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Interest on Reserves and Monetary Policy

I. Introduction

Monetary policy operating procedures have long been debated within the Federal Reserve and among monetary economists at large. For instance, economists have disagreed about whether a central bank should utilize bank reserves or the interest rate as the policy instrument. For the time being at least, the Fed has settled on an interest rate policy instrument and has announced its current federal funds rate target since 1994. The focus on interest rate policy is reflected in the ubiquitous use of the Taylor rule in monetary policy analysis.

Oddly enough, just as the longstanding debate over bank reserves and the federal funds rate was set aside, four developments combined to renew an interest in operating procedures. First, economists began to worry that technological progress in the payments system could threaten a central bank's leverage over interest rates in the future.[1] Second, deflation in Japan led to a zero interest rate policy that stimulated a reconsideration of the nature of monetary policy transmission. Third, Congress considered legislation that would empower the Fed to pay explicit interest on bank reserves.[2] Fourth, during the 1980s and 1990s, many of the world's central banks moved from credit controls to market-based procedures for implementing monetary policy. Today, the world's major central banks implement monetary policy by manipulating short-term interest rates. Yet important differences remain in the procedures by which short-term rates are managed. There is considerable interest in comparing alternatives currently in use and in exploring new procedures that might afford benefits in the future.[3]

Motivated by these four developments, this paper highlights the role of interest on reserves in understanding the leverage that central banks exert over interest rates and explores the potential for interest on reserves to improve the implementation of monetary policy. I find that interest on reserves can and should be employed as a policy instrument equal in importance with open market operations. In effect, my paper resolves the historical dispute over bank reserves and interest rate operating procedures by pointing out how a central bank can target both independently. I conclude that a central bank without the authority to pay and vary interest on reserves at a market rate is at a considerable disadvantage in the implementation of monetary policy.

Economists, most notably Friedman (1959), have long advocated the payment of interest on reserves at a market rate in order to eliminate the distortions associated with the tax on reserves.[4] To a large extent, the legislation mentioned above was introduced to address the reserve tax. I am proposing something more: that interest on reserves be adopted as an

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instrument of monetary policy in practice.[5] Some economists have argued that paying interest on reserves might actually impair the ability of a central bank to conduct monetary policy.[6] More recently, however, interest rate rules for monetary policy have been shown to deliver coherent outcomes for the price level and real variables, even in models that ignore the demand for reserves and money completely.[7] These latest findings imply that interest rate rules could achieve broader macroeconomic objectives in much the same way, whether or not interest is paid on reserves.

I build up the analytical core of the paper in Section II by reviewing the nature of the zero bound on nominal interest rates. I explain that a central bank can manipulate short-term interest rates either by employing open market operations to manage the interest opportunity cost of holding reserves or by varying the interest paid on reserves. I then explain how a central bank could employ interest on reserves together with open market operations to target independently and productively both short-term interest rates *and* the aggregate quantity of bank reserves.

Section III employs the reasoning developed above to address the viability of interest rate policy in the event that technological progress in the payments system causes the transaction demand for bank reserves and currency to shrink significantly and even to disappear completely. Such developments will indeed threaten the Fed's leverage over interest rates if the central bank persists in using its current operating procedures. However, a central bank's leverage over interest rates can be preserved fully by employing interest on reserves as a monetary policy instrument.

The financing of interest on reserves is considered in Section IV. Paying a market rate of interest on reserves could very well increase net interest transfers from the central bank to the Treasury. At worst, it would have a relatively small adverse effect on government finances. Interest on reserves could create cash flow problems for monetary policy on occasion, but these would be manageable.

II. The Interest-on-Reserves Regime

The means by which the Federal Reserve sets the level of the federal funds rate at a point in time is well known. In current practice, the Federal Open Market Committee (FOMC) announces a target for the federal funds rate and instructs the trading desk at the New York Fed to use open market operations to provide the quantity of reserves and currency that the economy demands at that federal funds rate. The quantity of monetary base demanded adjusts so that the implicit marginal liquidity services yield exactly matches the interest opportunity cost spread, that is, the federal funds rate target minus the (zero) interest rate on reserves.

I came to view the process by which a central bank manages the interbank rate in a different light a few years ago in a paper on the zero bound on interest rate policy.[8] Obviously, at the zero bound it is no longer possible for a central bank to operate on the interest opportunity cost *spread*. The spread is *zero*. Nevertheless, a central bank still may be said to manage the interbank rate when it is zero. Thus, something other than open market operations and the interest opportunity cost spread must matter for the implementation of interest rate policy.

Irving Fisher developed the fundamental logic of the lower bound on interest rates in his famous book *The Theory of Interest*. He pointed out that if a commodity could be stored costlessly over time, then the rate of interest in units of that commodity could never fall below zero.[9] Surprisingly, as far as I know, Fisher did not apply that reasoning to monetary issues. In my paper, I applied Fisher's logic to point out that banks will never lend reserves to each other at negative (nominal) interest if reserve deposits are costless to store (carry) at the central bank. The zero bound on the nominal interbank rate is a consequence of the fact that a central bank stores bank reserves for free.

Thinking about the zero bound this way suggests that variable interest on reserves could be utilized routinely and productively as an instrument of monetary policy. The Fed could replace its current operating procedures with a new *interest-on-reserves regime*. For heuristic purposes, I describe the implementation of the new regime in two steps, although the steps would take place simultaneously in practice. First, the Fed would purchase additional securities in the open market, adding enough reserves to satiate the market and drive the federal funds rate to zero. The Bank of Japan actually implemented this step recently with its zero interest rate policy. Second, the Fed would begin to pay interest on bank reserves held on deposit at the Federal Reserve Banks. If the current intended target for the overnight rate were, say, 5 percent, then the Fed would pay interest on reserves at 5 percent.

It is easy to see why the rate of interest paid on reserves would determine the overnight market rate in this regime. Clearly, by Fisher's logic the 5 percent interest rate paid on reserves would put a 5 percent *floor* under which banks would not lend reserves to each other. The 5 percent floor would also be a *ceiling* above which banks would not lend to each other either. The reason is that there could be no interest opportunity cost spread in equilibrium if the reserve market is satiated so that the marginal liquidity services yield on reserves is zero. Currency would not need to pay interest in this regime. The

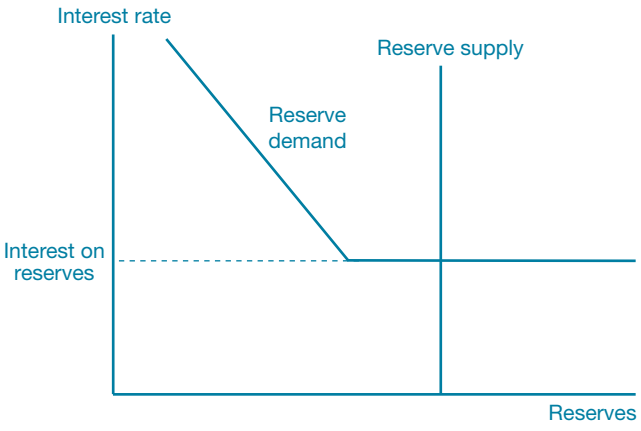
central bank would continue to accommodate the demand for currency as the Fed does today.

Thus, the interest-on-reserves regime would enable the Fed to exercise control of the overnight interest rate exactly as it does now. The main business of the FOMC would be to choose the interest rate paid on reserves, which would govern the level of short-term rates more generally as the federal funds rate target does today under the Fed's current operating procedures.

However, the interest-on-reserves regime would differ from the Fed's current operating procedures in one important respect. Open market operations would cease to support the interbank rate in the new regime. Open market operations would support neither the interest opportunity cost spread (which would be zero) nor the level of the interbank rate (which would be determined by the rate of interest paid on reserve balances at the central bank). Therefore, open market operations would be free to pursue another monetary policy objective.

Specifically, a central bank would be free to target any aggregate quantity of reserves above the minimum required to keep the interbank rate at the interest-on-reserves floor. This point is illustrated in the exhibit. The kink in the reserve demand locus reflects the fact that the quantity of reserves demanded rises as the market interest rate falls and becomes infinitely elastic when the market interest rate hits the rate paid on reserves. Reserve supply is vertical at the aggregate quantity of reserves supplied by the central bank. As long as the supply of reserves is large enough to cut the horizontal portion of the reserve demand locus, the central bank could use open market operations to target bank reserves, and independently use interest on reserves to pursue interest rate policy.

The Market for Bank Reserves



This opens an important new possibility for monetary policy: separate interest rate and bank reserves channels of monetary policy transmission. My zero-bound paper (Goodfriend 2000) explains how (negative) interest on reserves and reserve targeting could play independent and complementary roles in overcoming the zero bound on interest rates. In the paper, I pointed to the potential for quantitative policy to operate productively on *broad* liquidity even if *narrow* liquidity were satiated with the interbank rate at the interest-on-reserves floor. It is noteworthy that currently the Bank of Japan is considering supplementing its zero interest rate policy with quantitative easing. Most monetary economists agree that aggressive open market purchases in Japan could stimulate aggregate demand even with short rates immobilized at zero. Such logic suggests that the independent use of quantitative policy made possible in an interest-on-reserves regime could be of considerable value *even* when the interest rate is not immobilized at the zero bound.

It is beyond the scope of this paper to present a model of the separate interest rate and bank reserves channels of monetary transmission in an interest-on-reserves regime. However, one can understand the potential usefulness of the additional degree of monetary policy freedom as follows. Narrow liquidity services provided by the monetary base enable banks and the public to economize on time and effort in settling transactions. Broad liquidity, however, is a service yield provided by assets more generally according to how easily they can be turned into cash, either by sale or by serving as collateral for external finance. Households and firms are routinely subjected to liquidity shocks in which the flow of current income is insufficient to finance desired expenditures. Broad liquidity services are valued because they minimize the exposure of households and firms to the external finance premium.[10]

In the interest-on-reserves regime, bank reserves would pay a market rate of interest but would yield no narrow liquidity services at the margin. Hence, in such a regime, bank reserves would be equivalent to safe government debt with a floating daily rate of interest. However, bank reserves would continue to provide broad liquidity services at the margin in an interest-on-reserves regime, much as short-term government debt does. Holding interest on reserves fixed, an increase in bank reserves would increase the aggregate supply of broad liquidity. Thus, open market operations would have the potential to manage productively the aggregate quantity of broad liquidity in the economy independently of interest rate policy. A central bank could increase broad liquidity in the economy by using newly created reserves to acquire less liquid assets or by financing a temporary government budget deficit.

Why might a central bank value the latitude to pursue separate interest rate and bank reserves policies? Interest rate

policy could continue to be utilized to maintain overall macroeconomic stability. Bank reserves policy could then address financial market objectives. In the long run, a central bank could pursue an objective for bank reserves to optimize the broad liquidity services provided by the floating stock of government debt.[11] In the short run, for example, a central bank could increase bank reserves in response to a negative shock to broad liquidity in banking or securities markets or an increase in the external finance premium that elevated spreads in credit markets. The increase in bank reserves would help to stabilize financial markets by offsetting the temporary reduction in the private supply of broad liquidity. The latitude to pursue bank reserves policy and interest rate policy separately would be useful to the extent that shocks in financial markets and the macroeconomy are somewhat independent of each other.

Recent experience illustrates this point. Consider the fact that the Fed cut interest rates sharply in response to two of the most serious financial crises in recent years: the October 1987 stock market break and the turmoil following the Russian default in 1998. Arguably, in retrospect, interest rate policy remained too easy for too long in both cases. The latitude to increase bank reserves independently of interest rate policy conceivably could have enabled the Fed to stabilize financial markets in those cases with less risk of stimulating the overall economy excessively.

To some degree, the Fed can already manage broad liquidity under current operating procedures by changing the *composition of its assets*, for example, by selling liquid short-term Treasury securities and acquiring less liquid longer term securities. However, the government debt injected into the economy in this way would not be as liquid as newly created base money. More importantly, the Fed's ability to affect broad liquidity in this way is strictly limited by the size of its balance sheet. For the broad liquidity management contemplated here to be effective, a central bank might need the latitude to enlarge its balance sheet considerably and to vary the size of its balance sheet within a wide range independently of interest rate policy. That is not possible under the Fed's current operating procedures.

Monetary economists have long accepted the view that a central bank must choose between an interest rate instrument and a bank reserves policy instrument. Bank reserves and the interest rate, it is said, cannot be targeted independently.[12] The conventional view is misleading because it ignores the fact that interest on reserves at a central bank can be employed productively as a policy instrument. The fact that some central banks, including the Fed, have not yet been authorized to pay and vary interest on reserves should not cloud our understanding of the potential role of interest on reserves in implementing monetary policy. Nor should it preclude one's investigation of the benefits that full exploitation of the interest-on-reserves regime could achieve.

III. The Robustness of a Central Bank's Leverage over Interest Rates

In this section, I use the above framework to assess the robustness of a central bank's leverage over interest rates in a world where the transaction demand for bank reserves and even currency shrinks significantly and perhaps disappears completely. Is a central bank's leverage over interest rates threatened by banks' ongoing economization on reserves? The short answer is it need not be. My answer has four parts.

First, it is worth remembering that the reduction in reserve demand is in large part the result of the failure of reserves to pay interest. The incentive to economize on reserves was greater when inflation made nominal interest rates much higher than they are today. But even at current interest rates, banks continue to find ways to avoid holding reserves.[13] A falling demand for reserves is far from inevitable if the opportunity cost of holding reserve balances at a central bank is reduced by achieving price stability or by paying interest on reserves.

Second, we saw above that in general, a central bank need not maintain an opportunity cost of reserves in order to implement interest rate policy. A central bank could push the market rate down to the interest-on-reserves floor and vary interest on reserves to implement interest rate policy as described in Section II. With *no* opportunity cost of holding reserve deposits, there would be *no* incentive for banks to pay anything to economize on reserve balances. The demonetization of the reserve market would likely slow or stop, and reverse if reserve avoidance has an ongoing cost.

Third, an extremely small, unstable aggregate demand for reserves could create a problem for the Fed's current procedures. Today, the Fed defends its announced funds rate target with relatively infrequent interventions in the reserves market. Movements in the funds rate could become erratic if reserve demand shrinks further. The Fed might feel compelled to intervene more often. More frequent interventions, however, would tend to weaken market forces that would otherwise stabilize the funds rate around the Fed's intended target. The Fed could be drawn into a more or less continuous defense of a narrow band around its intended federal funds rate. In so doing, the Fed would end up inserting itself between trades to redistribute reserves among banks. That outcome would be highly inefficient because banks utilize the federal

funds market actively in the current environment, where reserves are costly to hold.

Contrast that possibility with what would happen in the interest-on-reserves regime. The central bank would control the overnight interest rate tightly with its interest-on-reserves policy instrument without any opportunity cost of reserves. Banks would continue to transfer reserve deposits among themselves to settle payment orders initiated by their depositors. However, banks would greatly enlarge their inventory of reserves, stockouts would be infrequent, and banks would redistribute reserves among themselves much less often via the interbank credit market. The overnight interbank market might become less active or disappear altogether, but only because banks had a more economical way to manage their reserves in an interest-on-reserves regime.

For our last look into the future, we consider what would happen if technological progress in the payments system caused the monetary base to lose its medium-of-exchange role gradually, and to *completely* lose that role eventually. This could happen if the banking system developed an electronic settlement system independent of the central bank, and currency was abandoned in favor of electronic devices that could access bank deposits remotely.[14]

Clearly, interest rate policy implemented by the Fed's current operating procedures could not survive in this case. If the Fed persisted in implementing interest rate policy with its current procedures, the Fed would continually sell securities to withdraw reserves and currency. Reserves, for example, would be withdrawn to keep their marginal narrow liquidity services yield from falling below the interest opportunity cost represented by the federal funds rate target. If the transaction demand for reserves disappeared completely, the Fed would end up withdrawing all bank reserves in defense of its federal funds rate target and lose its power to influence market interest rates. It is difficult to say what would happen next. Suffice it to say that economists and central bankers have reason to be concerned about this possibility.

However, the Fed's leverage over interest rates would be completely secure if it switched to the interest-on-reserves regime described above. Instead of withdrawing the monetary base, the central bank could let banks accumulate the unneeded currency and reserves. Banks could exchange currency for reserve balances earning the policy rate, which would also equal the market rate of interest. The aggregate quantity of reserves held by banks would be determined by the central bank's reserve target. Banks would regard deposits at the central bank as government debt with a floating daily market rate of interest and value them as such. Such developments would not interfere at all with the central bank's power to implement interest rate policy in an interest-on-reserves regime.[15]

I conclude that the threat to interest rate policy from the shrinkage or disappearance of the transaction demand for the monetary base is a consequence of the operating procedures that a central bank chooses to use. A central bank's leverage over interest rates is fundamentally secure as long as it utilizes the interest-on-reserves regime, which does not require open market operations to maintain a scarcity of reserves relative to their demand so as to support a positive interest opportunity cost of reserves.

IV. Financing Interest on Reserves

Paying interest on reserves would seem to be expensive from the Treasury's point of view. Interest earnings ordinarily transferred by a central bank as tax revenue to the Treasury would be diverted to pay interest on reserves. Moreover, the payment of interest on reserves would induce banks to enlarge substantially the quantity of reserves demanded, greatly enlarging the interest that a central bank would have to pay. This section addresses the financing of interest on reserves, and argues that the fiscal implications are likely to be more favorable than might be supposed.

Implementing an interest-on-reserves regime has two effects on government finances. First, there is an effect due to the increase in reserve deposits and assets acquired by a central bank as a result of the regime change. Second, there is an effect due to the payment of interest on preexisting reserve deposits. I consider these in turn.

Suppose a central bank such as the Fed confines its asset purchases mainly to Treasury securities. In that case, interest on the increase in reserves will be self-financing if there is a positive spread between longer term Treasury securities and the rate of interest on reserves. Reserve balances at the central bank paying market interest are like one-day Treasury securities. Hence, interest rate spreads between longer term Treasury securities and overnight deposits at the central bank should exhibit term premia ordinarily reflected in the Treasury yield curve. Therefore, a central bank such as the Fed should be able to self-finance interest on the enlarged demand for reserves in the new regime. In fact, the net interest spread earned on new assets acquired in the interest-on-reserves regime would raise additional revenue for the central bank.[16]

What about the effect on the government's finances of paying interest on preexisting reserve holdings? Paying a market rate of interest on reserves held previously would reduce transfers from the central bank to the Treasury because it would eliminate the tax on preexisting reserves. That said, reserve balances currently held by banks are relatively small,

and banks are likely to economize further on reserves if they continue to earn no interest. Moreover, net interest earned by expanding the central bank's balance sheet could offset, or more than offset, these losses. At most, switching to the interest-on-reserves regime would have a relatively small adverse effect on government finances and could very well increase central bank transfers to the Treasury.

Paying a market rate of interest on reserves could create cash flow problems for a central bank. One problem is that interest on reserves would be paid on a daily basis, but interest earnings would not accrue on a daily basis. Interest on short-term securities is paid on a discount basis rather than on a daily basis and interest on longer term securities is paid at infrequent intervals. Also, inevitably there will be periods in which the yield curve slopes downward, perhaps because the central bank had recently tightened policy and markets expect a return to lower overnight interest rates in the future. In such periods, interest on the central bank's portfolio could conceivably fail to cover interest on reserves.

Cash flow problems could be addressed in a number of ways. A central bank with sizable earnings on assets acquired with non-interest-bearing currency could utilize those net interest earnings to help pay interest on reserves. If necessary, a central bank could draw down its capital to help pay interest on reserves, replenishing its capital when cash flows are positive. If a central bank held Treasury securities, modifications could be made in the timing of interest payments from the Treasury once its securities were acquired by the central bank. These important operational issues must be addressed before the interest-on-reserves regime could be implemented. On the whole, however, cash flow problems would be manageable.

V. Conclusion

Open market operations are neither necessary nor sufficient to implement interest rate policy. These operations are not necessary because they work by restricting the supply of reserves in order to maintain a positive marginal liquidity services yield and an interest opportunity cost of reserves. By paying and varying interest on reserves, a central bank could exert leverage over market rates *without* maintaining an interest opportunity cost spread. Open market operations are not sufficient to implement interest rate policy either, because they govern *only* the interest opportunity cost spread. The level of the interbank rate is determined only if, in addition, the rate of interest paid on reserves is specified at zero or otherwise.

This unorthodox way of viewing monetary policy operating procedures is entirely consistent with conventional monetary theory. The change of perspective, however, enables us to better appreciate the potential role of interest on reserves for monetary policy. The main practical point of this paper is that a central bank can implement interest rate policy by paying and varying interest on reserves without maintaining an interest opportunity cost spread as long as the preexisting supply of bank reserves is large enough to keep the interbank rate pressed down to the interest-on-reserves floor.

The interest-on-reserves regime has four attractive features. First, the regime would make full use of two monetary policy instruments—open market operations and interest on reserves—to enable a central bank to simultaneously pursue interest rate policy and an independent objective for aggregate bank reserves. That would potentially improve on the Fed's current operating procedures that obligate bank reserves to support interest rate policy. Bank reserves could be varied to offset shocks to the private supply of broad liquidity in financial markets in the interest-on-reserves regime, while interest rate policy could be used to stabilize the overall macroeconomy.

Second, the interest-on-reserves regime would perfectly preserve a central bank's leverage over interest rates, even in the unlikely event that the transaction demand for base money disappeared entirely in the future. Moreover, banks would have no incentive to avoid central bank reserves in such a regime. In contrast, the Fed's current operating procedures might not fare well if the demand for reserves were to shrink further and would not work at all if the transaction demand for reserves were to disappear altogether.

Third, the interest-on-reserves regime might very well be self-financing; it even has the potential to generate significant additional revenue for the government. At worst, switching to the interest-on-reserves regime would involve a relatively small adverse effect on government finances. Paying a market rate of interest on reserves could create cash flow problems for a central bank; but these problems would be manageable.

Finally, the interest-on-reserves regime would eliminate entirely distortions in financial markets due to the tax on reserves. Banks would save resources that had been devoted to economizing on reserves. An abundance of costless, safe reserves would substitute somewhat for the costly and risky extension of private credit in the process of making payments. The shrinkage of private credit in making payments, in turn, would help a central bank to limit the extension of its own credit in support of the payments system.

Endnotes

1. See Friedman (1999) and the various papers in Posen (2000).

2. See Meyer (2001).

3. For instance, Woodford (2000) analyzes the channel system of interest rate control and compares it with the Fed's current operating procedures. See Borio (1997) for a survey.

4. See also Fama (1983) and Hall (1983).

5. A few economists have discussed the use of interest on reserves as a policy instrument. Hall (1983, 1999) shows how interest on reserves could be utilized to control the price level. Goodhart (2000) and Woodford (1999) discuss how interest on reserves could be utilized to implement monetary policy in a world without money. Interest on deposits at the central bank is also an important component of the channel system for implementing monetary policy.

6. See Sargent and Wallace (1985) and Smith (1991).

7. See, for example, Kerr and King (1996), McCallum (2001), and Woodford (1999).

8. See Goodfriend (2000).

9. A concise statement such as this does not actually appear in the book. The point is made through a series of examples. See Fisher (1930, pp. 186-94).

10. See Bernanke and Gertler (1995).

11. Economists have recently begun to analyze the role and management of broad liquidity in the economy. For instance, Aiyagari and McGrattan (1998), Heaton and Lucas (1996), and Holmstrom and Tirole (1998) analyze broad liquidity and consider how much the government should supplement the private supply of broad liquidity with a floating stock of government debt.

12. Economists such as Poole (1970) recognized that a central bank could pursue a combination policy involving both bank reserves and the interest rate. A combination policy can be interpreted as a rule that uses a weighted average of reserves and the interest rate as the policy instrument. In the conventional analysis, however, no interest is paid on reserves and the two instruments cannot be chosen independently of each other.

13. For instance, the recent introduction of sweep accounts greatly reduced required reserves in the United States.

14. Friedman (1999) and King (1999) regard such an outcome as a real possibility.

15. Goodhart (2000, part 3) and Woodford (1999, pp. 72-5; 2000, p. 255) reach a similar conclusion.

16. Note that the liquidity spread would tend to shrink as the supply of reserves increased.

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