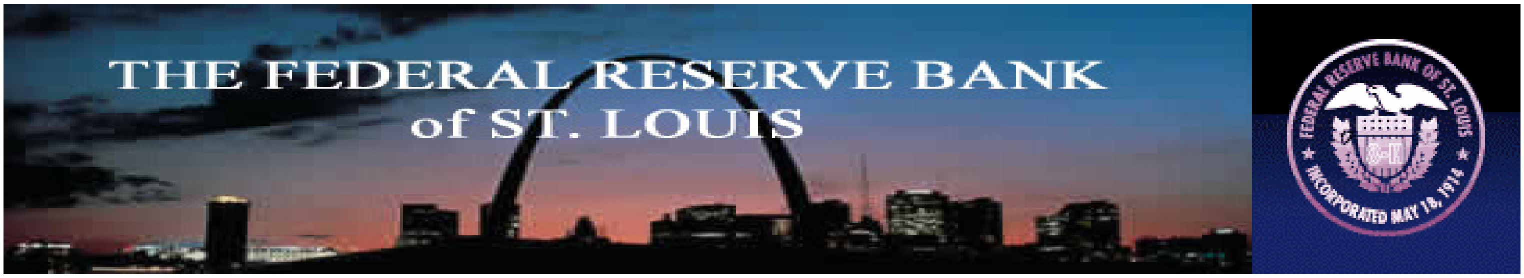

WORKING PAPER SERIES

Government Debt, Output, and Asymmetric Information

Joseph H. Haslag
and
D. C. Betts

Working Paper 1987-003A
http://research.stlouisfed.org/wp/1987/1987-003.pdf

1987

FEDERAL RESERVE BANK OF ST. LOUIS
Research Division
411 Locust Street
St. Louis, MO 63102

GOVERNMENT DEBT, OUTPUT, AND ASYMMETRIC INFORMATION

Joseph H. Haslag* and D. C. Betts**

Federal Reserve Bank of St. Louis

87-003

Recent explanation of monetary policy and its effect have centered upon a non-cooperative game involving the monetary authority and the private sector. Notably absent from the discussion of asymmetric information and its impact on decision making is fiscal policy. This note examines a simple model where the fiscal authority determines the optimal ratio of permanent to total government debt based on explicit optimizing behavior. Deficit financing can have short-run effects because of uncertainty concerning future fiscal policy. However, in the long run, changes in net private sector wealth due to government financing policies do not affect private sector behavior.

* Economist, Federal Reserve Bank of St. Louis

** Southern Methodist University and University of Texas at Austin

The authors wish to thank Nathan Balke, Michael Cox and Stephen McDonald for helpful comments. Any errors are, of course, the responsibility of the authors.

I. Introduction

Recent explanations of monetary policy and its effects have centered upon a non-cooperative game involving the monetary authority and the private sector. Kydland and Prescott (1977), Barro and Gordon (1983a,b), Canzoneri (1985) and Cukierman and Meltzer (1986) have developed frameworks to analyze the effects of such a policy game. Basically, the monetary authority is assumed to possess information about policy decisions which are not available to agents in the private sector. The usefulness of hoarding policy information is made clear by comparing the objective functions of the monetary authority and (a representative agent of) the public. Withholding current strategy information allows the Fed to achieve its targeted level of output, which is above the level determined in the private sector.[1] Indeed, unanticipated changes in the money supply, which arise due to the presence of asymmetric information, may lead to higher levels of output. Recognizing the potential implications of asymmetric information, wage setters demand a higher growth rate in nominal wages than if information sets were symmetric. Thus, the Fed's output target is achieved at the cost of higher rates of inflation.

Notably absent from the discussion regarding asymmetric information and its impact on decision making is fiscal policy. Arguably, the legislative process does signal the direction and intent of current fiscal policy actions. Yet, it is not difficult to imagine future policy strategies which the fiscal authority conceals and which may affect current decisions made by the public.[2] For instance, future tax policies may not be public information. With respect to current decision making, future tax policies may have ramifications for the net wealth content of publicly-held government bonds.

It has been argued that agents can infer future tax policies from current (and past) budget policies. The tax-discounting hypothesis argues that an endpoint constraint on future taxes exists such that the present value of future tax payments exactly equals the present value of government expenditures and government bonds. This constraint implies that government bonds are to be excluded from the definition of net private sector wealth because there is a tax liability which exactly offsets the increase in households' assets. In short, future tax policies do not affect the net wealth of government bonds according to the tax-discounting model.[3]

Yet, the implication of the tax-discounting hypothesis regarding government bonds has not reached a concensus among economists.[4] Explicit consideration of "permanent" government debt and wealth effects arising due to changes in this variable are discussed in Samuelson (1970), Stiglitz (1982), Bryant and Wallace (1984) and Cox (1985). The term permanent refers to the market value of government bonds which are considered net private sector wealth.[5]

The purpose of this note is to examine a simple model where the fiscal authority determines the optimal ratio of permanent to total government debt based on explicit optimizing behavior. It is outside the scope of this paper to discuss the methodological issues involved. By considering the government's criterion for "creating" net private sector wealth, it is possible to extend the "Second Irrelevance Proposition" found in Stiglitz. Specifically, short-run impacts may arise due to the uncertainty regarding future government tax policies.

II. The Model

In this section we will set up a framework for analyzing the choice of growth in permanent government debt. Each period the policymaker chooses the quantity of permanent debt to be issued so as to maximize a state dependent objective function. It is assumed that the policymaker has information about the state which is unavailable to the public. That is, the government knows the state in which its objective function lies.

The public knows the general structure of the objective function utilized by the fiscal authority. To deal with the uncertainty regarding the "true" state, the public forms a rational expectation conditioned upon an information set. This information set consists of all past realized values of the state.

We will first concentrate upon the behavior of the fiscal authority. Throughout this analysis it is assumed that the rate of inflation is positively related to changes in permanent government debt issued this period. The concern of the fiscal authority is to choose the optimal quantity of permanent government debt to issue. The selection of the ratio of permanent to total government debt considers the rate of inflation and the level of economic activity in the objective function.

2.1 The Fiscal Authority's Behavior

The fiscal authority knows how the public forms its conditioned forecasts of the current period issue of permanent government bonds. Moreover, current period budget of the government is known.[6] This latter assumption implies that a given ratio of permanent to total government debt issued in a given period will give rise to a certain level of unanticipated changes in net private sector wealth. The fiscal authority chooses the ratio by comparing the costs of permanent government debt with the benefits of unanticipated changes in the quantity of permanent debt issued.

The public enters into wage contracts prior to the realization of the state. Forming a rational forecast of the rate of inflation, laborers contract for a specified rate of increase in nominal wages. Firms are assumed to be on their marginal product curve. That is, at the market wage, firms will employ the profit maximizing quantity of labor. Assuming that the actual employment of labor occurs after the true state is realized, one benefit from a psoitive value for surprise inflation may be a higher level of economic activity.

A second benefit accruing from a higher rate of inflation than anticipated involves revenues. It is well known that inflation also generates revenues for the fiscal authority. However, the increase in nominal government revenues are exactly offset by higher interest payments in the case of perfectly anticipated changes in permanent government debt. Consider a policy where nominal interest payments on government debt are related proportionately to the expected price level (from which the expected rate of inflation is derived). This implies that real government interest payments are constant when there is not surprise inflation. However, with surprise inflation, nominal interest payments do no rise proportionately with the price level. Therefore, the fiscal authority creates additional net revenues.

The cost of permanent government debt consists of a direct and indirect effect. The indirect effect is attributable to the actual rate of inflation induced by changes in permanent government debt. It is assumed that the rate of inflation in any period is a monotonically increasing function with respect to changes in permanent debt. The evils of inflation have been described in other studies. As Canzoneri notes, despite the unconvincing arguments forwarded concerning the costs of inflation, "there is clearly a political mandate to sacrifice some employment and output to keep inflation in check."

The direct costs associated with permanent government debt involve the "additional" costs as compared to temporary debt. To illustrate, consider a case where the fiscal authority issues two $1 bonds, both paying $d per period and maturing in τ periods. Let one bond be permanent and the other be temporary government paper. The present value, or costs, of these bonds at time t = 0 may be expressed as:

$$(1) \qquad \sum_{t=1}^{\tau} d/(1+r)^t + {}^1(1+r)^\tau,$$

where, r is the constant discount factor. Suppose the fiscal authority raises taxes in period τ to retire the temporary bond and "rolls over" the permanent bond into consol continuing to pay $d per period forever. Let the transactions costs of these two processes (i.e., retirement and resale) be equal. Thus, the permanent government bonds costs (in present value terms at time t = 0) an additional $(d/r)/(1+r)^\tau$.

Formally, the fiscal authority's decision strategy is:

$$(2) \qquad z_t = (\alpha/2)(k_t D_t)^2 + b\, k_t - \theta_t[(k_t D_t) - (k_t^e D_t)).$$

The variable z_t denotes the "net" cost function facing the policymaker; k_t denotes the "true" ratio of permanent to total government debt; k_t^e, the point estimate of this ratio formed by the public; D_t denotes the current period per capita budget deficit of the government; α, the indirect inflation cost parameter; b, the direct cost parameter associated with permanent government debt issue; and θ_t, the benefit parameter.

In equation (2), the use of the quadratic form for the first term implies that the costs of higher rates of inflation rise at an increasing rate. The choice of simple linear functional forms for the direct cost and benefit parameters is for convenience.

For equation (2) to be meaningful, $D_t \geq 0$. In the case where $D_t < 0$, (i.e., a budget surplus) the fiscal authority obviously does not choose the quantity of permanent governemnt debt to issue. In periods of a budget surplus, it is assumed that the fiscal authority uses the funds to retire temporary debt. Note that the discussion of permanent government debt requires that (the expectation of) the present value of the sum of government expenditures in each period exceed the present value of the sum of government tax receipts.

The benefit parameter may move over time. It is assumed that $\theta_t > 0$, and θ_t is independently and identically distributed with constant mean and variance, denoted $\bar{\theta}$ and σ_θ^2, respectively. As we noted above, benefits from unanticipated inflation may reflect changes in the policymaker's preferences with regard to stimulating economic activity or raising revenues. An increase in θ_t represents a shift in the policymaker's preferences toward more stimulative economic activity policies. Note that under our assumptions, changes in θ_t through time are not serially correlated.

The current period (discretionary) cost-minimizing value of k_t chosen by the fiscal authority is obtained by differentiating equation (2) with respect to k_t.[7] Partial differentiation of equation (2) with respect to k_t (assuming k_t^e is fixed) yields the following expression:

(3) $$\frac{\delta c}{\delta k} = \alpha k_t (D_t)^2 + b - \theta_t (D_t).$$

Setting equation (3) to zero, and solving for k_t yields the discretionary policymaker setting of the ratio of permanent to total government debt. The expression for k_t may be written as:

(4) $$k_t^* = (\theta_t D_t - b)/(\alpha(D_t)^2$$

where k_t^* denotes the optimal ratio of permanent to total government debt. Note that equation (4) is essentially the same as the the discretionary result obtained in Barro and Gordon. With fiscal policy, the policymaker must also consider the explicit cost of issuing permanent debt. Equation (4) tells us that the optimal value of permanent to total government debt is positively related to the observed value for θ_t. In other words, as the fiscal authority prefers more stimulative policy action, the ratio of permanent to total government debt will rise. Moreover, the optimal value of k_t is inversely related to the cost parameters, α and b.

2.2 The Behavior of the Public

Individuals in this model are assumed to live one-period. At the end of this period, a subsequent generation is begotten. Preferences are assumed to be identical across generations, as well as with the current period generation. Thus, a representative agent faces a familiar constrained optimization problem, which may be expressed as:

(5) $$U_t = \phi(C_t, N_t, L_t),$$

$$W_t(1-L_t) + r_t + g_t - t_t = P_t \cdot C_t + N_t + (1-k_t)B_t$$

where U_t is the value of the utility function in period t; $\phi(\cdot)$ is the utility function which exhibits positive, diminishing marginal utility with respect to each of its arguments. The arguments in the utility are consumption spending, C_t; "net" bequests, N_t; and the ratio of leisure hours to total hours; L_t.

There are three sources of income from equation (5), wage income and interest payments from government bonds and government expenditures. The residual time not spent enjoying leisure is assumed to be providing labor. Thus, labor or wage income is $W_t(1-L_t)$. The per capita demand for consumption goods by the government is denoted g_t. It is assumed that government consumption is a perfect substitute for private consumption and the public treats government spending as income.[8] Per capita taxes are denoted t_t and r_t is the per capita interest payments. The difference, $r_t + g_t - t_t$, (i.e., the deficit, D_t) denotes the quantity of 1-period bonds issued this period. The per capita quantity of government bonds outstanding is designated B_t. The interest payment is expressed as r_t.

Agents purchase consumption goods at a price, P_t. Total or gross assets are given by $N_t+(1-k_t)B_t$. Gross assets less net bequests corresponds to the future tax liablities facing the representative agent. Thus, we may interpret $(1-k_t)B_t$ as the future tax liabilities. Since the true state is unknown by the public, the budget constraint is more accurately given by $(1-k_t^e)B_t$, where k_t^e denotes the "rational" point estimate of k_t formed by individuals. Consequently, agents must maximize "expected" utility.

Solving the constrained optimization problem found in equation (5) with k_t uncertain, we may derive demand functions for consumption goods, net bequests and labor supply.

Formally, the private sector demand functions derived from the constrained optimization problem in equation (5) may be specified as:

$$(6a\text{-}c) \qquad C_t = C^d(W_t, R_t, T_t, P_t, k^e_t, B_t)$$
$$N_t = N^d(W_t, R_t, T_t, P_t, k^e_t, B_t)$$
$$\ell^s_t = (1-L_t) = 1-L^d(W_t, R_t, T_t, P_t, k^e_t, B_t)$$

Firms employ labor services and produce output, denoted Y_t. As profit maximizers, firms transform the labor input into output, using the present state of technology embodied in $f(\ell)$, where $f(.)$ denotes the production function. The production function exhibits positive, decreasing marginal productivity with respect to labor. The demand for labor input will satisfy $VMP_L = W_t$, where $VMP_L = P_t \cdot MP_L$.

Markets meet simultaneously for commodities, bonds and labor. Recall that the nominal wage is set contractually prior to the market meeting based upon the expected ratio of permanent to total government debt. The equilibrium conditions for these three markets may be expressed as:

$$(7) \qquad C^d(\cdot) + g/P_t = Y^*_t$$
$$(8) \qquad N^d(\cdot) + (1-k^e_t)B_t = \bar{B}$$
$$(9) \qquad \ell^s(\cdot) = \ell^d(W_t, P_t) = \ell^*_t.$$

To complete the model, note that $Y^*_t = f(\ell^*_t)$. The simultaneous solution of equations (7)-(9) yields equilibrium values for the price level, wage rate and interest payments on government bonds.

There is an incentive for the fiscal authority to create unanticipated inflation. Similarly, there is an incentive for laborers to ask to higher nominal wages, making the government choice of k_t costly in terms of higher inflation. The existence of such an inflation bias is a common feature of models analyzing monetary policy. Where this framework provides additional insight is with respect to the Ricardian Equivalence Theorem.

To show how permanent government debt issuance is consistent with the Ricardian Equivalence Theorem, suppose long-run equilibrium prevails in period t-1. In period t, (a deficit period) let $k_t = k_t^e$. That is, all permanent government debt issued is perfectly anticipated. The effect of this shock is to induce an increase in the price level proportionate to the issuance of permanent debt. This implies that real net private sector wealth is unchanged by an issuance of nominal government bonds which are not backed by future tax payments. With $k_t = k_t^e$, the government is raising taxes through inflation. Thus, the irrelevance of the permanent government debt issue hinges upon both future explicit tax payments and implicit inflation taxes.

In the case where $k_t \neq k_t^e$, a temporary equilibrium exists in period t with an increase in real net private sector wealth. Recall that the public knows the general structure of the policymaker's objective function and true state realization. These two factors suggest that agents will realize the true value of k_t. Note that agents based their demand for net bequests (among other goods) upon k_t^e. In a long-run equilibrium, agents must allocate their portfolios between the net bequest use and future tax liability use based upon the true ratio of permanent to total debt in period t. Moreover, to return to a long-run equilibrium, the price level must rise proportionately with an increase in nominal net private sector wealth.

This long-run neutrality is essentially identical to the second irrelevance proposition in Stiglitz. That is, changes in net private sector wealth (in the form of governemnt paper) will affect only the price level. Real variables, on the other hand, will remain unchanged. The short-run effects arise due to the introduction of uncertainty. The increase in the price level amounts to raising an inflation tax, in addition to any future taxes associated with a current period deficit.

III. Summary and Conclusions

The impact of a change in government debt upon private sector behavior are criticized for unrealistic behavioral assumptions. In this paper we specify a simple model where the effects of deficit financing are possible in the short-run because of uncertainty concerning future fiscal policy. However, in the long-run, changes in net private sector wealth due to government financing policies do not affect private sector behavior. Moreover, the irrelevance of deficit financing implies that the government is raising additonal revenues through an inflation tax. The inflation tax is in addition to any explicit tax revenues raised to retire temporary debt.

There are many possible extensions to this analysis. For instance, including money balances as an element of net private sector wealth. In this case, the joint decision of the monetary and fiscal authorities may be of interest.

ENDNOTES

1. In part, the view that private sector determination of the level of output is 'too low' motivates taking monetary policy action. See Canzoneri.

2. O'Driscoll (1977) cites Ricardo's original text which questions the empirical content of the equivalence result which bears his name.

3. For a more complete description of the tax-discounting hypothesis, see Barro (1974).

4. See, for example, Buchanan (1975), Yawitz and Meyer (1976) and Feldstein (1982).

5. The quantity of permanent government debt is assumed not to violate the transverality condition. A limit will be reached at which further growth cannot be achieved by deficit finance. A more formal interpretation can be found in Sargent (1979) and Mundell (1965).

6. Hirschhorn (1984) examines the effects of "surprise" deficits.

7. Solving the current period cost-minimizing problem is shown to be equivalent to minimizing the present discounted costs by Barro and Gordon (1983b) provided:

8. See Bailey (1971) for a more complete discussion of the treating government spending as income.

BIBLIOGRAPHY

Bailey, M. N., 1971, National Income and the Price Level: A Study in Macroeconomic Theory, 2nd ed., New York: McGraw-Hill.

Barro, R. J., 1974, Are Government Bonds Net Wealth?, Journal of Political Economy, 82, Nov./Dec., 1095-

______ and D. B. Gordon, 1983a, A positive Theory of Monetary Policy in a Natural Rate Model, Journal of Political Economy, 91, 589-610.

______, 1983b, Rules, Discretion and Reputation in a Model of Monetary Policy, Journal of Monetary Economics, 12, Jan., 101-121.

Bryant, J. and N. Wallace, 1984, A Price Discrimination Analysis of Monetary Policy, Review of Economic Studies, 51, 279-288.

Buchanan, J. M., 1976, Barro on the Ricardian Equivalence Theorem, Journal of Political Economy, 84, April, 337-342.

Canzoneri, M. B., 1985, Monetary Policy Games and the Role of Private Information, American Economic Review, 75, Dec., 1056-1071.

Cuikerman, A. and A. H. Meltzer, 1986, A Theory of Ambiguity, Credibility and Inflation Under Discretion and Asymmetric Information, Econometrica, 54, Sept., 1099-1128.

Cox, W. M., 1985, Inflation and Permanent Government Debt, Federal Reserve Bank of Dallas Economic Review, May, 13-26.

Hirschhorn, E., 1984, Rational Expectations and the Effects of Government Debt, Journal of Monetary Economics, 14, July, 55-70.

Kydland, F. E. and E. C. Prescott, 1977, Rules Rather Than Discretion: The Inconsistency of Optimal Plans, Journal of Political Economy, 85, June, 473-491.

Mundell, R., 1965, Growth, Stability, and Inflationary Finance, Journal of Political Economy, 73, April, 97-109.

O'Driscoll, G. P., 1977, The Ricardian Non-Equivalence Theorem, Journal of Political Economy, 85, Feb., 207-209.

Sargeant, T. J., 1979, Macroeconomic Theory, New York: Academic Press.

Stiglitz, J. E., 1982, On the Revelance or Inrelevance of Public Financial Policy, National Bureau of Economic Research Paper #1057.

Yawitz, J. B. and L. H. Meyer, 1976, An Empirical Investigation ofthe Extent of Tax Discounting, Journal of Money, Credit and Banking, May, 247-254.