

**OPTIMAL FISCAL AND MONETARY POLICY
IN A BAUMOL-TOBIN MODEL**

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Abstract

When the government uses bonds to smooth tax distortions agents must use bonds to smooth consumption. This is not efficient because smoothing by bonds requires more real resources than smoothing by money. At the social optimum only money is used. This can be achieved by contracting a monetary aggregate which includes government deposits at the central bank, at a constant rate. Unlike models which allow a costless trip to the asset market at the beginning of each period, here the rate of change in the monetary base fluctuates over time.

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INTRODUCTION

Questions about the day-to-day operation of the central bank are far from resolved. There is no consensus about the definition of the monetary aggregate and the price index that should be targeted. Here I use an intertemporal optimal tax problem to discuss these issues.

In any smoothing activity (bridging the gaps between receipts and expenditures) there is more than one party involved. If the government chooses to use bonds for smoothing tax distortions it forces private agents to use bonds for smoothing consumption. This is not efficient because smoothing by money requires less resources. A similar argument was made by Bryant and Wallace (1979) who use an overlapping generations model. It is made here in a general equilibrium version of the Baumol-Tobin model.

When the government uses money for smoothing tax distortions, money must change hands between the government and individuals and the amount of money held by the private sector fluctuate.

I propose an institutional set-up in which the central bank smooth the rate of change in:

M^* = money held by the private sector (M) + the amount of money held by the government in its central bank domestic currency account.

I show that at the optimum, M^* contracts at the rate of the representative agent's subjective interest rate (ρ). This result may be viewed as a generalization of Friedman (1969).

Friedman (1969) followed the "money in the utility function" approach. He abstracted from fiscal policy issues by assuming that lump

sum taxes are possible and government expenditures are zero. He also abstracted from business cycles and growth. In this environment Friedman argues for a steady contraction of the money supply (M) at the rate of p .¹ Here I show that when we take explicit account of the government sector, M^* rather than M should contract at the rate of p .

At the optimum only money is used and the gross real rate of return on money is the price of current consumption in terms of future consumption. Sargent and Wallace (1982) argue that this relative price should change over time. For example, if government expenditures are temporarily high current consumption should be made expensive relative to past and future consumptions and the current rate of return on money should be made relatively high. It is possible that changes in the relative price of current consumption will be accomplished by changes in consumption taxes. Therefore, under an appropriate fiscal policy the central bank may smooth the rate of change in producer prices. But in any case, it should not attempt to smooth the rate of change in the consumer price index.

The paper may also be read as a contribution to the growing literature on the robustness of the optimality of zero nominal interest rate: The Friedman rule. A major objection to Friedman's rule was made by Phelps (1973) who applied Ramsey (1927) smoothing tax distortions logic to argue that real balances should be taxed like any other good.

¹ For other models in which zero nominal interest rate characterizes the optimum, see Sidrauski (1967) Grandmont and Younes (1973), Bewley (1980), Townsend (1980), and Stockman (1981). This result was also obtained in a Baumol-Tobin type model by Jovanovic (1982).

Phelps argument was challenged by Lucas and Stokey (1983) and Lucas (1986). They examined a model in which agents can go to the asset market only at the beginning of each period. During the period shoppers can buy some goods on credit and some goods ("cash goods") only with money. Lucas (1986) convincingly argue that "Liquidity is not 'another good' nor, indeed, a 'good' at all: It is the means to a subset of goods that an income tax has already taxed once. Tax spreading at each point in time means inflation tax fixed at zero, independent of the revenue to be raised." He therefore concludes that in the absence of a difference between the elasticities of cash and credit goods, zero nominal interest is optimal.² A similar argument was made by Kimbrough (1986) who models money as an intermediate good. Woodford (1990) and Chari, Christiano, and Kehoe (1993) provide a general discussion of the conditions under which Friedman's rule is optimal.

Lucas and Stokey (1983) assumed that agents do not hold any money and nominal interest-bearing government bonds at the time of the regime change. Chari, Christiano, and Kehoe (1993) argue that when the initial holdings of money and nominal government bonds are positive, it is optimal to set the initial price level at infinity and then start deflating at the Friedman rate. Many economists may feel uneasy about the initial hyper-inflation.

² Braun (1994) shows that if the income elasticity of the long run demand for money is less than unity, then some inflation tax is optimal. This result is developed in the context of a cash-in-advance model with an exogenous distinction between cash and credit goods. For models in which the distinction between the two types of goods is endogenous, see Gillman (1993) and Aiyagari and Eckstein (1994).

Here I use a general equilibrium version of the Baumol-Tobin model to argue that achieving zero nominal interest rate can be achieved by reducing M^* at the rate ρ . This is desirable even when there are fluctuations in aggregate income, lump sum taxes are not possible and initial hyper-inflation is prohibitively costly.

THE MODEL

I consider a single good economy which is populated by n infinitely lived agents. Agent h can produce the good by using labor input according to the constant returns to scale technology:

$$(1) \quad y_t^h = \theta_t^h L_t^h,$$

where y is the amount of the good produced, L is labor input and θ is a productivity parameter. There is no uncertainty: agent h knows the entire sequence $\{\theta_t^h\}_{t=1}^{\infty}$. But θ_t^h varies over time and agents in an unrestricted way. Therefore, aggregate income, $\sum_{h=1}^n y_t^h$, will in general vary over time.

I start by treating the government and the central bank as a single entity: "the public sector". Initially there are no assets. As in Lucas and Stokey (1983), at $t = 0$ the public sector introduces money and bonds by offering the public a loan with no maturity. There are no private bonds before and after $t = 0$.

The public sector announces a sequence of real interest rates $\{r_t\}_{t=1}^{\infty}$ and supplies the entire demand for loans: If agent h takes a loan of A_0^h real units he will pay the sequence $\{r_t A_0^h\}_{t=1}^{\infty}$ as interest.

The agent divides the initial loan from the public sector between real balances, m_0^h , and real bonds, b_0^h . Thus, $A_0^h = m_0^h + b_0^h$.

After $t = 0$, individuals can smooth consumption by changing the amount of assets they hold. Changing the amount of money is costless but changing the amount of bonds is not: It costs α units of time to go to the bank and change the amount of bonds held.

The public sector can levy flat-rate consumption taxes (T_t) and income taxes (τ_t). Most of the literature on optimal monetary and fiscal policy considers income tax only. Adding consumption tax is superfluous from a purely theoretical point of view. I do it for two reasons. First, it allows for a simple characterization of the optimal solution. But more importantly, it allows for a discussion of the price index that should be targeted.

I focus on a solution in which the rate of change in producer prices is smooth but the rate of change in consumer prices varies. It is therefore convenient to use the producer price index as a deflator. Thus, at time t , a unit of real balances can buy $1/(1 + T_t)$ units of consumption at consumer prices and one unit at producer prices. In general, the real value of a nominal amount that can buy a unit of consumption at producer prices is unity.

It is assumed that the public sector has perfect control over the rate of inflation. This assumption is problematic in view of the long and variable lags between money and prices. At the proposed optimum, producer prices change at a constant rate and this is less of a problem.

I use t to index time and h to index an individual agent;
 ρ = the subjective rate of interest ($\rho > 0$);
 $\beta = 1/(1 + \rho)$ = subjective rate of discount;

L = labor input;

c = consumption;

$u(c, L)$ = single period utility function;

m = real balances;

b = real bonds;

$y = \theta L$ = real income;

T = consumption tax rate;

τ = income tax rate;

π = tax rate on real balances \approx the inflation rate in producers' prices³;

r = the real interest rate on bonds.

I assume that the public sector can perfectly commit to current and future policies. At $t = 0$, it announces the sequence:

$$\Omega = \{T_t, \tau_t, \pi_t, r_t\}_{t=1}^{\infty}.$$

Each consumer computes the sequence of payments that he needs to make to the public sector: $\{T_t c_t^h + \tau_t \theta_t^h L_t^h + r_t A_0^h\}_{t=1}^{\infty}$. At $t = 0$, he gives his bank a standing order to pay this sequence. Thus the paying of taxes and interest on the initial loan do not require trips to the bank after $t = 0$.

³ In discrete time, the tax on real balances is $\pi = \zeta / (1 + \zeta)$, where ζ is the discrete rate of inflation in producer prices.

Given the announced policy, agent h chooses (m_0^h, b_0^h) and $\{m_t^h, b_t^h, c_t^h, L_t^h\}_{t=1}^\infty$ to solve⁴:

$$(2) \quad U^h(\Omega, \alpha) = \max \sum_{t=1}^{\infty} \beta^t u^h(c_t^h, L_t^h)$$

s.t.

$$(a) \quad (1 + \tau_t)c_t^h + b_t^h + m_t^h = (1 - \tau_t)\theta_t^h [L_t^h - \alpha i_t^h] + b_{t-1}^h (1 + r_t) + m_{t-1}^h (1 - \pi_t) - r_t A_0^h;$$

$$(b) \quad i_t^h = \{1 \text{ if } b_t^h \neq b_{t-1}^h (1 + r_t); 0 \text{ otherwise}\};$$

$$(c) \quad A_0^h = m_0^h + b_0^h; \quad c_t^h, m_t^h \geq 0, \quad 0 \leq L_t^h \leq 1 \text{ and } b_t^h \rightarrow 0 \text{ when } t \rightarrow \infty.$$

The right-hand side in constraint (a) are all the available resources at time t . The first term is net labor income. Note that only $L - \alpha i$ units of time are used for productive activities. The magnitude αi is the time allocated to a trip to the bank, in case that a trip is made. A trip is made under the conditions in (b). The second and the third terms are the value of bonds and money carried from the previous period, and the fourth term is the interest payment for the initial loan. The available resources can be spent on consumption or used to acquire current period assets.

It is shown in Appendix 1 that the price of current consumption in terms of future consumption depends both on the interest rates and the

⁴ Assuming that government expenditures affect the individual utility will not change the main results.

rates of inflation: Higher rates of inflation will make current consumption cheaper in terms of future consumption. To build intuition, consider an increase in c_t which is followed by a reduction in $c_{t+\Delta}$. The increase in c_t will initially affect the holdings of money and only later, when a trip to the bank is made, it will affect the holdings of bonds. Similarly, the holding of money between the trip to the bank which is prior to $t + \Delta$ and time $t + \Delta$ will be affected. Therefore the rate of return on money enters the computation of the relative price of current consumption and the role that the rate of inflation plays in this relative price gets more important as the rate of inflation goes down and agents reduce the number of trips to the bank.

This is different from models that allow a free trip to the asset market at the beginning of each period. In such models the rate of inflation does not affect the relative price of current consumption in terms of future consumption and deviation from the optimum rate of inflation will not lead to a distortion in these relative prices. For example, in Lucas and Stokey (1983), a rate of inflation which is above the optimum will lead to a distortion in the relative prices of cash and credit goods but will not lead to a distortion in the relative price of current consumption in terms of future consumption as is the case in this model.⁵

⁵ Thus, this model does not distinguish between the asset and the transaction motive for holding money. This distinction usually requires an environment in which the agent can do different things at the beginning of the period and during the period. Here nothing happens during the period and therefore there is no distinction between the asset and the transaction motive for holding money.

I now turn to write the budget constraint in a present value form.

Lemma: It is possible to replace constraint (a) in (2) by:

$$(3) \quad \sum_{t=1}^{\infty} D_t(1 + T_t)c_t^h = \sum_{t=1}^{\infty} D_t\{(1 - \tau_t)\theta_t^h[L_t^h - \alpha i_t^h] - m_{t-1}^h(r_t + \pi_t)\};$$

where $D_t = (1 + r_1)^{-1} \times (1 + r_2)^{-1} \times \dots \times (1 + r_t)^{-1}$.

The proof of the Lemma is in the Appendix. Note that the budget constraint (3) does not depend on the amount of the loan from the public sector: $(b_0^h + m_0^h)$. The intuition is that if you borrow money and hold it as bonds, the interest payments on the bonds will exactly cover the interest payments on the loan.

Let $q_t = D_t(1 + T_t)$; $w_t = D_t(1 - \tau_t)$ and $\gamma_t = D_t(r_t + \pi_t)$. Dividing both sides of (3) by q_1 leads to:

$$(4) \quad \sum_{t=1}^{\infty} (q_t/q_1)c_t^h = \sum_{t=1}^{\infty} (w_t/q_1)\theta_t^h[L_t^h - \alpha i_t^h] - (\gamma_t/q_1)m_{t-1}^h.$$

When $\alpha = 0$, (q_t/q_1) is the price of consumption at time t , (w_t/q_1) is the price of leisure at time t and (γ_t/q_1) is the price of holding money at time $t-1$, all in terms of consumption at time 1. When $\alpha > 0$, these relative prices do not have a simple interpretation.⁶

⁶ In particular, (q_t/q_1) is not the price of consumption at time t in terms of consumption at $t = 1$. It is the price of an amount in the savings account that, if converted into money, can buy a unit of consumption at time t in terms of an amount in the savings account that if converted into money can buy a unit of consumption at

We can write the solution to (2) as a function of the sequences:

$Q = \{q_t/q_1\}_{t=1}^{\infty}$, $W = \{w_t/q_1\}_{t=1}^{\infty}$ and $\Gamma = \{\gamma_t/q_1\}_{t=1}^{\infty}$. I use $\Phi = (Q, W, \Gamma, \alpha)$ and $V^h(\Phi)$ instead of $U^h(\Omega, \alpha)$ to denote the maximum level of utility that consumer h can achieve given α and the sequences (Q, W, Γ) . I assume a unique solution to (2) and use $L_t^h(\Phi)$, $c_t^h(\Phi)$, $m_t^h(\Phi)$, $b_t^h(\Phi)$ to denote it.⁷

I omit the superscript to denote the sum over all agents. Thus, $\theta_t L_t(\Phi) = \sum_{h=1}^n \theta_t^h L_t^h(\Phi)$, $c_t(\Phi) = \sum_{h=1}^n c_t^h(\Phi)$, and so on.

I assume a social welfare function, $\sum_{h=1}^n \omega^h V^h(\Phi)$, where ω^h is the weight of consumer h . The public sector chooses relative price targets using Ω as tools, to maximize social welfare subject to the constraint that the individuals' portfolio choices are consistent with financing exogenously given public sector consumption, $\{G_t\}_{t=1}^{\infty}$. Thus, the public sector solves:

$$(5) \quad v(\alpha) = \max_{Q, W, \Gamma} \sum_{h=1}^n \omega^h V^h(\Phi)$$

s. t.

$$(6) \quad G_t + b_{t-1}(\Phi)(1+r_t) + m_{t-1}(\Phi)(1-\pi_t) = \\ \{\tau_t \theta_t L_t(\Phi) + T_t c_t(\Phi)\} + \{[b_0(\Phi) + m_0(\Phi)]r_t\} + \\ \{b_t(\Phi) + m_t(\Phi)\}.$$

time = 1.

⁷ Note that increasing consumption taxes by $x\%$ in all periods and reducing income tax by $x\%$ in all periods is not neutral: It will affect Γ because there are no consumption taxes on the services from real balances. If we apply the consumption tax to the holding of money and replace $\gamma m/q_1$ in (4) by $(1 + T)\gamma m/q_1$, then the above change will be neutral.

The left-hand side in constraint (6) represents the total obligations of the public sector at time t . These include current expenditure and the real value of the (interest and non-interest bearing) debt from the previous period. On the right-hand side we have the sources for meeting these obligations, which are: current tax revenues, the interest payment on the initial loan, and the total current period debt.

The consumers' budget constraints and constraint (6) imply the market clearing condition⁸:

$$(7) \quad G_t + c_t(\Phi) + \alpha\theta_t i_t(\Phi) = \theta_t L_t(\Phi) ,$$

where $\alpha\theta_t i_t(\Phi)$ denotes the aggregate cost of trips to the bank. It is also true that the consumers' budget constraints and (7) imply (6). We may therefore substitute (7) for (6) in problem (5) and write:

$$(8) \quad v(\alpha) = \max_{Q, W, \Gamma} \sum_{h=1}^n \omega^h v^h(\Phi)$$

$$\text{s.t.} \quad G_t = \theta_t L_t(\Phi) - c_t(\Phi) - \alpha\theta_t i_t(\Phi) .$$

Thus, the public sector problem may be viewed as that of choosing relative prices that maximizes social welfare subject to the constraint that markets are always cleared.

⁸ To check that this is indeed the case, let αi_t denote the aggregate amount spent on trips to the bank. From the consumers' budget constraint (a) in (2) we have:

$$c_t = \theta_t L_t - \theta_t \alpha i_t - \tau_t \theta_t L_t - T_t c_t - \{b_t - b_{t-1}(1+r_t)\} - \{m_t - m_{t-1}(1-\pi_t)\} - (b_0 + m_0)r_t, \text{ which yields (8) if substituted in (7).}$$

When trips to the bank are costless ($\alpha = 0$), the maximum level of social welfare is: $v(0)$. I now show that this level can be achieved in any economy.

Proposition 1: $v(\alpha) \geq v(0)$; for all $\alpha \geq 0$.

The outline of the proof is as follows. When $\alpha = 0$, there is no need for money. The public sector may therefore set the price of holding money $\gamma_t = \infty$ for all t . I use $\Gamma = \infty$ for the sequence $\{\gamma_t = \infty\}_{t=1}^{\infty}$ and write the public sector's problem as:

$$(8') \quad v(0) = \max_{Q,W} \sum_{h=1}^n \omega^h v^h(Q, W, \infty, 0)$$

s. t. $G_t = \theta_t L_t(Q, W, \infty, 0) - c_t(Q, W, \infty, 0).$

I use $Q^* = \{(q_t/q_1)^*\}_{t=1}^{\infty}$, and $W^* = \{(w_t/q_1)^*\}_{t=1}^{\infty}$ to denote a solution to (8').

We now turn to the case $\alpha > 0$ and consider the case in which the public sector sets: $-\pi_t = r_t = \rho$ for all t . In this case, $\gamma_t = 0$ for all t and therefore individuals will borrow enough money at $t = 0$ (and no bonds!) so that $i_t^h = 0$ for all t . When $-\pi_t = r_t = \rho$, $(D_t/D_1) = \beta^{t-1}$ and, using the Lemma, the budget constraint is:

$$(9) \quad \sum_{t=1}^{\infty} \beta^t (1 + T_t) c_t^h = \sum_{t=1}^{\infty} \beta^t (1 - \tau_t) \theta_t^h L_t^h.$$

The relative prices are now:

$$(10) \quad w_t/q_1 = (\beta^{t-1}) (1 - \tau_t) / (1 + T_1);$$

And

$$(11) \quad q_t/q_1 = (\beta^{t-1})(1 + T_t)/(1 + T_1).$$

The public sector can choose:

$(1 + T_t)/(1 + T_1) = (q_t/q_1)^*/\beta^{t-1}$ and $(1 - \tau_t)/(1 + T_1) = (w_t/q_1)^*/\beta^{t-1}$ for all t . This choice implies the same relative prices as the solution to (8'), and therefore the same level of social welfare. This completes the proof.

We may think of the relative prices at time t as policy targets and the parameters (D_t, T_t, τ_t) as policy tools. There are more tools than targets and therefore imposing $r_t = \rho$ and $(D_t/D_1) = \beta^{t-1}$ does not restrict the choice of relative prices.⁹

We have shown that the best outcome for a frictionless world can be achieved even in the presence of frictions. I assume that adding frictions does not improve matters and therefore: $v(\alpha) = v(0)$. Under this assumption,

Corollary 1: There exists a solution to (5) in which $-\pi_t = r_t = \rho$ for all t .

Note that the gross real rate of return on money

⁹ Note that when $\gamma = 0$ and the consumer budget constraint is (9), an increase in consumption tax by $x\%$ in all periods which is followed by an $x\%$ reduction in income tax in all periods, is neutral.

$(1 - \Pi_{t+1}) = (1 + T_t) \times (1 + \rho) \times (1 + T_{t+1})^{-1}$ will fluctuate in the proposed solution. Such fluctuations are necessary to change consumption in response to an increase in government spending. I elaborate on this point later.

Differentiating between the central bank and the government: We have treated the public sector as a single entity. I now distinguish between the government and the central bank. I assume the optimal policy $(-\pi_t = r_t = \rho)$ and therefore no bonds. Money is issued by the central bank which treats the government in the same way it treats individuals: At $t = 0$, it offers the government m_0^g units of real balances for interest payments: $\{\rho m_0^g\}_{t=1}^{\infty}$. To simplify, I assume that the government chooses the initial amount of money to ensure that the cash-in-advance constraint $(m_t^g \geq 0)$ is not binding, and therefore after $t = 0$ the central bank does not issue more money.

The accumulation of government assets at the central bank is given by:

$$(12) \quad m_t^g - m_{t-1}^g (1 + \rho) = \tau_t \theta_t L_t + T_t C_t - G_t - \rho m_0^g.$$

At the proposed optimum, the accumulation of real balances by the private sector (m_t^p) is equal to the government deficit minus the interest payments to the central bank on the initial loan¹⁰:

¹⁰ This can be derived by substituting $b = 0$ and $-\pi_t = r_t = \rho$ in constraint (6).

$$(6') \quad m_t^p - m_{t-1}^p (1 + \rho) = G_t - \tau_t \theta_t L_t - T_t c_t - \rho m_0^p.$$

Adding (6') and (12) leads to:

$$(13) \quad m_t^* - m_{t-1}^* (1 + \rho) - \rho m_0^* = 0,$$

where $m_t^* = m_t^g + m_t^p$. Since (13) holds for all t we must have:

$$(14) \quad m_t^* = m_0^*.$$

Thus,

Proposition 2: When only money is used, both the private sector demand for money and the government demand for money fluctuates but aggregate demand over both sectors is stable.

To build some intuition I use (13) and (14) to get:

$$(15) \quad m_t^p - m_{t-1}^p = - (m_t^g - m_{t-1}^g).$$

Thus, the increase in the private sector's holdings of real balances is equal to the decrease in the government's holdings of real balances.

Let P denote the producer dollar price of a unit of consumption.

Thus, $m^* = M^*/P$. Since m^* does not change over time:

$d \ln(M^*/P)/dt = d \ln(M^*)/dt - d \ln(P)/dt = 0$. Since $-d \ln(P)/dt = \rho$, it follows that $d \ln(M^*)/dt = -\rho$. This is true for any level of consumption tax including $T = 0$. Thus,

Corollary 2: When only money is used, M^* declines at rate ρ .

Note that the rate of change in M^* is independent of the rate of growth in the economy. This is because at the optimum, the aggregate demand for money (m^*) does not depend on income: Agents (government and individuals) do not economize on the use of money and hold an amount that will bridge any future gap between expenditure and receipts.

The proof of the Lemma can be used to show that (12) implies:

$$(16) \quad \sum_{t=1}^{\infty} \beta^t G_t = \sum_{t=1}^{\infty} \beta^t (\tau_t \theta_t L_t + T_t c_t).$$

Thus,

Proposition 3: Money creation is not used to finance government expenditure: The revenue from initial money creation is used to finance the subsidy on holding real balances (the negative inflation tax).

Corollary 2 and the Proposition follow directly from the institutional arrangement: The central bank destroys the revenue from the initial creation of money (ρm_0^*). Note also that the capital gains on real balances are used to finance the interest payments, ρm_0^* .

INITIAL NOMINAL WEALTH

Under perfect commitment, the assumption of zero initial private holdings of nominal assets is rationalized by Chari, Christiano, and

Kehoe (1993) in the following way. If the initial stock of nominal assets held by the consumers is positive, welfare is maximized by increasing the initial price level to infinity. If the initial stock is negative, then welfare is maximized by setting the initial price level so low that the government raises all the revenue it needs without levying any distorting taxes. Therefore, the only interesting case is when initial private holdings of nominal assets is zero.

When trips to the asset market are costless, a policy of having high inflation initially and then deflating at the Friedman rate can be made time consistent by carefully managing the government debt.¹¹ This requires that individuals will change the portfolio of real (indexed) and nominal government debt so that the net nominal debt is always zero. See Lucas and Stokey (1983), and Persson, Persson and Svensson (1988).

When trips to the asset market are costly, as in the Baumol-Tobin framework used here, managing the national debt requires real resources, because individuals must keep going to the asset market and change their portfolios of government bonds.

Since the commitment mechanism of constantly managing the government debt is costly, the government may use reputation as a commitment device. In all models of reputation, the past behavior of the government is important in determining public expectations about future government actions. Therefore, high initial inflation is likely to erode the reputation of the government. But this does not necessarily change the main result.

¹¹ It is assumed that the government can commit to not renegeing on its debt obligations.

I now use the idea in Barro and Gordon (1983) to specify a reputation enforcement mechanism that impose restriction on the regime change. The regime change is announced at the beginning of period 0 before the beginning of trade for this period. To simplify, I assume that before $t = 1$, there are no consumption taxes.

At the time of the regime change, the public has expectations about the entire path of future rates of change in consumer prices. These expectations are denoted by $\{\Pi_t^{e-1}\}_{t=0}^{\infty}$, where the superscript $e-1$ denotes expectations at $t = -1$. It is assumed that the public does not like an announced inflation rate which is higher than expected. Whenever this happens, the public expects an infinite inflation rate. These expectations are self-fulfilling: If all agents expect that money will be useless, no one will accept it, and it will be useless. The main results do not depend on the extreme "punishment" assumed here.

Let the announced new policy with respect to the rate of change of producer prices be $\{\Pi_t^*\}_{t=0}^{\infty}$. I assume that expectations after the announcement are determined by:

$$(17) \quad \{\Pi_t^{e0}\}_{t=0}^{\infty} = \{\Pi_t^*\}_{t=0}^{\infty} \text{ if } \Pi_t^{e-1} \geq \Pi_t^* \text{ for all } t.$$

$$\text{Otherwise, } \Pi_t^{e0} = \infty \text{ for all } t.$$

If there are no more policy announcements after $t = 0$, expectations at $t > 0$ are determined by comparing actual inflation, Π_t , to the expected value. Here any deviations from the announced policy is interpreted as a loss of control and is therefore "punished". Thus,

$$(18) \quad \{\Pi_i^{e_t}\}_{i=t}^{\infty} = \{\Pi_i^{e_{t-1}}\}_{i=t}^{\infty} \quad \text{if } \Pi_t^{e_{t-1}} = \Pi_t \quad \text{for all } t.$$

Otherwise, $\Pi_i^{e_t} = \infty$ for all $i > t$.

The general idea is similar to the one in Barro and Gordon (1983). The difference is that here the public punishes the policy maker for unexpected bad news even if this is announced ahead of time. It is assumed that the inflationary expectations at $t = -1$ are sufficiently high, and the punishment of infinite rate of inflation (reverting to a barter economy) is sufficiently strong to make the central bank choose rates of inflation which are less than expected at $t = -1$.

To avoid punishment, while at the same time minimizing the real value of initial privately-held nominal assets, the central bank announces:

$$(19) \quad \Pi_0^* = \Pi_0^{e-1}.$$

Since before $t = 1$ there are no consumption taxes, $\pi_0^* = \Pi_0^*$. The real value of the initial nominal asset held by individuals at $t = 0$ is denoted by $mnb_0^h = mnb_{-1}^h (1 - \pi_0^*)$, where mnb stands for money not borrowed. Given (19), mnb_0^h can be treated as an exogenous variable.

To facilitate the adjustment to the new steady state, the central bank lets individuals borrow and lend. The amount the consumer borrows from (or lends to) the central bank is denoted by mb_0^h . Thus while the consumer's total holding of real balances at $t = 0$ is $m_0^h = mnb_0^h + mb_0^h$, he pays interest only on mb_0^h . The proof of the Lemma can be used to show that the budget constraint is now:

$$(20) \quad \sum_{t=1}^{\infty} D_t(1 + T_t)c_t^h = mnb_0^h + \sum_{t=1}^{\infty} D_t\{(1 - \tau_t)\theta_t^h[L_t^h - \alpha i_t^h] - m_{t-1}^h(r_t + \pi_t)\}.$$

Note that mnb_0^h is the present value of the interest payments $r_t mnb_0^h$ which the consumer is now exempt from paying.

But since the magnitudes mnb_0^h are exogenous from the point of view of the policy maker at $t = 0$, the proof of Proposition 1 goes through: It is possible to achieve the best outcome in a hypothetical frictionless economy ($v(\alpha) \geq v(0)$), also in this case.

WHAT PRICE INDEX SHOULD BE TARGETED?

In general it is not feasible to smooth all relative prices. I will show, by an example, that it is not optimal to smooth the relative price of current consumption in terms of consumption in other dates. This means that at the optimum the rate of change in consumer prices fluctuates: Only the rate of change in producer prices is smoothed.

To illustrate, I assume a temporary increase in government spending at time t which is financed by an increase in consumption tax: consumption tax is T for all periods other than t and $T + x$ in period t . The real rates of return on money, the prices of current consumption in terms of next period's consumption, are:

$$(1 - \Pi_t) = (1 + T) \times (1 + \rho) \times (1 + T + x)^{-1} < (1 + \rho) \text{ and}$$

$$(1 - \Pi_{t+1}) = (1 + T + x) \times (1 + \rho) \times (1 + T)^{-1} > (1 + \rho). \text{ This implies that}$$

$\Pi_t > -\rho$ and $\Pi_{t+1} < -\rho$. Thus, the rate of change in consumer prices will go up between time $t - 1$ and time t and will down between time t and $t + 1$.

I now turn to demonstrate by an example that smoothing the relative price of current consumption is, in general, not optimal and smoothing tax distortion does not imply smoothing taxes. The example is based on example 3 in Lucas (1986) and example 4 in Lucas and Stokey (1983).

An example: I assume a representative agent and no fluctuations in productivity: $\theta_t^h = 1$ for all t and h . Government expenditure are $g > 0$, at $t = 1$ and zero in all other periods. Figure 1 illustrates the possibility of using income tax only and insisting on a balanced budget in all periods. The composite consumption good is on the horizontal axis, leisure is on the vertical axis. If we can tax both leisure and goods, or if equivalently lump sum taxes are possible, E can be attained. With a tax on labor income, equilibrium occurs at a point like A.

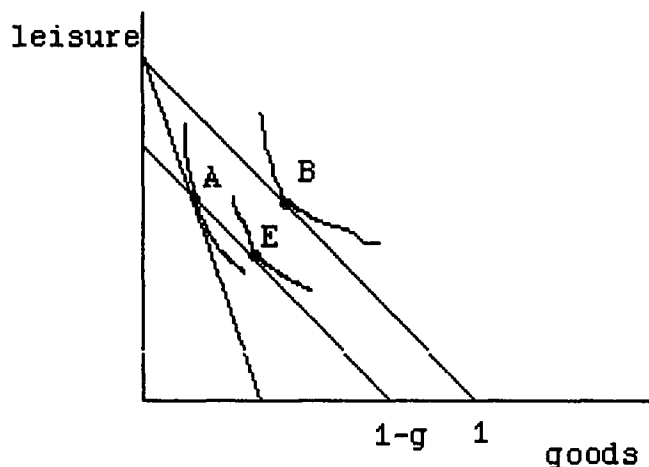


Figure 1

To simplify, I assume that the deadweight loss of taxation is the square of the distance between the actual allocation and the first best

allocation. I assume that the public sector minimizes the present value of the deadweight losses and that ρ is arbitrarily small. Under this assumption, it is not possible to do better than choosing relative prices which will make the representative agent choose points which are arbitrarily close to the first best in all periods: a point which is arbitrarily close to $E = (\bar{c}_1, 1 - \bar{L}_1)$ at $t = 1$ and points which are arbitrarily close to $B = (\bar{c}, 1 - \bar{L})$, at $t > 1$. I show that these allocations can be achieved.

To achieve an allocation which is close to the first best in all periods, the government must keep the real wage close to unity for all periods and make consumption at $t = 1$ expensive relative to consumption in other periods.

I start by treating the consumption tax at $t = 1$ (T_1) as given, and set:

$$(21) \quad T_t = 0 \text{ and } \tau_t = \rho(g/\bar{L})T_1; \text{ for all } t > 1,$$

$$(22) \quad \tau_1 = -T_1 + \rho(g/\bar{L}_1)T_1.$$

Because ρ is small, the real wage in terms of current consumption, $(1 - \tau_t)/(1 + T_t)$, is close to unity for all t . Given that the real wage is close to unity in all periods, we have to find a way to convince the representative consumer to consume less at $t = 1$. To do this we choose T_1 that satisfies the first order condition:

$$(23) \quad u_c(\bar{c}_1, \bar{L}_1)/u_c(\bar{c}, \bar{L}) = (1 + T_1).$$

Note that the government runs a primary deficit $gT_1 - \rho gT_1$ at

$t = 1$ and then runs a primary surplus of ρgT_1 at $t > 1$. I assume that initially individuals do not have any assets. The financing is done in the following way. The government borrows gT_1 from the central bank. The representative agent does not borrow anything. At $t = 1$, the government pay the agent $gT_1 - \rho gT_1$ and use the remaining balances in its account (ρgT_1) to pay interest on its initial loan. The central bank burns this interest payment. As a result the amount of real balances held at the end of period 1 by the agent (evaluated at period 1's producer's price) is $gT_1 - \rho gT_1$ and the amount of real balances held by the government is zero. Next period, at $t = 2$, the producer's price goes down and the agent's real balances becomes gT_1 . The agent pays ρgT_1 as taxes. The government uses these taxes to pay the interest on its debt. The central bank burns the interest payment. At the end of period 2 the amount of real balances held by the agent is again $gT_1 - \rho gT_1$ and the amount of real balances held by the government is again zero. The price falls and real balances held by the agent appreciate to gT_1 at the beginning of period 3. He pays taxes and the government transfer the tax revenue to the central bank who burns it. This continues for ever.

CONCLUDING REMARKS

In Friedman's optimum agents are satiated with money. This paper develops the implications of this characterization with respect to the monetary aggregate and the price index that should be smoothed.

I take transaction costs seriously and begin by observing that if the government chooses to use bonds for smoothing tax distortions it forces individuals to use them as well. Since using money does not

require trips to the bank, the government should use money rather than bonds for smoothing tax distortions.

I show that any outcome that can be attained in a hypothetical frictionless world in which trips to the bank are costless, can also be attained in a more realistic world in which trips to the banks are costly. This result is rather robust. It does not require lump sum taxes and it holds even if initially private agents hold money and announcing a short initial hyper-inflation is prohibitively costly.

I assume that the best outcome in the hypothetical frictionless world, is optimal also for the actual economy. To achieve this solution, the government smooth tax distortions and private agents smooth consumption by exchanging money. The central bank treats the government as any other firm and target $M^* = \text{money held by private agents (M)} + \text{the money held by the government at the central bank.}$ ¹²

The rate of change of M^* is $-\rho$ and the rate of change in M fluctuates. The fluctuations in M may look like "velocity shocks" but they are not. These fluctuations arise from the use of money as a smoothing device: money changes hands between individuals and the government.

At the optimum the central bank does not smooth the rate of change in the consumer price index. This is because the rate of return in the economy (the rate of return on money) must fluctuate to achieve the smoothing of tax distortions.

¹² In the present system the government holds its money in the central bank. At the optimum, when the cost of holding money is zero, the government may use private banks for getting banking services.

The solution I chose to focus on provides a simple rule that allows the public to understand and judge the public sector actions. The central bank reduces M^* at the constant rate ρ and producer prices are reduced at the same rate. The government varies the rates of return in the economy (the rate of change in consumer prices) by varying consumption taxes. This is done to achieve market clearing in an environment in which aggregate real income and government expenditures fluctuate.

This policy is simple to judge. Every deviation of the rate of change of consumer prices from its trend can be explained by changes in the consumption tax rate. Typically, a temporary (and perfectly anticipated) increase in government spending should lead to a contemporaneous increase in the consumption tax rate. The need to increase explicit taxation when government spending goes up is likely to lead to a healthy public debate.

At the optimum the central bank treats the government as a large private firm. In a more realistic environment in which the nominal interest rate is positive, the government will choose to smooth some tax distortions by changing the amount of money it holds at the central bank and some by selling bonds. I see no reason for the central bank to change these decisions by trying to smooth the monetary base or other conventional definitions of money.

To illustrate, assume that the government chooses to pay salaries at the beginning of the month in money but taxes are accumulated evenly during the month. Without intervention of the central bank, the money base will increase at the beginning of the month and decline during the month. If the central bank chooses to smooth these fluctuations in the

base, it must induce agents to buy government bonds at the beginning of the month and sell them during the month. This can be done by lowering the price of bonds at the beginning of the month and increasing it during the month so that the price differences is enough to cover the required trips to the bank. The smoothing of the base in this case will lead to a loss of revenue from selling and buying government bonds and to unnecessary trips to the bank.

Some elements of the institutional set-up proposed here can be found in several countries. In Israel for example, the central bank provides a substantial loan to the private sector but, unlike the proposal here, the interest on this loan is transferred to the government. The proposal here requires that the interest payments will be burned rather than used by the government.¹³

¹³ In addition to the loan provided by the central bank, the government in Israel sells bonds to the private sector. Thus the "representative agent" takes loans from the central bank to finance the purchase of government bonds. This circular transaction is rather costly from the social point of view. Direct loans from the central bank to the government are more efficient. Furthermore, the central bank can maintain control over the amount of direct loans to the government by making such loans possible only at the beginning of each fiscal year and requiring that these loans will be approved by parliament with the government budget.

APPENDIX 1: THE DERIVATION OF THE RELATIVE PRICE OF CURRENT CONSUMPTION

To illustrate this point, I derive now the price of consumption at t in terms of consumption at $t + \Delta$. For this purpose, let \hat{c}_t and \hat{L}_t denote the optimal consumption and labor supply which is implied by the solution to the consumer problem (2). I consider the following deviations from the optimal consumption and labor supply paths:

$$(A1) \quad c_t = \hat{c}_t + dc_t; \quad c_{t+\Delta} = \hat{c}_{t+\Delta} + dc_{t+\Delta}$$

$$\text{and } c_{t+i} = \hat{c}_{t+i} \text{ for all } i \neq 0 \text{ and } i \neq \Delta;$$

$$L_{t+i} = \hat{L}_{t+i} \text{ for all } i.$$

Let $\hat{dc}_{t+\Delta} = \max\{dc_{t+\Delta} \text{ s.t. (A1) and the constraints in (2)}\}$ denote the maximum feasible change in consumption at $t + \Delta$. I define the price of consumption at time t in terms of consumption at time $t + \Delta$ by the ratio $|\hat{dc}_{t+\Delta}/dc_t|$. Thus, I consider an increase in consumption at time t and ask what is the minimum required change in consumption at $t + \Delta$ under the assumption that only c_t and $c_{t+\Delta}$ are changed.

In Figure A1, the bold lines illustrates the proposed deviation from the optimal plan for money holdings (m), the amount in the savings account (b) and consumption (c). Note that changes in assets holdings occur between time t and $t + \Delta$ but not before time t or after time $t + \Delta$.

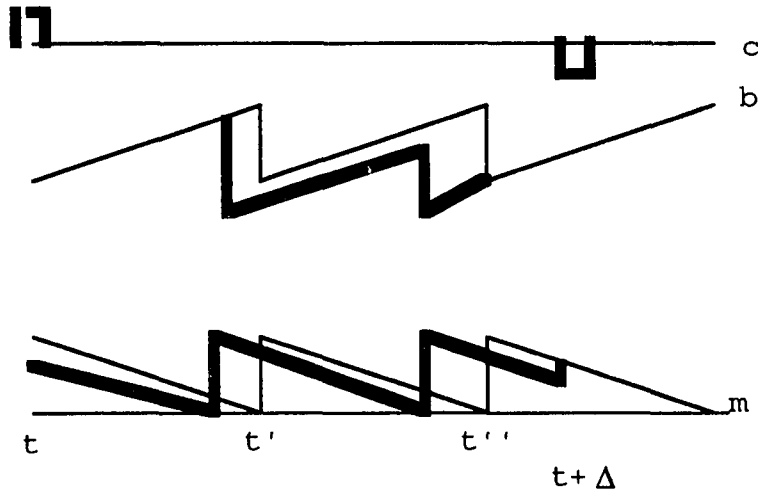


Figure A1

To compute the relative price $|\hat{dc}_{t+\Delta}/dc_t|$ I assume, as an approximation, that the dates at which the consumer goes to the bank do not change as a result of a small increase in consumption at time t . I use $(1 - \Pi_{t+1}) = (1 + T_t) \times (1 - \pi_{t+1}) \times (1 + T_{t+1})^{-1}$ to denote the gross rate of return on money: Π is approximately the rate of change in consumer prices.

Suppose, first, that the consumer does not plan to go to the bank between time t and $t + \Delta$. In this case, an increase in c_t by one unit, will lead to a reduction in the amount of real balances by $(1 + T_t)$ units. After Δ periods, this amount can buy:

$z_1 = (1 + T_t) \times (1 - \pi_{t+1}) \times (1 - \pi_{t+2}) \times \dots \times (1 - \pi_{t+\Delta})$ units at the producer price and

$z_1 \times (1 + T_{t+\tau})^{-1} = (1 - \Pi_{t+1}) \times (1 - \Pi_{t+2}) \times \dots \times (1 - \Pi_{t+\Delta})$

units at consumer prices. Thus,

$$|\hat{dc}_{t+\Delta}/dc_t| = (1 - \Pi_{t+1}) \times (1 - \Pi_{t+2}) \times \dots \times (1 - \Pi_{t+\Delta}).$$

In general, suppose that the consumer plans to go to the bank many times between time t and $t + \Delta$. Let his first visit to the bank after

time t be at t' and his last visit before time $t + \Delta$ be at t'' . A unit increase in c_t will lead to a reduction in real balances of $(1 + T_t)$. At the time of the next trip to the bank the agent will have

$z_1 = (1 + T_t) \times (1 - \pi_{t+1}) \times (1 - \pi_{t+2}) \times \dots \times (1 - \pi_{t'})$ units less of real balances. (His holdings of money at this point will be negative $z_1 - I$ allow it as an approximation). At time t' the agent will draw from the savings account an amount of money which can finance consumption until time t'' . The amount of money required is the same under both the optimal plan and the proposed deviation in (3). It follows that after the withdrawal at time t' the deviation at time t will lead to less z_1 units in the consumer's savings account but the same amount of money holdings. The amount of money holdings will not change until time t'' but at this point there will be

$z_2 = z_1 \times (1 + r_{t'+1}) \times (1 + r_{t'+2}) \times \dots \times (1 + r_{t''})$ units less in the savings account. At time t'' the agent will draw less z_2 units of real balances to restore the amount in the savings account to its planned level and as a result at time $t + \Delta$ the agent will have

$z_3 = z_2 \times (1 - \pi_{t''+1}) \times (1 - \pi_{t''+2}) \times \dots \times (1 - \pi_{t+\Delta})$ units less at $t + \Delta$. To restore his holdings of real balances to the planned level he must reduce his consumption at this point by $z_3 \times (1 + T_{t+\Delta})^{-1}$ units. Thus, the price of consumption at time t in terms of consumption at time $t + \Delta$ is:

$$(A2) \quad \left| \frac{\hat{d}c_{t+\Delta}}{dc_t} \right| = (1 + T_t) \times (1 - \pi_{t+1}) \times (1 - \pi_{t+2}) \times \dots \times (1 - \pi_{t'}) \\ \times (1 + r_{t'+1}) \times (1 + r_{t'+2}) \times \dots \times (1 + r_{t''}) \\ \times (1 - \pi_{t''+1}) \times (1 - \pi_{t''+2}) \times \dots \times (1 - \pi_{t+\Delta}) \times (1 + T_{t+\Delta})^{-1}.$$

In terms of the rate of change in consumer prices this is:

$$(A3) \quad \begin{aligned} |\hat{dc}_{t+\Delta}/dc_t| &= (1 - \Pi_{t+1}) \times (1 - \Pi_{t+2}) \times \dots \times (1 - \Pi_t) \\ &\quad \times (1 + r_{t+1}) \times (1 + r_{t+2}) \times \dots \times (1 + r_t) \\ &\quad \times (1 - \Pi_{t+1}) \times (1 - \Pi_{t+2}) \times \dots \times (1 - \Pi_{t+\Delta}). \end{aligned}$$

APPENDIX 2

Proof of the Lemma: Let $A = b + m$, denote total assets. Then we can write constraint (a) in (2) as:

$$(A1) \quad \begin{aligned} &(1 + \tau_t) c_t^h + A_t^h \\ &= (1 - \tau_t) \theta_t^h (L_t^h - \alpha i_t^h) - r_t A_0^h + A_{t-1}^h (1 + r_t) - m_{t-1}^h (\pi_t + r_t). \end{aligned}$$

Following Barro (1984, pp.83-88) and McCallum (1989, pp.36) I get from the $t + 1$ constraint:

$$(A2) \quad \begin{aligned} A_t^h &= \{ (1 + \tau_{t+1}) c_{t+1}^h + A_{t+1}^h + r_{t+1} A_0^h - (1 - \tau_{t+1}) \theta_{t+1}^h (L_{t+1}^h - \alpha i_{t+1}^h) \\ &\quad + m_t^h (\pi_{t+1} + r_{t+1}) \} / (1 + r_{t+1}). \end{aligned}$$

Substituting (A2) in (A1) yields:

$$(A3) \quad \begin{aligned} &(1 + \tau_t) c_t^h + \{ (1 + \tau_{t+1}) c_{t+1}^h + A_{t+1}^h + r_{t+1} A_0^h - \\ &(1 - \tau_{t+1}) \theta_{t+1}^h (L_{t+1}^h - \alpha i_{t+1}^h) + m_t^h (\pi_{t+1} + r_{t+1}) \} / (1 + r_{t+1}) \\ &- (1 - \tau_t) \theta_t^h (L_t^h - \alpha i_t^h) + r_t A_0^h + m_{t-1}^h (\pi_t + r_t) = A_{t-1}^h (1 + r_t). \end{aligned}$$

Using a similar step to eliminate A_{t+1}^h and so on, yields¹⁴:

$$(A4) \quad A_0^h = \sum_{t=1}^{\infty} D_t \{ (1 + T_t) c_t^h + r_t A_0^h - (1 - \tau_t) \theta_t^h (L_t^h - \alpha i_t^h) - m_{t-1}^h (\pi_t + r_t) \}.$$

Since $A_0^h = \sum_{t=1}^{\infty} D_t r_t A_0^h$ (the present value of the interest payments is equal to the value of the asset) we can write (A4) as:

$$(A5) \quad \sum_{t=1}^{\infty} D_t \{ (1 + T_t) c_t^h \} = \sum_{t=1}^{\infty} D_t \{ (1 - \tau_t) \theta_t^h (L_t^h - \alpha i_t^h) - m_{t-1}^h (\pi_t + r_t) \}.$$

This completes the proof.

¹⁴ Assuming here that the present value of m_t approaches zero as $t \rightarrow \infty$.

REFERENCES

- Aiyagari, Rao.S. and Eckstein, Zvi. "Interpreting Monetary Stabilization in a Growth Model with Credit Goods Production" Tel Aviv University W.P. #8-1994, March 1994.
- Barro, R.J. "On the Determination of the Public Debt" Journal of Political Economy, 1979, 87, 940-71.
- _____ "Reputation in a Model of Monetary Policy With Incomplete Information" Journal of Monetary Economics, 17 (1986) 1-20.
- _____ Macroeconomics. New York: John Wiley and Sons Inc. 1984.
- _____ and Gordon, David B., "Rules, Discretion, and Reputation in a Model of Monetary Policy" Journal of Monetary Economics, (1983) 101-120.
- Baumol, W, J., "The Transaction Demand for Cash: An Inventory Theoretic Approach" Quarterly Journal of Economics, 66 (November 1952): 545-56.
- Bewley, Truman, "The Optimum Quantity of Money". In Models of Monetary Economies, edited by John, H. Kareken and Neil Wallace. Minneapolis: Federal Reserve Bank, 1980.
- Braun, Anton, R. "How Large is the Optimal Inflation Tax?" Journal of Monetary Economics, 34 (1994) 201-214.
- Bryant, John and Wallace, Neil., "The Inefficiency of Interest-bearing National Debt" Journal of Political Economy, 1979, Vol. 87, no.2, 365-381.

- Chari, V.V., Lawrence J. Christiano and Patrick J. Kehoe "Optimality of the Friedman Rule in Economies With Distorting Taxes" July 1993, Minneapolis Federal Reserve Staff Report # 158.
- Clower, Robert W., "A Reconsideration of the Microfoundation of Monetary Theory" Western Economic Journal, Dec. 1967, 6, 1-8.
- Gillman, Max. "The Welfare Cost of Inflation in a Cash-in-advance Economy with Costly Credit" Journal of Monetary Economics, 31 (1993) 97-115.
- Grandmont, Jean-Michel, and Younes, Yves. "On the Efficiency of a Monetary Equilibrium" Review of Economic Studies 40 (April 1973): 149-65.
- Grossman, S. and Weiss, L. "A Transaction-Based Model of the Monetary Transmission Mechanism" The American Economic Review, Vol. 73, no. 5 (Dec. 1983): 871-881.
- Friedman, Milton. The Optimum Quantity of Money and Other Essays, Chicago: Aldine 1969.
- Jovanovic, Boyan, "Inflation and Welfare in the Steady State" Journal of Political Economy, June 1982, 90, 561-77.
- Kimbrough Kent, P. "The Optimum Quantity of Money Rule in the Theory of Public Finance" Journal of Monetary Economics, 18 (1986) 277-284.
- Kydland, Finn E. and Edward C. Prescott, "Rules Rather than Discretion: The Inconsistency of Optimal Plans" Journal of Political Economy 85, June 1977, 437-91.
- Lucas, Robert E., Jr. "principles of Fiscal and Monetary Policy" Journal of Monetary Economics, 1986, Vol. 17, 117-134.

_____ and Stokey, Nancy L. "Optimal Fiscal and Monetary Policy in an Economy Without Capital" Journal of Monetary Economics, 1983, Vol. 12, 55-93.

McCallum, B. T., Monetary Economics, Macmillan, 1989.

Persson Mats, Persson Torsten, and Svensson Lars E.O. "Time Consistency of Fiscal and Monetary Policy" Econometrica, 55 (1988) 1419-1432.

Phelps, E.S., "Inflation in the Theory of Public Finance" Swedish Journal of Economics, 1973, 75, 67-82.

Ramsey, F.P., "A Contribution to the Theory of Taxation" Economic Journal, 1927, 37, 47-61.

Sargent, Thomas, J. and John and Wallace, Neil., "The Real Bills Doctrine versus the Quantity Theory: A Reconsideration" Journal of Political Economy, Dec. 1982, Vol. 90, no.6, 1212-1236.

Sidrauski, Miguel, "Inflation and Economic Growth" Journal of Political Economy, Dec. 1967, 75, 798-810.

Tobin, J., "The Interest Elasticity of the Transactions Demand for Cash" Review of Economics and Statistics, 38, no.3 (August 1956): 241-47.

Townsend, Robert M. "Models of Money with Spatially-separated Agents" In Models of Monetary Economies, edited by John, H. Kareken and Neil Wallace. Minneapolis: Federal Reserve Bank, 1980.

Woodford Michael. "The Optimum Quantity of Money" in Benjamin M. Friedman and Frank H. Hahn eds. Handbook of Monetary Economics, Vol.2, 1068-1152. Elsevier Science Publishers B.V. 1990.

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