

Central Bank Credit in the Theory of Money and Payments

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I'm honored to have the opportunity to speak at this conference, although I must admit that I find the conference's title a bit puzzling. I can certainly think of more than two conferences on payment economics. Why, the Richmond Fed alone has sponsored two; one in 2000 and one way back in 1987.

But provenance aside, Jamie and Will and everyone else at the New York and Atlanta Reserve Banks who have contributed to organizing and staging these two conferences deserve our grateful commendations. Indeed, I'm quite heartened by the proliferation of gatherings like this, at which economic theory, econometric evidence and lessons from history are all brought to bear on questions surrounding payments systems. These conferences have been vital to the maturation of payment economics – the study of the mechanics of market exchange – as a distinct field of inquiry. Payment economics is no narrow technical specialty, either: it builds on monetary theory, since use in payments defines monetary instruments. It also draws on banking theory, based on the observation that virtually all institutions that we usually think of as banks are significantly involved in payments intermediation.

I want to talk this morning about the role of central bank credit in payments arrangements. There is a voluminous practitioner literature that touches on this subject. Much of it focuses on some of the terms on which credit is provided, and some recent discussion centers on the relative advantages of collateralization versus overdraft fees in managing the risks that arise from the provision of intraday central bank credit. I want to offer some thoughts on these issues, but my main purpose today is to explore what payment economics has to say about the role of central bank credit in the payments system.

One theme I will emphasize is that payments system policy – specifically, the terms on which daylight credit is offered – ought to be analyzed within the broader context of the array of central bank policies surrounding the provision of deposit accounts. This viewpoint naturally connects daylight credit policy to the lender of last resort function as well as the operational mechanics of setting the overnight interbank interest rate. This viewpoint leads me quite naturally to a modest proposal for improving payments system policy and the operations of monetary policy. I should emphasize at the outset that my policy proposal is offered up in the spirit of academic inquiry, with the aim of stimulating discussion that will enhance our understanding of how best to achieve our policy goals. I should also emphasize that the thoughts I'll be sharing with you this morning are my own, and do not necessarily represent the views of the Federal Reserve System.

Central Banks in the Payment System

Central banks play a variety of roles in the payment system. The most fundamental, I would argue, is providing banks with deposits and a means of transferring them to make interbank payments. Modern central banks provide electronic transfer systems, but systems based on paper or face-to-face payment orders go back centuries. Indeed, prototype central banks – that is, public sector institutions providing transferable deposits to banks for use in settlement – are documented in the early 1400s in the northern Mediterranean (van Dillen, 1964, and Mueller, 1997). I recommend to you a recent Atlanta Fed working paper by Stephen Quinn and Will Roberds that provides an excellent description and analysis of the 17th century Bank of Amsterdam, a prominent and well-documented example of this type of institution (Quinn and Roberds 2005).

Advances in the theory of payments have emphasized the role of communication and record-keeping in conveying information about the participants in an economic transaction. The economic function of a payment instrument is to communicate reliably (that is, in an incentive compatible way) about the buyer's past transactions (Townsend, 1989, and Kocherlakota, 1998). Banks, from this perspective, are fundamentally specialized institutions for issuing widely accepted payment instruments, in contrast to their traditionally emphasized role as balance-sheet intermediaries. Indeed, the provision of payments services, I believe, better defines banking than balance-sheet intermediation, which has been the traditional focus of banking economics, but which many other nonbanking institutions engage in as well.

Issuing, clearing and settling payment instruments are essentially communication and record-keeping activities. The central role of communication technologies in payment arrangements points, in modern settings, to the importance of economies of scale, common costs and joint production. These conditions can give rise to “network effects” in which much of the benefits and costs are shared among multiple participants. Private organizations that deal effectively with such technologies can be described as clubs, and the theory of clubs teaches us that terms of membership are just as important as unit service prices in inducing efficient participation in the presence of network effects.

Efficient communication arrangements often take the form of networks in which many paths connect through a central node. A clearinghouse can be viewed as a natural club arrangement for such centralized settlement activities. A central bank then represents a nationalized central settlement node for interbank payments. Contemporary legal restrictions more or less compel most banks to settle through the central bank. Some economists have argued that such nationalization was efficiency-enhancing (Goodhart, 1988). For club goods, however, there is often a range of allocations consistent with efficiency – that is, with Pareto optimality. The formation of central banks may represent the pursuit of a politically favored allocation of the net benefits of clearinghouse arrangements. For example, research into the Federal Reserve's entry into check collection suggests that it was less about cost-efficiency than it was about shifting the cost of collecting checks drawn on country banks.

If the fundamental core of central banking consists of interbank deposit services, then the fundamental core of central bank policy consists of all of the terms and conditions under which those deposit services are offered. These include the obvious pricing terms, such as the nominal rate paid on deposits (zero at your Federal Reserve Bank) and the fee charged for transferring funds. It also includes legal restrictions, such as reserve requirements, that impose constraints on deposit holdings. The determination of the quantity of deposit liabilities supplied is also a component of central bank policy. Under current U.S. arrangements, the New York Fed's trading desk conducts daily open market operations so as to supply an amount of deposits expected to result in an interest rate on overnight interbank loans equal to the target rate set by the Federal Open Market Committee. Thus the phrase "central bank policy" should be construed here to include the monetary policy operational regime, since, as I'll argue below, it affects banks' payment system choices. This connection between the Fed's daylight credit arrangements and the broader monetary regime implies that attempts to optimize each separately may not deliver the best policies.

Central Bank Credit in the Payment System

Central banks have traditionally viewed the provision of credit to the banking system as an essential tool for achieving their goals. The lender-of-last-resort function is a widely accepted role for central banks to play in responding to emergency liquidity needs. Bagehot's prescription – to lend freely but only at a high rate on good collateral to solvent institutions – is one of the most well-known maxims in central banking, although some of these distinctions can be tricky to apply in practice.

It is important to recognize, however, that central bank lending involves two distinct actions. The first is an increase in the deposit account liabilities of the central bank. The second is the acquisition of a private liability. In Bagehot's time, acquiring private liabilities was the main method of altering the aggregate supply of central bank deposit liabilities, and so the lender-of-last-resort policy he prescribed was the natural way to provide for an elastic supply of deposits when demand for those deposits spiked. The founding of the Federal Reserve System was motivated by a similar desire to prevent interest rate spikes when the demand for reserves surged. The advent of open market operations in liquid government securities, however, made it less obvious that acquiring private liabilities was the best way to manage the supply of central bank deposits. Most central banks now treat open market operations aimed at pegging overnight interbank interest rates as distinct from lending to individual banking institutions. In fact, pegging interest rates automatically sterilizes the effect of such lending on aggregate deposit supply. Discount window lending now represents a form of fiscal policy – a public sector loan to a private entity. It is no longer necessary to the provision of an elastic supply of reserves.

The lender-of-last-resort function typically involves overnight credit. Many central banks provide intraday credit in the course of operating interbank payment systems that provide payment finality. Of course, daylight credit that is not extinguished by the end of the

processing day becomes overnight central bank credit of some form or another. Central banks have taken different approaches to the provision of daylight credit. The Swiss used to just say no; now they lend via intraday repurchase agreements. Most central banks provide daylight credit on fairly liberal terms. Many insist that such credit be fully collateralized. The Fed currently allows daylight credit to be uncollateralized, but charges a fee equivalent to 36 basis points at an annual rate on daylight credit above a certain threshold.

Payments Theory

What does economics have to say about the role of central bank credit in the payments system? The nature of the problem provides some guidance, I believe, regarding the methodology one needs to bring to bear. To evaluate the role of central bank credit, one needs to assess the costs and benefits of alternative policy regimes governing the provision of that credit. To do that, one needs to understand how bank behavior will change when one changes central bank credit policy. In other words, how will deposit balances and the timing and magnitude of payment flows differ from one regime to another? Empirical analysis of payments systems data can provide some assistance here by providing an understanding of the underlying patterns of payment flows among banks. But such analyses invariably run into the “Lucas Critique” – that is, that estimated relationships from the status quo regime may shift dramatically in response to a change in regime. To the extent that one is evaluating an alternative regime that differs substantially from current policy, one must identify the “structural” determinants of bank behavior that are invariant across regimes. Thus, evaluating alternative payment policy regimes calls for a theoretical framework, although observations from history or across countries might also provide some insights. The analysis of a system’s likely response to a major shift in policy requires a plausible model that incorporates the effects of central bank policy on equilibrium private sector behavior.

What should we look for in models of payment activity? One important principle is embodied in William Baxter’s (1983) Dictum—that the issuance, use, clearing and settlement of a payment instrument is a service of joint benefit to the buyer and the seller and that service is provided jointly by all parties to clearing and settlement. As a result, a sound economic evaluation of alternative payment policies requires assessing the effect of those alternatives on the well-being of and costs incurred by all of the parties involved. Models that omit the parties for whom banks are clearing and settling payments – the “end-users” – will fail to satisfy Baxter’s Dictum, and will be potentially misleading.

As I mentioned earlier, payments arrangements are communications networks, and these often take the form of club goods. Private agents that find themselves in such environments will tend to create multilateral institutions to efficiently cope with their interdependencies. A good payments model should recognize that payment instruments and institutions are not exogenous, but are determined by the nature of the information and other frictions facing traders in the model environment. This endogeneity of payment behavior is what makes the application of carefully specified models essential for thinking about the consequences of significant changes in central bank policies.

Viewing instruments and institutions as endogenous adaptations to the structure of the economy has important methodological implications. First, whenever possible, models of payment behavior should be fully articulated general equilibrium models, specified, in the words of an old but useful slogan, at the level of preferences, endowments and technologies. This is essential for drawing welfare conclusions about alternative policies. Second, the endogeneity of institutions places mechanism design at the heart of payments theory, as is true for modern monetary theory. Under a mechanism design approach, payment instruments are seen as messages that embody contingent contracts, and one can model the information and risk allocation characteristics in a way that takes into account the limitations imposed by real-world payment technologies – for example, the costliness and falsifiability of communication, verification and authentication.

The Freeman Model

Scott Freeman (1996) developed a model that meets these criteria and has proven useful for studying the role of central bank credit in settlement arrangements. In the environment of the Freeman Model, both fiat money and private liabilities serve as means of payment. Moreover, each period many agents meet at a central location, some bearing private payment instruments that they want to exchange for money, and others bearing money with which they will redeem their debt. The (exogenous) timing of agents' arrivals and departures are such that early in the meeting there is an imbalance between agents bearing debt they wish to redeem for money and agents with money to offer for debt. Without central bank intervention, the debt sells at a discount early in the period, an inefficiency relative to frictionless settlement. In this model, the central bank can purchase debt for newly minted money and later retire that money by presenting the debt to issuers for payment.

The Freeman Model was developed to study the central bank's ability to accommodate a temporary bulge in the demand for money in connection with settlement in a way that does not create inflation. Freeman makes reference to Milton Friedman and Anna Schwartz's (1963) discussion of seasonal movements in money demand in the U.S. during the 19th century. But the series of central bank transactions described above can be interpreted as a short-term or even intraday loan from the central bank to the issuer of the debts. Under this interpretation, Ruilin Zhou (2000) has shown that the optimal terms for the central bank transaction are equivalent to daylight credit at a zero interest rate.

One important observation on the Freeman model is due to Ed Green (1997). By constructing a mechanism by which a coalition of private agents can achieve the same outcome as central bank intervention in the Freeman Model, Green showed that central bank credit was not essential for achieving an optimal allocation. In fact, the coalition described by Green's Theorem resembles the private clearinghouses which stood at the apex of the U.S. clearing and settlement systems before the creation of the Federal Reserve. This result highlights the lesson that the need for (perhaps quite complicated) multilateral coordination does not by itself create a need for public sector involvement in a payments system. This lesson is buttressed by the observation that many private net

settlement arrangements exist alongside central bank gross settlement systems. As I noted earlier, this reasoning suggests that the question of the central bank role in payments is less about efficiency and more about the distribution of costs and benefits.

Another important observation on the Freeman Model involves its finding that the optimal interest rate on intraday central bank credit is equal to zero. A key feature of his environment that helps deliver this result is the absence of intraday discounting. An interest rate is the intertemporal price of consumption, and in the Freeman model, consumption is discounted only period-to-period, not within the settlement period. This amounts to saying that there is no within period (intraday) opportunity cost of consumption or money, an assumption that may or may not be a good approximation to the operation of large value payments systems. Whether it makes sense to posit that all discounting takes place overnight is an important open research question, especially when the overnight period lasts just 2 ½ hours, as it does for Fedwire.

It is worth noting that the motivation for daylight credit in the Freeman Model is unrelated to any risk of so-called “gridlock.” People describe gridlock as occurring when banks strategically delay payments within the day, thereby increasing the system’s processing burden late in the day. The option to delay payment is not available in the Freeman Model. In more general settings, one important question regarding the potential for gridlock is the extent to which repeated interaction can constrain the incentive for strategic misbehavior. It is also worth considering whether gridlock could itself be a consequence of the status quo policy regime.

Yet another noteworthy feature of the Freeman Model is that the central bank’s extension of daylight credit is risk-free. From this perspective, one might view a daylight overdraft fee as compensation for risk. Ideally, one would want to set this fee in Pigovian fashion so as to eliminate banks’ incentives to overuse daylight credit. One might think that setting the fee at a level that compensates the central bank for its credit-risk exposure would do the trick, but this would ignore the role of the deposit insurance fund. A central bank’s claim on a failing bank’s collateral simply reduces the liquidation value of the institution and thereby increases the cost to the deposit insurance fund. Moreover, central bank lending can allow the chartering agency to delay closure and facilitate the exit of uninsured creditors, further shifting losses from private counterparties to the public sector and exacerbating moral hazard. Either way, Federal Reserve risk exposure is the wrong metric against which to benchmark overdraft fees. It is essential, in my view, to evaluate the risks associated with central bank credit from the comprehensive perspective of the consolidated fiscal balance sheet rather than from a purely central bank point of view.

While it is widely recognized that credit risk is an element of the benefit-cost calculus surrounding daylight credit, assessment of this risk is fraught with difficulty. When financial conditions are generally strong, the risk of actual loss due to daylight credit exposure is likely to be small, and even a small benefit in the form of a smoother functioning payment system might appear to make the provision of central bank credit worthwhile. Daylight credit is often particularly useful during a severe operational disruption, as illustrated by the aftermath of the terrorist attacks of September 11, 2001.

(Lacker, 2004) While some banks delayed payments out of concerns about incoming funds, the availability of daylight credit built confidence that payments would flow. (McAndrews, 2002) On September 11, the general condition of the banking system was quite strong. Should a major operational disruption occur when some financial institutions are generally more fragile, then an expansion of central bank credit could involve a substantial increase in exposure.

Operational disruptions aside, weak banking institutions can create broader moral hazard problems regarding daylight credit. Large banks build sophisticated payment processing systems assuming the availability of automatic daylight credit. Reconfiguring a bank's operations to cope with a denial of daylight credit can be very costly and highly visible to counterparties. This makes it difficult for the Federal Reserve to withdraw daylight credit in the case of weak or failing institutions, and this in turn can substantially weaken market and supervisory discipline.

Reserves versus Payments Credit

The Freeman Model has been cited as support for minimal daylight overdraft fees, but I would like to explore an alternative central bank policy regime that involves no daylight credit at all. Under this regime, the Fed would automatically "sweep" the overnight excess reserve balances of banks into reverse repurchase agreements. Specifically, at the close of Fedwire (6:30 p.m.) we would sell them U.S. Treasury securities in exchange for all of their excess reserve balance. At the opening of Fedwire on "the following day" (actually 9:00 p.m. the same night) the transaction would be reversed; we would buy back the securities and credit their account for the purchase amount, plus interest. Upon initiation of the service, the Fed would conduct a large one-time open market purchase of securities during the day to start the program up with abundant daylight reserves.

If the interest rate were set close to or at the target fed funds rate, this scheme would allow us to curtail daylight credit without imposing much cost on banks. For every dollar of daylight credit we withdraw, we could supply an additional dollar of daylight reserves via the initial open market purchase. In the limit, we could withdraw all access to daylight credit and increase the aggregate supply of daylight reserves by the maximum amount of daylight credit usage. In principle, any pattern of intraday payments that is feasible under current policy would still be feasible; no change in the timing of payments would be necessary.

The obvious cost to a bank of substituting overnight balances for daylight credit is the foregone interest on overnight balances. A Fed sweeps service would virtually eliminate the opportunity cost of holding large daylight balances if the interest rate was set at the overnight federal funds target rate. This illustrates the extent to which the demand for daylight credit can be viewed as driven by the tax on Fed deposits due to the lack of interest on reserves. Banks could hold large overnight balances now if they so desired, but they prefer to use daylight credit and hold quite minimal balances beyond those needed to meet reserve requirements.

Note that this policy is equivalent to the optimal policy recommended by the Freeman Model of intraday purchases of securities that are reversed at the end of the day. The sweeps service would withdraw substantial balances at the end of the settlement day and then inject them back in at the beginning of the next day. But the sweeps plan I described would not be feasible in the Freeman Model, because different agents participate in the settlement meeting each period. Thus, the Freeman Model does not provide opportunities to substitute overnight balances for daylight credit. This illustrates the source of the Freeman Model's crisp prediction regarding daylight credit interest rates: the market for daylight credit is sharply segmented from overnight asset markets. This suggests that to fully understand the economics of daylight central bank credit we need models that allow for nontrivial substitution between overnight balances and daylight credit.

In the Freeman Model, the central bank acquires the private payment liabilities that give rise to the daylight demand for money, while the sweeps proposal is agnostic on the debt used in the overnight reverse repurchase agreements, although U.S. Treasury securities are the natural candidate given the existing Fed book-entry securities service. Of course, private payment liabilities are the only debt in the Freeman Model, so no meaningful question arises there, but this points to what might be the most essential difference between various central bank daylight credit policy regimes: namely, the nature of the financial claims the central bank acquires. Under current Fed policy, the Federal Reserve Banks take unsecured claims when they provide daylight credit, although operating circulars create a lien on any bank collateral that happens to be pledged for use in overnight borrowing, so perhaps it is best to describe Fed daylight credit as partially secured. Central banks that require full collateralization of daylight overdrafts often allow a range of assets to serve as collateral – similar to the Fed's policies for discount window collateral. It is beyond my scope here, but the question of the appropriate collateral for central bank credit exposure is an open question that involves deeper issues surrounding the financial safety net and related moral hazard considerations. But note that the sweeps service I have described is nearly equivalent to collateralized daylight credit, if the eligible collateral and repurchase transactions are limited to the same set of assets.

Aside on simplifying monetary policy implementation

One side benefit of the sweeps service I have described is that it would allow us to simplify monetary policy operations. At present, New York Fed staff essentially estimates the banking system's demand for excess reserves each day at the funds rate target and they supply that amount through open market operations. In the process, they must estimate a variety of "technical" influences on the reserves market – changes in Treasury balances, for example. The New York Fed staff generally intervenes only once each day, however, usually in the morning. Unanticipated disturbances to reserve supply or demand can occur after they have intervened, and these can drive the market federal funds rate away from the target. Although it is unclear whether there are significant welfare costs of intraday fed funds rate volatility, substantial resources are devoted to assembling data and estimating reserve factors.

With a sweep service in place paying interest at the target rate, monetary policy operations could in principle be substantially simplified by supplying, via open market purchases, more reserves than the banking system wishes to hold. No bank would lend overnight funds in the market at less than the rate on our sweep service. And a bank in need of borrowed funds could always find a willing lender at a risk-adjusted spread over the sweep rate. The market funds rate thus would not rise above the sweep rate, except to reflect borrower-specific risk. The New York Fed staff would merely need to provide an amount of reserves that will be sufficient to oversupply the system with reserves and meet daylight settlement needs. But they would not need to estimate daily reserves positions as precisely as they do now, because a “miss” would rarely affect the funds rate.

It’s easy to think of interesting questions about how one would implement an idea like this. For instance, because of some peculiar accounting rules, banks’ overnight reverse repurchase holdings “uses balance sheet” and could require costly additions to capital for participating banks. If so, then even a rate equal to the target rate would not necessarily fully eliminate the opportunity cost of excess reserves. This and other interesting questions merit careful further analysis. But the proposal demonstrates my theme that central payment credit should be understood whenever possible in the context of the broader set of monetary arrangements in place. This, by the way, is a point that is made very cleanly by the Freeman model.

Conclusion

Let me conclude by emphasizing what I think are two key lessons from the theory of payments. First, understanding payments arrangements and the appropriate role of the central bank requires a clear understanding of private arrangements and private incentives in settings where the services (like payment clearing and settlement) involve multilateral benefits and shared costs. That is, models of payment behavior and analyses of payment policy should respect Baxter’s Dictum to evaluate effects on all parties to a payment arrangement. The Freeman Model, and other models derived from modern monetary theory are typically very diligent in this regard. Even so, it is hard in such models to identify imperfections that a central bank or other public entity is uniquely suited to resolve. As demonstrated by Green’s Theorem, pairing Baxter’s Dictum with a mechanism design approach makes clear the strong incentives that private agents have to find efficient arrangements, and this is the second lesson. The network nature of payments systems should not be taken to imply the existence of market failures when voluntary, multilateral arrangements are capable of incorporating all of the affected parties.

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