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Gerald P. Dwyer, Jr.
Federal Reserve Bank of Atlanta

Margarita Samartín
University of Carlos III

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Recommended Citation
Dwyer, Jr., Gerald P. and Samartín, Margarita, "Why Do Banks Promise to Pay Par on Demand?" (2006). *CRIF Seminar series*. Paper 13.
http://fordham.bepress.com/crif_seminar_series/13

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Why Do Banks Promise to Pay Par on Demand?

Gerald P. Dwyer, Jr.
Federal Reserve Bank of Atlanta

Margarita Samartín
University of Carlos III

March 2006

Abstract

We survey the theories on why banks promise to pay par on demand and examine evidence on the conditions under which banks have promised to pay the par value of deposits and banknotes on demand when holding only fractional reserves.

The theoretical literature can be broadly divided into four strands: liquidity provision; asymmetric information; regulatory restrictions and a medium of exchange. One strand of the literature argues that banks offer to pay par on demand in order to provide liquidity insurance services to consumers who are uncertain about their future time preferences and who have investment opportunities inconsistent with some of their preferred consumption paths. A second strand of the literature argues that banks offer to pay at par because of asymmetric information about banks' assets. The demand deposit contract can keep the bank from dissipating depositors' wealth by exploiting information available to the banker but not to depositors. The deposit is then on demand to make its value not contingent on states that are not verifiable by the depositor. In this sense, demand deposit contracts are a discipline device in this setup because the promise to pay par on demand helps to limit the riskiness of banks'

activities. The third strand of the literature argues that banks promise to pay par on demand because of legal restrictions which prohibit other securities from playing the same role as demand deposits. Finally, the fourth strand of the literature suggests that depositors may want a constant par value because it is more convenient when using deposits in transactions.

There are sharp predictions by the relevant theories. We assume that it is not zero cost to make a promise to redeem a liability at par value on demand. If so, then the antecedent conditions in the theories are possible explanations of the reasons for the banks promising to pay par on demand. If the explanation based on customers' demand for liquidity is correct, payment of deposits at par will be promised when banks hold assets that are illiquid in the short run. If the asymmetric-information explanation based on the difficulty of valuing assets is correct, the marketability of banks' assets determines whether banks promise to pay par. If the legal restrictions explanation of par redemption is correct, banks will not promise to pay par if they are not required to do so. If the transaction explanatiom is correct, banks will promise to pay par value only if the deposits are used in transactions.

After the survey of the theoretical literature, we examine the history of banking in several countries in different eras: fourth century Athens, medieval Italy, Japan, and free banking and money market mutual funds in the United States. We find that all of the theories can explain some of the observed banking arrangements and none explains all of them.

Acknowledgement 1 *Contact information: Gerald P. Dwyer, Jr.; Research Department; Federal Reserve Bank of Atlanta; 1000 Peachtree St. N.E.; Atlanta GA 30309; e-mail: gerald.p.dwyer@atl.frb.org. Margarita Samartín: Universidad Carlos III de Madrid; Departamento de Economía de la Empresa; Calle Madrid, 126; 28903 - Getafe; Madrid - Spain; e-mail: samartin@emp.uc3m.es. We thank John Boyd for helpful comments. We also benefited from research as-*

sistance by Lee Cohen. Earlier versions of this paper were presented at a Society for Economic Dynamics meeting and at the Tor Vergata Financial Conference. Dwyer thanks the Earhart Foundation for support of early work on this project. The views expressed here are those of the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any errors are the authors' responsibility.

INTRODUCTION

Banks promise to pay the par value of certain liabilities on demand in terms of other assets. This has been a long-standing practice even though it is trivially obvious that, due to gamblers' ruin, no bank can expect to honor this promise forever with less than one hundred percent reserves. Just as significantly, no bank customer can expect it to be honored always either. In addition, the consequences – banking panics – are not trivial. In the United States, banking panics happened during the free banking and National Banking periods and at the start of the Great Depression. These are far from unique historically, and financial crises in emerging countries are more recent related events.[1]

Given that these things are so, why do banks promise what they cannot deliver in the first place?

It is possible that banks promise to pay par on demand because depositors want this contractual agreement. There are at least four possible reasons for this desire. Depositors may demand a constant par value because this makes their deposit bal-

[1]For United States history, Dwyer (1996) summarizes some banking panics before the Civil War in the United States, Sprague (1910) summarizes banking panics in the National Banking period, and Friedman and Schwartz (1963) analyze the banking panics at the start of the Great Depression.Over 8000 banks failed in the U.S. from 1929 to 1933 (Friedman and Schwartz 1963.) Banking problems have not ended with the establishment of central banks. Lindgren, Garcia and Saal (1996) indicate that 73 per cent of the IMF´s member countries suffered banking crises between 1980 and 1996.

ances more predictable, thereby increasing the liquidity of deposits compared to assets that have a longer maturity. At many times and places, banks have held largely non-marketable assets; hence, customers cannot easily assess the assets' market values. Under these circumstances, deposit values that vary with the value of banks' assets may not be a feasible market equilibrium and redemption on demand can keep the bank from dissipating the depositors' wealth by exploiting superior information. Depositors may want a constant par value because it is more convenient when using deposits in transactions, a point that may be related to the predictability of balances in the liquidity explanation. Alternatively, banks may make this promise simply because they are legally required to do so and such promises would not occur without that requirement.

In this paper, we survey theories about banks' promise to pay par on demand to determine whether these theories can make empirical predictions about when financial intermediaries will promise to pay par on demand. We assume that it is not zero cost to make a promise to redeem a liability at par value on demand. If so, then the antecedent conditions in the theories are possible explanations of the reasons for why banks promise to pay par on demand.

One interpretation of the informativeness of these theories about actual banking arrangements is that they need not say anything about anything observed. As one theorist put it some years ago, "The real world is a special case, and not a very interesting one at that."

Alternatively, some would claim that these theories are stories with no relation to actual economies and are therefore uninformative. We think that our review of the literature shows that these theories can be interpreted as having predictions about when banks will promise to pay par on demand and when they will not make such promises and that the theories are informative for understanding banking arrangements..

Each of the theories can be interpreted as making strong predictions, namely that

promised payment at par will not be observed unless the theory is relevant. Alternatively, the theories can be interpreted as making weak predictions in the sense that the theory explains some observed promises to pay par on demand but not necessarily all of them. For example, a strong prediction based on customers' demand for liquidity is that payment of deposits at par is promised only if banks hold fractional reserves of the promised asset and the other assets are not exchangeable for the promised asset instantaneously at essentially zero cost. If the explanation based on asymmetric information about assets is correct, banks will promise to pay par only if depositors are less informed about banks' assets than are banks' managers. If the legal restrictions explanation of par redemption is correct, banks will promise to pay par only if they are required to do so.[2] If the explanation based on deposits' use as a medium of exchange is correct, then financial intermediaries will make such promises only if deposits are used in transactions. Weak predictions are that banks make promises to pay par if the theory is relevant, although banks may make such promises even if the particular theory is not relevant.

After the survey of the theoretical literature, we examine the history of banking in several countries in different eras: fourth century Athens; medieval Italy; Japan during its period of "seclusion"; and the United States. This examination focuses on promises to pay par on demand in early banking institutions and the types of assets that the banks held at the time. We have picked these cases to mitigate the sequential dependence of observations. Ancient Rome, examined in passing, is derivative of Ancient Athens in many ways. Western European banking development partly reflects experience in Italy, to the point that Lombard Street in London has a name based on the Lombardy bankers who set up business there. We examine banking in Japan because Japan was more or less cut off from the rest of the world for over

[2] Wallace (1996) does not mention legal restrictions in his analysis of narrow banking and dismissal of the importance of asymmetric information instead of Diamond and Dybvig's model.

two centuries and it is the country outside Western Europe with the largest literature on its banking history in English. The United States is considered because free banking on the U.S. frontier has some novel aspects as do money market funds. Truly independent observations would require examining banking on different planets before intergalactic travel – an impossibility today. We think that, while not independent, the observations in this paper are not completely dependent and the empirical evidence is consistent with some independence.

Table 1 summarizes the evidence concerning banking in different times and places. Perhaps most obviously, the legal restrictions theory fares poorly. Other than free banks whose assets were traded on the New York Stock Exchange, these banks have not been required to redeem their deposits on demand. Interestingly, both the liquidity explanation and the explanation based on asymmetric information fare equally well for historical banking, but neither appears to be consistent with money market funds.

THEORETICAL EXPLANATIONS FOR THE USE OF DEMAND DEPOSITS

In general, a bank that takes in deposits and invests the proceeds in long term loans exposes itself to many risks: the risk that depositors withdraw their funds, the risk that market deposit interest rates rise, and the risk that borrowers default with collateral worth less than the loan. These risks are correlated with each other and are driven by common macroeconomic factors (Hellwig 1998).

Given the above observations, it is curious that banks promise to pay the par value of deposits on demand when they hold risky assets and only fractional reserves of the asset that they promise to deliver on demand.

Theoretical research on banking provides four general explanations for making this promise: provision of liquidity, asymmetric information, legal restrictions and de-

posits' use as a medium of exchange. In this section, we summarize the basic theoretical analyses behind these explanations of par redemption on demand and their empirical implications.

Liquidity provision

One possible explanation for the use of demand deposit contracts is associated with liquidity insurance provided by financial intermediaries. Diamond and Dybvig (1983) formalize Bryant (1980) and introduce a demand for liquidity by the public which supports a transformation of assets' returns provided by banks. Diamond and Dybvig demonstrate that demand deposit contracts which transform illiquid assets into more liquid liabilities can explain both banks' existence and the existence of runs.

In the simplest formulation of this class of models, there is a continuum of ex ante identical agents who are risk averse and uncertain about the timing of their desire to consume. These individuals are endowed with one unit of the good at $T = 0$ and no additional endowment in subsequent periods.[3] They are subject to privately observed risk at $T = 1$, with probability p of being *early consumers* who derive utility only from consumption in period one and probability $1 - p$ of being *late consumers* who derive utility only from consumption in period two. Consumers can privately store the good with no appreciation or depreciation. There also is an investment technology available to consumers in which a unit investment at $T = 0$ yields one unit at $T = 1$ or $R > 1$ units at $T = 2$. In autarky, early consumers liquidate their investment at $T = 1$ and consume one unit; late consumers maintain the investment in the technology and receive R units at $T = 2$. There is no aggregate uncertainty: the fraction p of agents are early consumers and the fraction $1-p$ are late consumers.[4]

[3] The model presented is simpler than Diamond and Dybvig's but has the same implications in terms of promised payment and runs.

[4] This is a detail in autarky but an important part of the model with financial intermediaries.

Diamond and Dybvig show how a financial intermediary can improve consumers' ex ante welfare by offering them a demand deposit contract. This deposit contract can support the full-information risk-sharing equilibrium. The Pareto optimal solution is obtained by maximizing the ex ante expected utility of agents $pu(c_1) + (1-p)u(c_2)$, where $u(c_1)$ is an early consumer's utility from consumption in period one and $u(c_2)$ is a late consumer's utility from consumption in period two. This expected utility is maximized subject to the resource constraints $pc_1 = L$ and $(1-p)c_2 = (1-L)R$, where L is the amount of the investment liquidated at date 1. If the representative agent's relative risk aversion is greater than one, i.e., $-cu''(c)/u'(c) > 1$, the optimal solution satisfies $1 < c_1^* < c_2^* < R$, where c_1^* and c_2^* are the optimal consumption of early and late consumers respectively. This optimal contract insures depositors against being early consumers in the sense that $c_1^* > 1$, which is more than they would receive in autarky, and $c_2^* < R$, which is less than they would receive in autarky.

A deposit contract can achieve this optimal allocation. The demand deposit contract works as follows: for each unit deposited in the intermediary at $T = 0$, the deposit contract provides the option of withdrawing either $r_1 = c_1^*$ at $T = 1$ or $r_2 = \frac{(1-fc_1^*)R}{1-f}$ at $T = 2$. The second period payment depends on f, the fraction of agents who withdraw at $T = 1$. If only early consumers withdraw at $T = 1$, $f = p$, $r_2 = c_2^*$ and the demand deposit contract replicates the optimal allocation.

Implementing this allocation, however, subjects the intermediary to a possible coordination problem because a consumer's preference for early or late consumption is private information and the intermediary cannot guarantee that only early consumers withdraw at $T = 1$. In fact, late consumers' withdrawals are strategic and depend on what other agents do. If some late consumers withdraw at $T = 1$, then $f > p$ and $r_2 < c_2^*$. If enough late consumers withdraw at $T = 1$, then $r_2 < c_1^*$ and everyone withdraws at $T = 1$, which can be interpreted as a bank run.

In this model, there are two Pareto-ordered Nash equilibria: a Pareto dominant

equilibrium that achieves socially optimal risk sharing in which only early consumers withdraw at $T = 1$; and a second Pareto dominated equilibrium in which all agents withdraw at $T = 1$, which is the bank run equilibrium. The model can be used to show that there are several measures to prevent the occurrence of the bank run equilibrium.[5] The equilibrium arguments implicitly assume a sequential service constraint in which depositors are paid on a first-come, first-served basis, an assumption that motivates the papers by Wallace (1988, 1990) and has important implications for the discussion that follows.

There have been several important developments of this analysis. Jacklin (1987) shows that the optimal deposit contract also can be achieved by trading equity. Instead of making a deposit in the intermediary, suppose that agents invest their unit of endowment in stock in a firm and a market for ex-dividend shares opens at $T = 1$. The firm can promise a dividend stream of L units per share invested at $T = 1$ and $(1 - L)R$ units at $T = 2$ with $L = pc_1^*$. Early consumers want to trade their ex-dividend shares, which promise to pay $(1 - L)R$, for additional consumption in period 1 and are willing to do so as long as there is a positive payoff. Late consumers want to consume in the second period and have a storage technology available that lets them carry over consumption at no cost from $T = 1$ to $T = 2$. As a result, late consumers are willing to trade if the price of ex-dividend shares, P_{xs}, is less than or equal to the future payment $(1 - L)R$. Consumption for each early consumer is $c_1 = L + \frac{(1-L)R}{P_{xs}}$ and consumption for each late consumer is $c_2 = P_{xs}L + (1 - L)R$.

[5] If there is no aggregate uncertainty about the proportion of early consumers, the Pareto optimal equilibrium could be implemented by a policy of suspending convertibility once withdrawals equal the fraction p. This policy removes the incentive for late consumers to withdraw early; with this policy, late consumers always obtain a higher payoff if they wait until the second period than if they withdraw in the first period. If there is aggregate uncertainty, though, this measure is not effective for some realizations of p.

Market clearing implies that the equilibrium price $P_{xs} = \frac{p(1-L)R}{(1-p)L}$.[6] It must be the case that $1 \leq P_{xs}$ or else late consumers would not buy the stock. In addition, it must be the case that $P_{xs} \leq R$ or else $c_2 > R$, which implies that $c_1 < 1$. If $P_{xs} = \frac{p(1-L)R}{(1-p)L}$, then $c_1 = L + \frac{R(1-L)}{(pR(1-L)/(1-p)L)} = L + \frac{(1-p)L}{p} = L/p = c_1^*$. In addition, $c_2 = \frac{p(1-L)R}{(1-p)L}L + (1-L)R = \frac{p(1-L)R+(1-p)(1-L)R}{1-p} = \frac{(1-L)R}{1-p} = \frac{(1-pc_1^*)R}{1-p} = c_2^*$. These are consumption levels identical to those promised by the deposit contract. This result rules out a positive role for a bank or any other financial intermediary in the economy because equity markets and well functioning financial intermediaries are perfect substitutes, and arguably a bank is worse than a financial market because a financial market does not have a possibility of the bad equilibrium of a bank run.[7]

In the same paper, Jacklin noted that banks and equity contracts are not equivalent risk sharing instruments if consumers have more general preferences about consumption timing. If demand deposits can be traded, however, optimal risk sharing does not occur regardless of preferences.[8] In particular, Jacklin argues that financial inter-

[6] For each early consumer, $c_1 = L + \frac{(1-L)R}{P_{xs}}$. As a result, in the aggregate per capita, $p\left(L + \frac{(1-L)R}{P_{xs}}\right) = L$, or $pL + \frac{pR(1-L)}{P_{xs}} = L$, or $(1-p)L = \frac{pR(1-L)}{P_{xs}}$ which implies that $P_{xs} = \frac{pR(1-L)}{(1-p)L}$.

[7] Recent criticisms of the Diamond and Dybvig model by Green and Lin (1999, 2000) analyze why banking evolved with uninsured demand deposits. They examine the significance of the simple deposit contract and find that it is critical: confining agents to this type of contract is, in fact, the driving force behind the bank run equilibrium of the model. Green and Lin show that when agents in the Diamond and Dybvig model are allowed to use a broad class of banking contracts, the bank run equilibrium disappears even in the presence of a sequential service constraint. Their results suggest that economists need to attempt to understand the economic and legal environment that produces the simple deposit contract.

In a later paper, Peck and Shell (2003) show that even when banks can write more sophisticated contracts, bank runs are possible.

Goldstein and Pauzner (2005) address some of the more fundamental problems with the multiplicity of equilibria in Diamond and Dybvig's model.

[8] Other papers in the literature have analyzed the relative degrees of risk sharing provided by banks and equity contracts. For example, Hellwig (1994) considers a model similar to Diamond and

mediaries exist if trading restrictions limit consumers to demand deposit contracts of the Diamond and Dybvig type.[9]

This assumption highlights the importance of the sequential service constraint and its interpretation. Wallace (1988, 1990) explicitly incorporates a sequential service constraint in the Diamond and Dybvig model. This sequential service feature of the deposit contract is motivated by the fact that agents are isolated from each other. Agents demand liquid assets because they are impatient to spend and do not have access to asset markets in which they can sell the asset at the market price. An important implication of these models is that some form of isolation of agents is needed in order to motivate illiquid banking arrangements. Otherwise, individuals would in general want to participate in an asset market which is superior to illiquid banking.

Further work in this area has examined the role of demand deposits when there is a securities market in which agents can meet and trade (Diamond 1997, Von Thadden

Dybvig's with a stochastic technology from $T = 1$ to $T = 2$ that can be interpreted as technology-induced interest rate risk. He shows that there would still be no role for a bank in this extended framework. Samartín (2001) shows that in Hellwig's model, if individuals have more general preferences, then demand deposits perform better than equity contracts at low enough interest rates.

Jacklin and Bhattacharya (1988) and Alonso (1996) also consider the relative degree of risk sharing provided by traded and nontraded contracts in a framework in which bank assets are risky and individuals with smooth preferences are informed about bank asset quality. The basic result is that deposit contracts tend to be better for financing low risk assets.

[9]Haubrich and King (1990) reach the same conclusion, namely that

> Demand deposits *uniquely* provide insurance only if there are restrictions on financial side exchanges, which may be interpreted as exclusivity provisions or regulations on security markets. If these restrictions cannot be implemented, then our environment does not rationalize banks; other financial institutions can achieve the same real allocations and welfare levels. (Haubrich and King 1990, p. 362).

1998). Von Thadden (1998) presents a continuous-time version of the Diamond and Dybvig model in which depositors can continuously adjust their portfolios, i.e., they can join outside coalitions that engage in market activity. In this setting, demand deposits cannot attain the first-best allocation and the ability to trade demand deposits in financial markets severely limits liquidity provision by banks. Incentive-compatible deposit contracts are second best mechanisms for providing liquidity. At the optimum, liquidity provision is negatively correlated with the degree of irreversibility of the investment opportunity. In particular, if the investment is completely reversible, the only incentive compatible contract is the autarky allocation.

Diamond (1997) examines the roles of banks and markets when there is a financial market but with limited participation in the financial market. Such a market has an impact on bank activities but banks remain important. The paper focuses on the interactions between the bank provision of liquidity and the participation in the market. As more agents participate in the market, banks are less able to provide additional liquidity. The paper delivers the Diamond and Dybvig result when there is no participation and the Jacklin result when there is full participation.

In summary, this strand of the literature argues that banks offer to pay par on demand in order to provide liquidity insurance services to individuals who are uncertain about their future time preferences in a framework in which investment opportunities are inconsistent with preferred consumption paths of consumers. These depositors demand liquid assets because they are impatient to spend and they do not have access to financial markets in which they can sell the asset at its market price. These papers try to capture the role of consumers who are isolated from each other and cannot go to a security market to trade. As Wallace (1988) points out, sequential service is an outcome of this isolation assumption. If the trading restriction assumption is dropped from these models, the role of banks is severely limited (Jacklin 1987). A common assumption needed in most of these papers is that demand deposits cannot

be traded, which suggests that there are restrictions that impede banks and active markets from coexisting.[10]

Asymmetric information

A second explanation for the use of demand deposit contracts is linked to asymmetric information in loans: banks make loans with values that are costly for others to verify, bank managers' behavior is difficult to monitor, and some depositors acquire information about the realization of the random return.

[10] There have been several attempts to extend the Diamond and Dybvig framework to an overlapping generation context, and to analyze in this dynamic framework liquidity provision by banks, without the need of imposing trading restrictions, as in the finite models. Since these models allow for intergenerational transfers, liquidity provision is made more efficiently than in the finite ones. Examples of such work are Qi (1994), Bhattacharya and Padilla (1996), Bhattacharya, Fulghieri and Rovelli (1998), Fulghieri and Rovelli (1998) and Qian, John and John (2004). Allen and Gale (1997) analyze a different type of intertemporal smoothing role of financial intermediaries in a standard overlapping generations model.

Hölmstrom and Tirole (1998) analyze a different type of liquidity that arises in a framework in which moral hazard limits the effectiveness of transactions between firms with excess liquidity and firms that have a positive demand for liquidity. Hölmstrom and Tirole show that, if there is no aggregate uncertainty, there is a second best arrangement that allows firms to hedge against a liquidity shock at $T = 1$ by buying claims on other firms at $T = 0$ and selling them at $T = 1$. Kashyap, Rajan and Stein (2002) also focus on banks as creators of liquidity. They build on the observation that banks engage in two distinct activities, deposit-taking and lending. In particular, these institutions issue a product that may enable them to distinguish themselves from other lenders such as insurers or finance companies – loan commitments or credit lines. They develop the idea that credit lines and demand deposits can then be seen as two different manifestations of the same function: provision of liquidity on demand. There is a complementarity between these two ways of providing liquidity because they are not perfectly correlated. Once this fact is recognized, it is easy to argue that there may be important synergies in offering both products because the banks hold liquid assets. The paper develops a theoretical and empirical case for this particular synergy.

In this context, banking panics are not a manifestation of an inherent problem with banks; they are a reflection of depositors' monitoring of banks.

We continue to assume there is a continuum of ex ante identical agents who are risk averse and uncertain about their preferences concerning consumption. As in Diamond and Dybvig, they are subject to a privately observed risk of being early consumers and are endowed with one unit of the good at $T = 0$.[11]

There are two assets: a short-term asset and a long-term asset. The short term asset generates one unit at $T = 1$ for each unit invested at $T = 0$. The long-term asset has a random return at $T = 2$ which can be a high value $R_h > 1$ with probability q or a low value R_l with probability $1 - q$ and $R_h > R_l > 0$. For simplicity it is assumed that this long-term asset can be liquidated at $T = 1$ only at sufficient loss that it never pays to do so. Let L and $1 - L$ denote the ex-ante investments in the short and long-term assets respectively. Banks possess private information about their loan portfolio which can lead to inefficient allocations with liquidation of loans.

The bank offers depositors a demand deposit contract in exchange for their endowments. This deposit contract provides the option of withdrawing either $r_1 = c_1^*$ at $T = 1$ or $\tilde{r_2} = \frac{(1-fc_1^*)\tilde{R}}{1-f}$ at $T = 2$. The second period payment depends on f, the fraction of agents who withdraw at $T = 1$, and the payoff from the investment in the long-term risky asset. One way to think about this is that the bank promises an amount $r_2 = c_2^*$ which it can pay if $R = R_h$. If $R = R_l$, the bank is considered insolvent and depositors get R_l/R_h of their promised payments.[12]

[11] The model presented is simpler than Jacklin and Bhattacharya's but has the same implications in terms of the origins of bank runs and its policy implications. Other papers, such as Chari and Jagannathan (1988) or Allen and Gale (1998) also have versions of this basic setup.

[12] The optimal consumption levels, c_1^* and c_2^*, are obtained by maximizing the expected utility subject to the resource constraints and the incentive compatibility constraint,

$$\max_{c_1, c_2, L} \left[pU(c_1) + (1-p)AU(c_2) \right] \tag{1}$$

At $T = 1$, a fraction of late consumers receive correct information about the random return.[13] Given this information, late consumers select their optimal strategy. They prefer the first period payment of r_1 to the second period payoff if they receive negative information and $c_1^* > (R_l/R_h)\, c_2^*$, which can be rewritten $R_l < \frac{R_h c_1^*}{c_2^*}$. If $R_l < \frac{R_h c_1^*}{c_2^*}$, then it is optimal for all informed late consumers to withdraw their deposits in the first period. In this bank run equilibrium, the bank exhausts the liquid asset among withdrawals by depositors, which includes both early consumers and informed late consumers. After withdrawals by the fraction p of customers, payments are suspended and withdrawals are allowed in the second period only. As a result, some early consumers may not be able to withdraw at $T = 1$ and this bank run equilibrium makes agents worse off in terms of expected utility.[14]

In this class of models, banking panics are not a manifestation of an inherent problem with banks or banking contracts; they are a rational response by depositors to a bad state of the world. This is consistent with empirical evidence, which indicates that banking panics are explicable responses to bad states of the world (Rolnick and Weber 1984; Gorton 1988; Economopoulos 1990; Dwyer and Hasan 2005.)

$$\begin{aligned} \text{s.t.} \quad & pc_1 \leq L \\ & (1-p)c_2 \leq (1-L)R_h \\ & c_1 \leq Ac_2 \end{aligned} \tag{2}$$

where $A = q + (1-q)U\left(R_l/R_h\right)$

[13] This assumption is motivated by the observation that, if information were costly, late consumers would be more likely to purchase information. Also, if depositors were of different sizes, larger depositors would more likely to acquire information. These unmodeled aspects of the problem are captured by assuming that a fraction of late consumers is informed.

[14] It should be mentioned that given the complete irreversibility assumption of the long term investment, pure panics runs of the Diamond and Dybvig type are excluded, that is, there is no coordination problem among late consumers. As a result, in the good state informed consumers always obtain a higher payoff if they wait until the second period than if they withdraw early, independent on what other agents do, as the bank guarantees $c_1^* < c_2^*$.

A number of papers have focused on the incentive properties of demand deposits. The idea of these papers is that liquid deposits keep the bank's portfolio choice in line with depositors' preferences. The framework is similar to the one described above, but it includes the possibility that banks take actions that benefit the banks' owners and make depositors worse off. In these papers, the threat of a bank run by informed depositors after receiving negative information discourages banks' owners from investing in projects that are too risky or committing fraud. In this way, demand deposits discipline bank managers and reduce moral hazard problems. The deposit contract serves this role due to the combination of two inherent characteristics: the "on demand clause" and the sequential service constraint. The demandable nature of the contract motivates some depositors to monitor the bank, while the sequential service constraint discourages free riding by depositors on others' monitoring (see Calomiris and Khan 1991, Flannery 1994, Jean-Baptiste 1999, Gorton and Huang 2002a, 2003).[15]

Other papers (Gorton and Pennachi 1990, Jacklin 1993) have emphasized that liquid deposits protect uninformed depositors from losses they would otherwise suffer when trading other securities (equity) with better informed individuals. Gorton and Pennachi (1990) argue that financial intermediaries create liquid deposits in response to uninformed depositors. They define a liquid security as one that has no private information associated with it and model the proposition that trading in liquid securities such as deposit contracts protects uninformed depositors from losses that they would otherwise suffer if they traded illiquid – information-sensitive – securities with informed individuals. Therefore, demand deposits with promises to pay par value are created. In such a setup, demand deposit contracts are not the unique solution for creating liquid securities that protect uninformed agents. Other risk-free instruments

[15] Qi (1998) and Diamond and Rajan (2001a, 2001b, 2005a, 2005b), also study the disciplinary effects of liquid deposits in models that abstract from asymmetric information.

such as government bonds can accomplish the same role, a point made by Gorton and Pennachi.

Jacklin (1993) extends the basic framework based on Diamond and Dybvig described above, and introduces aggregate uncertainty regarding the proportion of early consumers in the population. The fraction $\tilde{p}$ of early consumers can take a value p_1 with probability r and p_2 with probability $1-r$. As before, the bank invests in a risky asset that yields a random return $\tilde{R}$ which has a high value R_h with probability q and a low value R_l with probability $1-q$ and some late consumers receive perfect information about the future payoff from the bank's assets. The two random variables $\tilde{p}$ and $\tilde{R}$ can have a nonzero correlation. Jacklin uses this extended analysis to compare risk sharing using demand deposits and equity.

Equity contracts and demand deposit contracts are equivalent risk sharing instruments if there is either risk associated with loans or aggregate risk, but not both. If there is only aggregate uncertainty about the total number of early consumers in the population, there exists a dividend function $L(\widetilde{p})$ and a price of ex-dividend shares $P_{xs}(\widetilde{p})$ that fully reveals the value of $\widetilde{p}$ with the financial market equilibrium being the same as the Pareto optimum. The same result applies if there is a risky technology and no aggregate uncertainty. In these two situations, equity contracts and demand deposit contracts are equivalent risk sharing instruments.

If there is both aggregate uncertainty and risky bank assets with depositors and banks asymmetrically informed about the risky asset quality, then demand deposits and equity contracts are not equivalent risk sharing instruments.

Jacklin's analysis indicates that the use of demand deposit contracts by banks requires an explanation encompassing more than just a need for liquidity transformation. Banking evolved with demand deposit contracts because they included a form of protection to uninformed depositors, who would have otherwise been disadvantaged relative to better informed depositors had equity contracts been used instead. The

basic message is that *liquidity should be provided using equity contracts when there is little or no potential for asymmetries for information concerning asset quality.*

This strand of the literature argues that banks promise to pay the par value of deposits because of asymmetric information about banks' assets. The demand deposit contract can keep the bank from dissipating depositors' wealth by exploiting information available to the banker but not to depositors. The demand deposit contract also protects uninformed depositors who would be disadvantaged relative to better informed individuals if banks offered equity contracts. The deposit is payable on demand because its value is not state contingent. In this sense, demand deposit contracts are a discipline device: banks promise to pay par on demand in order to control banks' riskiness.

Legal restrictions

A third explanation of why banks promise to pay par on demand is provided by the legal restrictions theory, which attempts to explain the coexistence of alternative assets, some of which have significantly higher returns than others (Wallace 1983 and references therein). As Wallace (1983) points out, an example of these paradoxical pattern of returns among assets is the coexistence of U.S. currency, bank deposits and default-free interest bearing securities such as U.S. savings bonds and Treasury bills. If currency, deposits and Treasury securities are perfect substitutes, no agent would hold non-interest bearing currency or deposits instead of Treasury bills. This coexistence can be explained by legal restrictions on Treasury bills which prevent them from playing the same role in transactions as do currency and deposits. If all three assets were allowed to be used in transactions without any legal restrictions, the prediction is that either nominal interest rates would go to zero or government

currency and bank deposits would become worthless.[16]

In summary, Wallace argues that banks promise to pay par on demand because of legal restrictions which prohibit other securities from playing the same role as demand deposits. There is a question of why such a legal restriction exists, of course. The argument could be made that the legal restriction merely formalizes a typical market contract. The counter-argument, in terms of Wallace's point, would be that the beneficiaries are the banks who have less competition than without legal restrictions on securities being used as a transactions medium. If the legal restriction explanation of par redemption is correct, banks will not promise to pay par if they are not required to do so.

Bank liabilities as a medium of exchange

Other models have been built based on the observation that bank liabilities function as a medium of exchange and payment (Williamson 1992, Freeman 1996a, 1996b, Green 1997, and McAndrews and Roberds 1999). In general, these papers consider a framework in which agents are either spatially separated, so they cannot contract and trade with everyone else at the same time due to their inability to meet at a

[16] White (1987) argues that the Scottish free banking system from 1716-1844 is a counterexample to the above theory in which non-interest bearing currency and interest-bearing securities coexisted and only non-interest bearing currency was used in transactions. He critiques Wallace's line of argument by suggesting that the liquidity services, or nonpecuniary yields, of currency and deposits are important in addition the pecuniary returns and risk. He argues that if technological and computation costs are appropriately considered, interest might not be worth collecting on at least smaller denominations of currency and any rents are dissipated by costs borne by banks in equilibrium. Hence, White argues, non-interest bearing currency would still survive in the absence of legal restrictions. Basically, White argues that the legal restriction theory overlooks costs involved in collecting interest on currency, recognizing only the intermediaries' costs of converting large interest bearing assets into smaller liabilities.

single location, or there are other frictions such as problems of contract enforcement or adverse selection. The papers can be interpreted as having implications for the question of whether banks pay par value, although the connection is not immediate.

Freeman (1996) and Green (1997) are similar, with both modeling the structure of trade and the stochastic component of agents meeting to trade. Repayment of debt at par value is optimal in these papers and the analyses are similar in various respects, with Green clarifying some issues in Freeman's analysis.

In Green's (1997) model, the structure of trade among agents requires debt outstanding within the period. Efficiency requires that the market value of this debt be at face value, because otherwise agents will be subject to uncertainty concerning whether they will be faced with a transaction in which they receive less than face value. Depending on parameters in the model, an equilibrium with agents acting only to buy and sell their own goods may not be efficient. A central bank and possibly a clearing house can provide a guarantee that the debt within the period will clear at face value.

McAndrews and Roberds (1999) provide a model in which exchange banks operate and transfer balances among depositors. In this paper, they impose par redemption rather than derive it as an implication.

A related paper by Kahn and Roberds (2004) develops a model in which traders settle debts with other debts. Basically, they examine transferable debt and compare it to using credit chains to resolve payments for trades among separated agents. They take payment at par for granted in this paper, as do McAndrews and Roberds (1999), although it may well be possible to motivate par redemption by issues of private information and resultant adverse selection.

In these models, private agents issue debt claims to facilitate paying for purchases. One issue that arises is the pricing of these debt claims – if the number of agents arriving to trade is not consistent with this debt trading at par, the liabilities trades

away from par. Trading away from par value is inconsistent with optimality in these models. These papers do not directly explore whether private intermediaries can improve on an equilibrium without them. They do point out, though, that an important characteristic of a medium of exchange may be that it entails little or no risk, i.e., its value is independent of the state of the world.

From a narrow point of view, these papers are insufficiently developed to show that financial intermediaries will promise to pay value even though it is clear that banks cannot honor this promise in all states of the world. From another point of view, they point toward sufficient conditions that are likely to be necessary to have this implication.

For our purposes, without any implication that the conclusion follows from the existing literature, this literature does suggest that the use of bank liabilities as a medium of exchange is an important characteristic. In our analyses of banking systems, we will take note of the ones in which bank liabilities are used as a medium of exchange.

EVIDENCE

This analysis implies that there are certain crucial questions to be asked in our summary of banking histories. Table 2 summarizes the basic analytical result in the theoretical analyses and suggests the questions to be asked about banking arrangements. First, did one or more institutions accept deposits and promise to pay their par value on demand and, if so, did they hold fractional reserves of the underlying asset promised? If so, was there a legal requirement that the banks make nothing less than payment of the amount deposited? What assets did the banks hold? Were banks' assets illiquid: exchangeable into the promised asset only over time at a significant cost? Did a large fraction or all of the assets held by the banks have an idiosyncratic component under circumstances consistent with asymmetric information? Were the

liabilities of the banks used as a medium of exchange? Were banks required to pay par value on demand?

There are two alternative interpretations of the theories, which we characterize as the *strong* and *weak* versions of the theories. In the strong interpretation of the theories, the theories make a prediction, namely that promises to pay par on demand will occur **only** under conditions consistent with the theory. This is similar to some theories in economics and finance, such as the law of demand which predicts that a higher price will decrease quantity demanded. Alternatively, the theories can be interpreted as providing explanations of why banks promise to pay par on demand, which need not mean that one theory explains all of the observations and a useful theory merely needs to be consistent with **some** of arrangements. Arguably though, a non-redundant theory will explain something not explicable by the other theories.

Athens, Fourth Century B.C.

Despite the difficulty of determining events millennia ago, certain aspects of banks' operations in ancient Athens and Rome are quite clear and quite pertinent for evaluating banking theories. Much is generally agreed upon by scholars, even though there is uncertainty and controversy. We indicate where those disagreements affect our conclusions.[17]

There is sparse evidence on how important banks were in Athens' economy in the fourth century B.C. (Thompson 1988, p. 829), although Shipton (1997) makes a good case that they were important in many different economic activities. The sources of much of the surviving evidence provides some indication of the reliability and possible biases in the information that is available. Millett's analysis is based on the evidence from the Attic Orators's speeches: "published versions of their commissioned

[17] The discussion in Andreau (1999) and Temin (2004) indicates that, other than the type of loans made, much of the analysis carries over to Ancient Rome.

speeches" (Millett 1991, p. 2); Cohen's analysis is based on the evidence from court cases (Cohen 1992, p. 27).[18]

Banks were unincorporated enterprises which were moneychangers before becoming full-fledged banks. Banks were known as *trapezitai*, related to the root word *trapeza* which means "table", because of their origin as moneychangers at tables in marketplaces. Banks generally were sole proprietorships, with some possibly being partnerships. A banker was liable for deposits up to the value of all of the banker's assets. There is no evidence of regulations that applied to banks' operations other than the general set of laws applied to commercial activities. Bankers operated their businesses at tables in the marketplace. At these tables, bankers provided currency exchange, accepted deposits of both money and other assets and made loans.

Banks were liable for the initial value of all assets deposited with them. Deposits in banks could be transferred to others, but there were no banknotes or checks, instruments for the which underlying legal foundation had not been laid. Transfers could be effected only by physically going to the bank. Some comments about foreign traders suggest that the depositor did not always have to be present to make a transfer, but the recipient of the transfer apparently did have to be present.[19] Runs on most or all of the banks – a banking panic – which might ensue from banks promising to pay par on demand would provide further evidence of a promise to pay par. One or more

[18] The discussion in this section of the paper largely relies on Thompson (1979, 1983, 1988), Millett (1991) and Cohen (1992). A contentious issue in the literature is whether loans were for "productive" or "unproductive" purposes. If mapped into commercial and consumption loans, this discussion makes some sense even if the reason for the discussion – whether Athen's economy was "primitive" – is irrelevant to our analysis. More generally, the issue is whether loans were impersonal transactions or loans generally were made to people with whom the banker had some personal relationship, with Cohen supporting impersonal transactions and Millett supporting personal transactions. Shipton (1997) provides an excellent brief summary.

[19] There are some suggestions that banks provided payments at distant locations, although Millett (1991) and Cohen (1992, Chapter 5) disagree in the predictable way.

banking panics may have occurred (Cohen 1992, pp. 215-24), although the evidence presented would not be compelling against a supposition of no banking panics.

In some cases, but not all, depositors were paid interest.[20] There does not appear to be enough evidence to distinguish the circumstances under which deposits did or did not pay interest. Perhaps no generalization would be very adequate, because the banks were essentially unregulated and the number of observations is not large.

The overall evidence is consistent with fractional reserve banking. Absent enough information to create balance sheets, it is not certain whether banks generally had fractional reserves, but there is no evidence that bankers made loans only with their own capital and there is no reason to believe that banks holding fractional reserves would have been engaging in a fraudulent activity.

Bankers made quite risky loans. In ancient Athens, these risky loans included real estate loans, consumption loans and commercial loans and perhaps maritime loans (Millett 1991, pp. 206-17; Cohen 1992, pp. 36-40, pp. 121-83; Shipton 1997.)[21]

[20] The literature agrees that banks paid interest. Thompson (1979, p. 228) and Millett (1991, pp. 203-306) argue that banks did not pay interest on deposits but only on "loans" to the bank, but the argument is about the definition of a loan and a deposit. Unless some other contractual term besides interest is different, there is no real difference between a deposit in a bank and a loan to a bank, and there is no evidence of other differences in contractual terms.

[21] In ancient Rome in the second century B.C., the loans made by banks were uncollateralized loans at auctions – both auctions to pay debts and estate auctions. (Andreau 1999, pp. 39-40.) Deposits were legally distinguished between those which were to be returned intact – e.g., the actual coins deposited – which were sealed deposits and called "regular deposits" and non-sealed deposits (Andreau 1999, pp. 40-41). Some deposits paid interest; some not. While it is hard to imagine that a banker paid interest on sealed deposits, for which it is more plausible that a banker charged for the safekeeping, there seems to be no clear consensus on what other deposits paid interest (Andreau 1999, p. 42.) Banks made short-term loans (Andreau 1999, p. 44.) There is no evidence that bankers made maritime loans out of bank assets, although the evidence does indicate that bankers were involved in receiving payments and storing contracts and as"intermediaries" (Andreau 1999, p. 56.) By the second century BC, banks had at least some accounts at other banks and transfers

These maritime loans were loans to provide funds for items included as cargo on ships in trade. They are an excellent example of a loan with asymmetric information and substantial risk. The safety of passage was in doubt and the lender's risk of loss was magnified by a common provision of maritime loans: the borrower owed no interest or principal if the cargo was lost en route.[22] Generally, these loans were over-collateralized. If the cargo failed to generate sufficient revenue to pay off the loan, other collateral was at least sometimes available (Andreau 1999, pp. 54-56.) The evidence indicates that banks financed these loans by deposits as well as the banker's own funds (Cohen 1992, p. 142), in addition to soliciting funds specifically to finance maritime loans and participating in loan syndicates (Cohen 1992, pp. 121-83.)[23]

Evidence from antiquity is informative because it is far in time from contemporary practice, even though the evidence is too uncertain to be adequate by itself. Banks had deposits that appear to have been redeemable on demand and redemption at less than par was regarded as default. From the viewpoint of the legal restrictions theory, this period is troubling because there is no evidence that banks were required to pay par on demand and there is evidence that they did so. The maritime loans especially, but also other loans, were consistent with both the liquidity and asymmetric information explanations of why banks promise to pay par. There is no reason to view these deposits as a medium of exchange, since the deposits were transferable between individuals only at the bank and there is no evidence to suggest that the

were made from one bank to another but there is no evidence of institutions designed to facilitate such transfers (Andreau 1999, p. 58.)

[22] Nonpayment in the case of loss of the collateral at sea is a common provision of loans on cargoes. This provision can be interpreted as a defining characteristic of maritime loans (Millett 1983, p. 36), although we have not defined maritime loans this way.

[23] It is not possible to rule out the possibility that term deposits financed maritime loans because there is no evidence to distinguish whether or not banks used deposits payable on demand to finance maritime loans.

deposits were used widely in exchange in place of the readily available coin, even in high-valued transactions.

Italy

After the fall of the Roman Empire about 500 A.D., banks did not exist in any recognizable form in Western Europe until the eleventh century in Southern Europe. The evidence is consistent with a supposition that the development of banks in Italy was determined more by opportunities at the time than by legal doctrines developed in the earlier Roman Empire (Lopez 1979, pp. 1-3.)

How did banking develop in Italy? In the fourteenth and fifteenth century, there were banks in many places in Europe (de Roover 1974, p. 205.) Banks flourished in Italy during the Commercial Revolution from 1200 to 1500 and then went into decline with the cities of Italy. There are two stages of Italian banking in this period. The first had banks operated by private individuals which developed from money changers, similar to development in Ancient Athens (Mueller 1997, p. 8.). Banks in the second period were organized and operated as agencies of city governments.

>From the standpoint of understanding what banks promised and why, the period with private banks obviously is of more interest.[24] Genoa in the twelfth century has the first known banks in medieval times with records available (Lopez 1979, p. 10). Banking in Italy in the 1300s was dominated by the Bardi and Peruzzi of Florence and in the 1400s by the Medici Bank with its head office in Florence (Kindleberger pp. 42-43.) Goldthwaite (1985) found account books for Florentine local banking – as opposed to international banking – in the 1400s and we use his study for Florentine banking.[25] Mueller (1979, 1997) has studied Venetian banking

[24] The fact that governments operated banks after private banking may indicate something about banking or banks' operations in this period, but that is a different issue than ours.

[25] Goldthwaite (1998) summarizes the banking in Florence a century later, including a summary

in detail. He (Mueller 1997, p. 8) indicates that not until almost 1300 is it possible to be sure that moneychangers in Venice had become bankers.[26] English (1988) is a thorough study of banking from the early 1200s to 1350 in Siena which was not a major banking center but which provides some background information.

Banks in Italy had deposits that were redeemable on demand and deposits that were not so redeemable. The evidence indicates that the earliest banks in Genoa were mainly engaged in exchange and deposit banking (Lopez 1979, pp. 12-23) and had both demand and term deposits (de Roover 1974, p. 201.) As early as 1100 A.D., banks accepted deposits payable on demand even though they were not required to do so, since they also accepted term deposits that could be redeemed only with notice, e.g. fifteen days (de Roover 1974, pp. 201-202.)[27] Goldthwaite's analysis indicates that Florentine banks' practices are consistent with the existence of banks that paid par value on demand (Goldthwaite 1985, pp. 19-27.) The term for these deposits in general was "current deposits." Mueller (1979, p. 51; 1997, pp. 11-15) elaborates on this by distinguishing demand and term deposits – irregular deposits – from regular deposits, which were deposits of valuables for safekeeping and for which restoration of the articles deposited was expected. There is no evidence that Florentine demand deposits paid interest. (Goldthwaite 1985, p. 27).[28]

It was not always the case that banks paid current accounts at par value. Premia and discounts occurred in Venice for short periods (Mueller 1979, pp. 84-94), and their occasional existence is not unique to Venice (Mueller 1979, p. 84; Mueller 1997,

of one local firms' operations.

[26] There is a clear reference to moneychangers in an 1164 contract, the names of moneychangers preserved from 1225 and the first regulation of them occurs in the 1260s (Mueller 1997, p. 8.)

[27] Some deposits also promised participation in profits, although this provision may have been a subterfuge for promised interest due to usury restrictions (de Roover 1974, pp. 201-202.)

[28] There is evidence that time deposits paid interest, which lessens the suspicion that the lack of evidence for payment of interest may reflect subterfuges to avoid the prohibition of payment of interest as usury.

pp. 166-74.)[29]

Despite these deviations from par, there were explicit legal requirements that banks pay par value on deposits payable on demand. Such requirements are explicit in a law in 1321 (Mueller 1997, pp. 16-17.) In 1421, the Venetian Senate "insisted on the total convertibility of bank money at par and on demand," a clause still in force in 1477 (Mueller 1979, p. 93.) This promise to pay par was backed up in Venice by a surety bond for bankers' deposits to provide funds to depositors in the event that a failed bank had insufficient funds (Lane and Mueller 1985, pp. 10-16; Mueller 1997, p. 9, pp. 52-62)

An important issue, but an easily resolvable one, is the money in which banks promised to pay par. Accounts sometimes were denominated in terms of a money of account, which also has been called "imaginary money" or probably better "ghost money."[30] Usher (1943, pp. 201-205) suggests that the general explanation for a money of account different than the circulating money was the reduction of denominational differences to common units for bookkeeping purposes. After considering a series of examples, Spufford (1988, pp. 411-14) concludes that "it may be taken as axiomatic that on closer inspection an historical explanation may be found for the existence of each money of account, and that such an historical explanation will indicate to which real coin the system continued to be attached." In summary, a so-called "imaginary" money of account provides no evidence of nonpar redemption.

The evidence for fractional reserves generally is indirect, because double-entry bookkeeping was unknown for the early part of this period. Goldthwaite (1985, pp. 37-39, Appendix B) examines whether banks held fractional reserves and reconstructs the ratio of cash to liabilities for a firm and finds that this Florentine bank definitely

[29] For example, there were discounts in Florence in 1340 and Genoa in 1398 (Mueller 1979, pp. 84-85.)

[30] Cipolla (1967, Ch. IV) suggests the term "ghost monies" because the monies' names are those of monies that had not existed for some time which no one alive may have ever seen.

held fractional reserves. Fractional reserves are a reasonable inference based on the Florentine laws requiring payment on demandable deposits in three days in one instance (Mueller 1979, p. 52.) If banks held one hundred percent reserves, such a requirement would be unnecessary, as would have been the surety bond or proposals for one hundred percent reserves (Mueller 1979, pp. 73-74.)

Bank deposits regularly were used to transfer funds between depositors. While the evidence differs across cities, possibly because of real differences across times and places and possibly because of selective discussion in the histories, it is clear that bank deposits were used to transfer funds. In Genoa, bankers transferred funds from one depositor to another by oral order (de Roover 1974, p. 216) and regularly transferred them from one bank to another (de Roover 1974, p. 202.) Funds in banks were used to make local and international payments (de Roover 1974, pp. 202-203 ; Lopez 1979 on international, p. 16.) Spallanzani (1978) provides clear documentation of written orders of payment in Florence in the late 1300s. Goldthwaite's canonical depositor in Florence is one who deposits funds on demand with no interest and then draws the balance down over several months (Goldthwaite 1985, pp. 19-27.) These withdrawals often were made by a written order to the banker to make a payment to the order's bearer. These payments could, and did include orders to pay construction workmen from these deposits, attesting to the widespread nature of these deposits and their use in payments. Transfers of deposits by oral order occurred in Venice from the end of the thirteenth century (Mueller 1979, pp. 48-50; Mueller 1997, p. 7, p. 15-20.)[31] Such transfers were used for purchasing merchandise, buying foreign exchange, lending among holders of accounts, paying real estate rents, and dealing in bullion (Mueller 1979, pp. 57-66.)

Banks made a large variety of risky loans. Banks in Genoa made loans to relatively well-off people, to "craftsmen and other small fry" and to those engaged in trade

[31] There is only weak evidence of interbank transfers (Mueller 1979, pp. 75-77.)

(Lopez 1979, p. 17.) In the eleventh century, bankers were allowed to invest in a trade but were required to obtain guarantors for their liabilities up to a specified limit (Lopez 1979, p. 11.) Loans in Genoa included maritime loans (Lopez 1979, p. 17.) In Florence banks made loans based on jewelry and promissory notes and they also purchased promised interest payments from funds established by the government. (Goldthwaite 1985, pp. 28-31.[32] Loans in Venice associated with silver and gold were extensions of short term loans (Mueller 1979, p. 67) and involved failures in 1374 (Mueller 1979, p. 63.) Venetian banks also made loans by overdrafts (Mueller 1979, pp. 77-78; Mueller 1997, p. 20) and became involved in government finances by buying government debt (Mueller 1979, pp. 78-84, p. 96.)

The risk of bank loans was well known and resulted in failures and attempts to limit the risk. Much of the information on banks' loans and investments comes from bankruptcies and liquidations (Mueller 1997, p. 81.) For example, in Venice in 1404, it was proposed that lenders lend no more than 150 percent of their patrimony (Mueller 1997, p. 57.) When discussing panics in Venice, Mueller's discussion (1997, pp. 122-97, 230-51) indicates the problems most importantly were due to difficulties experienced by borrowers associated with famines and war. Such events were not the only possible causes – Sienese banks made loans to ecclesiastics and nobility (English 1988, pp. 40-41) and failed during wars and conflicts in the 1290s (English 1988, p. 49, Part II.)

The bank failures over these centuries attest to the risk that banks bore. A bank failed in Genoa in 1259 (Lopez 1979, p. 20.) Florence had panics in 1340s and 1499-1500 and there were failures in Venice (Mueller 1997, pp. 122-123, Ch. 6, Appendix B.) The legal aspects of failure were a topic of political discussion in Venice including inspiring a bankruptcy law in 1330 (Mueller 1997, pp. 123-29.) Venice had a crisis

[32] Banks had to go to some effort to disguise interest payments by the borrower as, for example, gratuitous payments (Goldthwaite 1985, pp. 31-37.)

in 1374-1375 (Mueller 1997, pp. 145-157.) The Black Death precipitated a run on a bank in 1400 (Mueller 1997, pp. 163-164.) Venetian failures occurred due to borrowers' problems and the fall of Constantinople (Mueller 1997, p. 197, pp. 211-219.) As in other ages, banks in Siena had difficulties when their ecclesiastical and noble borrowers had difficulties (English 1988, p. 49.) The bank Bonsignori in Siena failed in the end due to attack on all Sienese merchants by Philip IV in the summer of 1307 (English 1988, p. 69.) The problems caused for the banks were sufficiently large that debtors in Siena could seize the sons of those unable to pay (English 1988, p. 89.) This can be contrasted with the somewhat less drastic treatment of debtors in Venice of banishing them or imprisoning them (Mueller 1997, pp. 123-25.)

Banks in medieval Italy promised to pay par, and although there were indeed laws requiring banks to pay par on demand, these laws followed rather than preceded that promise. The loans made by these banks were illiquid and the banks no doubt had better information on those loans than did the depositors. Compared to ancient Athenian banking, deposits were used as a medium of exchange in the same way that checks in the contemporary United States are used.

Japan

Japan has a very different development that is to some extent isolated from Western Europe in the Tokugawa period from 1603 to 1867-69. A government decree in 1639 closed Japan to most foreign trade.[33] Japanese were forbidden to travel to other lands, and communication by private parties was cut off and foreigners were restricted to a small enclave. This period of "seclusion" ended with the arrival of Commodore Perry

[33] The Tokugawa period itself is interesting because it had some of the characteristics of a command economy well before the command economies of the twentieth century and developed characteristics of a market economy over time (Crawcour 1989; Iwahashi 2004.)

to force the beginning of trade with the United States in 1853.[34]

Many practices easily recognizable as banking developed in Japan in this period. In fact, Japan had a developed financial system in Osaka – the major commercial center – and Edo – the major administrative center later renamed Tokyo – by the late 1600s. The available evidence indicates that lenders in the country evolved into financial intermediaries that accepted deposits and made loans by the 1800s.[35] While banking developed substantially after the end of the Tokugawa period in 1867 to 1868, the institutions were in large part intentional copies of those in the United States and Germany.[36]

Japan had a unified national coinage after the 1630s. The accounts of banks in Osaka were kept in silver and the accounts of banks in Edo were kept in gold, but a well functioning market for exchanging gold and silver developed. The major coins in actual use were gold and copper.[37]

Firms in Osaka that accepted deposits and issued receipts that passed as money

[34] See Hane (1988, pp. 23-24, pp. 65-69), Jansen (2000, Ch3) and Tashiro (2004.)

[35] Prior to the Tokugawa period, lenders were not banks and instead generally lent their own funds, in most respect being similar to pawnshops. Gay (2001) discusses this earlier incarnation of banks which operated analagously to pawnshops.

[36] Crawcour (1961) provides an overview of the development of banking in Tokugawa Japan. Patrick (1965, 1967) discusses the development of the banking system in the Meiji era (1868-1912) and Patrick (1967) relates it to earlier developments.

Soyeda (1896) and Tamaki (1995) are two general histories of Japanese banking that are primarily histories of banking after the Meiji restoration in 1868. Early chapters summarize banking in the Tokugawa period (Soyeda 1896, Ch. 1; Tamaki 1995, Ch. 1.)

Toby (2004) presents a very informative and readable account of the business activities of a country banker in the eighteenth and nineteenth centuries.

[37] For this description of the Japanese monetary system, we have relied on Crawcour (1961) and Crawcour and Yamamura (1970.) As Crawcour notes (1961, p. 346, fn. 18), the use of a money of account that is seldom used in transactions and physical monies denominated differently is not substantially different from earlier practice in Europe.

by the latter half of the 1600s evolved from money-changers. These firms are known as *ryogae*.[38] Wholesale merchants and financiers of local *daimyo* (local lords) were involved in loans related to their original businesses. The money changers, though, were directly involved in the original issues of notes, possibly as early as 1640 to the 1660s. These money changers, which were not corporations in the sense of English or American law, were numerous. In the 1850s, more than 1300 operated in Osaka and more than 750 operated in Edo.[39]

Bankers issued both bills that paid interest and passed from hand to hand, being endorsed at each step – the depositor's order – as well as notes that paid no interest and were not endorsed at each step – the *ryogae's* note.[40] The *ryogae's* note was a receipt for deposits promising to pay that amount either on demand or with notice. A depositor could obtain these notes in desired denominations that passed from hand to hand. If the bank had insufficient funds upon attempted redemption, a holder's only recourse was to the bank: the *ryogae's* note was a liability of the bank. Deposits also were the basis of "depositor's orders" which were similar to checks except that they were negotiable. Each holder signed the depositor's order when using it to pay for something until the note was returned to the bank. If the deposit account failed to have sufficient funds when returned to the bank, the holder's recourse was to the previous holders (presumably sequentially.) If the bank failed to honor the note because of its own difficulties rather than the depositor's lack of funds, the only recourse was to the bank. These notes could be for more than the value of the deposit, but they might not be honored on demand. (Crawcour 1961, pp. 352-53; Soyeda 1896, pp. 412-13; Tamaki 1995, pp. 6-7.)

[38] The *ryo* was a counting unit of gold coin.

[39] Crawcour (1961) and Tamika (1995, Ch.1) are the primary references for this paragraph.

[40] Crawcour (1961) calls these instruments "deposit notes" and "withdrawal notes" instead of "ryogae's notes" and "depositor's notes" as in Tamaki (1995), but the descriptions of the characteristics are the same.

Banks held fractional reserves. While there is no clear evidence on the aggregate reserve ratio, some evidence suggests reserves on the order of one quarter of deposits. Late in the Tokugawa period, reserves of only one-sixth or one-seventh are mentioned.[41]

A group of ten money changers in Osaka known as the "Ten Money Changers" exercised supervisory control over other bankers in Osaka, exercising some of the functions of a central bank. Reserves were held in other successively larger banks and used as clearing balances.[42]

The banks' assets were loans to private individuals, loans related to government remittances and direct loans to local governments. Some banks developed from wholesalers and provided book credit, later providing credit in the form of negotiable bills.[43]

HOW RISKY?

We have found no evidence that there was a legal requirement that banks redeem notes at par, and it is very unlikely that there is any such evidence. The political system in the Tokugawa period included a *shogun* – military governor – of Japan in combination with subordinate territorial lords who ruled the country. The legal system was relatively undeveloped and civil law consisted of proclamations combined with customary law. With rare exceptions, civil disputes in the Tokugawa period were resolved by the disputants, possibly with outside, but not governmental, assistance.[44]

Overall, the development of banking in Japan is interesting because, despite the cultural and legal differences from Western Europe and despite its seclusion, banking

[41] Tamaki (1995, p. 6) suggests this figure for Osaka banks and Toby (2004) suggests this figure for a country banker with surviving records. Crawcour (1961, p. 356) suggests reserves for Osaka banks on the order of one-third deposits early in the Tokugawa period but possibly a ratio as low as one-sixth or one-seventh at the end of the period.

[42] See Crawcour (1961, pp. 353-54), Soyeda (1896, p. 412) and Tamaki (1995, pp. 7-8.)

[43] See Crawcour (1961, pp. 347-56, p. 358; 1962, pp. 63-66), and Crawcour (1989, p. 586.)

[44] Glenn (2000, Ch. 9) discusses legal systems in Asia, primarily with an emphasis on China. Henderson (1968) and Oda (1999, Ch. 2) discuss the general framekwork of Tokugawa law.

developed in many ways similar to banking in Western Europe. Banks promised to pay par on demand even though they held fractional reserves and were not required to do so; banks made risky loans to individuals that were not readily marketable; and the banks' notes were even more clearly a medium of exchange than were Western European banks' liabilities.

United States

It might seem that banking in the United States is unlikely to be of much interest for this study because U.S. banking largely is a carryover of British institutions. Such a conclusion is incorrect. Institutions do not appear to have been carried over from Great Britain without thought to the different circumstances, although it is fair to say that the common law carried over from Great Britain made those institutions the default ones. In fact, some states in the antebellum period prohibited banks altogether, which was not true in Great Britain, while others had novel banking systems.

Free Banking.—

In the period immediately preceding the Civil War, individual states in the United States determined their own banking laws. Some states had a banking system patterned after the one introduced in New York, called "free banking." These free banking systems had certain distinguishing characteristics( ). Anyone who satisfied specific legal criteria was free to open a bank, which accounts for the name "free banking." Second, banks were permitted to issue notes that were used as a medium of exchange. Third, banks were required by law to redeem their notes at their par value when presented at the bank.[45] Fourth, banks were required to hold government bonds – called

[45] The legal requirement of par redemption generally appears to have followed the restriction of payments at the end of the 1830s. Nonetheless, banks may have promised par redemption before

"government stocks" in this period – which were traded on the New York Stock Exchange as backing for the banks' notes. For many free banks, these bonds were the largest part of their assets (Dwyer and Hasan 2005.)

This requirement to redeem notes at par value is consistent with the legal requirement explanation.[46] Since banks were in fact required to redeem their notes at par value, an economic explanation for that redemption such as asymmetric information is not really necessary and it is not possible to be certain whether banks would have promised to pay par if they had not been required to do so. Still, it is interesting to examine whether those explanations are applicable.

These bonds held as backing for the notes were marketable securities traded on the New York Stock Exchange and are not really a plausible basis for an asymmetric-information explanation of banking. There is no reason to think that banks had better information about states' finances than did noteholders. Although traded on the New York Stock Exchange, the bonds' prices were not readily available on the minute-by-minute basis on which they are available today. The prices generally were available, though, in the New York press on a weekly basis (Dwyer, Hafer and Weber 1999.) Furthermore, while a bank might know more about its balance sheet and changes in it than depositors, banks were required to publish their balance sheets periodically in local newspapers (Hasan and Dwyer 1994; Dwyer and Hasan 2005) which mitigated any lack of information by depositors.

It is less certain whether the liquidity explanation would have been sufficient to induce par redemption, but it does not seem like the case the theory has in mind. The bonds held by banks were traded on an organized exchange and were liquid in

this.

[46] Notes were not required to trade at par away from the bank, though, and they generally did not. Banknote prices in New York City generally deviated by a few percentage points from the par value, although they also sometimes deviated substantially from the par value (Gorton 1996; Dwyer and Hasan 2005.)

the sense that trading was reasonably continuous for the larger issues of bonds.

Money Market Funds.—

Removed in time and circumstances by 150 years, money market funds in the United States provide an interesting example of firms that seem to contradict most prevailing theories about why issuers of monetary liabilities promise to redeem deposits on demand at par. Money market funds are redeemable by check on demand. Money market funds are not required by law to redeem their liabilities at anything other than market value, but money market funds have gone to substantial effort to avoid the par value of their liabilities falling below the initial value of a dollar.

The Securities and Exchange Commission's (SEC's) website describes money market funds well(SEC 2004a).

> Money market funds typically invest in government securities, certificates of deposits, commercial paper of companies, and other highly liquid and low-risk securities. They attempt to keep their net asset value (NAV) at a constant $1.00 per share—only the dividend yield goes up and down. But a money market's per share NAV may fall below $1.00 if the investments perform poorly. While investor losses in money market funds have been rare, they are possible.

Money market funds in the 1970s were required to mark their assets to market, although there was variation in how the market value of the underlying assets were determined and some methods were tailored to keep NAV constant in the face of fluctuating security prices. Subject to restrictions on their portfolios, bank trust departments used amortized cost accounting to determine the value of assets in their pooled short-term investment funds and they preferred money market funds that used amortized cost accounting.[47]

[47] (Cook and Duffield 1979a, pp. 20-21.)

Stock and bond mutual funds in the United States mark their assets to market, but money market funds do not have to mark to market and do not do so. Instead money market funds use "penny rounding" and "amortized cost accounting." Under penny rounding, net asset value (NAV) is determined to the nearest one percent, rather than the nearest tenth of a percent or tenth of a penny. This technique of determining NAV avoids recognizing small losses of a few tenths of a percent. Amortized cost accounting is most easily explained in terms of securities with one payment at maturity. Under amortized cost accounting, the difference between the price paid and the amount received at maturity is accrued as income linearly as time passes after purchase, with no other intervening recognized gains or losses. As a result, NAV cannot fall below a dollar if all assets are held to maturity under amortized cost accounting. Capital gains and losses on securities between purchase and redemption are recognized over time instead of immediately when the price of the security changes. Money market funds using these valuation techniques are required to monitor deviations of NAV from market value and their portfolios' risk and maturity are restricted.[48]

Both methods of valuing securities imply that the value of investors' investment is diluted when interest rates rise or fall. The underlying logic is similar to the recent controversy concerning international funds and applies to any fund that creates predictable deviations between NAV and market prices (Greene and Hodges 2002.) When short-term interest rates rise, the value of the assets falls and NAV does not reflect this fall. As a result, an investor in a money market fund can sell the mutual fund at NAV and buy market securities, thereby receiving the higher market interest rate which they would not receive if they continued to invest in the money market fund. Because the investment was redeemed at NAV and the underlying securities were sold by the fund at the lower market prices, the remaining investors suffer a loss that is recognized as a lower return over time. Some investors will take advantage

[48] (Cook and Duffield 1979a, pp. 19-21; SEC 2004b.)

of the this arbitrage because it is worth the transactions costs, the fund will have more redemptions when interest rates are rising and consequently will have more securities trades and higher transactions costs. In sum, the higher market return creates an incentive to move funds out of the money market fund, thereby imposing losses on the remaining investors and on the mutual funds' organizers due to the higher transactions.

These effects were well known when these valuation techniques were adopted in the late 1970s and Lyon (1984) documented that the dilution was not merely a possibility. Lyon showed that money market funds had lower returns than the underlying portfolio when rates increased, and outflows predictably followed. Lyon's interpretation of the issue is very different than ours though. He interprets the dilution as an undesirable effect of these valuation methods which the SEC should prohibit. We interpret the dilution as a predictable cost of these valuations which customers and funds' managers are willing to pay. After all, money market funds are *not required* to use either valuation method, and money market funds that mark to market on a daily basis have less stringent restrictions on their portfolios.

These effects of amortized cost accounting and penny rounding continue. Figure 1 shows the differential between the average return on taxable money market funds and the 90-day Treasury bill rate by week since 1984. With occasional exceptions, the figure shows that the yield to maturity of a 90-day Treasury bill exceeds the return on money market funds. Ninety days is the maximum average term to maturity permitted to funds that use amortized cost accounting. As the analysis above predicts, the figure shows that the Treasury bill return rises relative to the money market return when interest rates rise and falls relative to money market returns when interest rates are falling.

How successful have money market funds been at keeping the redemption value constant? As of 2005, only one money market fund is known to have fallen below

the dollar redemption value, a money market fund called Community Bankers U.S. Government Money-Market Fund that failed in 1996 and paid 94 cents on the dollar.[49] This is the only money market fund that has ever failed with a net asset value less than a dollar. Other money market funds have closed in circumstances that would have created a net asset value less than a dollar, but the parent firm has put in funds to make up the difference. In one case, Salomon Brothers purchased securities from a subsidiary institutional money market fund at inflated prices to prevent a progressive collapse due to withdrawals (Stigum 1983, pp. 676-79).[50]

This constant dollar NAV has required intermittent payments to continuing money market funds by affiliated parties, both soon after adoption and recently. Institutional Liquid Assets in Spring 1980 returned $2 million in fees to keep NAV from falling below $1 (Lyon 1984, p. 1015.) In 2002 when interest rates on assets held by money market funds fell below expense rates, money market funds reduced the expenses charged to investors in the funds to avoid having the value of the funds "bust the buck" (Damato 2002a).

Deposits in money market funds are transferable by check. There are lower limits on the size of transactions, which makes such checks generally not useful for daily transactions such as purchases at a grocery store, but the limits are sufficiently small that they can be used to make mortgage payments for example.

Money market funds clearly are not required to maintain an NAV of a dollar,

[49] Some variable annuity accounts with money market sub-accounts fell below the par value of $1 due to annuity fees (Damato 2002b). This point is not in the original but is available at the end of the online version of the article by Damato in a section "Corrections and Amplifications" updated on November 8, 2002.

[50] Such behavior is, of course, consistent with the fund family maintaining its reputation and does not necessarily imply that there are benefits to the money market fund itself from having a stable NAV. This line of argument would require, though, that there are benefits to a fund family to a stable NAV but none to the money market fund itself.

which means that the legal restriction theory is irrelevant. Money market funds hold marketable assets with prices which can be determined at virtually zero cost, which means that the asymmetric information theory is irrelevant. Does this mean that the liquidity provision explanation explains why money market funds keep NAV at a dollar? Because the market for Treasury bills is large relative to any redemptions at money market funds to date, the assets held by money market funds can be sold at a moment's notice and are as liquid as the deposit. Whether money market funds are a medium of exchange is a matter of interpretation because there are minimum sizes of checks that can be written. Money market funds are checkable deposits, and therefore with this caveat, are consistent with this explanation.

CONCLUSION

There is a very large literature on banks and their promise to pay par on demand. One line of the literature follows Diamond and Dybvig, in whose model banks promise to pay par on demand because households have a demand for that contract's liquidity. In that specific analytical framework, the greater liquidity of the demand deposit liability is due to a maturity mismatch between the bank's assets and liabilities, but the general issue is the ability to exchange the deposit for the liquid assets at low cost. A second line of the literature takes a slightly different tack and bases the promised payment at par on information about loan quality known to the bank but not to depositors. Uninformed depositors have less information about loans than do bankers, and it is not an incentive-compatible equilibrium for nonmarketable loans on banks' books to be the basis of deposits that are marked to a market value determined by the bank. Hence, the uncertain market value of banks' assets becomes a known value of banks' liabilities by promising to pay the par value of deposits. Because a bank can take actions such as making riskier loans to make increase its profits without compensating depositors for the risk, promised payment on demand can reduce the

bank's payoff from such strategies. An alternative line of argument takes the simple course, which is not necessarily the wrong one because it is simple. Banks in the U.S. today are required to pay the par value of "demand deposits" on demand, and the existence of such a promise may reflect nothing other than that legal requirement. A fourth line of the literature suggests that liabilities of financial intermediaries which are used as a medium of exchange will be characterized by promised redemption at par value on demand.

Strong predictions from the theories have the form: Promised payment at par will be observed **only if** certain conditions are met. For example, the legal restriction theory can be interpreted as making the strong prediction that banks will promise to pay par on demand only if they are required to do so. Similar statements can be made for the other theories.

The theories also can be interpreted as partial explanations, explanations that work sometimes. For example, the legal restriction theory can be interpreted as making the weak prediction that banks sometimes will promise to pay par on demand if they are required to do so and for no other reason. In other words, an observation supporting the importance of the legal restrictions theory would be an observation at some time and place that banks promise to pay par on demand and none of the other theories can explain why they would make that promise.

All of the theories explain some of observed banking arrangements. This can be seen in Table 1, which indicates that all of the theories are consistent with some of the observed banking arrangements. At the same time, none of the theories explains all of the observed banking arrangements. Perhaps this is as it should be given the variety of arrangements that have existed in various times and places. That said, it is interesting that the most recently developed theory – the one based on money as a medium of exchange – is the one that is most consistent with recent developments.

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Table 1
Summary of Evidence

Time and Area	Characteristic						
	Pay Par on Demand	Fractional Reserves	Assets Not Liquid on Demand	Asymmetric Information	Legal Restriction	Negotiable	Medium of Exchange Away From Bank
Ancient Greece	Yes	Yes	Yes	Yes	No	No	No
Medieval Italy	Yes	Yes	Yes	Yes	No	No	No
Tokugawa Japan	Yes	Yes	Yes	Yes	No	Yes	Yes
U.S. Free Banking	Yes	Yes	No	No	Yes	Yes	Yes
U.S. Money Market Funds	Yes	Yes	No	No	No	No	Yes

This table summarizes the characteristics of banking in the times and places examined. The theories are attempting to explain why the banks paid par on demand while holding fractional reserves; hence they are necessary for the episodes to be informative about the theories. Negotiability - which means that the order to pay can be transferred to another - is a characteristic of notes that can be exchanged or of bills of exchange, but not of checks as used in the United States today. “Asymmetric information” is a theoretical term based on what agents know, but is used as a summary column title to denote assets that do not have prices readily available on a reasonably continuous basis. “Legal restriction” summaries whether the institutions were required by statutory law to redeem some deposits on demand at par.

Table 2
Summary of Implications of Theories

Theory	Primary Antecedent Condition for Par Redemption
All	Banks promise to pay par on demand with only fractional reserves of the promised asset
Liquidity Provision	Bank assets are exchangeable into the liability over time, at significant cost, or both instantaneously at no cost
Asymmetric Information	Banks are better informed about assets than depositors with no truth revealing equilibrium
Legal Restriction	An enforced law requires bank to pay par on demand
Bank Liabilities as a Medium of Exchange	Bank liabilities are used as a medium of exchange
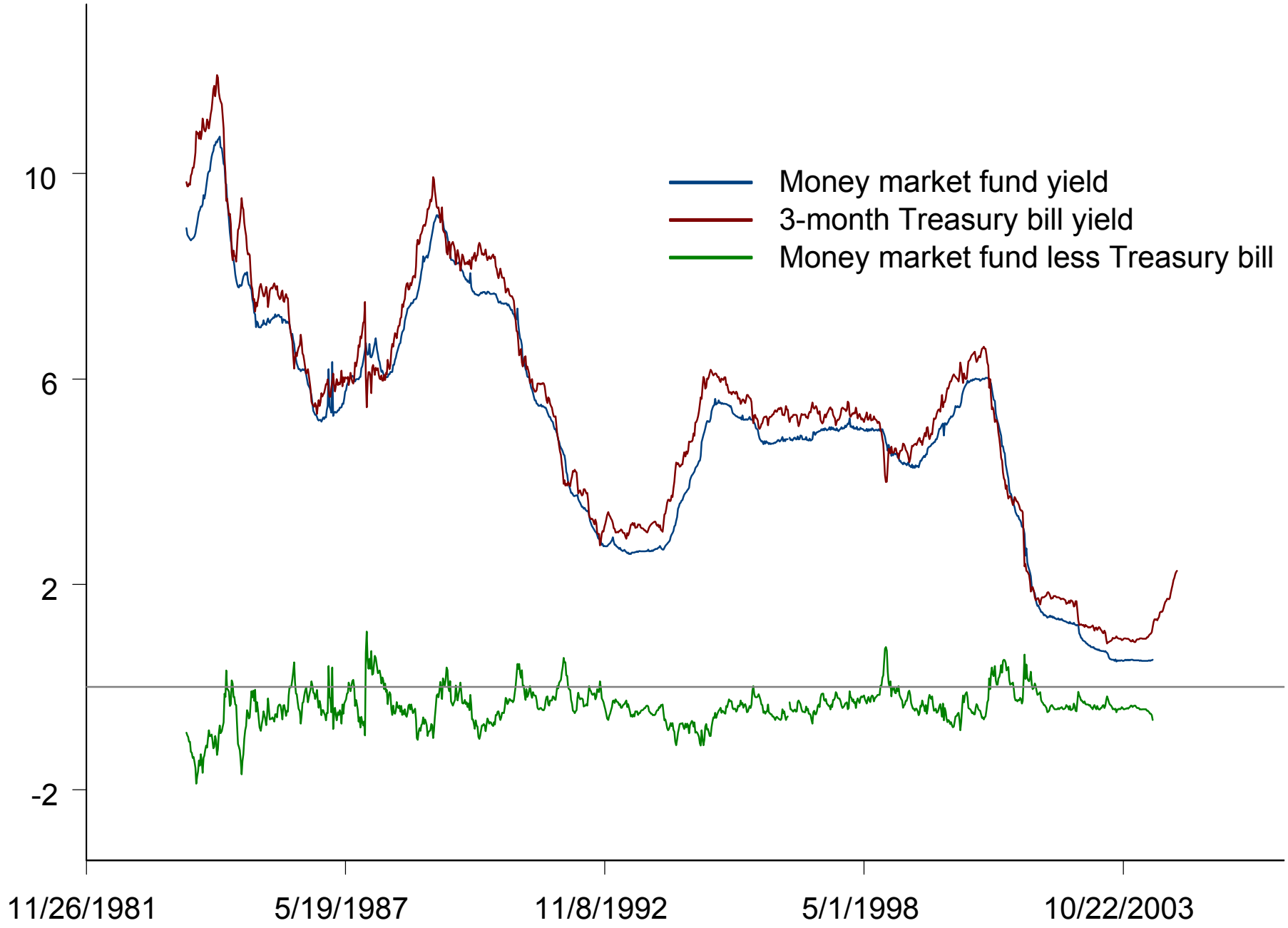
Figure 1
Money market fund yield and 3-month Treasury bill yield