

7 The Financial Stability Motive, Interest Rate Smoothing, and the Theory of Optimal Seigniorage

Cukierman (1992), ch. 7, sections 1-4

7.1 Introduction

Central banks of some industrialized countries engage in short-term interest rate smoothing. This policy is particularly evident in the United States where the Federal Reserve normally gears monetary policy to reduce fluctuations in short-term nominal interest rates. Even Paul Volcker's successful monetary experiment, during which wider rates fluctuations were tolerated, did not produce a permanent shift to a nominal stock rule as advocated by monetarists in the United States. This is puzzling for several reasons, not the least of which is the fact that monetarists' prescriptions have proved to be effective in delivering price stability. The tendency to revert to a policy of interest rate smoothing seems to be rather tenacious and as old as the Fed. Thus Miron (1986) and Mankiw, Miron, and Weil (1987) report that there has been a substantial change in the behavior of interest rates after the establishment of the Federal Reserve in 1914. After 1914 interest rates became substantially more persistent. Moreover the Fed was widely expected to dampen fluctuations in interest rates. Goodfriend and King (1988) note that prior to the Fed's creation fluctuations in the monthly average call money rate on short-term broker loans exhibited much wider irregular and seasonal fluctuations. Donaldson (1989) finds that after the foundation of the Fed, violent spikes in interest rates during financial panics virtually disappeared.

This chapter reviews and contrasts two alternative hypotheses about the objectives of monetary policy and their positive implications for the behavior of interest rates. One is that the central bank is concerned about the stability of the financial system. It is willing therefore to compromise on the objective of price stability, particularly when the stability of this system seems to be threatened, in order to reduce the likelihood of instability. In economies with developed financial markets, various intermediaries normally commit to loan contracts that stretch over longer periods than the term for which deposits are committed to them. This makes them vulnerable to surprise increases in market rates, since in the short run such increases affect their cost of funds more quickly than their revenues from loans. When such increases materialize, the central bank injects liquidity into the economy in order to reduce the resulting threat to the stability of the financial system. This moderates temporarily the increase in interest rates. Conversely, when market rates unexpectedly go down, the profits and stability of banks and other intermediaries go up. At such times the

central bank mops up some of the liquidity previously injected into the economy because it is also concerned with price stability. These reactions of the central bank to both upward and downward movements in interest rates dampen fluctuations in interest rates. This theory of interest rate smoothing seems to be particularly relevant for the Fed. But it is likely to be relevant also for the central banks of other countries with wide financial markets.

The other hypothesis surveyed, with particular attention to its implications for interest rates, is the *theory of optimal seigniorage*. It states that monetary policy is dominated by optimal public finance considerations in which the revenue motive from chapter 4 plays a central role. Revenues from seigniorage entail, like any other tax, deadweight losses. Hence monetary policy is conducted so as to minimize the discounted present value of deadweight losses from regular taxes and seigniorage subject to the constraint that a certain (fluctuating) level of public expenditures is financed. Provided the marginal social costs of both regular taxes and seigniorage are increasing, this hypothesis implies that seigniorage, and therefore inflation, should be positively related to the relative size of regular taxes. In the long run nominal interest rates and inflation are positively related because of the inflation premium in nominal rates. Hence the optimal seigniorage theory implies that nominal rates should be positively related to the relative size of regular taxes. Mankiw (1987) uses this implication of the theory to test it.¹ Another implication of the theory is that nominal rates and inflation should be positively related to the relative size of government.

Section 7.2 presents an overview of the hypothesis that interest rate smoothing arises as a by-product of the central bank's attempt to optimally trade off the costs of financial instability and the costs of price instability. The argument is developed in more detail in the subsequent two sections. Section 7.5 presents an overview of the optimal seigniorage theory and its implications for the behavior of nominal rates. The two hypotheses are compared and contrasted in section 7.6. This is followed by concluding remarks.

7.2 The Financial Stability Motive as an Explanation for Interest Rate Smoothing²

This section presents an overview of a positive explanation for the tendency of some central banks such as the Fed to smooth interest rates. The

explanation relies on two presumptions. One is that the central bank (CB) is concerned about the stability of the financial system as well as about price stability. The other is that banks commit to loan contracts that normally stretch over longer periods than the term for which deposits are committed to them. There is little doubt that the Fed is concerned about the stability of the financial system in general and that of the banking system in particular. The Fed has been founded to a large extent in order to avoid financial crises (Mankiw, Miron, and Weil 1987). Its charter makes it responsible for averting such crises and it is widely expected to do so by Congress and the public. The concern of the Fed with financial stability is consistent with general economic welfare; financial crises that are allowed to develop retard capital formation, thereby reducing real output (Bernanke 1983). As a bureaucracy the Fed may reasonably be expected to dislike the risks of banking failures sometimes even more than adverse general economic conditions such as unemployment. After all, the responsibility for the banking system is in the Fed's "own courtyard" while the responsibility for high unemployment is naturally shared by other policymaking institutions such as the fiscal authority. Brimmer (1989) makes a persuasive case that on various occasions the Fed's policy was geared mostly to safeguard the stability of the financial system.

The second presumption relies on the traditional function of banks, which is to transform short-term liabilities into longer-term loan assets. Although some variable rates loans have recently developed, a large fraction of loans in the United States specifies a fixed loan rate and volume in advance for the period of the loan.³ Many deposits, on the other hand (e.g., demand deposits, short-term money market accounts, and large certificates of deposit), have more flexible terms both with respect to maturity⁴ and return. This asymmetry is probably due to the fact that the fundamental service provided by banks on both sides of their balance sheet is liquidity. On the side of assets (loans), liquidity is provided by giving the borrower an advance unconditional assurance for the loan terms. On the side of liabilities (deposits), liquidity is provided by letting customers use their funds on demand. Another possible reason is that loan markets are more influenced by customer-specific considerations than deposit markets.⁵ In this chapter we take the asymmetry in the contract provisions of loans and of deposits as given, and explore the implications of its existence for the behavior of the central bank.

The advance commitment of banks to loan terms makes them vulnerable to changes in the conditions of financial markets after they have

committed their funds. For example, if after loan contracts have been made, there is an unexpected decrease in the aggregate supply of deposits, banks lose reserves and incur higher marginal costs of illiquidity.⁶ To correct this situation, each individual bank tries to regain deposits by raising its deposit rate. Since all banks do that, there is a general increase in the total cost of funds to banks and a decrease in the profits of the banking industry. The squeeze in profits is amplified by the fact that rates rise on the entire stock of deposits after loan rates and quantities have been preset. This in turn increases the likelihood that some relatively weak banks will fail. Since the CB is concerned about the stability of the banking system, it has interest in counteracting the increase in the likelihood of banking failures. Provided the price level is temporarily fixed, the CB can temporarily offset the decrease in banks' profits by stepping up the rate of increase in reserves. This action decreases banks' demand for deposits and dampens some of the increase in the rate of interest paid on deposits, thus offsetting at least some of the increase in the risk of banking failures. However, the higher rate of reserve expansion is also costly from the point of view of the CB, since after a while it leads to a larger rate of inflation. Hence, when the cost of funds to banks unexpectedly goes down, increasing bank's profits and decreasing the likelihood of failures, the CB puts more emphasis on the stability of the general price level and decreases the rate of growth of base money. In the short run this action dampens the initial decrease in the cost of funds to the banking industry.

Thus interest rate smoothing by the central bank arises as a by-product of the bank's attempt to minimize some combination of the risks of financial instability and of the costs of inflation. The central bank directs policy mostly to increase the soundness of the banking system when the risks of financial instability are relatively high. It focuses mostly on maintenance of price stability when profits in the banking industry are high and the risks of failure therefore relatively low. Since, owing to the asymmetry in the structure of their contracts, bank's profits are negatively related to the level of interest rates in the short run, the central bank's actions result in interest rate smoothing.

The concern of the Fed and other central banks for the profits of the banking industry may also be due to captive regulator elements. But since the weight given by the central bank to the profits of the banking industry may reflect its concern for financial stability or its concern for banks' profits, or both, the two hypotheses are observationally equivalent. What-

ever the motives of the Fed for caring about banks' profits, it is pretty clear that banks dislike large unexpected swings in interest rates, particularly if they are upward. Wooley (1984, p. 228, n. 10) reports, based on the Federal Advisory Council (FAC) minutes, that at the February 1969 FAC meeting the council advised the board that "the principal thesis of the Council's thinking was that bankers would accommodate to almost any policy of restraint when it was applied gradually, but that sudden twists caused serious dislocations."⁷ Wooley (p. 72) further notes that during the 1970s many banks became vulnerable to increases in interest rates "because sharp upward movements in interest rates force banks to buy money at rates higher than they have loaned it. Vulnerability of this sort seems, in fact, to be highest for the big multinational banks some observers suspect of being the Federal Reserve's closest friends."

7.3 Central Bank Behavior and the Structure of the Financial Sector

Both by law and custom a self-acknowledged goal of the Federal Reserve is the preservation of the stability of the financial system in general, and that of the banking system in particular (see, e.g., *Federal Reserve Bulletin*, July 1984, p. 548). The financial stability objective is more likely to be attained the higher the profits of the banking system. This statement is particularly relevant if the CB does not know the realizations of idiosyncratic shocks across individual banks. The profits of a single bank can be decomposed into a component that is common to all banks and into a component that is specific to the individual bank. If the common component of profits is large, even banks with particularly adverse realizations of the idiosyncratic shocks will be solvent, but if the common component of profits is small, even banks with moderately adverse idiosyncratic shocks will run into difficulties.⁸ Thus the higher the profits of the banking system, the smaller is the probability of a serious financial crisis. If the Fed values financial stability, it should, *ceteris paribus*, prefer a state of nature with higher profits in the banking industry to a state with lower profits. However, as total profits increase further, the incremental contribution to financial stability most probably diminishes. We will model those features by postulating that one component of the objective function of the central bank is a function $f(\pi)$ that increases in the profits π of the banking industry but at a decreasing rate. In addition, as noted in chapters 3 through 5, the central bank dislikes inflation. Thus the entire objective

function of the central bank can be stated as

$$-\frac{1}{2}(\ln P_{t+1} - \ln P_t)^2 + g f(\pi_t), f'(\cdot) > 0, f''(\cdot) < 0. \quad (7.1)$$

Here $\ln P_{t+1} - \ln P_t$ is the rate of inflation between period t and period $t + 1$, π_t are the profits of the banking industry in period t , and g is a positive parameter that measures the relative concern of the central bank for financial stability versus price stability. This formulation reflects a basic externality that is internalized by the CB. Each bank cares only about its own profits, but the CB cares about the profits of the entire industry because of the connection between this aggregate and financial stability. To focus on the consequences of the interaction between the central bank and the private banking system in isolation, we abstract from the employment, the revenue and the balance-of-payments motives for inflation.⁹

The CB picks the rate of growth of high-powered money μ_t subject to the structure of the economy so as to maximize the objective function in equation (7.1). To formulate this decision of the CB, it is necessary to specify the structure of the economy. This is our next task. To simply capture the fact that loan contracts are less flexible than the contracts governing banks' deposits, we postulate that each bank determines the quantity of one-period loans and their price at the beginning of each period for the period. This commitment is made before any shocks occur that affect the economy and the banking system during the period. But the volume and cost of deposits are determined within the period after the shocks occur. We refer to the preshocks equilibrium as the *ex-ante equilibrium* and to the equilibrium that determines variables, which are free to adjust after shocks occur, as the *ex-post equilibrium*. The shocks considered affect the supply of deposits to the banking system, the excess demand for bonds, and the demand for loans. These shocks, denoted ε_d , ε_b , and ε_l , respectively, are specified as white noises with zero means.

Suppose that there is an economywide short-term bond market. The (real) bond rate r_t is determined through market clearing after the occurrence of the various shocks that affect the economy. Bonds can be purchased by private banks as well as by the general public. Banks choose their bond portfolios after the occurrence of stochastic shocks within the period. To maintain the complexity of the model at a manageable level, we assume that bonds are traded only once within a period after the shocks occur. Furthermore only one-period bonds that mature just prior to trade in bonds in the next period are considered. This specification abstracts from the function of bonds as secondary liquidity. But it does account for the

tendency of banks to reduce their bond portfolios when they lose reserves, thus bringing out part of the function of bonds as secondary reserves¹⁰ as well as the effect of reserve losses on bond market equilibrium.

In addition to the interest it pays on deposits, the individual bank incurs various costs that are associated with illiquidity. Those costs increase at an increasing rate with the degree of the bank's illiquidity, which is measured in turn as the difference between the required reserves of the bank and its actual level of reserves. These costs generally induce banks to demand a positive level of reserves. The supply of reserves is determined by the CB after the occurrence of shocks. It bears repeating that in making this choice, the CB attempts to maximize its objective function in equation (7.1).

Prices of goods and services are relatively more sticky than the prices of highly liquid financial assets (Dornbusch 1976). To capture this element, we assume that the general price level is determined prior to the occurrence of shocks (and the choice of μ by the CB) in a manner that is designed to clear the market for bank reserves in an ex-ante sense.¹¹

The ex-post equilibrium determines r_b —the real rate paid on deposits—and the demands for bonds by the banking system and the public as functions of the shocks. The (contractual) variables determined at the beginning of the period in the ex-ante equilibrium are the volume and price of loans and the general price level. Each bank decides how much credit to extend and how much to charge for it so as to maximize expected profits. In doing that, it takes the actions of other banks and its expectation about the upcoming ex-post equilibrium as given. In the ex-post equilibrium each bank chooses the real rate it pays on deposits and the amount of bonds it holds so as to maximize its profits after the occurrence of shocks and after the choice of policy for the period by the CB. In doing that, the individual bank takes the actions of other banks and the market-clearing value of the real bond rate as given.

In summary, the general price level, the price of loans, and the volume of loans are determined in the ex-ante equilibrium by the ex-ante clearing of the market for reserves, the individual bank's first-order condition with respect to the real price of loans, and the demand for loans. The bond rate, the rate paid on deposits, and the volume of deposits are determined in the ex-post equilibrium by the clearing of the bond market, the individual bank's first-order condition with respect to the deposit rate, and the supply of deposits.

Given the number of banks the symmetric Cournot-Nash ex-ante and ex-post equilibria imply that the aggregate profits of the banking system are a decreasing function of the real bond rate r_b . A derivation of this result and related details appear in Cukierman (1990, sec. 3). For our purposes it suffices to present the intuitive reason for this result. An increase in the bond rate induces two opposing effects on the profits of the banking industry. On the one hand, there is an increase in the return on the bond portfolio and a related upward adjustment in the quantity of bonds held by each bank, both of which tend to increase the profits of banks. On the other hand, the more lucrative bond rate causes an intensification of the banks' competition for funds and results in an increase in the deposit rate on the entire stock of deposits. This market effect reduces the profits of the banking industry. If banks had not previously committed a large part of their funds to loans, they would have increased their investment in the bond market by decreasing the amount of loans offered to customers as well as by increasing the loan rate. However, the previously made commitment to a certain level of loans limits the banks' ability to take advantage of the better bond market opportunities. The larger this commitment, the more limited is the ability of banks to increase their bond portfolio because of increasing costs of illiquidity. This limitation is reflected through the fact that the total amount of earning assets of a bank (loans + bonds) is limited by a constant that depends on r_b and on the shock to the demand for deposits. Thus the ability of banks to take advantage of the more lucrative bond rate is limited by past commitments of funds. However, the increase in the deposit rate increases the cost of all funds, including those that are needed to fulfill the obligation to previously contracted loans. As a consequence the negative market-induced effect of an increase in r_b on profits dominates the direct positive effect.

Within the period the CB can temporarily reduce the (real) bond rate by increasing the supply of reserves through open market operations. This ability originates from the fact that the price level has been predetermined by the ex-ante equilibrium.¹² It vanishes once the price level is readjusted at the beginning of the following period. The equilibrium bond rate is also obviously negatively related to the shock ε_b , to the excess demand for bonds. These two facts are summarized in equation (7.2):

$$r_b = r(\varepsilon_b, \mu), \quad \frac{dr(\cdot)}{d\varepsilon_b} < 0, \quad \frac{dr(\cdot)}{d\mu} < 0. \quad (7.2)$$

The effects of r_b and of the shock ε_d to the supply of deposits on the profits of the banking industry are summarized in equation (7.3):

$$\pi = \pi(\varepsilon_d, r_b), \quad \frac{d\pi(\cdot)}{d\varepsilon_d} > 0, \quad \frac{d\pi(\cdot)}{dr_b} < 0. \quad (7.3)$$

The positive effect of ε_d on bank's profits is due to the fact that a rise in the supply of deposits reduces the equilibrium cost of funds to the banking system. The negative effect of r_b on profits has been discussed above.

It is shown in Cukierman (1990) that since the price level is determined at the beginning of each period, the CB problem in equation (7.1) can be reformulated as¹³

$$\max_{\mu_t} \left(-\frac{1}{2} \mu_t^2 + gf[\pi\{\varepsilon_{dt}, r(\varepsilon_{bt}, \mu_t)\}] \right). \quad (7.1a)$$

This restatement emphasizes the basic intraperiod trade-off confronting the central bank. It may, if it wishes, increase the profits of the banking system by stepping up the rate of nominal reserve creation μ_t . Such a policy increases the profits of banks by decreasing the bond rate and decreases the probability of financial failures. This is a benefit for central bank objectives. But an increase in the rate of reserve creation also increases the rate of inflation between the current and the next period, and that is a cost. The choice of μ_t involves weighing the benefits of increased financial stability against the costs of higher inflation. The first-order condition for an internal maximum of (7.1a) is

$$F_{\mu} \equiv -\mu_t + gf'(\pi_t) \frac{d\pi(\cdot)}{dr_{bt}} \frac{dr(\cdot)}{d\mu_t} = 0. \quad (7.4)$$

Since $d\pi_t(\cdot)/dr_{bt}$ and $dr(\cdot)/d\mu_t$ are negative, the first-order condition in (7.4) implies that the rate of reserve creation by the central bank is positive for every possible realization of the intraperiod shocks. Thus central bank concern for the stability of the banking system creates an inflationary bias similar to the one produced by the employment motive (chapter 3).¹⁴

7.4 The Trade-off between Financial Stability and Price Stability as an Inducement for Interest Rate Smoothing

We saw in the previous section that an unexpected intraperiod decrease in the demand for deposits, an increase in the bond rate due to an upward

shock to the supply of bonds, or a downward shock to the demand for bonds decreases the profits of the banking industry. When profits are lower, bank failures are more likely, and thereby the marginal value to the CB of an incremental increase in the profits of the banking industry is larger. The CB is then more willing to tolerate larger increases in bank reserves, even if they increase the rate of inflation, provided that the decrease in profits is attenuated.

The CB can dampen the short-run decrease in banks' profits by stepping up the rate of reserve creation, which would decrease the bond rate and the deposit rate. The CB's tendency to follow such a policy is stronger when unanticipated shocks to financial markets raise the bond rate and the deposit rate and concurrently decrease profits. In this view the CB has no long-term concern about the *level* of interest rates. However, because of the short-run negative correlation between the bond rate and the profits of the banking industry, the CB at least partially offsets unanticipated increases in interest rates in order to dampen the adverse effect that such increases have on the profits and the stability of the banking system. This implication is consistent with the view expressed by the U.S. Federal Advisory Council regarding what private banks are likely to tolerate (see section 7.2).

Conversely, when unanticipated shocks decrease interest rates and increase the profits of banks, the value to the CB of further increases in profits is diminished. It therefore puts more emphasis on reducing the rate of inflation by lowering the rate of reserve creation below its mean value. As a result the decrease in interest rates is not as large as it would have been without an active policy on the part of the CB.

In effect the central bank smoothes short-run fluctuations in real rates.¹⁵ When shocks push rates unexpectedly above their previously expected level, the bank steps up the rate of reserve creation and dampens the increase in rates. When shocks decrease rates below their previously expected level, the bank slows down the rate of reserve creation and dampens the decrease in rates. Strictly speaking, this smoothing result requires that the number of banks not be too small and/or that the index

$$\theta \equiv \left| \frac{f''(\pi)}{f'(\pi)} \right| \quad (7.5)$$

in the CB objective function be sufficiently large. Readers familiar with the theory of expected utility will recognize that θ is a coefficient of absolute

risk aversion. In the present context it measures how quickly the marginal contribution of additional profits to banks' stability diminishes with the level of profits of the banking industry. It can also be interpreted as reflecting how quickly the marginal "utility" of the CB from further increases in banks' stability decreases with additional increases in stability. It obviously may reflect a mixture of both elements. The first element is determined by the structure of the economy, while the second depends on the preferences of the central bank. We refer to θ as the index of aversion to instability remembering that it is in general affected by both the structure of the economy and the preferences of the central bank. The higher the θ , the quicker is the decrease in the marginal utility of profits because of the combined effects of further profits on stability and of more stability on the objectives of the central bank. The following propositions summarize the main qualitative results:

PROPOSITION 7.1 For a sufficiently large number of banks and/or a sufficiently large index of aversion to instability the central bank decreases the rate of growth of reserves when the intraperiod excess demand for bonds ε_b increases.

PROPOSITION 7.2 For a sufficiently large number of banks and/or a sufficiently large index of aversion to instability, the central bank responds to an unanticipated increase in the demand for deposits ε_d by slowing down the rate of reserves' expansion.

The propositions are demonstrated, by means of comparative statics, in Cukierman (1990, sec. 6). They do not state the smoothing result directly. But it nevertheless is a corollary of these propositions. This can be seen by noting that a decrease in ε_b or in ε_d raises the bond rate and reduces the profits of the banking industry. The propositions imply that the central bank reacts to such increases by stepping up the rate of reserves' creation, which pushes the bond rate in the opposite direction.

In general the CB responds to a combination of the shocks ε_b and ε_d . If the realization of shocks changes profits in a given direction, the CB responds by altering the rate of change of reserves so as to move the bond rate in the same direction. Since, in the absence of intervention, profits and the bond rate are negatively correlated, the CB acts on average to dampen fluctuations in r_b . Stated somewhat differently, the effects of ε_b and of ε_d on r_b through the CB response function are opposite in sign to the direct effects of those shocks on r_b .

Since the price level is sticky within a period, the rate of inflation is equal to the rate of increase in high-powered money μ . (Details appear in Cukierman 1990, sec. 5.) It follows from the first-order condition in equation (7.4) that expected inflation is

$$E\mu = gE f'(\cdot) \frac{d\pi(\cdot)}{dr_b} \frac{dr(\cdot)}{d\mu} > 0. \quad (7.6)$$

Since all shocks are transitory, the right-hand side of equation (7.6) is a constant. This reflects the (financial stability-induced) average inflationary bias of the CB. The nominal bond rate in period t is therefore

$$n_{bt} = r_{bt} + E\mu. \quad (7.7)$$

Hence the nominal bond rate is equal to the real bond rate plus a positive constant. It follows that the central bank's response to shocks induces smoothing of short-term nominal as well as of real rates.

To this point the analysis was based on the assumption that the entire volume of loans is predetermined before the realization of shocks during the period of the loan. In practice part of banking credit takes the form of credit lines in which borrowers are free to determine the actual amount borrowed, up to a predetermined ceiling, after the realization of shocks (Brady 1985). To examine the robustness of the smoothing result to the presence of credit lines, consider the other extreme case in which all loans take the form of credit lines. In particular suppose that the loan contract requires banks to passively accommodate any intraperiod changes in the demand for loans at the rate that was preset at the beginning of the period.

The main novelty in this reformulation is that now the profits of the banking industry also depend on the shock ε_t to the demand for loans. An unexpected positive ε_t induces banks to passively substitute loans for bonds in their portfolios, causing an increase in the costs of illiquidity and a rise in the bond rate. If the loan rate is equal to or smaller than the bond rate, the effect on banks' profits is unambiguously negative. If the loan rate is larger than the bond rate, an unexpected increase in the demand for loans generally has an ambiguous effect on the profits of the banking system. On the one hand, profits are squeezed, as in the previous case, because of the increase in the bond rate brought about by the larger demand for loans. On the other hand, since the loan rate is larger than the bond rate, a substitution of loans for bonds increases profits. However, for

a sufficiently large number of banks the negative effect on profits is likely to dominate. (Details appear in Cukierman 1990, sec. 8.) Hence in either case an unexpected rise in ε_t increases the bond rate and reduces banks' profits and the stability of the financial system.

The central bank responds to the increased demand for credit by increasing the rate of reserve's creation. It offsets at least partially the upward effect of this increased demand on the bond rate. The bank's attempt to preserve the profits of the banking industry within a "reasonable range" induces it to accommodate changes in credit demand, raising reserves more when demand for credit increases and lowering their rate of expansion when the demand for credit diminishes.

In summary, the major result that the central bank smoothes fluctuations in interest rates extends to the case in which credit is allocated to customers via credit lines. In fact the presence of credit lines enables the bank to smooth fluctuations in interest rates that are due to shocks to the loan market as well as to shocks to the bond and deposit markets. Since shocks to the demand for credit are positively correlated with the cycle, the procyclical response of reserves growth is amplified by the existence of credit lines.

An interesting implication of the theory concerns the effect of an increase in the supply of government bonds on the policy of the CB. The policy response of the CB differs depending on whether the increased supply of bonds has been anticipated at the time loan contracts were made. If it had been anticipated, its consequences would have been built into the price level and loan contracts. In such a case an increase in the supply of bonds by government does not trigger any reaction by the CB. Consider alternatively the case in which the increased supply of bonds has been unexpected at the beginning of the period. Such a change is equivalent to a negative realization of the excess demand for bonds shock ε_b . Since such a shock temporarily reduces banks' profits and their stability, the CB reacts by stepping up the rate of monetary expansion. Hence an unanticipated increase in a bond-financed budgetary deficit triggers increased monetization by the monetary authority. But when the increase is anticipated, the CB does not monetize. Thus the concern of the CB for the stability of the financial system does not imply that budgetary deficits that were widely known in advance will be monetized.