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Resolving the National Bank Note Paradox*

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Economists have long been interested in the relationship between monetary arrangements and interest rates. One particular question has been whether, over substantial periods of time, real interest rates are influenced by monetary arrangements or instead are determined solely by tastes and technology. By tastes and technology we mean people's willingness to substitute between present and future consumption and the opportunities technologies present to make such substitutions. One way to attempt to answer this question is to look at historical periods. The more than 30-year period in the United States from 1882 to 1914 seems, on the surface, to be a good candidate for providing evidence in favor of the monetary arrangements view. During this period, *national banks,* private banking firms with national charters, could issue their own circulating notes, provided those notes were backed by specified government securities. This, one would surmise, could easily lead to a situation similar to one in which nominal interest rates are pegged at a low level through the lending activities of a central bank and in which those rates affect real interest rates.

More precisely, the conclusion that real interest rates were determined by monetary arrangements during the 1882–1914 period would follow from confirmation of three straightforward hypotheses. The first is that nominal interest rates on those government securities eligible to back note issue were determined by the costs of note issue. Everyone agrees that national bank notes functioned in their role as hand-to-hand currency just like base money, so that the nominal interest rate on national bank notes was zero. As a result, the nominal interest rates on eligible bonds should have equaled the cost of note issue. Otherwise, the implied profits would have induced additional demand for eligible bonds which would have tended to lower their yields.

The second hypothesis is that all nominal interest rates were determined by those on the eligible bonds. Since all the eligible bonds were not being held as backing for notes, some of them were competing with other assets in people's portfolios. As a result, returns on eligible bonds should have been competitive with those on other assets, which implies that all nominal interest rates were the same as those on eligible bonds (once adjustments are made for risk).

The first two hypotheses imply that nominal interest rates were determined by monetary arrangements during this period. The third hypothesis is that during this period, when the United States was on a gold standard, no mechanism connected the (expected) inflation rate directly to the monetary arrangements. Such a connection must exist, however, in order to reconcile a nominal interest rate determined by monetary arrangements with a real interest rate determined solely by

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tastes and technology—unless one allows for the unlikely possibility that such a reconciliation occurred by accident. Thus the three hypotheses, if confirmed, would indeed imply that monetary arrangements for the 1882–1914 period did determine real interest rates.

This conclusion has not been reached by most other researchers, however. The main reason is that the first and perhaps most obvious of the hypotheses has not been confirmed. Instead, what has come to be called the *national bank note paradox* has been discovered: nominal interest rates on eligible bonds were seemingly too high to be explained by the costs of intermediating them into notes or, equivalently, were so high that note issue was extremely profitable.

In this paper, we resolve the paradox by pointing out some costs of note issue that previous studies have ignored. Previous studies have neglected costs of note issue stemming from two sources. First, banks were generally unable to keep all their issued notes in circulation. Second, the requirement that banks redeem their notes on demand in base money and the fact that actual redemptions were highly variable exacerbated reserve management problems for note issuing banks. Once these costs are recognized, the interest rates on eligible bonds do not seem paradoxically high and the first hypothesis does not have to be rejected. The paradox disappears. Such a result opens the way to further study of the second and third hypotheses and, if these hypotheses are confirmed, to the conclusion that monetary arrangements affect real interest rates.

Reassessing the Profit Paradox . . .

On the whole, previous studies of national bank note issue have found a paradox: note issue was an extremely profitable activity for national banks. These studies have generally used the same approach to determine the profitability of a bank's marginal decision to issue more notes, treating it like a pure arbitrage opportunity. But as we will show, the decision to issue more notes was far from being a risk-free or pure arbitrage opportunity for bankers.

The standard approach researchers have taken can be explained in terms of a typical national bank's balance sheet, which is shown in the table. The balance sheet has three main categories of assets: U.S. government bonds that were eligible to back note issue (B), reserves held against notes and deposits, and other earning assets (A). The balance sheet also has two main categories of liabilities—deposits and notes (N). The difference between assets and liabilities is the bank's net worth or equity, which consisted of paid-in capital and surplus.[1]

Under this standard approach, the profitability of note issue is analyzed by considering a marginal decision to issue additional notes by adding an eligible bond with par value 1 dollar and price p dollars. If we let Δx stand for the change in category x in the balance sheet, this decision is $\Delta B = p$. Once these additional bonds were deposited with the U.S. Treasury, a national bank could increase the amount of notes it issued. A national bank could issue an amount of notes no greater than 90 percent (100 percent after 1900) of the lesser of par or market value of its eligible bonds on deposit with the U.S. Treasury. Thus based on this bond purchase, $\Delta N = \alpha\min(p,1)$, where α is equal to 0.9 before 1900 and equal to 1.0 thereafter and *min* means minimum. The difference between bonds purchased and notes issued is $\Delta B - \Delta N = p - \alpha\min(p,1)$, which is positive or zero depending on the price of bonds and the magnitude of α. When the difference is positive, it must be financed—either by a reduction in the sum of other assets plus excess reserves or by some combination of that plus an injection of capital. For now, we assume that the difference was financed by a reduction in other assets: that is, $\Delta A = \Delta N - \Delta B$. To summarize, the balance sheet effects of a decision to add an eligible bond with par value 1 dollar and price p dollars are that the holdings of eligible bonds increase by p, the holdings of other earning assets decrease by $p - \alpha\min(p,1)$, and note issue increases by $\alpha\min(p,1)$.

Typical National Bank Note Balance Sheet

Assets	Liabilities
Eligible Bonds	Deposits
Reserves	Notes
Other Earning Assets	
	Net Worth (Equity)
	Paid-In Capital
	Surplus

The change in a bank's profits from adding an eligible bond with par value 1 dollar and price p dollars follows from the changes in revenues and costs associated with these alterations in its balance sheet. The increase in a bank's holdings of eligible bonds increases its revenues by the amount of interest earned on the bond holdings. If we let r_B stand for a measure of the annual yield on the eligible bond, the increased revenue is $r_B p$. The decrease in holdings of other earning assets decreases the bank's revenue. If we let r_A stand for the annual

[1]Paid-in capital was that portion of a bank's subscribed capital that had actually been purchased by its stockholders. National banks were required to have 50 percent of their subscribed capital paid in before commencing business, with the remainder to be paid in installments. Surplus is the bank's accumulated undistributed profits.

yield on other earning assets, the decreased revenue is $r_A[p - \alpha\min(p,1)]$. Increasing note issue also increases a bank's costs. Previous studies have assumed that these costs were proportional to the quantity of notes issued. Letting t stand for the total costs associated with note issue, the cost increase is $t\Delta N = t\alpha\min(p,1)$. Thus the implied change in profits, denoted $\Delta\pi$, is the increase in revenues from increased holdings of eligible bonds less the decrease in revenues from holding fewer other earning assets less the increase in costs from the higher note issue, or

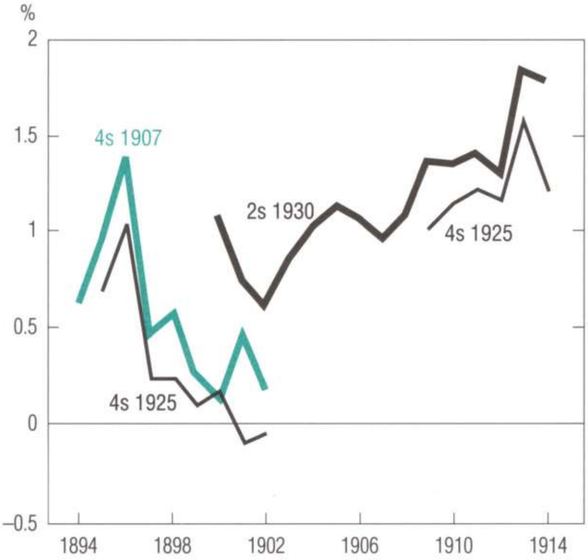
(1) $$\Delta\pi = r_B p - r_A[p - \alpha\min(p,1)] - t\alpha\min(p,1).$$

A profitability calculation using formula (1) was performed by the U.S. Comptroller of the Currency (various dates). The Comptroller did the computation for selected eligible bonds from 1894 to 1914. For r_B, the annual yield, an approximation of the yield to maturity on the bond was used. For r_A, the yield on other assets, 6 percent was used. For t, the costs, the Comptroller used the tax on note issue plus other costs associated with note issue. The tax on notes was 1 percent per year except for notes issued after 1900 and backed by holdings of bonds with a 2 percent coupon rate. On these notes, the tax was ½ percent per year. The Comptroller estimated other costs to be \$62.50 per \$100,000 (par value) bond, so that when the tax was 1 percent per year, the Comptroller let t be $0.01 + 0.00625/\alpha$. For the Comptroller, these other costs are fees assessed to banks by the Treasury for its note redemption costs, fees for printing and transporting newly issued notes, and agents' fees.

The Comptroller obtained mostly positive estimates of $\Delta\pi$. In addition, the Comptroller presented estimates of $\Delta\pi/p$, which were labeled the *profit on circulation in excess of 6 percent on the investment*. The Comptroller obtained estimates of $\Delta\pi/p$ ranging from –0.5 to 3.8 percent, with most of the estimates in a range from 0.4 to 1.3 percent. The Comptroller's estimates for three representative bonds are shown in Chart 1. (Throughout, we refer to a bond by its coupon rate and date of maturity. Thus, for example, the 2s of 1930 were bonds with a 2 percent coupon rate that matured in 1930.)

Cagan (1965) and Friedman and Schwartz (1963) criticize $\Delta\pi/p$ as a profit rate on the grounds that p is not the amount of additional capital tied up when issuing additional notes. Their view is that the difference between the eligible bonds purchased and the notes issued, which was assumed to be financed by reductions in other assets in obtaining formula (1), is financed by an injection of capital. Thus $\Delta B - \Delta N = p - \alpha\min(p,1)$ is the additional capital tied up when issuing additional notes. Cagan then measures the rate of return on capital for issuing notes as the return on eligible bonds less the cost of issuing notes as a percentage of additional capital tied up. Expressed in terms of the components in (1), Cagan's rate of return on capital from note issue, denoted r_C, is

Chart 1
The Comptroller's Profit Rate
For Selected Bonds Backing National Bank Notes*
Annually, 1894–1914



*Bonds are identified by their coupon rate and date of maturity.
Source: Comptroller's *Annual Reports*

(2) $$r_C = [r_B p - t\alpha\min(p,1)]/[p - \alpha\min(p,1)].$$

Cagan's rate of return can also be interpreted as the yield on alternative assets—other earning assets, if we take the Comptroller's view of financing or the return on bank equity, if we take Cagan's view—that would make $\Delta\pi$ in (1) equal to zero. To see this, divide both sides of (1) by $p - \alpha\min(p,1)$, ignoring for the moment the possibility that $p - \alpha\min(p,1)$ may be zero, to get

(3) $$\Delta\pi/[p - \alpha\min(p,1)] = r_C - r_A.$$

Then we see that $\Delta\pi = 0$ if and only if r_A is equal to r_C.

Using the Comptroller's estimate of t and using for r_B the yield to maturity for eligible bond holdings by national banks which increased the most from the previous year, Cagan reports a times series for r_C for 1879–97. He obtains values between 4.8 and 10.5 percent. For the period after 1900, Cagan gives some representative calculations of r_C using for r_B the yield to maturity on the 2s of 1930. He obtains very high magnitudes of r_C. The view that large, unexploited profit opportunities from note issue existed is based on Cagan's estimates of r_C. Cagan and Schwartz (1991) estimate r_C for the entire 1900–1914 period using Cagan's method. Their estimates, which range from a low of 16 percent in 1901 to infinity in 1913, confirm Cagan's earlier calculations for this period.

. . . Revealing Missed Costs and Uncertainty . . .

Cagan's profitability calculations, in contrast to those of the Comptroller, show that note issue was a profitable activity for national banks, especially after 1900. However, both Cagan's and the Comptroller's computations ignore some costs of note issue. We now consider two such groups of costs. The first are those costs associated with *idle notes,* that is, the notes issued by the Comptroller to a bank that were not in circulation. The second group of costs are those associated with managing reserves to insure that a bank could redeem its notes on demand. Once we recognize these additional difficulties associated with note issue, it becomes clear not only that formula (1) overstates the expected or average profits from note issue but also that the actual profits from note issue were random, not certain.

Idle Notes

The first group of costs ignored by most studies are those associated with idle notes. Formula (1) treats notes issued as if they were always in circulation, earning the return r_A because they have been used to purchase earning assets. This does not account for the possibility that notes could be idle, that is, that the number of notes in circulation could be less than the number of notes issued.

Physically, idle notes could have been in one of two places. They could have been en route from the Treasury to the issuing bank in the process of being redeemed, or they could have been in the vaults of issuing banks. We compute the aggregate amount of idle notes as the difference between total notes issued to national banks as reported by the Treasurer and total notes in circulation as given in call reports.[2] The resulting time series on idle notes is shown in Chart 2, which depicts idle notes as a percentage of notes issued. It shows that prior to 1900 a substantial fraction, as high as 40 percent in the late 1880s, of notes were sometimes idle. After the late 1880s, the fraction of idle notes fell almost continually until there were virtually no idle notes by 1914.

Idle notes call for amending formula (1) in two ways. Suppose a bank expects the fraction $\phi\,(0 \leq \phi \leq 1)$ of notes issued to be in circulation on average. First, the difference between bonds purchased and notes in circulation is $\Delta B - \phi\Delta N = p - \phi\alpha\min(p,1)$, a difference that is increasing in the fraction of notes that are idle. This means that the larger the fraction of idle notes, the more a bank has to reduce other earning assets. In particular, the decreased revenue from the decrease in holdings of other earning assets in formula (1) becomes $r_A[p - \phi\alpha\min(p,1)]$. Second, since according to Cagan-Schwartz the tax on notes was levied only on notes in circulation, the cost t, which consists almost entirely of the tax, should be multiplied by ϕ. The amended profit, denoted $\Delta\pi^*$, is

$$\text{(4)} \qquad \Delta\pi^* = r_B p - r_A[p - \phi\alpha\min(p,1)] - t\phi\alpha\min(p,1).$$

Therefore, when we compare (4) with (1) and note that r_A exceeds t, we see that taking account of idle notes lowers the marginal profits from note issue by the amount $(r_A - t) \times \phi\alpha\min(p,1)$.

The Reserve Management Problem

The second group of costs ignored by most studies involves a bank's reserve management difficulties. As noted previously, a national bank had to redeem its notes for lawful money if called on to do so. The Comptroller, Cagan, and other researchers presumed that the redemption obligation on the part of a bank presented no reserve management problems and, hence, made no attempt to account for the costs associated with a bank managing its reserves.

Redemptions caused reserve management problems for issuing banks primarily because an issuing bank did not know what redemptions it would be called on to make. If, instead, a bank knew in advance how many notes it would be called on to redeem at each future date, then the bank could plan its asset holdings so that loans were being repaid or bonds were maturing on a schedule that matched known redemption claims. Without such advance knowledge of redemptions, either banks had to adjust their earning assets by calling in loans or selling securities or they had to finance the redemptions out of excess reserves. Both methods are costly. Calling in loans disrupts customer relationships, while selling securities involves brokerage fees and possible capital losses; holding excess reserves forgoes interest. The reserve management problem facing bankers in this period, then, was to choose amounts and types of earning assets and levels of excess reserves that would minimize these costs. Neither formula (1) or formula (4) accounts for these costs.

Ideally, we would like to modify either formula (1) or formula (4) to take account of the reserve management costs

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[2]During the period studied here, national banks were required to submit call reports five times annually to the Comptroller of the Currency, with the due dates of the reports randomly announced by the Comptroller. Although the Comptroller determined the exact content of the reports, they consisted mainly of balance sheet items.

Charts 2 and 3

Sources of Missed Costs

By Annual Percentage of Issued National Bank Notes, 1882–1914

Chart 2 **Idle Notes**

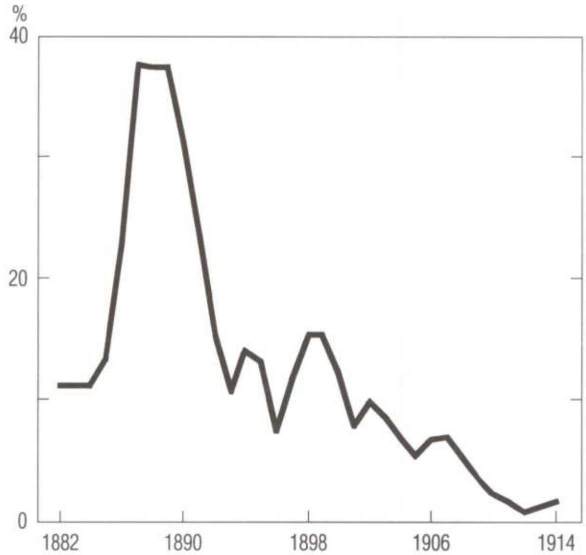
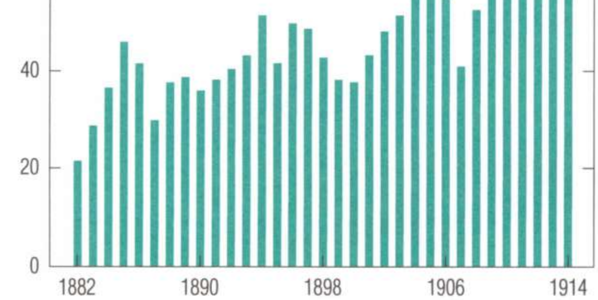


Chart 3 **Redemptions**



Source: Comptroller's *Annual Reports*

when a bank increased its note issue. This would require estimates of how increased note issue affected the uncertainty about a bank's cash flows due to bank note and deposit redemptions, loan repayments, and so forth. It would also require some estimate of the costs of making earning asset adjustments.

Unfortunately, data to make such estimates are not available. We have been unable to locate data on the costs of making earning asset adjustments, such as bid-ask spreads on U.S. government bonds. Data on cash flows or even on bank note and deposit redemptions do not exist on a bank-by-bank basis. What we have are data on aggregate monthly redemptions of national bank notes through the U.S. Treasury. We can use these data to make some inferences about the uncertainty regarding note redemptions. In this way, we obtain some idea of the magnitude of the reserve management problem that note issuing banks faced.

National banks faced two potential sources of note redemptions. They received direct, or over-the-counter, requests and requests that originated through the U.S. Treasury. A national bank was required to accept the notes of other national banks at par as payment of any debt owed to it. When a bank received notes of other national banks, either it could attempt to reissue them and obtain eligible bonds or other earning assets, or it could send them to the U.S. Treasury and receive lawful money in return. The Treasury, in turn, demanded that issuing banks redeem their notes by sending lawful money to the Treasury. While we do not have any data on over-the-counter redemptions, we do, as noted previously, have data on aggregate monthly redemptions through the Treasury. Annual redemptions for 1882–1914 are shown on Chart 3 as a percentage of notes issued. Redemptions averaged 50 percent of notes issued and ranged from approximately 20 to 90 percent of notes issued.

Since the available data are on aggregate redemptions, it seems convenient for purposes of drawing inferences about the redemption uncertainty facing a note issuing bank to suppose that this uncertainty had two components. One of these was uncertainty about aggregate redemptions, that is, uncertainty about the total redemptions national banks faced. The other is uncertainty particular to an individual bank for a given magnitude of total redemptions.

To get at the uncertainty in aggregate redemptions, we computed a least squares regression of the monthly series for the percentage of issued notes redeemed through the Treasury on time and monthly dummy variables. This regression has a residual standard deviation of 3 percent of notes issued. This standard deviation is one measure of the unpredictable part of the monthly aggregate series on the percentage of issued notes redeemed.

As regards the uncertainty at the level of the individual bank for a given total of aggregate redemptions, we can only make some conjectures. One model which implies that the additional uncertainty at the individual bank level is not substantial is one that assumes that each in-circulation note has an equal chance of being redeemed. For example, suppose that each of 100 banks has 5,000 notes in circulation (each bank has $100,000 in $20 denomination notes in circulation) and that aggregate redemptions are 10 percent of the stock. If notes are drawn randomly, one-at-a-time without replacement until 10 percent of the stock is drawn, then for each bank the distribution of the fraction redeemed has a mean of 10 percent and a standard deviation of 0.4 percent. This implies very little additional uncertainty at the individual bank level. One way to get more uncertainty at the individual bank level is to assume that the random process generating redemptions acts on bunches of notes of individual banks. It also seems likely that systematic differences existed among banks in different regions which make assessing individual bank level uncertainty more difficult.

In any case, these estimates and the existence of over-the-counter redemptions suggest that banks faced considerable uncertainty regarding the monthly redemptions of notes in circulation. Such uncertainty must have contributed to the difficulty of managing reserves. It would not do so only if redemptions were highly negatively correlated with a bank's other cash flows.

. . . And Resolving the Paradox

As reviewed earlier in the paper, previous attempts to explain nominal interest rates on eligible bonds in terms of the costs of note issue treated the opportunity to issue notes as a pure arbitrage opportunity. If it were and if those attempts included a complete accounting of costs, then we should have found that $\Delta\pi \leq 0$ for all eligible bonds. Any deviation from this condition would be paradoxical. We have now shown that these previous attempts omitted some costs and that the opportunity to issue notes should not be treated as a pure arbitrage opportunity because the realized return on note issue is random—at least because of uncertainty regarding redemptions.[3]

Nor is it sensible to believe that we would have a full accounting of costs even if we were to able quantify costs due to idle notes and the added reserve management problems that accompany note issue. Dealing with note issue almost certainly took additional managerial time, for example. Such unquantifiable aspects of note issue imply that even after adjusting to take account of idle notes and, if we were able to do so, of the extra average costs of managing reserves due to note issue, the amended $\Delta\pi$ would be only an estimate of an upper bound on the expected or average profits from additional note issue. It would be only an upper bound because omitted costs would remain; it would be average or expected profits because the actual profits are random. On both grounds, then, the mere finding that such an amended $\Delta\pi$ is positive would not be paradoxical. The remaining issue would then be whether positive magnitudes of $\Delta\pi$ are reasonable or paradoxically large, rather than whether they exist at all.

The Cagan procedure is to judge such magnitudes relative to $[p - \alpha\min(p,1)]$. The problem with this procedure is that $[p - \alpha\min(p,1)]$ can be very small or even zero. This makes the implied rate of profit extremely or infinitely sensitive to errors in estimating average costs, especially after 1900 when $\alpha = 1$ and $[p - \alpha\min(p,1)]$ is sometimes zero (as it was in 1913). We, therefore, prefer to judge the magnitude of $\Delta\pi$ in a different way.

We judge the magnitude of $\Delta\pi$ by what note issue equal to the difference between the maximum and minimum note issue for a bank implies for its profits and for its profits as a fraction of its equity. A national bank was required to hold a minimum amount of eligible bonds and, therefore, had a minimum note issue. A bank with paid-in capital of more than $150,000 was required to hold $50,000 in eligible bonds; otherwise, it was required to hold ¼ of paid-in capital in such bonds. A national bank also had a maximum note issue. A bank could issue notes no greater than 90 percent of its paid-in capital before 1900 and 100 percent thereafter. For example, for a national bank with paid-in capital of $200,000, the maximum note issue minus the minimum was $135,000 prior to 1900 and $150,000 thereafter.

The problem of judging the magnitude of $\Delta\pi$ is exacerbated by a measurement problem. While we can quantify the costs associated with idle notes, we cannot quantify the costs from the added reserve management problems that accompanied note issue. We, therefore, compute amended values for $\Delta\pi$ taking account of idle notes only.

We take account of the effects of idle notes on the profitability of note issue by using formula (4) above. We compute a semiannual (June and December) time series of $\Delta\pi^*$ for 1882–1914 for each of the eligible bonds. To make such computations, we require values of ϕ, r_B, r_A, and t.

Ideally, we would like to set ϕ equal to the fraction of notes that banks thought would be in circulation during the

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[3]Champ (1990) and Kuehlwein (1992) assert that note issue was risky because the government bonds eligible to be used as backing were long-term bonds while the liabilities, notes, were short-term liabilities. Both researchers report that holding period yields on eligible bonds varied considerably over time. Such variability would not be a problem for a bank if it did not face the need to redeem its notes.

Another source of uncertainty is emphasized by Goodhart (1965), namely, the possibility that the note issue privilege would be revoked and that prices on government bonds would fall as a result.

following year. We approximate this by the average fraction of idle notes computed from the 15 most recent call reports, that is, those from the preceding three years.

For r_B, we use the yield to maturity for each eligible bond. Chart 4 shows the yields on three selected bonds used in our computations. (Yield data for all eligible bonds are available on request.) Because all of the eligible bonds had call provisions and call provisions were not exercised in the most straightforward way, there is no obviously correct way to determine their yields to maturity. So we follow Champ (1990) and compute these yields as follows: Prior to the first call date, we assume that the market expected that the bond would be called at the first call date if its price was above the call price, which was almost always the case. As it turns out, however, not all such bonds were called. For those that were not, we computed the yields after the call date, assuming people knew when the bond would be called.[4]

In our computations, we want to be careful not to bias $\Delta\pi$ downward by our decisions about r_A and t. We think the Comptroller and others have used unjustifiably high values of r_A.[5] Since $\Delta\pi^*$ in (4) is nonincreasing in r_A, this by itself biases $\Delta\pi$ downward. Throughout the 1882–1914 period, yields until maturity on eligible bonds were generally between 1.5 percent and 3 percent. Moreover, at no time were all the eligible bonds held as backing. Therefore, some were competing in ordinary portfolios with noneligible assets. For this reason, we assume that r_A is the largest yield on eligible bonds. Banks may, of course, have been making loans at higher rates, but if these were not default-free loans and were costly to administer in various ways, then their gross yield is not comparable to those of default-free bonds. As regards t, the Comptroller includes as other costs some which do not qualify as marginal annual costs; for example, the costs of plates. We eliminate such costs from t. As a result, the value of t in our computations is the tax on notes plus other costs of $50 per $100,000 of note issue.

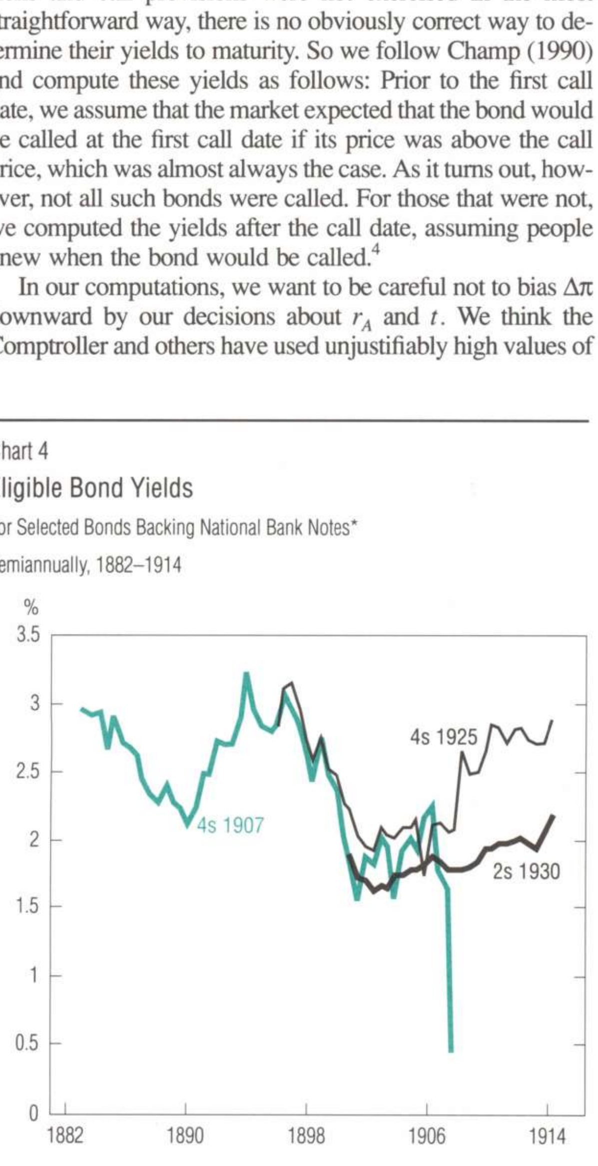
The total change in profit implied by (4) for a bank with paid-in capital, K, from moving from minimum to maximum note issue, denoted $\Delta\pi_E$, is

$$(5) \qquad \Delta\pi_E = K\{[1/\min(p,1)] - \beta\}\Delta\pi^*$$

where $\Delta\pi^*$ is given by (4) and where βK is the minimum required eligible bond holdings. As noted above, β is ¼ for banks with $K \le \$150,000$ and $\beta = \$50,000/K$ otherwise. For all eligible bonds, we computed semiannual estimates of $\Delta\pi_E$ for a national bank with a paid-in capital of $200,000 with our interpretation of ϕ, r_B, r_A, and t and with $\beta = ¼$. For such a bank, fully using its note issuing privilege meant increasing its holdings of eligible bonds by $150,000 over the minimum it had to hold. The median estimates of $\Delta\pi_E$ for all bonds is $1,910. The range of the estimates, excluding the upper and lower deciles because of the problems computing bond yields around call dates, is from $279 to $3,420. To us, it seems plausible that the marginal costs associated with issuing $135,000 ($150,000 after 1900) worth of additional notes could have been as high as these added profits.

A slightly different perspective on profits implied by (4) is to judge the above total profits relative to the bank's equity—its paid-in capital plus surplus, S. This added return on

Chart 4
Eligible Bond Yields
For Selected Bonds Backing National Bank Notes*
Semiannually, 1882–1914



*Bonds are identified by their coupon rate and date of maturity.
Source of basic data: Commercial and Financial Chronicle, Various dates

[4]While it is not obvious what alternative to use, our method of computing yields around call dates should be viewed with suspicion since our assumptions about the market's views of when bonds would be called and when they would mature are extremely implausible. One consequence of our method is that yields on some bonds exhibit fairly erratic behavior around the time of call dates. However, because such observations are only a small fraction of the total, our method of computing yields does not affect our overall conclusions about the profitability of note issue.

[5]James (1976) has some success explaining the cross-sectional pattern of regional note issue by using local loan rates. However, he makes no adjustment for different degrees of risk in local loan rates across regions, and in any case, he does not explain away the seeming profitability of note issue.

equity, denoted Δr_E, is obtained by dividing the expression in (5) by $K + S$:

$$\Delta r_E = \{[1/\min(p,1)] - \beta\}\Delta\pi^*/\{1 + (S/K)\}. \quad (6)$$

The formula (6) gives an upper bound on the expected added return on bank equity from fully using the note issuing privilege.

We compute a semiannual time series for Δr_E for all eligible bonds, and in Chart 5 we present values of this series for the same three selected bonds shown in Charts 1 and 4. (The data on estimated Δr_E for all eligible bonds are available on request.) In our computations, we use the aggregate surplus to paid-in capital ratio, S/K, from the call report with the date closest to our observation. The median estimate of Δr_E for all bonds is 0.50 percent. The range of the estimates, again excluding the upper and lower deciles, is from 0.08 to 0.85 percent. This does not seem paradoxically high given the uncertainty and additional costs stemming from redemptions that would accompany the full use of the note issue privilege.

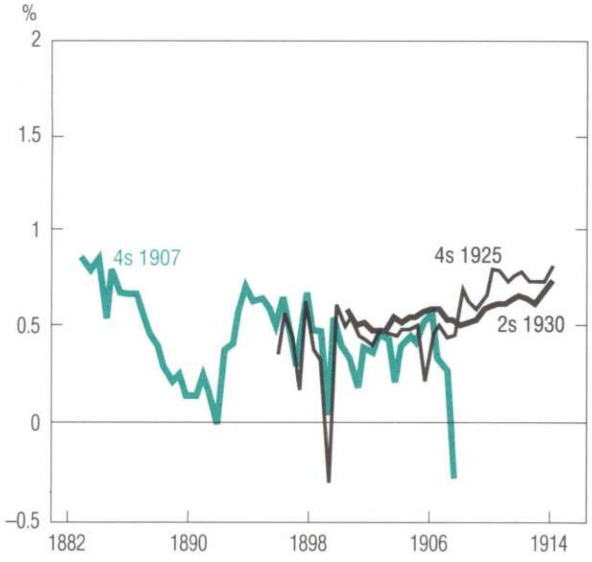
Note, finally, that our time series for Δr_E are nearly constant, except near call dates when they inherit the sharp fluctuations in yields on eligible bonds mentioned previously. (See, for example, Chart 5.) The behavior of Δr_E before and after 1900 contrasts sharply with the behavior of the Cagan and Cagan-Schwartz profitability measure, which increases sharply after 1900. Constancy is what one would hope to find for a measure of expected profitability if the omitted costs and the nature of the risks were more or less constant over time. The sharp increase in profitability beginning in 1900 found by both Cagan and Cagan-Schwartz can be explained by omitted costs and by judging profits relative to tied-up capital, which became small or zero after 1900 because of a change in the rules.

Chart 5

An Alternative Profit Rate

Added Return on Equity for Selected Bonds Backing National Bank Notes*

Semiannually, 1882–1914



*Bonds are identified by their coupon rate and date of maturity.

Concluding Remarks

We have now described the sense in which yields on eligible bonds were not paradoxically high during the 1882–1914 period. Based on the costs we were able to quantify, bonds were priced so that a bank fully exploiting the note issue privilege would have added about ½ percent to its average return on bank equity. Given that note issue gave rise to additional uncertainty, to reserve management costs, and possibly to other costs that we have not quantified, such a finding is consistent with the view that eligible bonds were priced in a way consistent with the costs of note issue.

This conclusion, a confirmation of the first hypothesis, makes it desirable to further explore the other two hypotheses stated in the introduction. If they are also confirmed, we would conclude that real interest rates were determined by monetary arrangements during the 1882–1914 period.

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