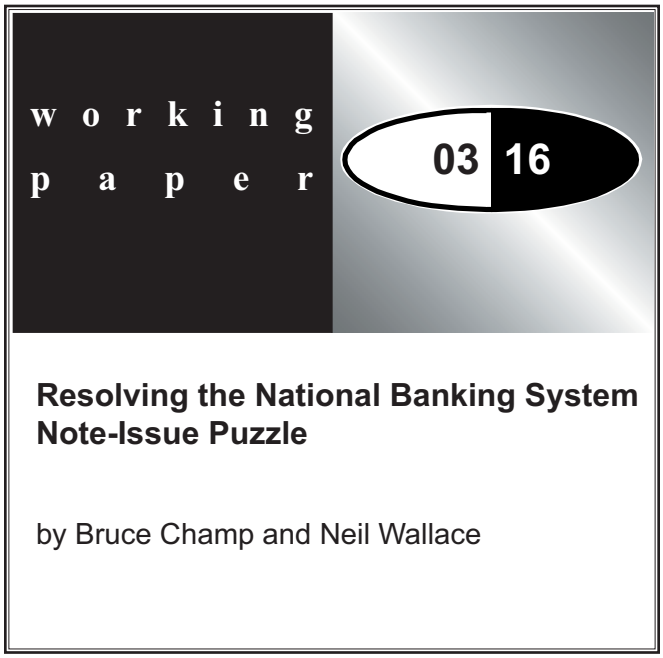

Resolving the National Banking System Note-Issue Puzzle

by Bruce Champ and Neil Wallace

FEDERAL RESERVE BANK OF CLEVELAND

Working Paper 03-16 December 2003

Resolving the National Banking System Note-Issue Puzzle

by Bruce Champ and Neil Wallace

Under the National Banking System, 1863-1914, national banks that deposited sufficient collateral could issue notes provided they paid a tax on notes in circulation: 1 percent per year before 1900 and ½ percent thereafter. Because note issue was far below the allowed maximum, an arbitrage argument predicts that short-term nominal interest rates should have been bounded above by the tax rate. They were not. That is the note-issue puzzle. Our resolution takes the form of a model in which notes play a role, but in which the profitability of note issue is not tied to anything that resembles a market rate of interest.

JEL Classification: E42, N11
Key Words: bank notes, National Banking System, interest rates, random matching model

Bruce Champ is at the Federal Reserve Bank of Cleveland and may be reached at Bruce.A.Champ@clev.frb.org or (216) 579-3062, Fax: (216) 579-3050.
Neil Wallace is at Pennsylvania State University and may be reached at neilw@psu.edu.

1 Introduction

Under the National Banking System (NBS), in effect from 1863–1914, national banks that deposited sufficient collateral could issue notes provided they paid a tax on notes in circulation: 1% per year prior to 1900 and $\frac{1}{2}$% thereafter (see, for example, Friedman and Schwartz [6], pp. 20–23). The simple and predominant view of this system uses the observation that note issue was far below the allowed maximum and an arbitrage argument to predict that the system should have produced a low and constant upper bound on short-term nominal interest rates—a bound equal to the tax rate on notes outstanding (see, in particular, Champ, Wallace, and Weber [4]). The easiest way to understand the arbitrage argument is by way of an analogy to a central-bank discount window that makes loans on demand at an interest rate equal to the tax rate subject to a collateral requirement. So long as eligible collateral exceeds the amount used as collateral, the collateral requirement does not impose a cost. Therefore, such a system produces a perfectly elastic supply of money at an interest rate (on safe loans) equal to the tax rate—perfectly elastic up to the quantity at which all eligible collateral is used as collateral. Unfortunately, as is well known and documented in Champ, Wallace, and Weber, data on interest rates contradict that prediction: the data suggest the presence of arbitrage profits. That is the note-issue puzzle.

Champ, Wallace, and Weber suggested a route to resolving the puzzle. They said that the questionable ingredient in the arbitrage argument is the assumption that banks could earn the market rate of interest on any quantity of notes they chose to issue. In particular, the rules concerning note issue and redemption suggest that issuing notes to buy securities in the markets of financial centers was unprofitable. Such notes would almost certainly be presented for redemption in a matter of days and the redemption processing costs, which were charged to the issuing bank, would more than offset the interest earned even at interest rates far in excess of the tax rate.[1] In terms of the discount-window analogy, it is as if the discount-window loans take the form of identifiable notes—say, by serial numbers—and that whenever such notes pass through the clearing system, the borrowing bank has its reserves and its discount-window debt reduced by the amount of such notes. (In other words, the discount-window loans are callable with calls determined by

[1] Friedman and Schwartz hint at aspects of this when they say "An issuing bank ... had no way of identifying banks that returned its notes to the Treasury for redemption; hence its New York City correspondents could do so with impunity." ([6], footnote 8, page 21.)

whether the notes show up in the clearing system.) In this paper, we pursue that suggestion.[2] Indeed, we pursue it in an extreme way.

We study the profitability of note-issue in a model in which notes play a role, but in which there is no securities market. In the model, a variant of the Cavalcanti-Wallace model of inside money (see [2] and [3]), the benefit of note issue is that of having a credit line: a note issuer's current spending is less tied to recent earnings than is that of a non issuer. The cost is the tax rate levied on outstanding notes. Neither, by construction, depends on anything that resembles a market rate of interest. Hence, an equilibrium in which there is indifference between issuing and not issuing notes does not pin down a market interest rate.

We first describe the sense in which the observations look like there was indifference between issuing national bank notes and not issuing them. Then we present the model. Finally, we comment on the association—or lack thereof—between entities in the model and entities in the actual NBS economy. As part of that discussion, we comment on what is missing from the model, including a market in securities, and provide guesses about the consequences of a model that would incorporate some of what is missing.

2 Under-issuance of Notes

During the period of the NBS, national banks could issue bank notes backed by holdings of eligible U.S. governent bonds (see Huntington and Mawhinney [7] for the complete set of laws governing national banks). Upon the deposit of eligible bonds with the U.S. Treasury, a national bank would receive an amount of bank notes equal to 90% (100% after March 14, 1900) of the par or market value, whichever was less, of the deposited bonds. National banks were required to redeem their own notes in lawful money—specie or greenbacks—and to accept the notes of other banks at par. After 1874, in order to facilitate the redemption process, national banks were required to maintain a redemption fund with the U.S. Treasury equal to 5% of their

[2]Redemption costs are also the subject of Champ, Freeman, and Weber [5]. However, they do not build on the central idea of this paper, which is that a bank could influence how quickly notes would be presented for redemption by the use to which it put newly issued notes. Their approach, which delivers a version of the arbitrage argument adjusted for *average* costs and rates of redemption, is not consistent with the conclusion that any direct attempt to arbitrage by using notes to buy securities in financial markets was almost certain to generate a loss.

outstanding circulation. A bank that desired to redeem the notes of another national bank could ship the notes to the U.S. Treasury or any assistant treasurer's office and an equal amount of lawful money would be returned, paid out of the issuing bank's redemption fund. The costs associated with the redemption process were charged to the issuing bank.

2.1 State banks

There were straightforward rules and requirements for obtaining a charter to become a national bank. Initially, there seemed to be an expectation that most state banks would seek such charters. But that never happened. Even though the Act of 1865, which imposed a 10% tax on state bank notes, led to the disappearance of state bank notes, it never led to the demise of state banks. In 1860, the total number of state banks stood at 1,562; by 1868, only 247 state banks remained (Barnett [1], p. 11). However, this trend was short-lived. According to Friedman and Schwartz [6], p. 19, "By 1867, the decline in the deposits of state and private banks had ceased. These banks then expanded so rapidly that by 1871 the deposits of non national commercial banks equaled national bank deposits." The existence of a large state banking system which does not have the note issuance privilege is one sense in which note issue seemed not to be profitable.

2.2 Under-issuance by national banks

There are two senses in which national banks themselves did not fully exploit the opportunity to issue notes. First, as is widely known, they never held all the eligible bond collateral required as backing for note issue. Prior to 1900, national banks held only 20–30% of the eligible bond collateral. After 1900, when the tax on note issue was effectively lowered to $\frac{1}{2}$% per year and the amount of notes that could be issued for a given bond deposit was increased from 90% to 100%, the proportion of eligible collateral held as backing increased steadily to over 80% by 1914.

Second, national banks frequently did not issue circulation up to the amount possible, given their actual holdings of eligible collateral. Furthermore, some national banks chose not to issue notes at all. In each annual report during the period, the Comptroller of the Currency presented a table of non-issuing national banks. Several relatively large New York City banks appeared frequently in these tables. Table 1 presents information on these

banks, including the years in which those banks did not issue notes.[3] These banks typically held the minimum amount of government bonds as backing required by law and issued no notes against those holdings.

Table 1. Non-Issuing New York City National Banks

National Bank	Bank Capital Relative to Average Bank Capital[a]	Period of Non-Issue
American Exchange N. B.	25.2	1881–1889
Chemical National Bank	1.5	1868–1905
Fulton National Bank	2.5	1868–1887
Mechanics' National Bank	11.1	1881–1903
Merchants' National Bank	11.9	1889–1905
National City Bank	4.6	1868–1892
National Park Bank	10.8	1888–1892
Third National Bank	5.0	1881–1888

[a]This column represents a measure of the size of each listed bank relative to a typical national bank. The capital of each listed bank was divided by the average capital across all banks. This ratio was then averaged across the years the listed bank did not issue notes.

3 The model

We first set out the environment. Then, because the above observations strongly suggest that there were not net benefits to participating in note issue under the NBS, we describe the conditions for a steady state which is internal in the sense that not everyone eligible to issue notes does so.

3.1 The environment

The Cavalcanti-Wallace model uses a version of the background environment of Shi [8] and Trejos and Wright [9]. Time is discrete and the horizon is

[3]Table 1 presents information solely on New York City non-issuing national banks. There were other large and small banks across the country that did not issue notes during the period. However, the number of non-issuing national banks never exceeded 1% of banks. We thank James Thomson for emphasizing the existence of non-issuing banks and for originally assembling the raw data.

infinite. There are $S > 2$ perishable goods at each date and a $[0, 1]$ continuum of each of S types of people. A type s person consumes only good s and is able to produce only good $s + 1$ (modulo S). Each person maximizes expected discounted utility with discount parameter $\beta \in (0, 1)$. The period utility function is $u(x) - y$, where x is consumption of the relevant good and y is production of the relevant good. The function u is strictly concave and increasing, and satisfies $u(0) = 0$, $u'(0) = \infty$, and $u'(\infty) = 0$.

Cavalcanti and Wallace split the $[0, 1]$ continuum of each type into two intervals. The interval $[0, A]$ consists of those whose previous actions are perfectly monitored, and, therefore, are common knowledge. We call them the "known" people. The rest, the interval $(A, 1]$, are not monitored at all so their previous actions are private. We refer to them as the "unknown" people. The parameter A can be interpreted as society's monitoring capacity. A person's specialization type and known-unknown status are common knowledge and people cannot commit to future actions.

In Cavalcanti and Wallace [2], each known person has a printing press. The printing press turns out uniform, indivisible, and perfectly durable objects called notes. The notes of any person can be distinguished from those of any other person. These notes are the only durable assets. Finally, each person can carry from one date to the next at most one note. We maintain these assumptions.

In the original version of the model, each person meets one person per date at random. So, for example, an unknown person meets another such person with probability $1 - A$ and meets a known person with probability A. Here, we change the meeting pattern slightly in a way which is innocuous for our purposes and which simplifies the model a bit. We assume that unknown people meet others at random as in the original model, but known people never meet each other.

3.2 Simple stationary allocations

We limit consideration to pure strategy steady states and to allocations which do not depend on the specialization type, s, and which are simple in other respects that we now describe. In Cavalcanti-Wallace, all known people were assumed to behave the same way. Here, because the goal is an outcome in which some known people issue notes and others do not, we let λ denote the fraction of known people who participate in the note-issuing scheme. The participants can issue notes, must redeem notes, and must pay a tax on notes

outstanding. The non-participants, the fraction $1-\lambda$ of the known people, use notes of participants and are not subject to the tax.

One of our simplifying assumptions is that a producer in a single-coincidence meeting is given a note whenever that is feasible. Subject to the condition that there are no gifts (of notes or output), such a trade pattern gives rise to as much trade as is possible given the assumptions about production and consumption opportunities and the unit bound on note holdings. A consequence of that trade pattern is that there is a unique steady-state distribution of notes: half of the non-participants and half of the unknown people have a note. Therefore, the outstanding stock of notes (per specialization type) is $\frac{1-\lambda A}{2}$.

Cavalcanti and Wallace study somewhat general allocations in which notes can have one value in terms of goods when issued, another value when traded among unknown people, and still another value when redeemed. (They also allow for the possibility that known people are forced to give gifts of output or notes.) We build in the observation that NBS notes always traded at par and were redeemed at par and that it was not part of the system to force known people to give gifts. Therefore, we assume a single value of a note in terms of output, a value denoted y. Thus, for us, an allocation is a pair (y, λ).

In terms of output, the value of the notes outstanding is $y\frac{1-\lambda A}{2}$, which is the total tax base. We assume that each participant pays a tax equal to $\tau y\frac{1-\lambda A}{2\lambda A}$, where τ is the tax rate. That is, the tax base for each participant is the per participant value of notes outstanding. We assume that tax revenue disappears.[4]

3.3 Conditions for an internal steady-state

We now set out the conditions for existence of a steady state with $\lambda \in (0,1)$, one with both participants and non-participants. We begin by describing expected discounted utilities at the start of a date as functions of λ and y. Although the crucial conditions for an internal steady state depend on those for participants and non-participants, we begin with those for the unknown people. They are relevant for participation constraints which limit the set of possible y's.

[4]A version in which such taxes are paid out as lump-sum gifts from note-issuer producers to unknown consumers in meetings would not be siginificantly different for "low" tax rates.

We let v_{uj} denote expected discounted utility of an unknown person with j notes at the start of a date, prior to meetings, and let $\Delta_u \equiv v_{u1} - v_{u0}$. These values satisfy

$$(1-\beta)v_{u0} = \left[\frac{\lambda A}{S} + \frac{1-\lambda A}{2S}\right](-y + \beta\Delta_u) \tag{1}$$

$$(1-\beta)v_{u1} = \left[\frac{\lambda A}{S} + \frac{1-\lambda A}{2S}\right][u(y) - \beta\Delta_u], \tag{2}$$

where $\frac{\lambda A}{S}$ is the frequency of meetings with participant producers and of meetings with participant consumers and where $\frac{1-\lambda A}{2S}$ is the frequency of meetings with other producers without a note and of meetings with other consumers with a note.

For the above kind of allocation, a participant has no state. Thus, we let v_k denote expected utility of a participant. This satisfies

$$(1-\beta)v_k = \frac{1-A}{2S}z(y) - \tau y\frac{1-\lambda A}{2\lambda A}, \tag{3}$$

where $z(y) \equiv u(y) - y$. The first term on the right-hand side represents the expected payoff coming from meetings with unknown people and the second term taxes on notes outstanding.

Finally, we describe expected discounted utilities for non-participants. We let $\tilde{v}_{kj}$ denote the discounted expected utility of a non-participant with j notes and let $\tilde{\Delta}_k = \tilde{v}_{k1} - \tilde{v}_{k0}$. These satisfy

$$(1-\beta)\tilde{v}_{k0} = \frac{1-A}{2S}[-y + \beta\tilde{\Delta}_k] \tag{4}$$

and

$$(1-\beta)\tilde{v}_{k1} = \frac{1-A}{2S}[u(y) - \beta\tilde{\Delta}_k]. \tag{5}$$

In each case, the right-hand side represents the expected payoff coming from meetings with unknown people.

For the purpose of comparing the value of participating to that of not participating and consistent with a steady state analysis, we take the payoff of a non-participant to be the expected value of $\tilde{v}_{k0}$ and $\tilde{v}_{k1}$. Because the steady state has half of non-participants with a note and half without a

note, that expected value, denoted $\tilde{v}_k$, is the simple average of $\tilde{v}_{k0}$ and $\tilde{v}_{k1}$. Therefore, from (4) and (5), we have

$$(1-\beta)\tilde{v}_k = \frac{1-A}{4S}z(y). \tag{6}$$

From (3) and (6), we have

$$(1-\beta)(v_k - \tilde{v}_k) = \frac{1-A}{4S}z(y) - \tau y\frac{1-\lambda A}{2\lambda A}. \tag{7}$$

The first term on the right-hand side represents the gain to participating. The gain is more frequent trade with unknown people: the ability of participants to issue notes makes trade more frequent because it makes their current trades less dependent on their recent trades.[5] The cost to participating is the tax. It follows that the tax rate that implies $\tilde{v}_k = v_k$, denoted $\tau^*(y,\lambda)$, satisfies

$$\tau^*(y,\lambda) = \frac{\frac{z(y)}{y}}{2S}\frac{A(1-A)}{(\lambda^{-1}-A)}. \tag{8}$$

This last condition is one of the requirements for an internal solution for λ.

Finally, we set out the constraints coming from the requirement that no one in the model can commit to future actions. In keeping with the NBS rules, we assume that trades by unknown people and by non-participants are voluntary, but that a participant who fails to redeem a note is severely punished. These are expressed by imposing that unknown people and non-participants always get non-negative gains from trade, but that participants are punished by permanent autarky for failing to redeem a note. These participation restrictions are

$$y \leq \beta\Delta_u \leq u(y), \tag{9}$$

$$y \leq \beta\tilde{\Delta}_k \leq u(y), \tag{10}$$

and

$$y + \tau y\frac{1-\lambda A}{2\lambda A} \leq \beta v_k, \tag{11}$$

where the first pertains to unknown people, the second to non-participants, and the third to participants. Because the v's are uniquely determined by y

[5]This is the basis for the result in Cavalcanti and Wallace [2] that inside money achieves strictly more outcomes than outside money.

and λ, these are restrictions on y and λ. In general, they are more stringent the smaller is β.

We now have all the requirements for existence of an internal steady state. Any (y, λ) with $\lambda \in (0, 1)$ that implies v's that satisfy (1)–(11) is such a steady state. Although the quantitative implications of the model should not be taken seriously, we present an example for which we compute τ^* for λ near $\frac{1}{2}$, just to illustrate one way to use the equilibrium conditions. A somewhat neutral choice of y is to set it at the unconstrained maximum of z, denoted y^*. Then, if we let $u(x) = x^{1/2}$, a simple function that has been used before in related models, we have $y^* = z(y^*) = \frac{1}{4}$. Next, we set $S = 3$—the smallest S consistent with no double coincidences. We let $A = 0.1$, to reflect the idea that most people in the NBS economy would not have qualified for credit lines from banks. These choices, any sufficiently high β, and any $\lambda \in (0, 1)$ satisfy the participation constraints. Then, (8) implies that for values of λ near $\frac{1}{2}$, tax rates near 0.8% are consistent with an internal steady state.

4 The model and the NBS economy

On the surface, the above model bears little resemblance to the NBS economy. Therefore, we now discuss how we associate entities in the model with entities in that economy. We also discuss some of what is missing from the model—notably outside money and markets in securities.

4.1 Notes and note issuers

The notes in the model look like payable-to-the-bearer, trade-credit instruments. In the model, notes get into circulation only when an unknown person without a note produces for a participant and receives a note. They get redeemed when an unknown person receives goods from a participant in exchange for a note. Thus, notes do not get into circulation through the granting of loans by participants and are not redeemed by way of the repayment of loans.

Given those aspects of notes in the model, in order to identify them with NBS notes, we interpret the set of participants in the model as a consolidation of note-issuing NBS banks and their customers who borrow in the form of notes. (Strictly speaking, this interpretation only works if note-issuing NBS

banks had balance sheets consisting of nothing more than notes as liabilities and loans in the form of notes as assets.) Several comments are in order about this interpretation.

First, in the actual NBS economy, note-issuing banks were sometimes asked to redeem notes for lawful money. Although lawful money (outside money) could be added to the model, we have chosen not to do so here. Instead, the model has redemption for goods. In terms of unconsolidated entities, we can associate redemption in the model with the following two-part transaction involving a banker: when a note is presented to a banker for redemption in goods, the banker calls in a loan which the borrower repays in goods. Second, there is no collateral requirement for note issue in the model. This omission is justified by the fact, described above, that the collateral restriction was not binding in the aggregate: the amount of eligible collateral exceeded the amount used as collateral. In any case, this omission tends to make note issue in the model more attractive. Third, note issue in the model is like a credit line with a nonbinding limit. This, again, tends to make note issue in the model more attractive than it probably was in the NBS economy. Fourth, this interpretation obviates the need to be concerned about how NBS note-issuing banks shared the gains from note issue with those who borrowed in the form of notes. Loans are complicated contracts and borrowers who accepted loans in the form of notes rather than in the form of lawful money may have gotten more favorable terms on their loans. In our interpretation, these loans net out and do not need to be considered. Finally, and most important, if note issue was profitable for NBS banks, then it should have been profitable for the consolidated entity consisting of the bank and its customers who borrow in the form of notes; after all, those who borrowed in the form of notes from NBS banks should not have incurred losses by engaging in such borrowing.

There is, however, one very unattractive aspect of the model. In (8), $\tau^*(y, \lambda)$ is increasing in λ. Therefore, across steady states, there is a positive association between the tax rate and participation in the note-issue scheme. This arises because the benefit of note issue does not depend on the outstanding stock or λ, while the cost in the form of taxes is decreasing in λ. (The total outstanding stock is decreasing in λ and the per-participant share of a given stock is decreasing in λ.) The positive association would be overturned if the benefit was sufficiently increasing in the outstanding stock per participant. It would be increasing if note issuers were acquiring assets when they issued notes. In the model, note issuers consume when they issue a

note. Therefore, there is no continuing pay-off associated with the outstanding stock. That being so, perhaps we should not have levied the tax on the outstanding stock. We did so to mimic the actual NBS rules.

4.2 Outside money and markets in securities

It is tempting to try to add outside money to the model and to allow for trade in securities. Then the rate of interest in that market could with some justification be identified with the interest rates in the financial markets under the NBS. Adding outside money to the model creates no problems: it is easy to get unknown people to treat outside money and notes as perfect substitutes. Adding a market in securities raises complications that we do not see how to deal with at this time.

The market should resemble the commercial paper market. In terms of the people in the model, it would make sense to allow all known people to be borrowers in this market—i.e., to be issuers of commercial paper. To be consistent with the claim made above that NBS note issuers would not want to use newly issued notes to buy commercial paper, there should be a reason why borrowers in that market should want to acquire outside money and not notes. We do not yet see how to easily motivate that demand. (In the NBS economy, national banks could not use notes as reserves against deposits.) As regards lenders, the informational structure would allow anyone to lend in this market. However, it is tempting to exclude unknown people simply as part of the assumed exogenous meeting structure. If all of that were done, then the market would be a source of liquidity for all known people, whether they were participants in the note-issuing scheme or not. If anything, it would seem that this source of added liquidity would be more valuable to non-participants than to participants. Thus, a market structured in that way would tend to reduce the benefits of participating in the note issue scheme. It would certainly not restore the possibility of arbitrage between notes and securities.

4.3 Other restrictive assumptions

In the model, the only form of inside money is notes. In the actual NBS economy, known people could have had a credit line against which they could write checks. If the model allowed for that possibility, then it would provide another alternative to participation in the note-issue scheme. Also, the value

of the credit line in the form of notes that is in the model seems, if anything, to be enhanced by the assumptions that notes are indivisible and that people can hold at most one unit. In the model, non-participants are severely constrained by the upper bound on note holdings, while participants are not at all constrained by that bound. Therefore, weakening that bound would seem to reduce the net benefits of participating in the note issue scheme.

In the model, we treat participation as a once-for-all decision. That, in turn, justifies levying a tax on per participant notes outstanding, because the per participant amount is the expected value of the tax base for each participant. Given our view of the role of notes, we think this once-for-all aspect of the decision to participate is sensible. If NBS notes were issued to customers for the purpose of working capital, then the amount issued for that purpose could not be easily adjusted. Banks, instead, would decide whether they wanted to be in that business and, if so, would stand ready to make loans in the form of notes.

5 Concluding Remarks

Although our model can display an internal solution for note issue, we have to admit that we have only pointed out a direction toward resolving the note-issue puzzle. First, our paper rests on the view that using newly issued notes in organized financial markets was unprofitable. Conceivably, additional direct evidence about the validity of that view could be mustered. Second, even if that view is accepted, a resolution should simultaneously describe the organized financial markets and the role of NBS notes. We have described a role for notes when there are no organized markets. At best, our model is a picture of an economy in which there is a complete separation between trade in NBS notes and trade in organized financial markets. Obviously, that is too extreme a view.

References

[1] Barnett, G. E., *State Banks and Trust Companies Since the Passage of the National-Bank Act*. 1911, Washington, DC: Government Printing Office.

[2] Cavalcanti, R., and N. Wallace, Inside and outside money as alternative media of exchange. *Journal of Money, Credit, and Banking*, 31 (August 1999, part 2), 443–57.

[3] Cavalcanti, R., and N. Wallace, A model of private banknote issue. *Review of Economic Dynamics*, 2 (1999), 104–36.

[4] Champ, B., N. Wallace, and W. Weber, Interest rates under the U.S. National Banking System. *Journal of Monetary Economics*, 34(3), (December 1994), 343–58.

[5] Champ, B., S. Freeman, and W. Weber, Redemption costs and interest rates under the U.S. National Banking System. *Journal of Monetary Economics*, 31(3), Part 2 (August 1999), 568–89.

[6] Friedman, M., and A. Schwartz, *A Monetary History of the United States*. 1963, Princeton: Princeton University Press.

[7] Huntington, A., and R. Mawhinney, *Laws of the United States Concerning Money, Banking, and Loans, 1778–1909*. 1910, Washington, DC: Government Printing Office.

[8] Shi, S., Money and prices: a model of search and bargaining. *Journal of Economic Theory* 67 (December 1995), 467–98.

[9] Trejos A., and R. Wright, Search, bargaining, money and prices. *Journal of Political Economy* 103 (January 1995), 118–41.

Federal Reserve Bank
of Cleveland
Research Department
P.O. Box 6387
Cleveland, OH 44101

Address Correction Requested:
Please send corrected mailing label to the
Federal Reserve Bank of Cleveland
Research Department
P.O. Box 6387
Cleveland, OH 44101

PRST STD
U.S. Postage Paid
Cleveland, OH
Permit No. 385