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Interest Rates Under the U.S. National Banking System

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ABSTRACT

According to previous studies, the demand-liability feature of national bank notes did not present a problem for note-issuing banks because the nonbank public treated notes and other currency as perfect substitutes. However, that view, when combined with nonbindingness of the collateral restriction against note issue, itself an implication of the fact that not all eligible collateral was used on collateral, implies that the safe short-term interest rate is pegged at the tax rate on note circulation. Since evidence on short-term interest rates is inconsistent with such a peg, that view must be rejected.

*Preliminary versions of this paper were presented at seminars at the Bank of Italy, Cornell University, the Federal Reserve Bank of Minneapolis, SUNY at Stony Brook, and the University of Miami. We are indebted to participants at those seminars for helpful comments. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

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For the half-century from 1863–1914, the United States had a monetary system in which banks were permitted to issue payable-on-demand liabilities in the form of bearer notes subject to two main restrictions: a roughly 100 percent collateral or reserve requirement in the form of government bonds and a tax on notes outstanding—1 percent per year until 1900 and, effectively, 1/2 percent thereafter. All students of this period agree that in most transactions the nonbank public did not distinguish between national bank notes and lawful money, currency issued directly by the government. Because of that observation, the predominant view in previous studies of the period is that the demand-liability feature of notes did not present a problem for note-issuing banks. The view is that since the nonbank public did not distinguish between national bank notes and lawful money, a bank could always exchange its own notes for lawful money (at par) or, put differently, could always get its own notes into circulation and, in effect, keep them outstanding. We call this view the equivalence view (because it asserts equivalence for a bank between its own notes and lawful money).

An early statement of the equivalence view appears in *A Monetary History of the United States 1867–1960.*

> National bank notes differed in usefulness from currency issued directly by the U.S. government in only one respect. Federal law did not permit them to be used to meet legal reserve requirements of national banks . . . . But inasmuch as the public at large regarded national bank notes as equivalent to other notes [lawful money] and [inasmuch as] other types of currency were always a multiple [greater than unity] of bank vault cash, that restriction was of no great practical importance. We know of no episode after 1874 in which it raised any significant problems for banks (Friedman and Schwartz, 1963, p. 21).

According to this statement—the third sentence, in particular—there are two kinds of currency, lawful money and national bank notes. Some holders (the nonbank public) are indifferent between them;

others, the banks, are not since national bank notes cannot count as reserves. However, since the amount of lawful money exceeds the demands of banks, the indifferent holders, the nonbank public, will accommodate the banks' demands for lawful money. In particular, according to this view, there cannot be a premium on lawful money in terms of national bank notes, because the amount of lawful money exceeds the demand of those who are not indifferent between the two. (The last sentence refers to the absence of such a premium after 1874, a point we return to later.) And a note issuing bank can never have a problem exchanging its notes for lawful money, because the indifferent holders, the nonbank public, accommodate such exchanges. If so, then the demand-liability feature of their notes cannot be a problem for note issuing banks.

Several previous studies, most notably those of Friedman and Schwartz (*A Monetary History of the United States, 1867–1960*), Cagan (*Determinants and Effects of Changes in the Stock of Money, 1875–1960*), James (*J. of Political Economy,* 1976), and Cagan and Schwartz (*J. of Money, Credit, and Banking,* 1991), have combined the equivalence view with some other, usually implicit, assumptions—either no risk aversion or no perceived risk on the part of national banks—to derive an arbitrage condition, one that relates the yield on the securities eligible to serve as collateral for note issue to the tax rate on notes outstanding and the yield on other potential bank assets. This has led to what we call the collateral price puzzle: "The real puzzle, as we see it, is why the market prices of most of the eligible bonds were not bid up until they were no longer attractive for securing note issues" (Cagan and Schwartz, p. 297).

Previous attempts to explain the collateral price puzzle have focussed on the implicit assumptions about an absence of risk. Goodhart (1965) and Champ (1990) discuss the risk of changes in the rules concerning note issue, while Kuehlwein (1992) notes that the yield on eligible collateral

was variable so that holding it was, indeed, risky. In this paper, we focus instead on the equivalence view and argue that it should be rejected. The argument is, essentially, an argument by contradiction.

Every student of this period has noted that at no time was all the eligible collateral for note issue actually serving as collateral. (Indeed, this fact has sometimes been called the under-issuance-of-notes puzzle.) However, no one has combined this fact with the equivalence view and drawn from them two related implications. First, the collateral restriction on note issue is not binding. Second, the nominal, short-term safe interest rate is pegged at the tax rate on note issue. However, as will not be a surprise to most students of the period, the available data on short term interest rates seem inconsistent with such a peg. That leads to rejection of the equivalence view.

How, though, can we reconcile rejection of the equivalence view with the observation that the nonbank public seemed not to distinguish between national bank notes and lawful money and with the fact that the amount of lawful money exceeded bank reserves? We do not have a model that does that. We do, however, in the conclusion offer suggestions about features that such a model ought to include. We suggest that a successful model should reject the centralized market view implicit in the equivalence view and should take seriously the stories that are usually given to "explain" why there is a demand for currency and why there is a demand for excess reserves, stories that are inconsistent with a centralized market.

1. Regulations on National Banks

In this section, we briefly review the restrictions on note issue by national banks and other restrictions on national bank operations that are relevant for the discussion below.[1] Our discussion covers only restrictions in effect from 1882, when absolute limits on note issuance by individual banks were dropped, to 1914, when the Federal Reserve System was established.

National banks were not permitted to issue liabilities other than bank notes and deposits. A national bank was permitted to issue notes that it was required to redeem on demand in lawful money, specie, or greenbacks. These notes were legal tender for all payments to the government except import duties and for all payments by the government except interest on public debt. In addition, national bank notes could not be counted as part of the reserves that a national bank was required to hold against its deposits.

National bank note issue had to be backed by a deposit of collateral in the form of U.S. government securities with the U.S. Treasury. A national bank could issue notes up to some percentage of the minimum of the market or par value of the securities so deposited—90 percent prior to March 14, 1900; 100 percent thereafter.

A national bank was taxed on the average amount of its notes *in circulation.* A bank was not taxed on notes that had been issued to it by the Treasury but were not in circulation. This tax was 1 percent per annum on the average circulation until March 14, 1900, when it was lowered to 1/2 percent per annum on notes that were backed by government securities with a coupon rate of 2 percent.

A national bank was required to accept the notes of any other national bank at par in payment for any debt or liability to it. An act of June 20, 1874, provided that a bank could convert the notes of another national bank to lawful money at par at the U.S. Treasury or any assistant treasurer's office. The redeeming bank would be reimbursed by the Treasury for the shipping costs involved. The issuing bank would be charged for the average shipping and sorting costs incurred by the Treasury in proportion to its notes redeemed through the Treasury.

2. A Choice Problem for Banks Under the Equivalence View

We now set out a discrete-time competitive choice problem for national banks under the equivalence view. We begin with the constraints of the problem. For our purposes, we need to include explicitly in the constraints only some of the assets and liabilities that banks could hold and issue. We include as liabilities national bank notes, as assets collateral for note issue in the form of bonds normalized so that they have a coupon of unity, and as either assets or liabilities safe short-term loans or securities.

(1) $n_t - l_t - v_t(s)q_t + ... \geq p_t(s)c(s)$

(2) $-[1 + \tau_t(s)]n_t + [1 + r_t(s)]l_t + [1 + v_{t+1}(s')]q_t - ... \geq p_{t+1}(s')c_{+1}(s')$, for each s'

(3) $v_t(s)q_t - \alpha_t(s)n_t \geq 0$

(4) $q_t \geq 0$ and $n_t \geq 0$.

Inequalities (1) and (2) constrain consumption at t and t + 1, respectively. (The ellipsis represent omitted assets and liabilities.) Here c(s) is consumption of a banker at date t in state s, $p_t(s)$ is the time t price level in state s, $v_t(s)$ is the price of the collateral security at t in state s and q_t is the amount held from t to t + 1, $\tau_t(s)$ is the tax rate on notes at t in state s and n_t is notes outstanding from t to t + 1, $r_t(s)$

is the interest rate on safe short-term loans or securities at t in state s and l_t is the quantity held from t to t + 1. (The interpretation of $r_t(s)$ as a safe, rather than a risky short-term rate follows from the fact that it does not depend on s′, the state at t+1.) Constraint (3) is the collateral restriction, where $\alpha_t(s)$ is the multiple of notes that determine the required collateral. In (4), we restrict note issues and holdings of collateral to be nonnegative, but we do not restrict safe loans to be nonnegative. (When safe short-term loans are liabilities are negative, they should be interpreted as time deposits.)

The assumption that national bank notes and lawful money trade at par is embedded in (1)–(4) by having all prices be the same in national bank notes and lawful money. The equivalence view, the assumption that the demand liability feature of notes does not pose a problem for note issuing banks, is embedded by writing these constraints in discrete time and by allowing the bank to hold assets that mature when notes come due. Notice that according to these constraints, issuing notes is equivalent to getting a "discount window" loan at an interest rate equal to the tax rate on notes subject to the collateral restriction in (3). This is an implication of the equivalence view, but one that has not been emphasized.

We assume expected utility maximization, but, aside from assuming strictly concave utility and positive consumption, we do not impose any special form on utility. We let $u^b(\ )$ be banker b's utility function which has as argument the vector of consumption from t on by state. In what follows, we let E stand for expectation conditional on being at t in state s and we let $u_{,s}(\ )$ be the partial derivative of u^b with respect to consumption at t in state s. Assuming price-taking behavior, the implied first-order conditions are as follows:

(5) (w.r.t.to n_t) $E_{[}u_{,s}(\ )_{]}/p_t(s) - [1+ \tau_t(s)]E_{[}u_{+1,s'}(\ )/p_{t+1}(s')_{]} \leq \alpha_t(s)\lambda_{t,s}$

(6) (w.r.t. to l_t) $-E_{[}u_{,s}(\ )_{]}/p_t(s) + [1+ r_t(s)]E_{[}u_{+1,s'}(\ )/p_{t+1}(s')_{]} = 0$

(7) (w.r.t. to q_t) $-v_t(s)E_{[}u_{,s}(\ )_{]}/p_t(s) + E_{_}[1+ v_{t+1}(s')]u_{+1,s'}(\ )/p_{t+1}(s')_{_} \leq -v_t(s)\lambda_{t,s}$.

In (5) and (7), $\lambda_{t,s}$ is the nonnegative multiplier associated with the collateral constraint, (3). We will have several uses for (5)–(7). The first is to deduce from them the collateral-price puzzle.

3. The Collateral-Price Puzzle

The arbitrage condition that generates the puzzle about the price or yield on collateral is that the yield (until maturity) on eligible collateral is a weighted average of the tax rate on note issue and some other market rate where the weight on the former is $1/\alpha_t(s)$ and the weight on the latter is $[\alpha_t(s) - 1]/\alpha_t(s)$. Although this arbitrage condition seems straightforward, it is instructive to derive it from (5)–(7).

To do that we need to impose some additional assumptions. In addition to (5) and (7) at equality, one possibility is (i) no uncertainty regarding the future prices of the collateral securities and (ii) static expectations concerning the yield on them. The first of these allows us to factor $[1 + v_{t+1}(s')]$ out of the expectation expression in (7), while the second implies that the one-period holding-period return, $[1 + v_{t+1}(s')]/v_t(s)$, is equal to unity plus the yield until maturity. Alternatively, in place of (i), one could impose linear utility (no risk aversion) and independence between the future prices of collateral and the future price level.

The result of imposing (i) and of substituting from (5) and (6) into (7), all at equality, is the weighted average described above, but for the holding period return on collateral:

$$(8) \qquad [1 + v_{t+1}(s')]/v_t(s) = [1 + r_t(s)][\alpha_t(s) - 1]/\alpha_t(s) + [1 + \tau_t(s)]/\alpha_t(s).$$

Under assumption (ii), the holding period return on the left side of (8) is equal to unity plus the yield until maturity.

As noted above, constraints (1) and (2) are written so that $r_t(s)$ is a safe short-term rate. Those who have calculated the right-hand side of (8) (and compared it to the gross yield on eligible bonds)

have used a risky rate as an empirical counterpart of $r_t(s)$—Cagan (1965) and Cagan and Schwartz (1991) used the yield on bank equity, while James (1976) used the interest rate on bank loans region by region. Despite this, the computed right-hand side of (8) tends to be lower than the gross yield on collateral. Indeed, since $\alpha_t(s)$ is close to unity, the right-hand side of (8) will be within a few basis points of unity plus the tax rate for almost any reasonable magnitude for $r_t(s)$. However, yields on eligible securities were considerably higher than the tax rate, mostly in the range of 2 percent to 3 percent (see Figure 1). This is the collateral-price puzzle.

[insert Figure 1: Yields on eligible bonds, 1882–1914]

Kuehlwein (1992) notes that the assumption that yields on eligible bonds were deterministic, assumption (i), is counterfactual and on that ground dismisses (8) as a reasonable prediction. He, however, does not attempt to explain the observed yields on eligible collateral, and, like everyone else, fails to notice that nonbindingness of the collateral restriction, by itself, generates a more confounding puzzle.

4. Nonbindingness of the Collateral Restriction

If the collateral constraint, inequality (3), is not binding, then it follows from (5) and (6), without any additional assumptions, either about risk or anything else, that $r_t(s) \leq \tau_t(s)$. That is, if (3) is not binding, then the corresponding multiplier, $\lambda_{t,s}$, is zero. Then (5) and (6) imply $r_t(s) \leq \tau_t(s)$, and with equality if notes were issued, as, in fact, they were. Thus, as asserted above, nonbindingness of the collateral restriction and the equivalence view imply, without any ancillary assumptions, that the safe short-term interest rate is pegged at the tax rate on note issue. We now argue that nonbindingness of (3) is highly plausible.

Every observer of this period has noted that at no time were all the bonds eligible to serve as collateral for note issue ever deposited to serve as collateral. In fact, very substantial amounts were not used as collateral. These amounts were either held by national banks or by others. We first examine holdings by national banks.

Call reports of national banks list holdings of government bonds in three categories: those deposited as collateral for note issue, those used as collateral for public deposits, and other bond holdings. We show in Figure 2 the third category, other bond holdings, as a percentage of bonds held as collateral for note issue. Although the percentages are not large, unless one can claim that these holdings were meeting other constraints imposed on national banks, then they are direct evidence of nonbindingness of the collateral constraint for some national banks and, hence, imply that $r_t(s) \leq \tau_t(s)$.

[insert Figure 2: Excess eligible bonds held by national banks

(% of note collateral)]

Figure 3 shows holdings of eligible bonds outside national banks as a percentage of total eligible bonds. The percentages are substantial, at least until 1907. As we now argue, the fact that eligible bonds were held outside national banks also suggests that constraint (3) was not binding.

[insert Figure 3: Percentage of eligible bonds held outside national banks, 1882–1914]

Constraints (1)–(4) can be taken to apply to nonnational banks provided we replace $n_t \geq 0$ in (4) by $n_t = 0$. It follows that an implication of positive holdings of eligible bonds outside national banks is

$$(7') \qquad -v_t(s)E_{[}u_{,s}(\ )_{]}/p_t(s) + E_{_}[1 + v_{t+1}(s')]u_{+1,s'}(\ )/p_{t+1}(s')_{_} = 0$$

where the superscript h refers to a holder of eligible bonds other than a national bank. Notice that the left-hand sides of (7) and (7′) are identical except possibly for the marginal utilities. It seems plausible that the relevant ratios of marginal utilities do not differ between owners of banks and others. Complete risk-sharing markets would imply that the relevant ratios of marginal utilities are equated across everyone. Even in the absence of such markets, it seems far-fetched to say that owners of national banks and other holders of government bonds had systematically different attitudes toward risk and consumption patterns. Such differences are necessary in order that (7) and (7′) be consistent with a positive multiplier for the collateral constraint (3).

Could there be such differences? It is true that national banks could not, as banks, issue securities with return streams that match those of eligible securities and use the proceeds to buy eligible securities. They were not permitted to issue bonds, and, certainly, could not have issued bonds which had priority over their note and deposit liabilities as claims on their holdings of government bonds. However, owners of national banks could themselves have sold claims with return patterns that approximated those of the eligible securities and used the proceeds to buy eligible collateral. Alternatively, and more simply, ownership of national banks could be transferred. If there were systematic differences between attitudes towards risk and consumption patterns between owners of national banks and other holders of eligible bonds in the direction that would make (3) binding, then there would be utility gains to both from having nonbank holders of eligible bonds take ownership of national banks.

We conclude, essentially from the fact that substantial amounts of eligible collateral were not held as collateral, that bindingness of the collateral restriction is extremely implausible. That conclusion and the equivalence view embedded in (1)–(4) imply that the safe short-term interest rate should be equal to the tax rate on notes outstanding—equal rather than simply bounded above because

notes were, in fact, issued. We next examine whether the available data on short-term interest rates seem consistent with this implication.

5. Observed Short-Term Interest Rates

As just explained, nonbindingness of the collateral restriction and equivalence imply that the safe short-term interest rate is pegged at the tax rate on notes outstanding; that is, at 1 percent prior to 1900 and at 1/2 percent thereafter. So far as we know, there is no systematic data on safe (default-free) short-term rates for the period under consideration. We do, however, have data on call loan rates. These are shown in Figure 4 for the decade ending in 1900 and in Figure 5 for the decade beginning in 1900. These rates vary, are known to display a seasonal, and show no tendency to be lower after 1900 than before 1900. There is also casual evidence that banks usually paid 2 percent on deposits of other banks, another short-term rate that exceeds the tax rate on notes outstanding. In order to reconcile these short-term rate observations with a peg of the safe short-term rate, every discrepancy between these rates and the tax rate must be ascribed to a default-risk premium.

[insert Figure 4: Call loan rates, weekly, 1890–1899) and

Figure 5: Call loans rates, weekly, 1900–1909)]

Given this evidence on short-term rates, there are three options, the first two of which are quite unattractive. First, we can maintain the equivalence view, reject the implication that the safe short-term rate is pegged at the tax rate, and say that banks were not optimizing—in particular, did not take advantage of the profit implied by the ability to borrow at 1 percent (1/2 percent after 1900) and lend safely short-term at a higher rate. For the usual reasons, this is unattractive.[2] Second, we can maintain the equivalence view and its implication concerning the peg of the safe short-term rate. We then have two problems. One problem is the discrepancies between observed short-term rates and the tax rate on

note issue. As discussed above, the second view implies that all such discrepancies must be explained by default risk on the securities to which the observed interest rates apply. The second problem is a term-structure puzzle. If the safe short-term rate is pegged at 1 percent or 1/2 percent, why are yields on default free longer term bonds at 2 percent or higher as shown in Figure 2? The only possible explanation is Goodhart's: that there was uncertainty about the permanence of the rules about note issue. In particular, if people thought that the rules might be changed in such a way as to imply substantially higher safe short-term rates in the future, then that could explain the implied upward-sloping yield curve. Although call loans were somewhat risky and although there is some basis for believing that there was uncertainty about the permanence of the note issue rules (see Goodhart 1965 and Champ 1990), this second option is also unattractive. In particular, it seems farfetched to ascribe the discrepancies between observed short-term rates and the tax rate on note issue solely to default risk. That leaves only the third option: rejection of the equivalence view.

6. Other Purported Evidence on the Equivalence View

Rejection of the equivalence view means rejection of the view that the demand liability feature of national bank notes did not pose a problem for banks issuing notes. Alternatively, it means rejection of the view that a note issuing bank could always keep its notes outstanding. Here we want to examine other evidence that has been taken to support the equivalence view.

We first want to argue that rejection of the equivalence view is consistent with the absence after 1874 of an observed discount of notes in terms of lawful money, a fact alluded to by Friedman and Schwartz in the quotation cited in the introduction (see Friedman and Schwartz, footnote 8, p. 21). As explained by Cagan and Schwartz (1991), after 1874, banks that accumulated notes of other banks could easily get those notes converted into lawful money by turning them in at U.S. Treasury offices located in major cities or by shipping them to the Treasury in Washington, D.C. and charging shipping

costs to the Treasury. The notes would then be returned to the issuing banks. The issuing bank had to redeem them for lawful money and was charged, in proportion to its notes redeemed through the Treasury, for the average costs to the Treasury of the redemption process. This procedure implies that there would not be a market in which notes trade for lawful money at an explicit discount. Holders of notes issued by other banks would not sell notes at a discount, precisely because the redemption process allowed banks to get lawful money at par without bearing shipping or other costs. An issuing bank would not sell its own notes at a discount unless it was assured that the notes would not be presented quickly for redemption. Not only could there not be such assurance, but, on the contrary, such redemption would be likely precisely because it would be profitable and because of the ease with which it could be carried out. Therefore, because of the ease with which banks could get lawful money for notes issued by *other* banks, the absence of an explicit discount on national bank notes in terms of lawful money says nothing about the ability of an issuing bank to keep its issued notes outstanding. If anything, the redemption process suggests that the notes a bank issued could very quickly be presented for redemption through the Treasury.

Although that could happen, what matters is whether a bank contemplating putting its notes into circulation would anticipate a connection between such circulation and redemption of its own notes—either through the Treasury or over its counter or through a clearing house. Cagan and Schwartz seem to deny such a connection.

> By all accounts national bank notes were interchangeable to the public; consequently, the fraction of currency flowing into any bank which was its own issue roughly equaled the fraction of total notes in circulation which it had issued . . . (Cagan and Schwartz, p. 299)

On the other hand, they also say,

> Merchant banks, doing little business over the counter with the public, may well have been limited in their ability to pay out currency, especially during a seasonal low in the public's demand for currency. It was no alternative to use the notes for settling adverse clearings with other banks, for the recipient banks would immediately send most of them through the redemption process again. (Cagan and Schwartz, p. 305)

Cagan and Schwartz denigrate the overall significance of this last possibility by twice citing the Commercial and Financial Chronicle (1900, p. 505): "a bank manager does not exist that ever found it difficult to get out of each year 12 month' earnings for its note issues." We see no reason to take this assertion seriously.

The two quotations from Cagan and Schwartz give very different pictures of the connection between a bank's own note circulation and the notes it can expect to be called on to redeem. The first says that a bank can expect its own notes to be mixed in with the notes issued by every other bank so that the proportion of its own notes presented to it will be proportional to its notes issued as a fraction of the total.[3] The second quotation says that some uses of its own issued notes will lead to almost immediate presentation of those notes for redemption. We think that the second view is plausible. More generally, we think it is plausible that a note issuing bank would be concerned with what would happen to its own notes in the same way that a bank granting deposits is concerned with what will happen to those deposits—are the deposits so-called "core" deposits or are they "hot" deposits.

The merchant bank situation described by Cagan and Schwartz could apply often to many potential uses for a bank's own notes. In particular, it seems plausible that a bank would often view its own notes as unsuitable for the purchase of money market instruments—precisely the kinds of securities for which we have short-term interest rate observations. For example, we noted above that it was fairly standard for interest to be paid at 2 percent on banker's balances at other banks,

correspondent banks. If a bank used its own notes to make such a deposit, then it would be concerned about the possibility that the notes would be presented for redemption quickly through the Treasury redemption process. If they were, then, even if the deposit earned interest for a few days, the bank would be charged the redemption costs described above and would have to bear the costs of redeeming the deposit or of selling off other assets. Those would more than offset interest for several weeks at 2 percent.[4] Thus, if the bank thought that its notes would quickly be sent in for redemption, then it would not deposit them with a correspondent bank. No such reluctance would apply to making a deposit in the form of lawful money or another bank's notes. A similar distinction applies to the correspondents. Why did they pay 2 percent on deposits if they could get funds in the form of their own notes at 1 percent or 1/2 percent? The likely answer is that they anticipated that their own notes would be quickly presented for redemption, which would impose direct and indirect costs on them.

Thus, we find no convincing direct evidence for the equivalence view. The absence of an explicit discount on national bank notes is irrelevant. The other evidence is one assertion by a newspaper reporter.

7. Conclusion

We have reviewed the evidence for what has been the predominant view about the situation of note-issuing banks under the national banking act. Based on the observation that the nonbank public accepted notes at par in most, if not all, of its transactions, that view has been that the demand-liability feature of notes did not present a problem for note-issuing banks. According to that view, which we have labelled the equivalence view, national banks could always keep their notes outstanding, and, hence, would never have a problem when faced with the need to redeem their notes in lawful money. Our main contribution is to point out a previously unnoticed implication of this view. When combined

with nonbindingness of the collateral restriction, which is highly plausible given that all of the eligible collateral for note issue was never used for that purpose, the equivalence view implies that the safe short-term interest rate is pegged at the tax rate on note issue. The observations on interest rates seem inconsistent with that implication. Therefore, and because there is no other persuasive evidence for the equivalence view, we reject it. However, that leaves us with a modeling challenge. How do we reconcile nonequivalence with the observations that the nonbank public did not distinguish between national bank notes and lawful in most transactions?

The analogy we have suggested concerning notes and deposits seems to point us in the direction of a model for a note-issuing bank that is concerned about the demand-liability feature of its outstanding notes. It seems to point us toward models of reserve management. The problem, of course, is that all those models are partial equilibrium models which take interest rates as given. We do not have models in which the settings assumed in those partial equilibrium models are part of a coherent environment in which interest rates are endogenous. Instead, the models of interest rate determination we have are centralized market models which cite those partial equilibrium models as "justification" for their assumption that there is a "demand" for reserves on the part of banks or, equivalently, that reserves are an argument of bankers' utility functions. However, those centralized market models will not give us the right answer. In accord with the quotation from Friedman and Schwartz, given indifference on the part of the nonbank public between lawful money and national bank notes, those models will imply that the note issuing scheme results in a peg of the safe rate of interest at the tax rate on notes outstanding.

An adequate model of the note issuing scheme in effect under the National Banking system will have to take seriously some version of the decentralized market setting that is implicit in partial equilibrium reserve management models and in most stories of why people hold currency and do not

transact using other assets. The experience under the National Banking system is interesting because it provides evidence of the inadequacy of the modeling procedure which justifies the holding of reserves or money in a centralized market model through complicated partial equilibrium stories, stories whose settings are inconsistent with the setting of the centralized market model being justified. When such a centralized market model fails, as it does for experience under the national banking system, we should not be particularly surprised, since we know that the model does not represent an internally consistent view of an economy. A noncentralized market setting should be able to reconcile the observation that members of the nonbank public in most transactions did not distinguish between national bank notes and lawful money with the possibility that a bank would anticipate difficulty in keeping its own notes outstanding and would view its own notes as unsuitable for some asset purchases.

Footnotes

[1]For a more complete discussion of regulations on national banks, see Champ (1990) and Cagan and Schwartz (1991). The original laws governing national banks are in Huntington and Mawhinney (1910).

[2]Here is one piece of evidence consistent with optimizing behavior by national banks. An implication of nonbindingness of the collateral restriction is that national banks should have been indifferent among all forms of collateral that permitted note issue at the same tax rate and should have favored collateral that permitted note issue at a lower tax rate. Bindingness would imply that banks should have favored low coupon bonds among those that permitted note issue at the same tax rate, because the required collateral was stated as the minimum of market and par and all eligible bonds sold at a premium for most of the period.

Prior to 1900, all eligible collateral permitted note issue at a tax of 1 percent. During that period, national banks never held as collateral for note issues more than 80 percent of any particular bond issue. After 1900, collateral in the form of 2 percent coupon bonds allowed a lower tax rate, 1/2 percent. After 1900, banks held as collateral almost all the 2 percent bonds and very little of any other eligible bonds.

[3]Actually in order to conclude that the derivative of the per-unit-time inflow of its own notes with respect to its notes issued is small, an additional assumption is needed; namely, that the per-unit-time inflow of all national bank notes into the bank relative to total notes outstanding is small.

[4]The redemption costs alone, roughly $.75 to $1.50 per $1,000 redeemed according to the Annual Reports of the Comptroller of the Currency, are enough to offset more than 2 weeks of interest at 2 percent per year.

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