Reputation Formation in Early Bank Note Markets

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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 that 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 that provides an incentive for firms not to 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 (1838–60). The presence of a reputation effect in note prices is confirmed: the notes of new banks are discounted more heavily than the notes of banks with credit histories. Note holders are then motivated to monitor new banks because the excess discount provides an incentive for the 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 because of 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. It focuses particularly on the market for bank notes during the American Free Banking Era (1838–60), 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 1971, 1974, 1975, 1985, 1989; 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 via note redemption and reputation formation, existed that provided incentives for banks not to engage in wildcat banking.

The theory of reputation formation in debt markets that is tested here is due to Diamond (1989). He 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 are otherwise identical (hereafter called "seasoned" firms). Diamond's main result 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 that can choose between projects may find the safer project more attractive. The importance of reputation in

[1] In general, a "wildcat" bank refers to a bank that inflated its currency to the point at which it could not be continuously redeemed. A number of more precise definitions of wildcat banking have been proposed in the literature. Rockoff (1974, 1975) provided the definition that 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 that 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 that were insufficiently backed. The difference was earned as seigniorage, and the bank was left to fail. See Dillistin (1949) for a discussion of the origin of the term.

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 and (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 in which the issues arise in a very clear way and that 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 Rockoff 1975; Rolnick and Weber 1983). 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 at which 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 not to 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.[2] A re-

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

lated 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 issue debt only 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 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.

The main problem in empirically testing for the presence of reputation effects is that a counterfactual is posed: whether new firms are charged a premium that declines over time requires knowing what the interest rate would be if the same firm had a reputation.[3] Such a comparison poses the difficult problem of finding a seasoned cohort of firms with the same asset risk.[4] Also, 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 bank loan interest rate data are generally unavailable).

An additional empirical problem is that in Diamond's theory, lenders learn by observing defaults, but they happen only over relatively long periods of time for most entering cohorts of firms. For example, 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

[3] There is a literature that examines the "seasoning process" for corporate bonds, i.e., the differences in yield to maturity between newly issued bonds and bonds that have been outstanding for some time. The most recent results do not seem to find that new issues have higher yields that persist for any significant period (see Ederington 1974; Lindvall 1977; Weinstein 1978; Sorensen 1982; Fung and Rudd 1986; Wasserfallen and Wydler 1988). None of these studies analyzes price differences between bonds that are the obligations of firms issuing debt for the first time and those of experienced or seasoned firms.

[4] 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.

identical firm. But the longer the time it takes learning to occur, the more likely the fundamentals of the new firms and those of the benchmark firms will diverge.[5]

B. *The Free Banking Era*

In this paper a sample of firms that avoids many of the difficulties noted above 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 (1838–63). A bank note was a non-interest-bearing, risky, perpetual debt claim on the bank that could be redeemed at par on demand. This was effectively the only private debt that was publicly issued during this period.[6] Moreover, operating 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 note issuance during this period; that is, 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 that 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.

[5] 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.

[6] In the latter part of the period, railroads issued bonds.

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 that "overissue" 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 change affects reputation formation and monitoring using a measure of technological change constructed from pre–Civil War travelers' guides.

C. *Outline of the Argument 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 addresses this issue; I argue 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 expected risk so that the seasoned note prices can be used as benchmarks against which the prices of new banks' notes can be compared. Appendix A presents a model to make this point formally.

The argument depends on showing that the value of a 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

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. This monitoring mechanism supports the equilibrium in which all seasoned banks (at a given location) have the same risk.

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 that became insolvent or a new bank that 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 argument, 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. This is a result of the fact that bank notes functioned as a medium of exchange.

Section IV empirically examines the predictions of the argument above 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, 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 notes of new banks are discounted more heavily than the notes of seasoned peer banks. In addition, I investigate whether the prices of new banks' notes are fair lemons premia. The size of the initial discount on new banks' notes relative to the discount on the notes of seasoned peers, the lemons premium, depends on the degree of adverse selection. 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. In other words, whether there is evidence of a reputation effect or not, market participants may have sufficient information to distinguish between banks of different types. Section VIII examines the issue of technological change. The introduction and spread of the railroad and the telegraph may alter the ability of market participants to monitor banks and price notes. 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 offers a conclusion.

II. Pre–Civil War Bank Note 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.[7] If a free banking law was passed, then free and chartered banks could coexist if free banks entered the industry. During the Free Banking Era, 18 states adopted a version of free banking and 15 retained the chartered banking system.

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. For example, Gouge (1833, p. 57) wrote that "of large payments, 999 in a 1,000 are made with paper. Of small payments, 99 in a 100. The currency of the country is . . . essentially a paper currency." With a well-functioning government currency system, bank notes might be dominated, but during the antebellum period, the costs of using specie were sizable. The government did not print paper money, and there were problems with the available coins. Not only was specie difficult to transport, but many 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 (see Carothers 1930).

Banks issued notes to finance loans, mortgages, and security purchases (mostly state bonds). The notes then circulated as media of exchange. At a 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.

It is not clear whether bank notes circulated across different states and regions in significant amounts. Unfortunately, there is no direct

[7] "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 Cleaveland (1857), Grant (1857), Dewey (1910), and Hammond (1957).

evidence in the form of note volumes that can be brought to bear on this question. The qualitative evidence, however, is highly suggestive. First, during this period, there were large interregional trade flows.[8] Some of this trade appears to have been conducted with bank notes because of the transportation costs of using specie (see the discussion in Atherton [1971]). The literature of the time repeatedly makes this point. For example, "Bank paper is 'convertible' into silver only, which is inconvenient for large payments, and for transportation to distant places in large amounts" (Gouge 1833, p. 59). There are many examples in which the observer reports the common use of distant notes to conduct trade. For example, in 1864 one observer commented that "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). Or, in another case, "In April, 1838, the circulation of the northern portion of Wisconsin Territory was made up almost wholly of the notes of the banks organized under the general banking law of Michigan" (Merritt 1900). Green (1972) makes the point that Louisiana banks' notes circulated widely throughout the South. See also Atherton (1971).

Such observations are consistent with the fact that newspapers reporting the prices of bank notes, called "bank note reporters," were published in all major cities and were also consulted in rural areas (see Dillistin 1949). Bank note reporters were exhaustive in their coverage; that is, they reported a price for every existing private money in North America. The bulk of such newspapers was devoted to listing these prices together with descriptions of counterfeits. Demand for these newspapers is consistent with notes' traveling some distance in the course of trade.

A. *Bank Note Price Data*

Note prices represented a system of fixed exchange rates with wide bands. Notes were redeemable in specie (at par), but only at the location of the issuing bank. 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. These discounts reflected the risk of the bank's

[8] Interregional trade flows in antebellum America were sizable (see Pred 1980; Mercer 1982). Fishlow (1964) presents quantitative evidence on the size of these flows, and Lindstrom (1975) specifically discusses Philadelphia.

asset portfolio, leverage of the bank, and the time involved to take the note back to the issuing bank (see Gorton 1993).

Note prices or discounts were established in informal secondary markets, where note brokers traded notes. Note prices in the secondary market were reported by the 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 taken from *Van Court's Counterfeit Detector and Bank Note List,* a bank note reporter printed monthly in Philadelphia from February 1839 through December 1858.[9] *Van Court* was a small tabloid providing general business news together with the discounts from par on the notes of the banks of 29 states and territories and three provinces of Canada. In all, note prices of approximately 3,000 banks are provided. (Appendix table B1 shows the coverage provided by *Van Court.*)

The prices reported by *Van Court* are in the form of discounts from par; that is, the number "3" means that a $1.00 note of that bank is trading for 97 cents worth of gold (see Gorton 1989*b*).[10] 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 shall see below, because the distances 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; and some had private arrangements among banks that were important.

A traditional hypothesis is that banking systems that passed free banking laws experienced more bank failures and larger losses than

[9] See Gorton (1989*b*) for a more detailed description of *Van Court's Counterfeit Detector and Bank Note List.*

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

chartered banking systems did. Rockoff (1971, 1974, 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 are a better explanation of failures in free banking states. Rockoff and Rolnick and Weber do not directly compare 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" (p. 885), though Kahn stresses that this is based on ex post data.

It is important to emphasize 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 (1974) 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.

It is important to note that, besides differing as to whether free banking was allowed or not, state banking systems significantly varied in other ways as well. 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 that 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 and Schwiekart 1988; Calomiris 1989). Also, some states had successful state insurance systems (Indiana, Iowa, and Ohio), whereas 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 Whitney 1878; Dewey 1910; Mullineaux 1987).

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*

This study focuses attention 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 seems reasonable 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.[11]

The definition of a new bank results in a sample of 1,673 banks that entered during the period. Figure 1 presents a bar graph of the number of new banks entering each year during the sample 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.

III. Bank Note Prices, Arbitrage, and Monitoring via Redemption

A crucial step for the subsequent analysis is the proposition that *all seasoned banks at the same location will have identical note discounts at given distant locations, corresponding to identical asset risk (assuming capital requirements are binding so banks have the same leverage).* In this section

[11] 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 that were seasoned but had not been 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 that would otherwise have been classified as new. That the remaining banks are, in fact, new was checked for a small sample of New York banks by comparing the state regulatory listings for banks not previously listed with *Van Court*'s new entries. This confirms that the banks are, in fact, new.

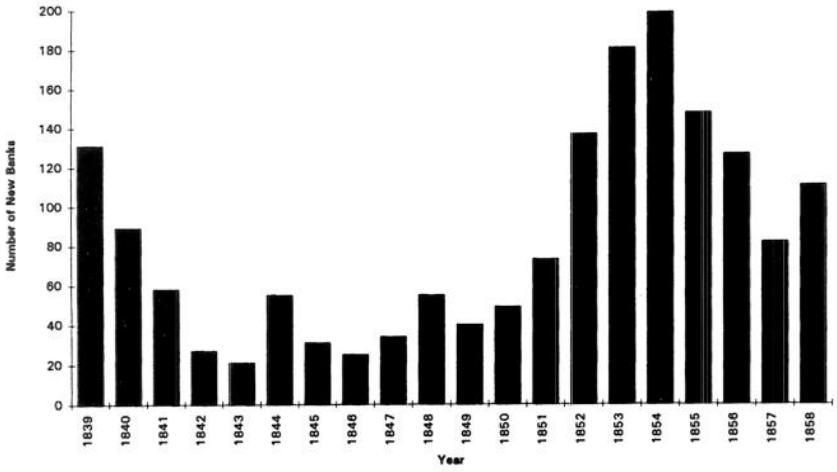

FIG. 1.—Number of new banks

I discuss this proposition informally; it is established formally in Appendix A in the context of a specific model. The proposition is stronger than the statement that note prices (discounts) must accurately reflect the default risk of the issuing bank. While this is true, the proposition says that the asset risk of banks at a given location must be the same. I show that the reason is that notes are used as media of exchange. The mechanism that enforces the equilibrium is redemption of notes of banks that choose higher levels of risk than that of seasoned peers. This monitoring feature of note redemptions is induced by arbitrage possibilities that arise if a bank chooses higher asset risk than its peers. The proposition will be examined empirically 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. I shall also examine evidence of monitoring via redemptions in the next section.

A. *Bank Note Discounts*

Imagine an economy in which agents are spatially separated and trade because they have a preference for goods from other, more distant, locations. I assume that (i) bank notes are used as media of exchange; that is, they are used to satisfy a cash-in-advance constraint; (ii) bank notes are risky because they finance risky assets; the issuing bank may fail to honor its notes at par if they are presented for redemption; and (iii) the further a bank's note is away from the issuing bank's location, the longer time it takes to return the note for redemption. The assumption that bank notes are used as media of

exchange, assumption i, presumes that they are not dominated by another medium, such as specie. As discussed above, there was no government paper currency during this period, and trade with specie was costly. The assumption that banks are risky, assumption ii, should be interpreted further to mean that the investment opportunity set of banks and the cost of capital are taken as given (i.e., it is optimal for seasoned banks to be risky). Assumption iii will be interpreted to mean that distance away from the issuing bank is equivalent to the time it takes to receive the risky payoff of a note redemption.[12] In other words, think of distance as the maturity of the risky note. With these assumptions we can ask how a bank's note price (discount from par) is determined at any given location.

It is easy to price the note of a bank when the note is at the same location as the issuing bank. At the location of the issuing bank, its notes must trade at par because, if not, there is an arbitrage opportunity since it is costless to redeem the note at the bank (the time it takes to return to the issuing bank is zero). But if a particular bank's note moves further away from the bank's location in the course of trade, then a discount from face value will arise along the way (it is this capital loss that would make notes dominated if there were a superior alternative). The reason is that, from distant locations, it takes time to return the note to the location of the issuing bank, and the bank is risky. Pricing the note in this context is equivalent to pricing a risky pure discount bond in which the maturity is equal to the time it takes to return to the issuing bank. In fact, at first glance, it would seem that the notes of different banks at the same location could be priced differently at some particular distant location (i.e., maturity), as long as the different prices reflected the different default risks. This would be true in efficient markets if notes were not used as a medium of exchange.

Now consider the implications of using notes as a medium of exchange. At any date a particular bank's note may be held by an agent to satisfy the cash-in-advance constraint or it may be sent back to the issuing bank for redemption (i.e., the agent will receive a risky payoff some periods from now, depending on how far away the issuing bank is located). If the agent is indifferent between these two alternatives, then the note may again be priced as a risky (pure discount) debt claim with maturity corresponding to distance away from the issuing bank. Otherwise a price bound is established. In Appendix A, conditions are provided under which a closed-form solution for note prices based on Black and Scholes (1973) can be derived. This pricing for-

[12] If the issuing bank is a distance d away, then assume that the maturity of the note is d periods, ignoring, for simplicity, the fact that there is a round-trip.

mula is useful because it shows that (as usual with bonds) the value of a note varies inversely with time to maturity, risk, and leverage.

The basis of the proposition is the fact that the value of a note declines as it moves further away from the issuing bank (because it then will take more time for the note to be returned for redemption). More specifically, a standard result on risky debt from contingent claims (see Merton 1974) is that the riskier the note (bond), the greater the decline in value as it moves further away (i.e., as the maturity increases). Since notes finance consumption purchases that may be made at locations further away from the issuing bank's location, the consumer will not be indifferent between the notes of two banks of different risk an equal distance away. If the consumer moves still further away from the issuing banks' location, increasing the time to redemption (maturity), the riskier banks' notes will decline in value by relatively more; hence the consumer exchanges fewer consumption units when shopping at the distant location. A less risky bank's notes will be preferred as a medium of exchange and the riskier bank's notes will be sent for redemption. But then equilibrium requires that the notes of all banks at a given location have the same risk, and none is sent for redemption. If banks could produce riskless liabilities and still earn the required rate of return on bank equity, then such notes would predominate. Of course, if using specie is less costly, then it might dominate notes. The proposition describes a world in which these alternatives are not available.

B. Discounts and Monitoring

Establishment of the equilibrium in which all banks at a given location have notes trading at the same prices relies on the argument that the notes of a higher-risk bank, at a given location, will be redeemed. Because a riskier bank will face more redemptions, it would have to hold more reserves or become insolvent. Since reserves are not interest-bearing, a bank with more reserves would be less profitable. Thus any difference in note prices induces a natural monitoring mechanism, namely, note redemptions. The mechanism of redemptions establishes the equilibrium quality (risk) of banks, resulting in the circulation of seasoned banks' notes at the same price without redemption.

Privately each bank may have an incentive to increase risk (above the equilibrium level of risk of bank portfolios at its location), that is, to be a "wildcat bank." Increasing risk will increase the value of the bank's equity, but 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 (the lemons pre-

mium in Diamond's [1989] model). Since the new, possibly wildcat, bank chooses a level of risk higher than the seasoned banks at its location, its notes will have a higher discount. In that case, by the argument above, all its notes will be redeemed. Redemption results in verification of bank type by establishing the ability of the bank to honor its notes with reserves, borrowings from other banks, or asset sales to other banks. If redemption occurs fast enough, wildcatting will not be profitable. The threat of redemption can prevent wildcat banking. Redemption corresponds to monitoring in Diamond (1991). This argument is formalized in Appendix A.

In the context of the Diamond (1989) setting, the arguments above should be interpreted as follows. The notes of new banks, to the extent that they are perceived to be riskier than seasoned peers, 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, they will become insolvent faster. Thus, while new banks' notes will have higher discounts initially compared to those of 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. The Enforcement of One Discount per Location: Empirical Evidence

The proposition says 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. In this section these predictions 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 that seasoned solvent banks' notes (at a given location) trade at the same discount, table 1 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.[13] The states shown in table 1 are representative geographically and with respect to type of banking system. At each date the bank notes of most banks at each 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

[13] Gorton (1989*b*) contains the full set of results.

TABLE 1

PERCENTAGE OF BANKS WITH NOTES AT THE MODAL DISCOUNT: SELECTED STATES

	CONNECTICUT		GEORGIA		LOUISIANA		MASSACHUSETTS	
	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
1840	97.35	42	57.81	26	95.16	21	100.00	135
1841	96.73	42	54.19	18	96.06	19	100.00	130
1842	94.42	41	77.95	20	52.10	20	97.88	133
1843	95.00	40	63.40	18	50.88	20	96.32	133
1844	98.37	42	87.33	19	47.42	21	97.03	132
1845	98.16	42	85.28	28	50.00	20	97.74	133
1846	98.75	40	86.67	20	52.63	19	97.44	133
1847	99.58	40	89.76	18	52.63	19	98.80	110
1848	100.00	37	78.89	14	50.00	18	98.80	112
1849	100.00	40	83.98	13	79.66	18	99.54	122
1850	100.00	44	94.87	13	100.00	8	100.00	129
1851	97.94	47	77.57	13	100.00	8	100.00	133
1852	99.36	56	96.80	14	100.00	6	99.92	141
1853	99.42	63	96.77	18	100.00	8	100.00	150
1854	99.48	69	82.01	16	100.00	10	100.00	156
1855	100.00	69	97.02	18	100.00	10	100.00	162
1856	100.00	73	60.63	25	100.00	9	100.00	164
1857	96.27	77	64.84	24	100.00	8	99.75	175
1858	87.87	81	58.97	30	100.00	11	99.27	179

	NEW YORK CITY		NEW YORK STATE*		OHIO		PHILADELPHIA	
	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks	Modal Percentage	Number of Banks
1839	93.71	41	78.33	148	89.89	38	100.00	42
1840	94.71	43	92.07	181	83.51	42	96.06	39
1841	85.43	38	68.13	168	84.13	40	82.92	39
1842	80.78	41	78.25	164	71.71	34	59.17	32
1843	73.51	39	67.50	166	67.72	36	70.83	30
1844	83.49	39	82.63	183	61.38	35	78.00	29
1845	89.15	36	83.35	184	70.48	35	94.09	26
1846	80.09	36	77.58	185	80.07	40	94.12	25
1847	78.70	36	76.89	203	81.52	39	93.44	22
1848	84.25	34	76.84	212	82.41	44	93.33	22
1849	100.00	29	81.30	209	77.27	44	93.68	21
1850	99.18	32	86.79	209	76.28	44	93.75	21
1851	97.50	41	87.35	238	76.85	43	93.75	21
1852	97.43	49	96.21	234	92.86	30	93.75	21
1853	98.18	64	87.93	286	94.60	39	100.00	21
1854	97.68	68	95.85	309	100.00	37	100.00	20
1855	88.29	68	96.44	318	93.32	37	100.00	20
1856	92.23	70	96.57	337	91.36	38	100.00	20
1857	93.38	68	95.86	320	87.12	38	100.00	20
1858	98.28	58	84.11	283	81.46	36	94.52	20

NOTE.—The modal percentage is the average of the 12 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.

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 1989*b*).[14] 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 2 provides the modal discounts, averaged over the months of each year, and the average nonmodal discount.[15] It can be seen that the nonmodal discounts are typically much larger than the modal discounts.[16] As expected, in Philadelphia, the modal discount is always zero, indicating that bank notes trade at par at the home location. Also, notably, even states such as New York, where free banks and chartered banks covered by state insurance coexisted, the discount on the notes of all solvent banks is the same!

The high percentages of banks with notes trading at the modal discount are consistent with the proposition above. Banks not trading at the modal discount are insolvent.

B. Evidence of Monitoring

The argument above also predicts that the notes of a new bank that are trading at a discount higher than the modal discount of seasoned peers at their location will be redeemed more frequently. In the face of such redemptions, we would expect "bad" banks, that is, high-risk banks, to be detected fairly fast. In fact, the notes of banks of higher perceived risk would not circulate as far.[17] 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

[14] This was verified for a small sample of New York State banks.

[15] The reader will note some negative entries in table 2. They 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 (1989*b*) for a more complete discussion.

[16] 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 modal discount.

[17] In terms of the model in App. A, with a higher σ, the optimal d that solves (A4) is lower.

TABLE 2

Modal and Nonmodal Discounts: Selected States

	Connecticut		Georgia		Louisiana		Massachusetts	
	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount
1839	.045	−.021	5.975	7.754	3.773	13.125	−.318	.313
1840	−3.083	4.615	7.375	11.035	2.417	25.000	−3.083	10.833
1841	−1.500	8.906	8.917	16.516	4.125	25.000	−1.917	···
1842	−.167	19.315	9.167	13.308	18.337	27.979	−.167	56.515
1843	.833	21.708	3.750	10.333	2.542	50.827	.833	54.846
1844	.500	3.500	2.000	14.286	1.500	41.302	.500	55.417
1845	.500	5.000	2.000	13.667	2.000	44.667	.500	27.692
1846	.500	5.000	1.833	15.548	2.500	38.333	.500	34.194
1847	.500	5.000	1.229	16.818	1.250	38.333	.500	60.000
1848	.500	···*	1.833	3.818	1.083	38.333	.500	60.000
1849	.430	···	1.375	1.900	1.833	35.930	.430	43.000
1850	.380	···	1.000	.750	1.438	···	.380	···
1851	.380	.250	.979	1.036	1.104	···	.380	···
1852	.326	.500	1.021	1.250	1.229	···	.326	.380
1853	.250	38.750	.885	2.750	.917	···	.250	···
1854	.388	3.000	1.063	3.711	1.021	···	.388	···
1855	.313	···	1.208	1.250	1.792	···	.313	79.500
1856	.250	···	1.000	2.000	1.917	···	.250	53.347
1857	.229	17.827	2.042	3.624	1.021	···	.229	5.607
1858	.295	8.623	1.542	7.780	1.313	···	.295	3.167

	New York City		New York State†		Ohio		Philadelphia	
	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount	Modal Discount	Nonmodal Discount
1839	−2.0450	−.026	−.795	−1.276	4.409	2.368	.000	···
1840	−4.0330	31.239	−2.375	1.770	4.833	4.407	.000	21.667
1841	1.0630	30.356	−1.583	16.694	7.250	8.706	.000	24.927
1842	−.8750	31.500	.292	32.623	10.167	23.556	.000	38.561
1843	.1670	29.600	.197	42.599	2.792	38.727	.000	33.214
1844	.0210	22.071	.750	40.290	1.646	24.600	.000	22.058
1845	.0000	28.813	.750	33.893	2.021	25.565	.000	28.636
1846	.0000	47.244	.813	26.813	2.125	30.025	.000	24.167
1847	.0000	51.914	.750	24.667	1.333	38.838	.000	18.917
1848	.1670	50.159	1.010	24.376	2.083	42.418	.000	14.833
1849	.1250	···	.802	19.784	1.625	48.000	.000	12.333
1850	.0100	.750	.750	9.350	1.448	49.500	.000	13.833
1851	.0000	.750	.750	9.811	1.271	49.328	.000	15.000
1852	.1250	.589	.688	12.495	1.271	70.000	.000	15.000
1853	.1250	.500	.510	8.742	.979	31.155	.000	···
1854	.1250	.097	.542	12.197	1.866	···	.000	···
1855	.1560	3.643	.542	14.813	1.475	35.397	.000	···
1856	.1250	4.903	.500	11.725	1.000	20.000	.000	···
1857	.0104	40.271	.458	16.891	2.250	30.198	.000	···
1858	.8960	15.000	.375	6.638	1.208	29.938	.000	60.000

Note.—The modal discount is the annual average of the 12 monthly modal discounts. Similarly, the nonmodal discount is the average of the monthly nonmodal discounts.

* 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.

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 shall rely on the prediction that such a bank eventually has notes priced the same as those of seasoned peers. Therefore, a good bank is defined to be a bank whose note discount has converged to the modal discount (at that location) 13 months after entry.[18] Other banks are deemed bad banks (their note discounts become increasingly larger than the modal discount as time goes by).

A bank that 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 is no longer reported. A bank whose discount is initially in excess of the modal discount may eventually (after 1 year by the definition above) become a good bank. Suppose it is assumed that new banks that *Van Court* drops from newspaper coverage are bad banks that 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. The percentage of new bad banks that *Van Court* discontinues reporting on provides a *lower bound* on the number of bad banks that have been detected.

Examining the percentage of new bad banks that *Van Court* discontinues reporting on provides some sense of the speed with which bad banks are detected. Table 3 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 in which no bad banks have been detected within the first year are states that are distant from Philadelphia and have 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 and Indiana. The evidence in table 3 is consistent with the notion that bad banks are forced into insolvency via redemptions since their assets typically would have maturities longer than 1 year.[19]

I shall 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 that have been in existence for some time.

[18] The requirement is that the discount of the entrant be at the mode for three consecutive months, 13, 14, and 15 months after entry. Results are not particularly sensitive to a variety of other definitions of good and bad banks.

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

TABLE 3

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
District of Columbia	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

V. Reputation Formation and the Primary Note Market

We are now in a position to ask whether the notes of new banks are discounted more heavily than those of seasoned peer banks at that location. We shall examine the discounts on new banks' notes compared to the modal discount of banks at that location. The "excess entry discount" for new banks, entering the market at time t, at a particular location, is defined to be

$$\frac{\text{entry discount}_t - \text{modal discount}_t}{|100 - \text{modal discount}_t|}.$$

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, if it 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 Notes of New Banks

The main prediction of Diamond's reputation theory is that the excess entry discounts should be significantly positive because the notes of new banks must offer a premium to note holders (over the rate offered on the notes of seasoned banks) to induce them to hold them since new banks do not have credit histories. To examine this question the excess entry discount is computed for all new banks during the period; there are 1,673 new banks. A finding of a significantly positive excess entry discount would be evidence in favor of the theory.

Panel A of table 4 provides the average excess entry discount on the notes of all new banks that entered during the period. Also provided are the results of the test that the excess entry discount is significantly different from zero. As can be seen, 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 4.[20]

[20] The subperiods are chosen to correspond to the measure of technological change introduced in Sec. VIII.

TABLE 4

EXCESS ENTRY DISCOUNT

Period	Mean Excess Entry Discount	Number of New Banks	Standard Deviation	Minimum	Maximum	*t*-Statistic
			A. All Banks			
1839–58	.0258	1,673	.110	−.286	1.290	9.56
			B. By Period			
1839–45	.0697	412	.171	−.059	1.290	8.26
1846–50	.0220	203	.107	−.021	.797	2.94
1851–58	.0080	1,058	.068	−.286	.737	3.96

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 that suffer capital losses (when the bank fails or when information that it is a bad bank is revealed) and some notes that 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 can 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

$$\frac{P_{Nt+12} - P_{Nt}}{P_{Nt}} - \frac{P_{St+12} - P_{St}}{P_{St}} \equiv R_N - R_S,$$

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 5

RETURN DIFFERENCES BETWEEN PORTFOLIOS OF NEW BANKS' NOTES AND PORTFOLIOS OF SEASONED PEER BANKS' NOTES

	1839–58 (N = 1,673)	1839–45 (N = 412)	1846–50 (N = 203)	1851–58 (N = 1,058)
Mean return difference	−.0045	−.0046	.0023	−.0063
Standard deviation	.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

Table 5 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 this sense, 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 non–mutually exclusive alternative hypothesis concerns counterfeiting of bank notes. Counterfeiting during the Free Banking Era was a serious problem (see Dillistin 1949; Glasner 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 that a new bank's note is counterfeit was 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 4 and 5. 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 3), making counterfeiting the notes of new banks very risky. Moreover, as we have seen in table 4, 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, pp. 85–86)]

A second point concerns how counterfeiting was actually accomplished. The dominant method was not engraving, printing, photographing, or otherwise creating replicas of real notes. These technologies were expensive and not widespread. Instead, rather than the replication of notes, the predominant method involved the alteration of existing notes.[21] A typical method was to raise the denomination of an existing note, for example, by turning a $1.00 bill into a $10 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 as follows:

> 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

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

> 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. [*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 that were poorly designed or poorly printed, which made alterations easier, or on notes that 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 that were more profitable to counterfeit. The conclusion is that counterfeiting cannot be the explanation for the results in tables 4 and 5. 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 that 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 also affect the benchmark of the modal discount if seasoned bank risk is affected (see Gorton 1993). So the excess entry discount will be affected only 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 that included 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 divides these systems into successful insurance systems and unsuccessful insurance systems on the basis of 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 because of 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, for example, 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 factors above 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. In every case in which 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 argument above—that all note prices of banks at a given location will be the same—implies 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 the opposite will occur. 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 (the asset value variance implied by the modal note price, found by inverting the Black-Scholes formula) trading at the modal discount 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. 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. By revealed preference, 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, the degree of adverse selection might be worse in free banking states. In that case the excess entry discounts would be larger because of the entry of more bad banks. 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 (see App. A).

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 the entry of large numbers of bad banks 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

independent variables above, measured as dummy variables. If the banking system 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 6 presents the results of the regressions.[22] The cross-section variation of excess entry discounts by state does reflect risk factors that are expected a priori 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 6, 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.

The regression includes two variables intended to capture business cycle variation: an index of stock prices and a dummy variable for suspension of convertibility.[23] Excess entry discounts are lower when the stock market goes up, possibly because new banks entered with more equity during these periods. The excess entry discount is not significantly affected by whether the new bank entered during a period of suspension of convertibility (suspension period). (The variable travel time is discussed below.)

With respect to whether the state allowed free banking or not, table 6 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 performance significantly different from that of 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

[22] There are no intercepts in the regressions because all the dummy variables are used.

[23] The monthly index of stock prices is taken from Smith and Cole (1935). A suspension period occurs during a banking panic, during which time all banks refuse to convert debt liabilities into specie on demand.

TABLE 6

CROSS-SECTION VARIATION IN EXCESS ENTRY DISCOUNTS

INDEPENDENT VARIABLE	1839–58		1839–45		1846–50		1851–58	
	Parameter Estimate (1)	*t*-Value	Parameter Estimate (2)	*t*-Value	Parameter Estimate (3)	*t*-Value	Parameter Estimate (4)	*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	.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	
Degrees of freedom	1,637		410		194		1,033	

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 13 months by the definition above), whereas 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 banks (i.e., on the basis of their ex post performance). The question is whether the excess entry discounts are significantly different for the two groups. Table 7 shows the average excess entry discounts for all bad new banks entering during the period (col. 1) and all good new banks entering during the period (col. 2). 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 from 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 (1846–58), entering good banks' notes are priced the same as (i.e., insignificantly different from) seasoned peers' notes.

The tests in panel B 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.[24] In other words, while the market significantly discounted the notes of new banks relative to those of seasoned peers, participants could distinguish good banks from bad banks and (relatively) priced them accordingly.

[24] The tests in panel B of table 7 and in table 8 are tests of the equality of means, assuming that the samples are independent and have different population standard deviations (which is consistent with the different degrees of risk of bad banks and good banks). Consequently, instead of an ordinary t-statistic, the following statistic was calculated:

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

TABLE 7

A. Excess Entry Discounts for Good Banks and Bad Banks

	All New		Subperiods					
	1839–58		1839–45		1846–50		1851–58	
	Bad Banks (1)	Good Banks (2)	Bad Banks (3)	Good Banks (4)	Bad Banks (5)	Good Banks (6)	Bad Banks (7)	Good Banks (8)
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

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

	1839–58	1839–45	1846–50	1851–58
t'	8.96	7.27	3.05	4.07
Degrees of freedom	928	184	50	641

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 1 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 8. Table 8 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, 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.

As seen in table 8, there are several notable differences between the various groups of banks. With respect to city banks, bad banks have significantly *more* notes and stock (i.e., bonds) whereas they have significantly *fewer* deposits, *less* specie, and *less* real estate.[25] Deposits and real estate require some time to acquire market share, whereas stock can be easily purchased as an asset. When seasoned country banks are compared to bad (new) country banks, bad banks have significantly *more* deposits and stock whereas they have significantly *less* specie, *less* real estate, and *fewer* loans. Good (new) country banks have significantly *more* notes, specie, stock, and capital than seasoned

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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 7 and 8, the degrees of freedom shown are the adjusted degrees of freedom.

[25] The term "stocks" refers to what we call bonds in modern parlance.

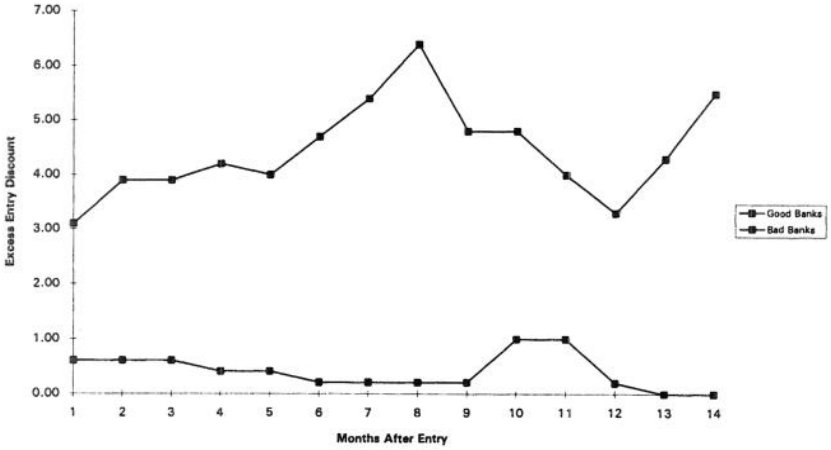

FIG. 2.—Excess entry discounts for good and bad banks: Tennessee

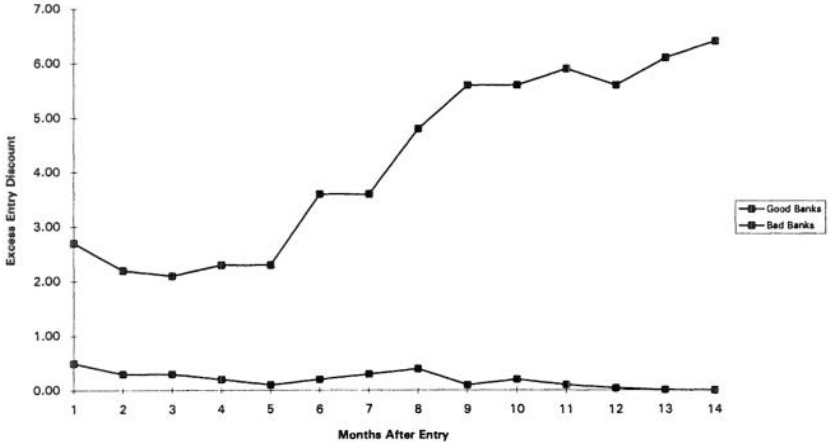

FIG. 3.—Excess entry discounts for good and bad banks: New York

country banks and have *fewer* deposits, *less* real estate, and *fewer* loans. Finally, when bad (new) country banks are compared to good (new) country banks, bad banks have significantly *more* deposits and stock and have *fewer* notes, *less* specie, and *less* 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 comparisons above is that bad banks,

TABLE 8

COMPARISON OF BALANCE SHEET RATIOS FOR NEW YORK STATE BANKS

	NEW YORK CITY BANKS			NEW YORK COUNTRY BANKS								
	Seasoned Banks (N = 687)	New Bad Banks (N = 63)	t'	Seasoned Banks (N = 3,003)	New Bad Banks (N = 104)	t'	Seasoned Banks (N = 3,003)	New Good Banks (N = 249)	t'	New Bad Banks (N = 104)	New Good Banks (N = 249)	t'
Notes/total assets	.093	.113	−2.38*	.280	.278	.21	.280	.305	−3.02*	.278	.305	−2.22*
	(.061)	(.064)		(.131)	(.094)		(.131)	(.125)		(.094)	(.125)	
Deposits/total assets	.376	.326	3.74*	.180	.209	−2.64*	.180	.149	5.07*	.209	.149	4.91*
	(.106)	(.101)		(.111)	(.110)		(.111)	(.091)		(.110)	(.091)	
Specie/total assets	.092	.070	4.05*	.018	.016	2.37*	.018	.022	−2.15*	.016	.022	−3.00*
	(.053)	(.040)		(.017)	(.008)		(.017)	(.029)		(.008)	(.029)	
Real estate/total assets	.034	.026	2.26*	.024	.012	6.79*	.024	.017	3.87*	.012	.017	−2.09*
	(.042)	(.025)		(.032)	(.017)		(.032)	(.027)		(.017)	(.027)	
Loans/total assets	.616	.591	1.30	.569	.517	3.69*	.569	.538	2.58*	.517	.538	−1.17
	(.102)	(.150)		(.173)	(.140)		(.173)	(.183)		(.140)	(.183)	
Stock/total assets	.074	.104	−2.51*	.152	.249	−9.52*	.152	.205	−4.84*	.249	.205	3.05*
	(.077)	(.092)		(.152)	(.100)		(.152)	(.167)		(.100)	(.167)	
Capital/total assets	.365	.465	−7.78	.398	.429	−2.61	.398	.439	−5.50*	.429	.439	−.73
	(.105)	(.097)		(.125)	(.119)		(.125)	(.112)		(.119)	(.112)	

NOTE.—Standard errors are in parentheses.
* Significant at the 5 percent level.

whether city or country, have less specie reserves than seasoned banks or good banks. Since new bad banks' notes face significantly higher discounts, more of their notes would be redeemed than notes of new good banks. But their specie to total assets ratio is significantly lower than that of 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.

Table 8 examines each ratio individually. I next ask which balance sheet characteristics are priced by the market for new banks' notes. Table 9 addresses this by regressing the excess entry discounts for new banks in New York State on the balance sheet ratios. Because balance sheet ratios are often highly correlated, several specifications are examined. The only ratios that are significant are the ratios of notes to total assets and specie to total assets. As expected, 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). It is perhaps surprising that the capital to total assets ratio is not important, but perhaps the reason is that it is a book value measure.[26]

VIII. Technological Change and Primary Note Prices

During the Free Banking Era, 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 United States shortly thereafter. Between 1838 and 1860, railroad mileage increased from 3,000 miles to over 30,000 miles (see Fogel 1964; 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 Thompson 1947; Du Boff 1980, 1983, 1984). 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

[26] There is also a timing problem. The date of the bank's entry according to *Van Court* is typically earlier than the regulatory authorities' publication of the balance sheet data. During this interval the market value of bank equity could change by a lot because of learning by market participants via redemptions.

TABLE 9

DETERMINANTS OF EXCESS ENTRY DISCOUNTS: NEW YORK STATE (N = 541)

Dependent Variable: Excess Entry Discount

Independent Variable	Parameter Estimate (1)	t-Value	Parameter Estimate (2)	t-Value	Parameter Estimate (3)	t-Value
Intercept	.0008	.225	.0004	.145	−.0031	−1.977
Deposits/total assets	−.005	−1.499	−.006	−1.780	...	...
Real estate/total assets	.006	.066	.011	1.230	.0134	1.447
Loans/total assets	−.0006	−.220	...	...	...	...
Stock/total assets	−.005	1.410	...	...	...	...
Notes/total assets	.008	2.120	.005	1.600	.0082	3.273
Specie/total assets	−.08	−7.870	−.080	−7.800	−.0803	−8.177
Capital/total assets	.002	.560	.002	.540	.0049	1.978
R^2	.1855		.1814		.1766	
F-value	17.38		23.76		28.80	
Prob > F	.0001		.0001		.0001	

changes, an index of technological change is required. Subsection *A* 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 travelers' guides, which provided the most commonly used routes and the means of transport (steamship, canal boat, stagecoach, or railroad) along each leg of the trip. The guides also provide the number of miles traveled 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[27] (see Gorton [1989*a*] 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: 1839–45, 1846–50, and 1850–58. 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 the influence of both the railroad and the telegraph (see Thompson 1947).

Improvements in travel times were dramatic during the two decades from 1839 to 1858. Figure 4 shows the travel times for representative locations for each of the three years. It is important to note that there is a good deal of cross-section variation: for some locations the largest gains came in the middle period, whereas for others they 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 notes initially. There are two effects. 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

[27] Gorton (1989*a*) 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 the issuing bank is analyzed.

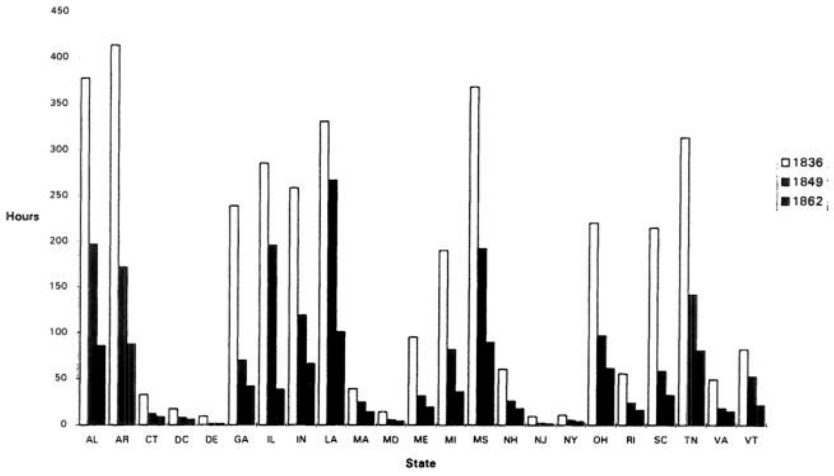

FIG. 4.—Technological change

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 effect on initial note prices. A reduction in redemption time corresponds to a decrease in maturity. But, as argued above, this would reduce the prices of bad banks' notes by more than those of good banks' notes (see the lemma in App. A). 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 faster (approaching the modal discount).

The second effect 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 in which 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.[28]

[28] The effects 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).

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, 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, in turn, 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 that 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 shall now examine 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 4 above. This panel computes the excess entry discount by subperiod. As can be seen in table 4, there is a marked decline in the mean excess entry discount, though it is still significantly positive in the last period. Table 7 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 7 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 6 uses the travel time index and provides further evidence of the importance of technological change. Column 1 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 con-

firming 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, .0697. If this corresponds to an average travel time of 3 days (72 hours) and this time is reduced to 1 day, then the excess entry discount falls to .0216, a third of the initial excess entry discount. Thus technological change is not only significant in the regression but quite dramatic in practical terms.

The rest of table 6 addresses the issue of whether the information possessed by market participants about new banks became finer over time. Columns 2–4 of table 6 present a time-series, cross-section seemingly unrelated regression of the excess entry discounts on the a priori risk factors for the three subperiods. Notably, the risk factors of state banking systems are priced in the early period, but in the last period they are not priced. 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.[29]

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 the notes of banks with credit histories. Consumers, who use the bank notes as a medium of exchange, had 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 that limited the degree of adverse selection, explain the success of the Free Banking Era (in the sense that wildcat banking was not widespread).

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

Appendix A

This Appendix presents a simple model of bank notes, based on Svensson (1985) and Gorton (1993). The main simplification is that the model assumes that only privately issued notes can be used in exchange; the costs of using specie make notes preferable.

Assume that agents are identical except that they 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. (A time subscript on d will usually be omitted for ease of notation.) Because of symmetry, the distance measure, d, is an index of agents' locations. (The home location is $d = 0$.) The representative agent (at a representative location) is assumed to prefer goods procured from locations further from home rather than nearer to home. The agent's objective is to maximize

$$E_t\left[\sum_{j=t}^{\infty} \beta^{j-t} U(C, d)\right], \tag{A1}$$

where C is consumption, $0 < \beta < 1$, $U'_C > 0$, $U''_{CC} < 0$, $U'_d > 0$, and $U''_{dd} < 0$. The assumption that utility depends on distance says that the "same" good purchased further away "tastes" better; it is intended to capture the notion of a division of labor, motivating trade. Each agent is endowed with a nontradable project that 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. Assume that the current endowment, $y_t(d)$ (each location d), is public information.[30] Expectations below are taken over uncertainty concerning future endowments. The standard deviation of endowments at location d is $\sigma(d)$ and is assumed constant through time. Later, however, we shall briefly consider thought experiments in which an agent a distance d away has a higher $\sigma(d)$ than other agents at that location, and also the case in which σ may be chosen by the agent.

Since agents prefer goods from distant locations, they will trade. Assume that agents face a cash-in-advance constraint that can be satisfied only by issuing private money. Each agent issues two types of claims against future endowments: bank notes and equity. The notes are non-interest-bearing debt claims that allow for conversion into consumption goods on demand at par at the location of the issuing agent. For simplicity the equity does not pay dividends.

Each agent is to be thought of as a buyer-seller pair, as in Lucas (1980). There is a division of labor between the household seller and the household buyer. Each household will be involved in transactions at two locations each period, corresponding to this division of labor. At the home location, the seller stays at home and sells the household endowment (minus the amount of notes that the household has redeemed, explained below) to buyers from other locations, receiving bank notes of other agents in exchange. The seller

[30] 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.

receives notes with a value equal to y_t (minus the amount of notes that the household has redeemed). Also, at the home location, the household trades in the securities market later. Notes at the home location are indexed by d, indicating the distance to the issuing bank from the home location. Indicate note prices (in terms of consumption units) at the home location of notes issued by banks a distance d away by $P_t(d)$. The other transaction is carried out by the buyer and occurs at a distant location. Only one (distant) market can be visited at each date t. The buyer chooses a distance, d, and a direction to travel, and purchases goods at that distant location, paying for them with bank notes.[31] We shall also need to index notes at this location. Let d' be the distance to the issuing bank from the distant location at which the buyer purchases goods. Indicate note prices (in terms of consumption units) at the distant location of notes issued by banks a distance d' away by $P_t(d')$. Note that d' depends on d (though this dependence is suppressed). For example, $d' < d$ when the buyer goes to a distant market, which brings the bank note closer to the issuing bank. When the buyer goes to a distant market, which takes the note even further from the issuing bank, $d' > d$.

The sequence of events in period t is as follows. First, households receive their endowments $y_t(d)$. Second, households honor notes turned in for redemption (this is described below). Third, the markets for goods open. The buyer travels to a distant market carrying the portfolio of bank notes held over from the previous period and purchases C_t consumption units from sellers at that location, using bank notes, and then returns home. Simultaneously, the household seller sells goods remaining from the household endowment (after notes have been honored) in the home market, receiving bank notes in exchange. Fourth, households go to the securities market at their home location to trade bank notes and bank shares. Households choose a portfolio of notes and shares and, in particular, may decide to redeem some notes. The choice of the new portfolio of notes will reflect the direction and distance that the buyer will travel next period (this is currently known). 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. Thus there is 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 (if redemption of the note is chosen). This asymmetry is introduced for tractability.

[31] The direction and distance the buyer will travel can be taken as certain. By symmetry, the direction the buyer travels in does not matter, though it will be taken into account when the household chooses a portfolio of notes to be carried over to finance consumption. The household will buy the notes of that distant location (d') in its home market in order to carry them to their home location, where they will trade at par, or at least at a lower discount. In this securities market at the home location, the notes will be sold at discounts. An alternative assumption is that the direction the buyer goes in is random and only the distance is chosen. In this case, the buyer will be forced to carry notes to a distant location, and they will be sold at discounts. The assumption of a random direction requires that this uncertainty be taken into account. The first assumption avoids this complication without changing the conclusions.

Recall that $P_t(d')$ is 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 (d' is the distance from the market the buyer has chosen to the issuing bank). The cash-in-advance constraint faced by the buyer is

$$C_t \leq \sum_d P_t(d')N_{t-1}(d). \tag{A2}$$

Each period the household may choose to send some notes for redemption at distant banks. The household may also face a demand for redemptions of its own notes. Redemptions are honored out of the household endowment before the markets for goods open. Let $N_t^R(d)$ be the amount of notes of banks at location d that are sent for redemption in period t. Notes that the household sent for redemption k periods ago will be honored this period if $d = k$. Otherwise, $d > k$, and the notes are still in transit.[32] The face amount the household must itself currently honor is $N_t^R(0)$.

When notes are redeemed, they are redeemed at face value if the bank is solvent. Otherwise, there is a loss. Let $P_t^R(d)$ be the price at which a note is redeemed; $P_t^R(d) = 1$ if the bank is solvent.[33] There are no bankruptcy costs, and the household is assumed to subsequently issue new notes with a face value equal to the face value of the amount redeemed.[34] For simplicity assume that no new equity is issued. Thus leverage is constant.[35]

Trading in the security market and the sending of notes for redemption occur at the home location. Let $q_t(d)$ be the price of equity claims and $Q_t(d)$ the number of shares of bank d stock held at time t. The household budget constraint is

$$\begin{aligned} P_t(0)^R N_t^R(0) + C_t + \sum P_t(d)N_t(d) + \sum P_t(d)N_t^R(d) + \sum q_t(d)Q_t(d) \\ \leq \sum P_t(d)N_{t-1}(d) + \sum q_t(d)Q_{t-1}(d) + y_t \\ + \sum_{d=k} P_t^R(d)N_{t-k+d}^R(d) + P_t(0)N_t^R(0). \end{aligned}$$

The right-hand side of the inequality lists the sources available to the household. They consist of, respectively, notes held over from the previous period, the equity portfolio held over, the household endowment, redemptions received, and new notes issued. These sources are used to finance the items on the left-hand side: the amount of the household's own notes that are redeemed, consumption, a new portfolio of notes, notes sent for redemption, and an equity portfolio. Rewriting the budget constraint, we get

[32] 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 that have not been redeemed yet. This complication is dealt with by Gorton (1993) and, for simplicity, is ignored here.

[33] The price $P_t^R(0) = \min[1, y_t/N_t^R(0)]$, where $N_t^R(0)$ is the face value of the notes that the household must honor this period.

[34] A household cannot issue new notes in order to cover losses on old notes.

[35] This can be viewed as a binding capital requirement.

$$C_t \leq \sum P_t(d)\{N_{t-1}(d) - [N_t(d) + N_t^R(d)]\} + \sum q_t(d)[Q_{t-1}(d) - Q_t(d)] + y_t + \sum_{d=k} P_t^R(d)N_{t-1}^R(d) + N_t^R(0)[P_t(0) - P_t^R(0)]. \quad \text{(A3)}$$

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, $N_t^R(d)$; an amount of notes of each type, d, to be used to satisfy the cash-in-advance constraint, $N_t(d)$; and an amount of equity shares of each type, $Q_t(d)$, to maximize (A1), subject to (A2) and (A3). The first-order conditions for distance to travel (d), the amount of each note type to redeem ($N_t^R(d)$), the amount of each note type to hold ($N_t(d)$), and the amount of each equity type to hold ($Q_t(d)$) are, respectively,

$$U'_{dt} = -E_t\left\{\mu_t \sum_d \frac{\partial P_t(d')}{\partial d}[N_{t-1}(d)]\right\}, \quad \text{(A4)}$$

$$U'_{Ct} \geq \beta^d E_t\left[U'_{Ct+d}\frac{P_{t+d}(d)}{P_t(d)}\right] \quad \text{each } d, \quad \text{(A5)}$$

$$U'_{Ct} \geq \beta E_t\left\{U'_{Ct+1}\left[\frac{P_{t+1}(d)}{P_t(d)}\right] + \mu_{t+1}\left[\frac{P_{t+1}(d')}{P_t(d)}\right]\right\} \quad \text{each } d, \quad \text{(A6)}$$

and

$$U'_{Ct} = \beta E_t\left[\frac{U'_{Ct+1}q_{t+1}(d)}{q_t(d)}\right] \quad \text{each } d, \quad \text{(A7)}$$

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. (There is also a transversality condition for the notes of each bank.)

Equilibrium requires that (1) the goods market clear at each location d, $C_t(d) = y_t(d) - P_t^R(d)N_t^R(d)$; (2) the equity market clear at each location d, $Q_t(d) = Q_{t-1}(d) = 1$; and (3) the note market clear at each location d, $N_t(d) + N_t^R(d) = N_{t-1}(d)$. Condition 1 determines prices of notes at each location. Conditions 2 and 3 determine security prices for bank equity and notes issued by distant banks.

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 (eq. [A6]) and sending the note back to the issuing agent for redemption, resulting in a risky payoff in d periods (eq. [A5]). If (A5) and (A6) are satisfied with equality, the agent must be indifferent between these alternatives. In particular, if (A5) holds as an equality, then the notes can be priced as risky pure discount bonds with maturity d.[36] Further, if preferences display constant relative risk aversion, then a closed-form solution for note prices based

[36] If no notes are sent for redemption, then (A5) does not hold as an equality, but provides a bound on the note price. The remaining case occurs when the bank's notes

on Black and Scholes (1973) can be derived. (The proof of this proposition is standard and is due to Rubinstein [1976].)[37] The price of a note is then given by

$$P_t(d) = [N_t^R(d)]^{-1}\{V_t(d)[1 - N(h_D + \sigma)] + (1 + r_f)^{-1}D_t^R(d)N(h_D)\},$$

where

$$h_D \equiv \frac{\ln[V_t(d)/N_t^R(d)] + \ln(1 + r_f)}{\sigma} - \frac{\sigma}{2},$$

σ is the standard deviation of one plus the rate of change of the value of the bank (i.e., the standard deviation of output), r_f is the risk-free rate of interest (assumed constant), $V_t(d)$ is the value of the debt and equity claims on household d at time t, and $N(\cdot)$, without a superscript, indicates the cumulative normal distribution function.[38]

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 (see Merton 1974). Note, in particular, that the value of the note is decreasing in maturity, d.

Condition (A4) determines how far the buyer should choose to travel. By symmetry, the direction the buyer travels in is irrelevant (this was chosen before trading in the securities market and is currently known). Consider a buyer traveling to a distant location that takes a note even further away from the issuing bank than the home location (i.e., $d' > d$). In that case, maturity is increasing since it will take longer to return from the buyer's market. From the pricing formula we know that in this case $\partial P_t(d')/\partial d < 0$; that is, notes decline in value as they travel further away from the issuer. On the other hand, at the distant location the buyer is going to, some notes will be closer to the issuing bank, so maturity will have declined for these notes, and $\partial P_t(d')/\partial d < 0$. No matter what direction the buyer travels in, some notes in his portfolio will increase in value (as he moves closer to the issuing bank) and some notes will decline in value (as he moves further away from the issuing bank). According to (A4), 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.

The model above considers a setting in which all banks (households) at each location have access to the same project. 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. 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

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are sent for redemption so that (A5) holds with equality but (A6) does not; i.e., the notes are more valuable being redeemed than they are being used as a means of exchange next period.

[37] This assumes that there are no notes currently in transit.

[38] For simplicity the model has no riskless security. However, the shadow price of a riskless bond can always be calculated. A riskless security could easily be incorporated.

d). The new bank is the same as the seasoned banks at its location except with respect to project risk. I shall 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) (taken as exogenous).

The following lemma is a standard result from contingent claims (see Merton 1974).

LEMMA. Consider two banks, bank N (for new) and bank S (for seasoned), which are the same distance away (d) and 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 decays 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 state the following proposition.

PROPOSITION A1. 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 have identical risk; that is, the two banks have the same σ's.

Proof. The proposition is proved by contradiction. Consider two banks, bank S and bank N, identical except that $\sigma_N > \sigma_S$. I shall show that the notes of bank N will tend to be sent for redemption, whereas those of bank S will circulate (i.e., be used to satisfy the cash-in-advance constraint). Let N_t^{Ri} be the amount of bank i's notes being sent for redemption and let N_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. I shall show that this cannot be an equilibrium. If both types of notes circulate, then $N_t^i > 0$ for $i = S, N$ and (A6) holds with equality for each bank's notes. Also, by hypothesis (of an interior solution), (A5) holds with equality for each note type, that is, $N_t^{Ri} > 0$ 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 ΔN_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 $(P_t^N/P_t^S)\Delta N_t^{RN} = \Delta N_t^{RS}$, so that the expected value of the total amount being sent for redemption is the same. (Note that this strategy is self-financing since $P_t^N \Delta N_t^{RN} = P_t^S \Delta N_t^{RS}$.) 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 and the amount of bank N notes being held for circulation is decreased. Now, using (A8), consider the effect on the choice of distance:

$$\Delta U_d = -E\left[\mu_t\left(\frac{\partial P_t^S}{\partial d}\Delta N_t^{RS} - \frac{\partial P_t^N}{\partial d}\Delta N_t^{RN}\frac{P_t^S}{P_t^N}\right)\right].$$

But, imposing that the strategy is self-financing, recalling that $P_t^S > P_t^N$, and noting that the difference in partial derivatives is negative (by the lemma), we see that the agent is better off. Q.E.D.

Finally, consider the case of endogenous asset risk, that is, an "out-of-equilibrium" wildcat bank that increases asset risk above σ_S. Suppose that a new bank issues notes for the first time at date t. These notes, printed at date $t-1$, will be used to finance initial consumption so that $C_t \leq P_t(d)N_{t-1}$ is the initial budget constraint and, coincidentally, the cash-in-advance constraint; N_{t-1} is the initial amount of notes printed. Next period this agent/bank will have none of its own notes (since they will have been spent at a distant location) but will have received other agents' 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

$$-U'_{Ct}\frac{\partial P_t}{\partial \sigma}N_{t-1} = \beta E_t\left[U'_{Ct+1}\frac{\partial q_{t+1}}{\partial \sigma}(Q_t - Q_{t+1})\right].$$

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.[39] 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, if the arbitrage bound is violated, all its notes will be redeemed, say, next period.[40] Then the wildcat bank can benefit only if it does not go bankrupt and the choice of risk is given by

$$-U'_{Ct}\frac{\partial P_t}{\partial \sigma}N_{t-1} = \beta\int_0^{y^*}\left[U'_{Ct+1}\frac{\partial q_{t+1}}{\partial \sigma}(Q_t - Q_{t+1})\right]f(y)\,dy,$$

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

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

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

Appendix B

TABLE B1

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				

* Incomplete coverage means that the *Van Court's 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.

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

‡ Montana became the forty-first state in 1889.

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