the data were missing.

Table 1

States With and Without Free Banking Laws

States With Free Banking Laws	Year Law Passed	States Without Free Banking Laws
Alabama	1849[1]	Arkansas
Connecticut[6]	1852	California
Florida	1853[1]	Delaware
Georgia[3]	1838[1]	Kentucky
Illinois	1851	Maine[6]
Indiana[4]	1852	Maryland
Iowa[4]	1858[1]	Mississippi
Louisiana	1853	Missouri
Massachusetts[6]	1851[1]	New Hampshire[6]
Michigan[5]	1837	North Carolina[3]
Minnesota	1858	Oregon
New Jersey	1850	Rhode Island[6]
New York[5]	1838	South Carolina[3]
Ohio[4]	1851[2]	Texas
Pennsylvania	1860[1]	Virginia[3]
Tennessee[3]	1852[1]	
Vermont[5]	1851[1]	
Wisconsin	1852	

Source: Rockoff (1975), Rolnick and Weber (1983)

1 According to Rockoff, few free banks entered in these states.

2 In 1845, Ohio passed a law that provided for the establishment of "Independent Banks" with bond-secured notes.

3 Branch-banking states.

4 Successful state insurance systems. See Calomiris (1989).

5 Unsuccessful state insurance systems. See Calomiris (1989).

6 Banks in this state were members of the Suffolk System.

Table 2

Percentage of Banks with Notes at the Modal Discount: Selected States*

	Connecticut		Georgia		Louisiana		Massachusetts		N.Y. City		N.Y. State**		Ohio		Philadelphia	
	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks
1839	84.03	42	63.69	25	95.26	20	98.49	136	93.71	41	78.33	148	89.89	38	100.00	42
1840	97.35	42	57.81	26	95.16	21	100.00	135	94.71	43	92.07	181	83.51	42	96.06	39
1841	96.73	42	54.19	18	96.06	19	100.00	130	85.43	38	68.13	168	84.13	40	82.92	39
1842	94.42	41	77.95	20	52.10	20	97.88	133	80.78	41	78.25	164	71.71	34	59.17	32
1843	95.00	40	63.40	18	50.88	20	96.32	133	73.51	39	67.50	166	67.72	36	70.83	30
1844	98.37	42	87.33	19	47.42	21	97.03	132	83.49	39	82.63	183	61.38	35	78.00	29
1845	98.16	42	85.28	28	50.00	20	97.74	133	89.15	36	83.35	184	70.48	35	94.09	26
1846	98.75	40	86.67	20	52.63	19	97.44	133	80.09	36	77.58	185	80.07	40	94.12	25
1847	99.58	40	89.76	18	52.63	19	98.80	110	78.70	36	76.89	203	81.52	39	93.44	22
1848	100.00	37	78.89	14	50.00	18	98.80	112	84.25	34	76.84	212	82.41	44	93.33	22
1849	100.00	40	83.98	13	79.66	18	99.54	122	100.00	29	81.30	209	77.27	44	93.68	21
1850	100.00	44	94.87	13	100.00	8	100.00	129	99.18	32	86.79	209	76.28	44	93.75	21
1851	97.94	47	77.57	13	100.00	8	100.00	133	97.50	41	87.35	238	76.85	43	93.75	21
1852	99.36	56	96.80	14	100.00	6	99.92	141	97.43	49	96.21	234	92.86	30	93.75	21
1853	99.42	63	96.77	18	100.00	8	100.00	150	98.18	64	87.93	286	94.60	39	100.00	21
1854	99.48	69	82.01	16	100.00	10	100.00	156	97.68	68	95.85	309	100.00	37	100.00	20
1855	100.00	69	97.02	18	100.00	10	100.00	162	88.29	68	96.44	318	93.32	37	100.00	20
1856	100.00	73	60.63	25	100.00	9	100.00	164	92.23	70	96.57	337	91.36	38	100.00	20
1857	96.27	77	64.84	24	100.00	8	99.75	175	93.38	68	95.86	320	87.12	38	100.00	20
1858	87.87	81	58.97	30	100.00	11	99.27	179	98.28	58	84.11	283	81.46	36	94.52	20

* The modal percentage is the average of the twelve monthly modal percentages (percentage of total banks with notes trading at the modal discount). The number of banks is the number of banks in existence during the year.

** All banks in New York State excluding New York City banks.

Table 3

Modal and Nonmodal Discounts: Selected States*

	Connecticut		Georgia		Louisiana		Massachusetts		N.Y. City		N.Y. State**		Ohio		Philadelphia	
	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount
1839	0.045	-0.021	5.975	7.754	3.773	13.125	-0.318	0.313	-2.0450	-0.026	-0.795	-1.276	4.409	2.368	0.000	-
1840	-3.083	4.615	7.375	11.035	2.417	25.000	-3.083	10.833	-4.0330	31.239	-2.375	1.770	4.833	4.407	0.000	21.667
1841	-1.500	8.906	8.917	16.516	4.125	25.000	-1.917	-	1.0630	30.356	-1.583	16.694	7.250	8.706	0.000	24.927
1842	-0.167	19.315	9.167	13.308	18.337	27.979	-0.167	56.515	-0.8750	31.500	0.292	32.623	10.167	23.556	0.000	38.561
1843	0.833	21.708	3.750	10.333	2.542	50.827	0.833	54.846	0.1670	29.600	0.197	42.599	2.792	38.727	0.000	33.214
1844	0.500	3.500	2.000	14.286	1.500	41.302	0.500	55.417	0.0210	22.071	0.750	40.290	1.646	24.600	0.000	22.058
1845	0.500	5.000	2.000	13.667	2.000	44.667	0.500	27.692	0.0000	28.813	0.750	33.893	2.021	25.565	0.000	28.636
1846	0.500	5.000	1.833	15.548	2.500	38.333	0.500	34.194	0.0000	47.244	0.813	26.813	2.125	30.025	0.000	24.167
1847	0.500	5.000	1.229	16.818	1.250	38.333	0.500	60.000	0.0000	51.914	0.750	24.667	1.333	38.838	0.000	18.917
1848	0.500	-	1.833	3.818	1.083	38.333	0.500	60.000	0.1670	50.159	1.010	24.376	2.083	42.418	0.000	14.833
1849	0.430	-	1.375	1.900	1.833	35.930	0.430	43.000	0.1250	-	0.802	19.784	1.625	48.000	0.000	12.333
1850	0.380	-	1.000	0.750	1.438	-	0.380	-	0.0100	0.750	0.750	9.350	1.448	49.500	0.000	13.833
1851	0.380	0.250	0.979	1.036	1.104	-	0.380	-	0.0000	0.750	0.750	9.811	1.271	49.328	0.000	15.000
1852	0.326	0.500	1.021	1.250	1.229	-	0.326	0.380	0.1250	0.589	0.688	12.495	1.271	70.000	0.000	15.000
1853	0.250	38.750	0.885	2.750	0.917	-	0.250	-	0.1250	0.500	0.510	8.742	0.979	31.155	0.000	-
1854	0.388	3.000	1.063	3.711	1.021	-	0.388	-	0.1250	0.097	0.542	12.197	1.866	-	0.000	-
1855	0.313	-	1.208	1.250	1.792	-	0.313	79.500	0.1560	3.643	0.542	14.813	1.475	35.397	0.000	-
1856	0.250	-	1.000	2.000	1.917	-	0.250	53.347	0.1250	4.903	0.500	11.725	1.000	20.000	0.000	-
1857	0.229	17.827	2.042	3.624	1.021	-	0.229	5.607	0.0104	40.271	0.458	16.891	2.250	30.198	0.000	-
1858	0.295	8.623	1.542	7.780	1.313	-	0.295	3.167	0.8960	15.000	0.375	6.638	1.208	29.938	0.000	60.000

* The modal discount is the annual average of the twelve monthly modal discounts. Similarly, the nonmodal discount is the average of the monthly nonmodal discounts. A "-" indicates that all the banks during the months of that year had notes trading at the modal discount.

** All banks in New York State excluding New York City banks.

Table 4

Speed of Detection of Bad Banks

State	Number of Bad Banks	Percentage of Bad Banks Surviving After:				
		2 months	3 months	6 months	12 months	16 months
Alabama	4	100.00	100.00	100.00	100.00	100.00
Connecticut	12	100.00	100.00	100.00	66.67	16.67
Delaware	1	100.00	100.00	100.00	100.00	100.00
D.C.	21	57.14	52.38	42.86	19.05	9.52
Georgia	47	93.62	82.98	70.21	59.57	31.92
Illinois	30	93.33	93.33	73.33	36.67	26.67
Indiana	113	70.80	69.90	65.50	53.10	47.80
Louisiana	12	100.00	91.67	83.33	41.67	41.67
Maine	59	52.54	52.54	42.37	37.29	30.15
Maryland	24	100.00	95.83	87.50	87.50	79.17
Massachusetts	19	100.00	89.47	84.21	57.90	21.05
Michigan	46	45.65	45.65	41.30	30.44	23.91
Mississippi	19	36.84	31.58	31.58	31.58	31.58
Montana	11	100.00	90.91	81.82	54.55	9.09
Nebraska	9	100.00	100.00	100.00	100.00	100.00
New Hampshire	20	95.00	95.00	65.00	15.00	10.00
New Jersey	25	92.00	84.00	76.00	56.00	40.00
New York	256	67.58	63.67	60.55	56.64	47.27
North Carolina	0	-	-	-	-	-
Ohio	15	93.33	80.00	66.67	46.67	33.33
Pennsylvania	54	96.30	90.74	70.37	53.70	37.04
Rhode Island	7	100.00	100.00	100.00	57.14	14.29
South Carolina	7	100.00	100.00	100.00	85.71	71.43
Tennessee	36	97.22	91.67	83.33	75.00	63.89
Vermont	4	100.00	100.00	100.00	75.00	50.00
Virginia	39	100.00	100.00	94.87	87.18	79.49

Table 5

Excess Entry Discount

Period	Mean Excess Entry Discount	Number of New Banks	Standard Deviation	Minimum	Maximum	*t*
Panel A: All Banks						
1839 - 1858	.0258	1673	.110	-.286	1.290	9.56
Panel B: By Period						
Year < = 1845	.0697	412	.171	-.059	1.290	8.26
1845 < Year < = 1850	.0220	203	.107	-.021	0.797	2.94
1850 < Year	.0080	1058	.068	-.286	0.737	3.96

Table 6

Return Differences Between Portfolios of New Banks' Notes
and Portolios of Seasoned Peer Banks' Notes

	1839 - 1858	Year < = 1845	1845 < Year < = 1850	1850 < Year
Mean Return Difference	-0.0045	-.0046	.0023	-.0063
Standard Deviation	0.114	.122	.110	.105
Minimum Difference	-1.045	-.983	-.443	-1.045
Maximum Difference	2.240	2.240	1.000	.0301
t-statistic	-1.720	-1.090	.328	-1.68
# of observations	1673	412	203	1058

Table 7

Cross-section Variation in Excess Entry Discounts

Independent Variable	1839 - 1858		Year <= 1845		1845 < Year <= 1850		1850 < Year	
	Parameter Estimate	*t*-value	Parameter Estimate	*t*-value	Parameter Estimate	*t*-value	Parameter Estimate	*t*-value
Branching Dummy	-.4100	-3.800	-.1340	-6.240	-.0780	-2.261	.0090	.746
Free Dummy	.0610	3.500	.3480	8.200	.1300	.979	.0250	1.244
Chartered Dummy	.0800	4.602	.3230	8.120	.1760	1.371	.0280	1.422
Good Insurance	-.0300	-2.730	.0170	0.630	-.0780	-2.293	.0030	.261
Bad Insurance	-.0150	-1.920	-.1330	-7.400	-.0130	-.505	-.0002	-.027
Stock Index	-.0004	-2.110	-.0010	-2.810	-.0010	-.748	-.0002	-1.101
Suffolk Member	-.0290	-3.680	-.0530	-3.240	-.0770	-3.700	-.0050	-.596
Suspension Period	-.0030	-.470	-.1060	-9.590	-	-	.0240	1.760
Travel Time	.0003	6.580	-	-	-	-	-	-
R^2	.1032		.3113		.2009		.2224	
F-value	21.93		20.141		20.45		20.52	
Prob > *F*	.0001		.0001		.0001		.0001	
d.f.	1637		410		194		1033	

Table 8

Excess Entry Discounts for Good Banks and Bad Banks

	All New		Subperiods					
Period	1839 - 1858	1839 - 1858	Year < = 1845		1845 < Year < = 1850		1850 < Year	1850 < Year
	Bad Banks	Good Banks	Bad Banks	Good Banks	Bad Banks	Good Banks	Bad Banks	Good Banks
Mean Excess Entry Discount	.0471	.0021	.124	.014	.086	.0005	.016	-.0004
Number of Banks	881	792	178	133	51	152	552	507
Standard Deviation	.147	.023	.200	.024	.200	.008	.091	.025
Minimum	-.286	-.286	-.011	-.011	-.015	-.021	-.286	-.286
Maximum	1.290	.211	.756	.167	.797	.091	.737	.211
t-value	9.490	2.560	8.270	6.500	3.090	.849	4.220	-.347

Tests of Difference of Mean Excess Entry Discount between Good and Bad Banks

	1839 - 1858	Year < = 1845	1845 < Year < = 1850	1850 < Year
t'	8.96	7.27	3.05	4.07
degrees of freedom	928	184	50	641

Table 9

Comparison of Balance Sheet Ratios for New York State Banks

	NY City Banks			NY Country Banks								
	Seasoned Banks	New Bad Banks	t'	Seasoned Banks	New Bad Banks	t'	Seasoned Banks	New Good Banks	t'	New Bad Banks	New Good Banks	t'
Notes/Total Assets	0.093	0.113	-2.38*	0.280	0.278	0.21	0.280	0.305	-3.02*	0.278	0.305	-2.22*
standard error	0.061	0.064		0.131	0.094		0.131	0.125		0.094	0.125	
Deposits/Total Assets	0.376	0.326	3.74*	0.180	0.209	-2.64*	0.180	0.149	5.07*	0.209	0.149	4.91*
standard error	0.106	0.101		0.111	0.110		0.111	0.091		0.110	0.091	
Specie/Total Assets	0.092	0.070	4.05*	0.018	0.016	2.37*	0.018	0.022	-2.15*	0.016	0.022	-3.00*
standard error	0.053	0.040		0.017	0.008		0.017	0.029		0.008	0.029	
Real Estate/Total Assets	0.034	0.026	2.26*	0.024	0.012	6.79*	0.024	0.017	3.87*	0.012	0.017	-2.09*
standard error	0.042	0.025		0.032	0.017		0.032	0.027		0.017	0.027	
Loans/Total Assets	0.616	0.591	1.30	0.569	0.517	3.69*	0.569	0.538	2.58*	0.517	0.538	-1.17
standard error	0.102	0.150		0.173	0.140		0.173	0.183		0.140	0.183	
Stock/Total Assets	0.074	0.104	-2.51*	0.152	0.249	-9.52*	0.152	0.205	-4.84*	0.249	0.205	3.05*
standard error	0.077	0.092		0.152	0.100		0.152	0.167		0.100	0.167	
Capital/Total Assets	0.365	0.465	-7.78	0.398	0.429	-2.61	0.398	0.439	-5.50*	0.429	0.439	-0.73
standard error	0.105	0.097		0.125	0.119		0.125	0.112		0.119	0.112	
# of Banks	687	63		3003	104		3003	249		104	249	

* Indicates significant at the 5% level

Table 10

Determinants of Excess Entry Discounts: New York State

Dependent Variable: Excess Entry Discount
Number of Observations: 541

Independent Variable	(1) Parameter Estimate	(1) t-value	(2) Parameter Estimate	(2) t-value	(3) Parameter Estimate	(3) t-value
Intercept	.0008	0.225	0.0004	0.145	-0.0031	-1.977
Deposits/Total Assets	-0.005	-1.499	-0.006	-1.780	-	-
Real Estate/Total Assets	0.006	0.066	0.011	1.230	0.0134	1.447
Loans/Total Assets	-0.0006	-0.220	-	-	-	-
Stock/Total Assets	-0.005	1.410	-	-	-	-
Notes/Total Assets	0.008	2.120	0.005	1.600	0.0082	3.273
Specie/Total Assets	-0.08	-7.870	-0.080	-7.800	-0.0803	-8.177
Capital/Total Assets	0.002	0.560	0.002	0.540	0.0049	1.978
R^2	.1855		.1814		.1766	
F value	17.38		23.76		28.80	
Prob > F	.0001		.0001		.0001	

Figure 1
Number of New Banks

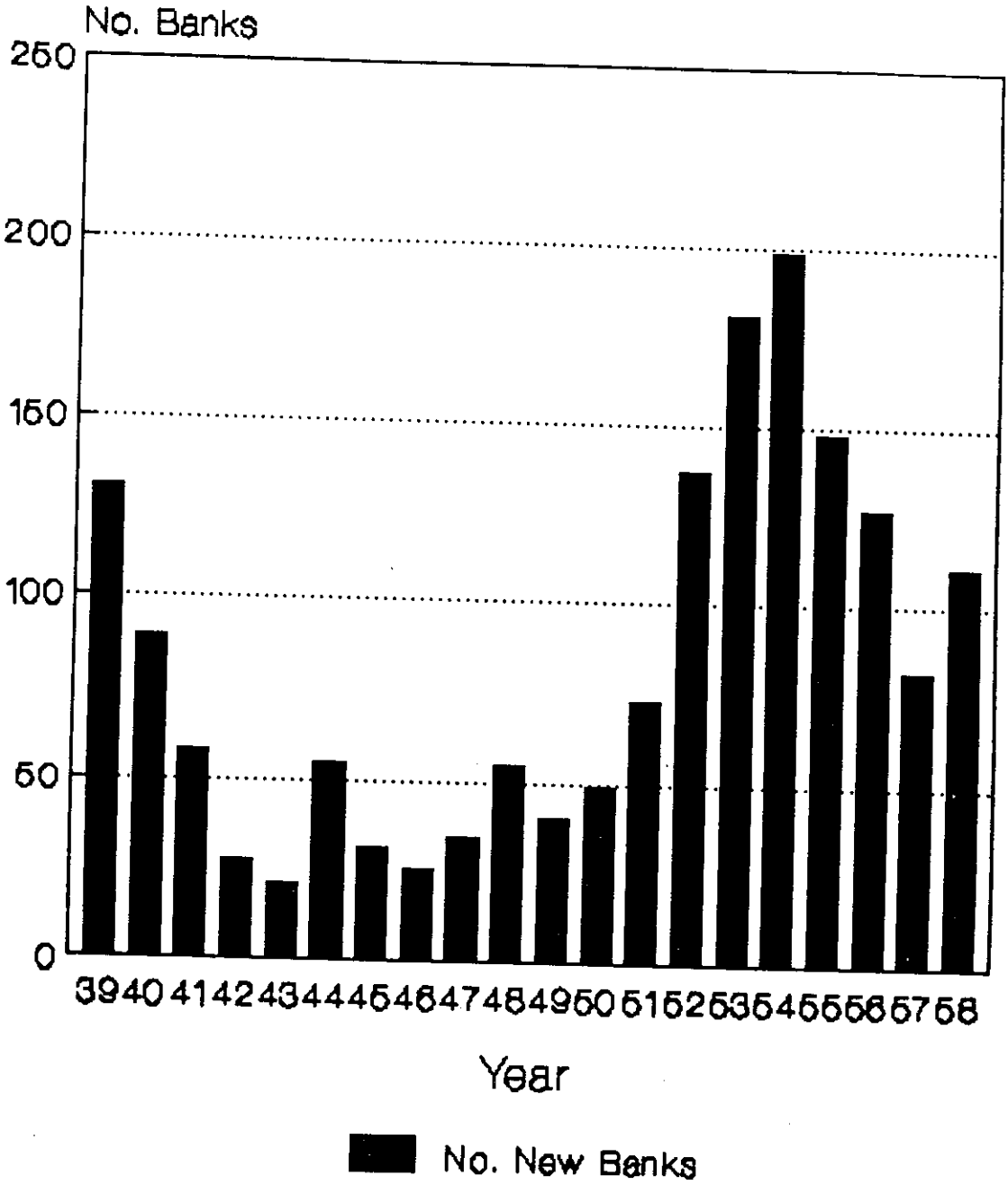

Figure 2
Tennessee

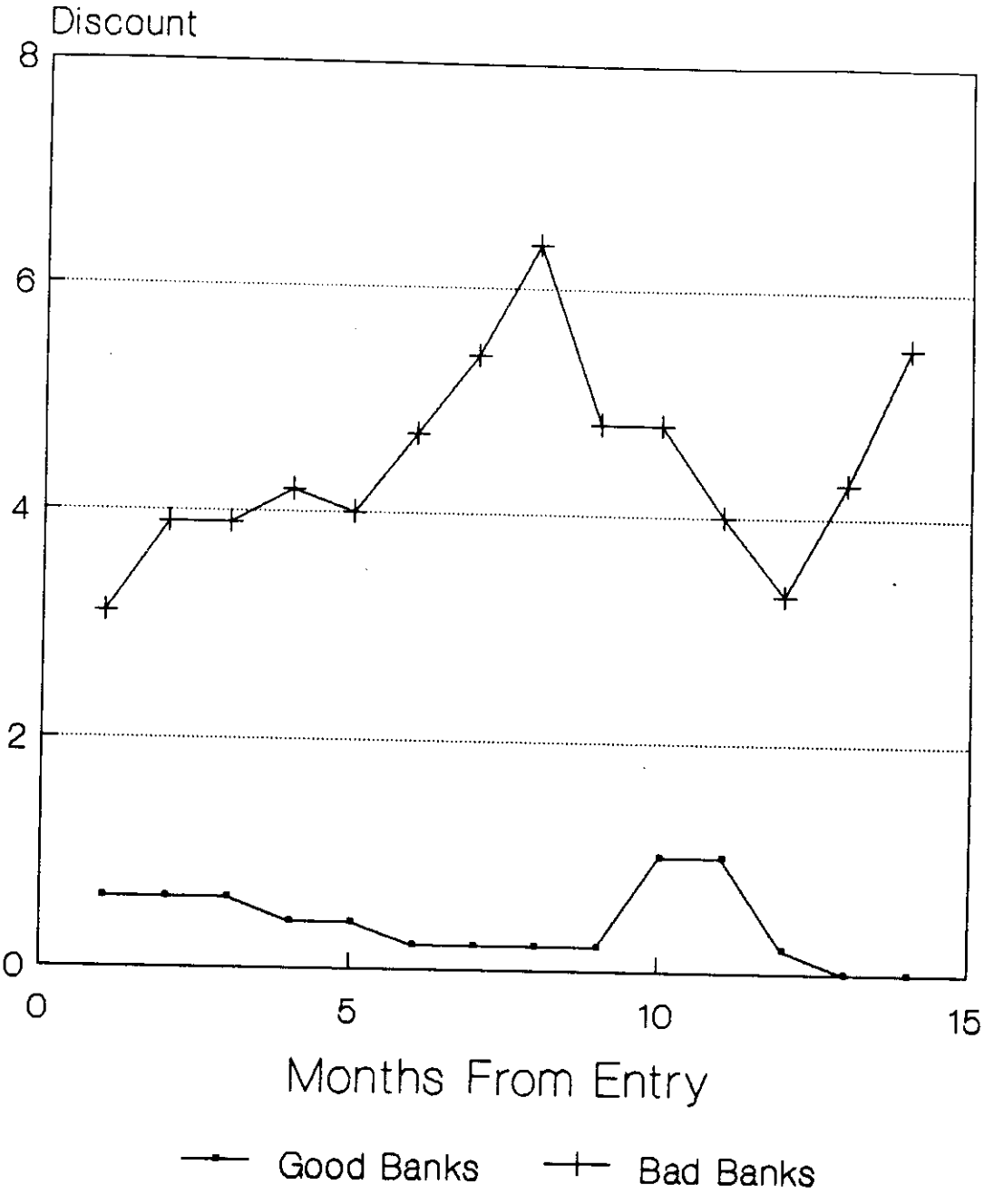

Figure 3
New York

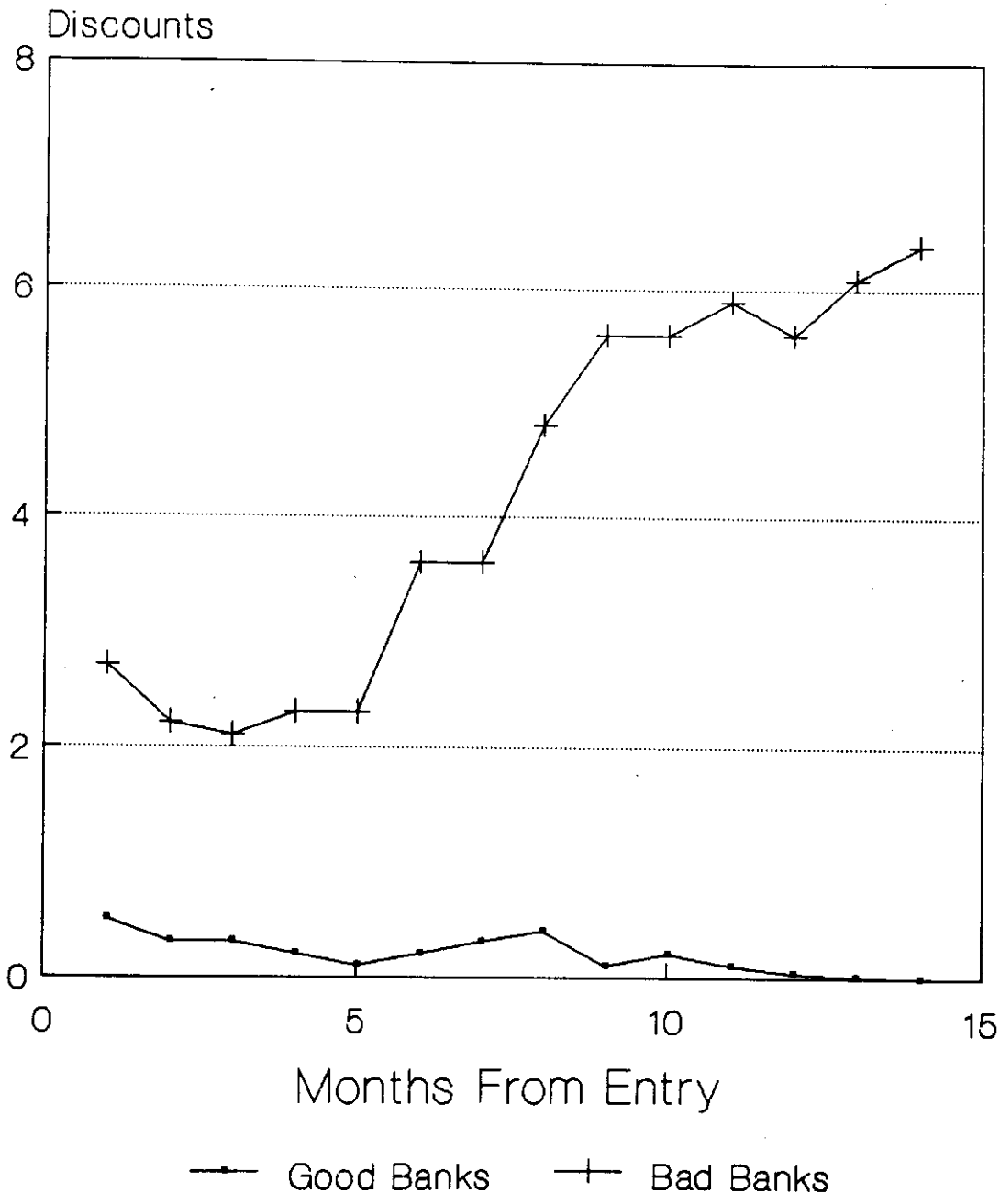

Figure 4
Technological Change