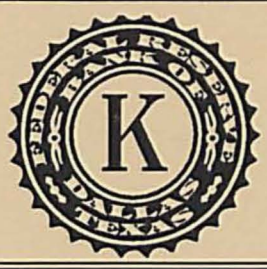

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Price Stabilization, Output Stabilization and Coordinated Monetary Policy Actions

by

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Federal Reserve Bank of Dallas

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Price Stabilization, Output Stabilization and Coordinated Monetary Policy Actions

Joseph H. Haslag*

Abstract: This paper examines the effects that monetary policy actions have on prices and output when the monetary authority uses open market operations in conjunction with changes in reserve requirements. Both anecdotal and empirical evidence suggest that the Fed uses open market opertions to accommodate changes in the reserve requirements. In this paper, I derive separate accommodation schemes in which the monetary authority stabilizes prices and stabilizes output. The paper, thus, describes what the monetary authority can accomplish by coordinating their policy actions. Furthermore, the description may be helpful in terms of judging past monetary policy behavior.

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1. Introduction

Monetary policy has three tools--open market operations, discount window borrowing, and changes in reserve requirements--through which it can change the quantity of monetary base. In this paper, I analyze the effects associated with using two of these tools simultaneously. In particular, I am interested in studying how changes in reserve requirements interact with open market operations.

Does the Federal Reserve routinely coordinate changes in reserve requirements with open market operations. The answer is apparently yes.[1] Muelendyke (1992, p.3) asserts that the Federal Reserve uses open market sales, for example, to accommodate the decrease in the demand for (required) reserves associated with lower reserve requirements. Haslag and Hein (1993) find that a 1-percentage-point increase in monetary base growth contributed by lowering reserve requirements is systematically matched by a decrease of less than 1-percentage-point in the contribution by high-powered money to monetary base growth. Dwyer and Saving

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[1] Another issue is whether changes in reserve requirement ratios occur frequently enough to examine the effcts of coordinated policy. Haslag and Hein (1993) find that reserve requirement ratios were implemented in 48 of the 372 months between January 1960 and December 1990. The frequency with which the Federal Reserve changes reserve requirements over this time period, therefore, is approximately once every eight months. The 1960-1990 period includes the Monetary Control Act of 1980 which specified a phasing-in of reserve requirment changes for member and non-member depository institutions. While this certainly inflated the frequency of changes in reserve requirements, it does not diminish the need to study the effects of coordinated monetary policy actions since the Fed routinely accommodated such mandated reserve requirement changes during the 1980s.

(1986) provide some theoretical motivation for coordinating changes in reserve requirements and open market operations. In their model, the monetary authority has a seignorage revenue target. Holding the seignorate revenue target constant, if the monetary authority lowers reserve requirements then the growth rate of high-powered money declines.

The main contribution of this paper is an investigation into the effects that coordinated monetary policy actions have with respect to prices and output. The proportion to which the monetary authority accommodates the percentage change in reserve requirements with a percentage change in high-powered money is defined as an accommodation scheme. The question addressed here is whether accommodation schemes exist such that coordinated monetary policy actions yield either zero change in the price level or zero change in output. (Here, zero change or stabilization refers to a case in which policy actions do not result in changes relative to the existing steady-state.) The findings reported here are useful insofar as one cares about the implications of such accommodation schemes, which are part of the Fed's tool kit. As such, the results provide some basis for interpreting the Fed's historical behavior.

The main findings presented in this paper are essentially proofs that two accommodations scheme exist, one in which the price level is stabilized and one in which output is stabilized. I show that the price level is stabilized when the monetary authority fully accommodates changes in reserve requirements.

Output stabilization is achieved with a partial accommodation In addition, the implications the money multiplier and capital are also derived. Thus, the findings imply that coordinating monetary policy actions can stabilize either prices or output, but not both simultaneously.

The model economy specified here is a simple overlapping generations model. Agents are forced to hold part of their deposits in the form of fiat money balances--the reserve requirement. This assumption resolves the problem present when other stores of value, such as government bonds, offer higher rates of return.

Two features of the overlapping model drive the results in this paper. The fact that the monetary authority can stabilize prices does not depend on the model specification. However, the type of the accommodation scheme--perfectly accommodating changes in reserve requirements--is a property of the model. Specifically, the overlapping-generations model yields a money demand specification that is linear in the reserve requirement ratio. In a more general money demand function, matching the change in reserve requirement percentage-point-for-percentage-point with changes in high-powered money would not result in zer change in the price level. The way to interpret my results is as a special case, not as a necessary condition for stabilizing prices.

The second assumption is neccessary in this model for the existence of an accommodation scheme to stabilize output. I

assume that nominal government bonds are net wealth. I further assume that the monetary authority determines the government's debt burden through open market operations. In other words, open market purchases are equivalent to retiring an equal amount of the government's debt burden. The effects of coordinated monetary policy actions, in terms of stabilizing output, depends crucially on open market operations affecting the size of agent's net wealth in this non-Ricardian set-up.

The paper is organized as follows. Section 2 briefly reviews the literature on the effects of changes in reserve requirements considered in isolation. Section 3 describes the model. The accommodation schemes necessary to achieve price stabilization and output stabilization are derived in Section 4. The results are briefly summarized in Section 5.

2. Literature Review

Studies looking at the effects of reserve requirements have generally focused on two issues. One strand of literature has developed focusing on the effects that reserve requirements have on economic activity. The other strand has examined the welfare implications of reserve requirements.

Baltensperger (1982) and Horrigan (1988) exemplify the strand in which reserve requirements affect economic activity. In both papers, the focus is on whether the presence of reserve requirements stabilizes the demand for money and economic activity. In this literature, comparisons are typically made

between 0 percent and 100 percent reserve requirement cases. For example, Baltensperger finds that a 100 percent reserve requirement does not necessarily result in lowering the variance of output compared with a 0 percent reserve requirement. Horrigan demonstrates that reserve requirements can reduce output variability. Horrigan also finds that the reserve requirement is irrelevant in an interest-rate targeting regime.

The second strand in the literature focuses on the welfare implications of reserve requirements. Freeman (1987) shows that when reserve requirements are combined with inflation, welfare is lower. The optimal setup is one in which the reserve requirement ratio is zero and inflation is infinite. Russell and Mourmouras and Russell (1992) generalize Freeman's motivation for holding fiat money. They find that the welfare implications are ambiguous in a more general structure. Hence, a non-zero reserve requirements may be optimal. Cothren and Waud (1991) argue that a positive reserve requirement can yield higher utility than an economy with free banking. In Cothren and Waud's model, reserve requirements raise are (weakly) Pareto dominant to a case without reserve requirement because the reserve requirement lowers search costs.

A paper more closely related to this one is Romer (1985), in which the effects of that changes in reserve requirements are examined; specifically the effects on the price level, interest rates, and inside money. Romer finds that changes in reserve requirements do not change the price level. Hence, the Fed does

not need to accommodate changes in reserve requirements in order to stabilize prices. In addition, Romer finds that deposits (inside money) is positively related to changes in reserve requirements when the Fed does use open market operations in conjunction with changes in reserve requirements.

This paper deviates from the the first two strands of literature in the sense that (i) I do not examine the welfare implications of the reserve requirement and (ii) I examine changes in reserve requirements, but do not compare a case in which requirements are present to a case in reserve requirements are present. Instead, the paper is more closely associated with Romer's work, extending the analysis to consider joint monetary policy actions and to examine the output implications of such policy actions.

3. The Model

The model adapts Cass and Yaari's (1966) version of the overlapping-generations model of Samuelson (1958). Agents carry over money balances, capital, and government bonds from the first period to the next in order to consume in the second period. Returns offered by both bonds and capital (which, for simplicity, are perfect substitutes) strictly dominate money balances. The model modifies Freeman (1987) in that agents are required to hold a fraction of their deposits as money balances, representing a "reserve requirement."

3.1 Agent's Characteristics

Agents live two periods. In each period $t \geq 1$, N_t agents are born (the young generation), coexisting with those born in the previous period (the old generation). The population grows at the (positive) constant gross rate n, so that $N_t = nN_{t-1}$. At time $t = 1$, there are N_0 members of the old generation.

Each young agent maximizes the utility function represented as $U(c_1, c_2)$, where c_i denotes consumption in the i th period of the agent's life. We assume that the utility function is twice-continuously differentiable, strictly concave, and strictly increasing in both c_1 and c_2. (For those old agents at time $t = 1$, utility is an increasing function of consumption.) In addition, we assume that $U_1/U_2 \to 0(\infty)$ as $c_1/c_2 \to \infty(0)$, where U_i is the marginal utility with respect to the consumption in the i th period of the agent's life.

3.2 Production

Each agent is endowed with one unit of labor when young and nothing when old. People in the young generation supply labor inelastically. Capital is created from the unused consumption good at a one-for-one rate, combined with labor in the next period to produce aggregate output, denoted y. However, I assume that capital cannot be created from less than κ units of the consumption good where $\kappa > y$. Each unit of capital created in period t will produce x units of the consumption good in period

t+1.[2] I assume that $x > n$. The capital stock is completely depreciated when the production process is finished.

3.3 Financial Environment

With $\kappa > y$, agents must pool their savings in order to obtain the higher return offered by capital. Similarly, government bonds are issued in units too large for isolated individuals to purchase. Agents, however, can form "intermediaries" that pool enough savings to overcome the minimum size restriction on capital and bonds. We refer to the pooled savings as deposits, denoted D. Financial intermediation is assumed to be costless and competitively provided. A fraction of these intermediated deposits are held in the form of high-powered money, which can be thought of as non-interest bearing currency.[3]

The old agents in period $t = 1$ are endowed with M_0 units of fiat money, consisting of unbacked, intrinsically useless pieces of paper that are costlessly produced. Money supply increases

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[2] Rebelo (1991) examines the long-run effects of fiscal policy, using a linear production technology similar that used in this paper. Growth is endogenous in the sense that exogenous shocks to productivity or population growth are not required for the path of output growth to change. Note also that the production technology follows Diamond (1965) in the sense that capital goods are not productive until the following period. Thus, whatever happens to the capital stock in period t shows up as an output response in period t+1. Hence, one should interpret x as the gross real return on capital.

[3] Becuase of the rate of return dominance, currency holdings in this model are more closely associated with vault cash. A more general framework would generate a need for currency and deposits to be held simultaenously. The mainf feature of this general framework would be that money demand is not a linear function of reserve requirements.

according to the following rule: $M_t = \theta_0 M_{t-1}$, for each $t \geq 1$.

3.4 Government

Expansion of the fiat money supply is used to purchase g units of the consumption good per young person by the government. The goods collected by the government through the expansion of the money supply do not affect the utility of individual agents. The government collects a lump-sum tax (or equivalently, a labor income tax) of τ units of the consumption good from each young person. Government expenditures can also be financed via nominal denominated debt worth B units of fiat money. Government expenditures are on the consumption good and interest payments to holders of government debt. Formally, the government's budget constraint is represented as follows:

$$(1) \qquad N_t p_t g_t + xB_{t-1} = N_t p_t \tau_t + B_t + (M_t - M_{t-1})$$

where p is the price of goods in units of fiat money.

I further assume that when the monetary authority conducts open market operations, the government debt burden to the members of the young generations changes. In short, open market sales (purchases) are associated with increases (decreases) in B_t. This assumption is motivated by the fact that the Federal Reserve returns most of its profits to the Treasury. Whatever interest or capital gains earned by the Fed are routinely given back to the Treasury. This characterization suggests that Fed ownership of Treasury debt is equivalent to retiring government debt

burdens.

3.5 Stationary Equilibria

Throughout the paper we will focus our attention on equilibria in which the economy's total desired capital stock exceeds the minimum size restriction; that is, $k_t > \kappa$.[4] The stationary equilibrium in this economy is easy to characterize. Let r denote the gross rate of return on savings and s is the savings of an agent. Then an agent chooses s to maximize $U(c_1, c_2)$ subject to $y = c_1 + s$ and $c_2 = r^*s$. Saving, the difference between income and consumption when young, is formally described as

$$s_t = k_t + b_t + \gamma D_t, \tag{2}$$

where γ is the reserve requirement ratio and D denotes the real stock of intermediated deposits. This specification differs slightly from Freeman's in that he applied reserve requirements to total savings. Here, reserve requirement are applied only against deposits. This change primarily affects the algebra, not Freeman's conclusions.

We define steady-state level of real money holdings as h. The market-clearing conditions for money balances and government

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[4] Champ and Freeman (1990) derive a closed-form dynamic representation for the capital stock. In that paper, the authors assume that utility is time separable and the second-period utility exhibits risk-neutrality. In addition, agents are assumed to hold a fixed real quantity of fiat money, whereas here fiat money is held as a fraction of intermediated deposits.

bonds are represented as

$$M_t = N_t p_t h$$

and

$$B_t = N_t p_t b_t.$$

One can rewrite the market-clearing condition for money, solving for the price level, $p_t = M_t/N_t h$. Thus, the gross real rate of return on fiat money equals

$$p_t/p_{t+1} = n/\Theta_0. \tag{3}$$

By assumption, $n/\Theta_0 < n < x$. Because the rate of return on bonds and capital dominate the rate of return on money, agents hold money balances up to the point where they are required.

By definition, $h = \gamma D$. We define $\bar{D}$ as the steady-state level of real intermediated deposits. Clearly, a steady state quantity of intermediated deposits implies as steady-state level of savings, denoted $\bar{s}$. From equation (2), we know that

$$k_t = \bar{s}/(1+\gamma) - b_t. \tag{4}$$

In addition, the money-growth rule and the steady-state level of real money balances per young person can be substituted into the (aggregate) government budget constraint. After dividing equation (1) through by $N_t p_t$, one gets

$$b_t = g_t + x/\Theta_0\, b_{t-1} - \tau_t - \gamma\bar{D}(1-1/\Theta_0). \tag{5}$$

Note that the last term on the right-hand-side in expression (5) is the real seignorage revenue per young person earned by the government.

Substituting equation (5) into equation (4) yields the following expression for capital

$$(6) \qquad k_t = \bar{s}/(1+\gamma) - [g_t + x/\theta_0\, b_{t-1} - \tau_t - \gamma\bar{D}(1-1/\theta_0)].$$

Equation (6) indicates that both the supply of money and reserve requirements affect the capital stock through their effects on real seignorage revenue per young person raised by the government. Each action also affects capital through separate channels: changes in the money stock affect the real interest payments on government bonds, while reserve requirements have a portfolio allocation effect which crowds out other types of saving.

4. Coordinated Monetary Policy

In this section, I focus on the effects that changes in reserve requirements and open market operations have on the steady-state equilibrium. Becuase we focus on steady-state comparisons, the analysis is simplfied to consider policy actions that are one-time, unanticipated changes.

Here, the term "perfect" accommodation describes the case in which the monetary authority uses open market operations to fully match the quantity of fiat money freed (absorbed) by lowering

(raising) reserve requirement ratios; formally, this case is defined as $d\gamma/\gamma = dM/M$. The main findings in the paper are presented in four propositions--two apply to the full accommodation scheme and two to a partial accommodation.

4.1 The full-accommodation case

Proposition 1: Changes in reserve requirements that are perfectly accommodated by open market operations have no effect on either the price level or the quantity of intermediated deposits.

Proof: The equilibrium condition for the money market is sufficient to demonstrate that prices do not change in response to such coordinated monetary policy actions. Substituting $h=\gamma D$ into the money market equilibrium condition, the elasticity of prices with respect to γ and M, respectively, is represented by the following pair of equations (time subscripts are omitted for convenience):

$$(7) \qquad dp/d\gamma(\gamma/p) = -[M(N\gamma\bar{D})^{-2}](N\bar{D})(\gamma/p) = -1$$

$$(8) \qquad dp/dM(\gamma/M) = [Np\gamma\bar{D}]^{-1}(M/p) = 1.$$

Together, equations (7) and (8) indicate that with $d\gamma/\gamma = dM/M$, the price level is unchanged. Thus, coordinating the same percentage-change in reserve requirements and fiat money results

in no change in the price level.[5]

Recall that the steady-state quantity of intermediated deposits (or inside money) is $\bar{D} = M_t/\gamma$. Clearly, with perfectly offsetting changes in reserve requirements and fiat money (in percentage-change terms), the ratio of fiat money to reserve requirements is unaffected. Hence, the steady-state quantity of intermediated deposits is not affected by perfectly coordinated monetary actions.

The intuition in proposition 1 is fairly straightforward. Changes in the reserve requirement ratio affect the demand for money. Thus, an decreased demand for fiat money associated with lower reserve requirements, for example, can be exactly matched by a decrease in the supply of fiat money without affecting the price level. The quantity of inside money is not affected because equal-sized changes in reserve requirements and fiat money do not neceessitate any crowding out of deposits.

The main implication of proposition 1 is that the monetary authority can perfectly accommodate changes in reserve requirements with changes in fiat money to stabilize movements in prices and the broader monetary aggregates. The effect of perfectly coordinated monetary policy action on output is described in the following proposition.

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[5] Note that Dwyer and Saving (1986) find that seignorage revenue is similarly unchanged in response to an the percentage-change in reserve requirements being accommodated by an equal-sized percentage change in government money.

It is also clear from equations (7) and (8) that the linear demand for fiat money drives the result that the perfect accommodation scheme has no effect on the price level.[6] In this specification, setting the percentage-change in reserve requirements equal to the percentage-change in fiat money supply will not affect prices. A more general money demand specification does not overturn the results in the sense that price stabilization can still be achieved through coordinated monetary policy actions. However, the accommodation scheme necessary to stabilize prices will, in general, not be of the type in which $d\gamma/\gamma = dM/M$.

Proposition 2: If the monetary authority lowers reserve requirements that are perfectly offset by open market sales, then the capital stock and output decline.

Proof: Proposition 1 indicates that the real quantity of intermediated deposits are unaffected by perfectly coordinated monetary policy actions. With lower reserve requirement ratios, fiat money is reduced by open market sales, more specifically, $-dM = dB$. Since selling debt raises the government's debt and with the quantity of intermediated deposits fixed, the increase

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[6] This is where this model really differes from Romer's. In Romer, the steady-state equilibrium for inflation is not a function of reserve requirements. In the case where the steady-state inflation rate is zero, the monetary authority does not need to accommodate changes in reserve requirements with open market operations in order to stabilize the inflation rate. In this model, the reserve requirement does affect the steady-state inflation rate.

in government bonds implies that the capital stock falls. Consequently, the decline in capital results in less output next period.

With prices constant, the full accommodation scheme is similar to Poole's (1970) interest-rate peg. The question, therefore, is whether the coordinated monetary policy actions keep the interest rate constant. Note that there are several interest rates present in this setup. However, one can be dismissed as trivial for a policy pursuit. Specifically, the marginal product of capital, is not very interesting because I assume a linear production technology. With capital and bonds as perfect substitutes, the return on government bonds is pegged independent of monetary policy. Of course, under a more general production technology (declining marginal products), the effect of the full-accommodation scheme on capital would be to drive down its real return. Since prices are fixed by fully accommodating changes in reserve requirements, such policy coordination is, in general, not consistent with pegging interest rates.

Alternatively, the monetary authority may target the agent's rate of return, represented as:

$$(9) \qquad r^* = \gamma(n/\theta_0) + (1-\gamma)x.$$

In a full-accommodation scenario, a one-time, permanent decrease

in reserve requirements, for example, implies a, one-time, permanent decrease in the stock of fiat money. Or, the permanent decrease in reserve requirements has an effect on the rate of change in fiat money, resulting in $\theta' < \theta_0$. Hence, coordinated monetary policy actions will result in a change in r^*. To show this point, differentiate equation (9) with respect to θ and γ (evaluated at $\theta=\theta_0$), which yields

$$(n/\theta_0 - x)d\gamma - \gamma n(\theta_0)^{-2}\, d\theta.$$

With $n/\theta_0 < x$ and $d\gamma < d\theta < 0$, this expression is negative. Thus, lowering reserve requirements, for example, will result in a higher return on agent's portfolios.

4.2 The partial-accommodation case

Proposition 3: There exists a unique coordinated action in which the monetary authority partially offsets lower reserve requirements with open market sales such that the price level rises and capital and next-period output are unchanged.

Proof: The existence of a partial accommodation scheme is demonstrated by first examining the effect of lowering reserve requirements without any offsetting open market operations. In this case, differentiating equation (6) with respect to γ yields the following:

$$(10) \qquad dk/d\gamma = -\bar{s}/(1+\gamma)^2 + \bar{D}(1-1/\theta_0).$$

With $\theta_0 > 1$ (the "initial" gross rate of money growth), the two terms in equation (10) opposite in sign. A decrease in reserve requirements, holding everything else constant, increases the proportion of the portfolio that could be used to purchase capital. This "crowding-out" effect is embodied in the first term. The second term indicates that a decrease in reserve requirements is associated with an decrease in real seignorage revenue, which decreases capital. I assume that the crowding-out effect dominates the seignorage-revenue effect so that lowering reserve requirements is associated with an <u>increase</u> in capital stock.

Changes in the fiat money stock are positively related to changes in the capital stock. A decrease in fiat money reduces real seignorage revenue, resulting in a lower capital stock. From proposition 2, we know lower reserve requirements that are perfectly accommodated are associated with a decrease in capital; that is, $dk/d\gamma < 0$. With the crowding-out effect dominating, lowering reserve requirements with zero accommodating results in greater capital; that is, $dk/d\gamma > 0$. What is yet to be proved is that partially accommodating lower reserve requirements with a decrease in the fiat money stock (relative to its normal rate of growth) will yield a zero change in output.

To complete the proof, it is necessary to show that $dk/d\gamma$ is

a continuous, decreasing function of the percentage-change in the fiat money stock accommodating changes in reserve requirements. I begin by defining a variable α as the proportion of the percentage-change in reserve requirements that is accommodated by the monetary authority. For example, when $d\gamma/\gamma = dM/M$ (where dM/M represents deviations from the "normal" growth rate of fiat money) the monetary authority perfectly accommodates changes in reserve requirements and $\alpha = 1$. Formally, let $\alpha \in [0,1]$, thereby eliminating cases in which the monetary authority so that the monetary authority excessively accommodates ($\alpha > 1$) or enhances ($\alpha < 0$). Furthermore, let $0'$ denote the growth rate of fiat money such that $\alpha = (0'-0_0)/d\gamma/\gamma$. From this representation, α is a continuous, increasing function of changes in the stock of fiat money balances relative to normal path. From equation (10), $dk/d\gamma$ is negatively related to changes in the growth rate of fiat money. Since the agent's utility function is twice-continuously differentiable, $dk/d\gamma$ is continuous. Thus, $dk/d\gamma$ is a continuous, decreasing function in α.

The main implication from proposition 3 is that the monetary authority can stabilize output and capital by only partially accommodating changes in reserve requirements with open market operations. The next proposition identifies the effect that a partial accommodation scheme has on the price level and intermediated deposits.

Proposition 4: Suppose the monetary authority partially accommodates a reduction reserve requirements, denoted α^*, such that the capital stock and output remain constant. The α^* strategy is associated with higher prices and an increase in intermediated deposits.

Proof: By definition, with $0 < \alpha^* < 1$, the percentage change in reserve requirements is greater than the percentage change in fiat money. With lower reserve requirements, there is an excess supply of fiat money resulting in a higher price level. Similarly, the quantity of intermediated deposits rise as the ratio of fiat money to reserve requirements increases.

Thus, Propositions 1 and 2 indicate that the monetary authority can stabilize the price level and inside money supply by coordinating reserve requirement changes with open market operations such that the percentage change in the respective tools is identical. A perfect accommodation scheme, however, results in changes in capital and output. The results also show that the monetary authority can conduct a partial accommodation that stabilized capital and output, but at the cost of price level and inside money volatility.

Note that a role for output stabilization depends crucially on the assumption that government bonds are net private wealth. One reason is because seignorage can reduce the real burden of the national debt. If government bonds were indexed, then agent's net wealth will not be transferred to the government via

real devaluations.[7] Consider a Ricardian setting. If government bonds are not net private wealth, seignorage revenue would not affect the value of the agent's government bond holdings. Accordingly, open market sales used to decrease the supply of fiat money will perfectly accommodate lower reserve requirements, but will not crowd out capital. In short, if government bonds are not net private wealth, no accommodation scheme would stabilize output.

5. Summary

In this paper, I show that the monetary authority can stabilize prices and inside money by perfectly accommodating changes in reserve requirements with open market operations. However, this accommodation scheme results in changes in both capital and output. I also show that a partial accommodation scheme exists such that capital and output remain constant, but price and inside money fluctuate. The two accommodation schemes, therefore, imply that the monetary authority can stabilize prices in one accommodation or output in another stabiliztion scheme. Such coordinated monetary policy actions cannot simultaneously satisfy both price and output stabilization goals.

The main contribution of this paper is to explicitly examine

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[7] Analysis of the real effects of seignorage revenue on the government's debt burden can be found in Metzler (1951), Miller (1981), and Champ and Freeman (1990).

how coordinated monetary policy actions effect economic activity. Both anecdotal and empirical evidence suggest that the Fed uses these policy tools in conjunction. Hence, the results in this paper add to our understanding of the effects of monetary policy. Moreover, the results establish conditions in which the monetary authority can stabilize prices or output. One might use this framework for analyzing the Fed's behavior in the sense that the Fed chooses either of the two pure accommodation schemes identified here to stabilize prices or output (the pure stabilization strategies) or chooses $\alpha^* < \alpha < 1$ (a mixed strategy), reflecting the central bank's willingness to have both prices and output fluctuate instead of fluctuation all in one variable.

Several extensions to this analysis are worth noting. First, the analysis here does not address the welfare implications associated with coordinated monetary policy actions. Generally, the question remains whether an optimal accommodation scheme exist.

Second, what are the empirical implications of this analysis? Clearly, there are accommodation schemes in which both prices and output are affected. Accordingly, the Fed may be willing to trade-off more or less price variability relative to output variability. Insofar as movements in reserve requirements reflect other monetary policy concerns (competitiveness with other regulatory agencies prior to 1980, for example), the results presented here suggest that the appropriate accommodation

scheme maximizes a Barro-Gordon (1983) type Fed objective function with output variability and price variability as arguments. In this way, one might be able to examine the properties of the optimal accommodation scheme. And derive more specific testable hypotheses.

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