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AND ECONOMIC ACTIVITY

James Tobin and Willem Buiter

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FISCAL AND MONETARY POLICIES, CAPITAL FORMATION, AND ECONOMIC ACTIVITY<sup>\*</sup>

James Tobin and Willem Buiter<sup>\*\*</sup>

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<sup>\*\*</sup>James Tobin, Sterling Professor of Economics, Yale University  
Willem Buiter, Assistant Professor of Economics, Princeton University

## FISCAL AND MONETARY POLICIES, CAPITAL FORMATION, AND ECONOMIC ACTIVITY

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Large econometric models assign to fiscal and monetary policies considerable influence on the paths of output, employment, investment, and other real economic variables and through them on wages, prices, and inflation. These models are generally Keynesian in structure. They attribute short-run fluctuations in economic activity primarily to variation of aggregate demand. They explain aggregate demand for goods and services from its components -- consumption, domestic investment, government purchases, foreign investment. Among the determinants of these expenditures and their sub-components are macroeconomic policies, or variables more or less directly dependent on these policies. Empirical models of this genre are widely used for forecasting and for comparing alternative policies.

Yet their theoretical foundations are under strenuous attack. The attacks differ, but they converge on a single point: Fiscal and monetary policies have little or no influence on real economic outcomes, short or long run. Active use of these instruments to stabilize and steer the economy will not succeed and may have adverse side effects. These views have gained a substantial following among economists, policymakers, and influential laymen. If they are correct, most econometric models are wrong, and so are similar but less elaborate and less formal accounts of the way macroeconomic policies work.

This paper will review major theoretical issues concerning the effects of fiscal and monetary policies, with particular stress on their

effects on capital formation. We will consider challenges to the modern Keynesian paradigm. The lively theoretical controversies of recent years have sharpened understanding of macroeconomic structure and of the complexities of policy-making. We conclude that the essential messages of the paradigm remain relevant: macroeconomic policies have important and durable real effects, for better or worse.

Readers who wish to avoid the technicalities of formal analysis of theoretical models will be able to find our central message in the text. However, the appendix sets forth a model of asset and commodity markets in which the effects of government fiscal and financial policies are rigorously analyzed.

## I. CROWDING OUT AND NEUTRALITY: THEORETICAL ISSUES

### Policies, Environments, and Runs

The government policies to be discussed are of three main types: (1) purchases of goods and services, (2) financing of purchases by taxation, debt issue, and monetary issue, (3) other monetary and financial policies. The first refers principally to variations in the aggregate real amount of goods and services purchased for government use. The content of these purchases -- e.g. the mix of public investment, collective consumption, and "regrettable necessities" like defense and internal security -- is also relevant to some issues. The second refers to the mixture of sources of financing of a given expenditure program. Taxation is to be reckoned net of transfer payments or "negative taxes," government payments to economic agents for which no goods or services are currently rendered in return. The kinds of taxes and transfers used -- whether lump-sum, direct, or indirect -- are important for some issues.

Debt issue means sale of interest-bearing obligations to non-governmental buyers, typically at market-determined prices. Public debt obligations are predominantly promises to pay the national currency at specified dates in future. Price-indexed bonds are seldom issued, and we shall not consider them in this paper.

A national government can also finance outlays by issuing its own currency, which bears no interest at all. With modern banking institutions, the printing press is largely supplanted by a more sophisticated process. Central bank purchases of its government's securities augment, directly or indirectly, the government's demand deposit account in the central bank. As the Treasury draws on the account to pay its bills, this convenient equivalent of currency is transferred to private ownership. In the United States deposits in Federal Reserve Banks are reserves for member commercial banks. The supply of base money, or what we call "high-powered" money, is also augmented when the central bank buys foreign currency assets, gold, or other international reserves. Monetary financing of current government expenditure is operationally the same as monetization of pre-existing debt by central bank open market purchases. But it is useful to maintain a conceptual distinction between monetary issue for financing the current budget deficit and other open market operations. The third category of policies could include central bank manipulation of other instruments including its lending rate, reserve requirements, and ceiling rates on bank deposits. But we shall not discuss them in this paper.

The effects of these policies are likely to depend on the economic environment in which they are applied and to differ with the length of time during which the economy adapts to them. With respect to economic environment, the important distinction is between situations with unemployed resources which can be productively employed by expansion of aggregate demand and situations in which output is limited by supplies of productive resources. By supply limits we do not mean the technological and physical maxima applicable to wartime mobilizations. We refer rather to market-clearing equilibria in which product and factor prices have successfully balanced supplies and demands throughout the economy. Output is not supply-constrained in disequilibria in which excess supplies of labor, capital services, and other resources persist at prevailing prices, disequilibria to which price and wage levels and trends adjust slowly and sluggishly. Some theorists -- the protagonists of the "new classical macroeconomics" -- contend that underemployment disequilibria are infrequent and transient. They describe the economy as a sequence of market-clearing equilibria. This viewpoint naturally colors their view of macroeconomic policy interventions.<sup>1/</sup> We shall not debate this empirical proposition here, but simply record our belief that underemployment of labor and capital is sufficiently frequent and persistent to justify analysis of policy interventions in both environments.

As for time horizons, we shall consider short runs of both environments, and long runs with full utilization, meaning by "short run" a period in which the economy has not reached a stationary or steady growth

equilibrium, and, in particular, has not adapted completely to prevailing policies. Full adaptation has several dimensions. One is that expectations about policy and other variables are realized: agents have no reason in experience to revise the expectations on which they act. Another is that stocks of assets and debts are stationary or growing at a common steady rate; otherwise behavior will change as a result of uneven stock accumulation. But unlike Keynes's short run, ours are not so short that asset accumulation is altogether ignored. We wish to allow current saving and financial flows to affect supplies and demands in asset markets, saving to augment wealth, investment to increase the capital stock, government deficits to raise the public debt. The model specified in the appendix enables us to examine both stock and flow effects of government financial policies.

We shall also analyze the effects of policies in long-run stationary or steady-growth equilibrium, where expectations are fulfilled and asset supplies have adjusted to permanent long-run demands. In both "runs," one of our interests is the effect of policy on capital formation. In the short run the variable of interest is real investment; in the long run it is the stock of capital per worker or per unit of output.

#### Government Purchases of Goods and Services

The proposition that government purchases have macroeconomic effects is scarcely controversial. In buying goods and services for public use, the government is clearly doing something real, which will almost

inevitably have real consequences. Neutrality has been claimed for government financial policies, but rarely for exhaustive (resource-using) public expenditures. Indeed those who argue that finance doesn't matter stress that the true measure of fiscal burden is always the share of national product used by government.

In a fully employed economy, government purchases necessarily displace other uses of resources. The only question is which ones. The answer may depend partly on the nature of public expenditures. Perhaps they provide goods or services which are close substitutes for current private consumption. Perhaps they are capital projects which will yield future consumption or augment the productivity of the nation's resources, whether employed privately or publicly. Perhaps they are expenditures for war or defense or internal security, which substitute for neither present nor future consumption. Rarely are government purchases perceived to provide citizens with such close duplicates of what they are already doing for themselves that citizens cut their private purchases and automatically cede the economic room. As a rule, less direct mechanisms of "crowding out" are needed: increases in prices or interest rates.<sup>2/</sup>

In underemployment situations, "crowding out" is not arithmetically inevitable. The question is then the degree to which government purchases increase aggregate demand. If the government provides goods that are by nature substitutes for private consumption or investment, direct "crowding out" may occur. Otherwise, government purchases add to aggregate demand at prevailing prices and interest rates. Private agents have no incentive to make offsetting reductions in their spending, and no tightening of their budget constraints forces them to do so. According



to the famous "balanced budget multiplier theorem," this is true even if the incremental government expenditures are matched by taxes: the multiplier is 1 . It is at least equally true if they are financed by borrowing or by printing money. Keynesians would expect the multiplier to exceed one in those cases; presumably the "neo-Ricardians" who argue that finance doesn't matter would keep it at one.

#### Monetary Crowding-Out v. Monetary Accommodation

However, monetary policy may not accommodate an increase in national product as large as the increase in government purchases. In this case, the multiplier will be less than 1, perhaps zero. Private expenditures for goods and services will decline, perhaps by as much as government purchases rise. Monetary crowding-out is a third mechanism, to be distinguished from crowding-out forced by supply constraints and from displacement by individual agents' substitution of public for private goods.

Accommodation means that the central bank provides an additional supply of money equal to the additional demand for money generated by the new government purchases, enough to keep constant the interest rates relevant for private spending decisions. The additional demand for money arises from the extra private transactions involved; agents receive incomes from selling goods and services to government, and return the funds to government in taxes or purchases of securities. To

manage the extra transactions, they may need on average somewhat higher cash balances. (The government does too, but its cash balances are not conventionally counted in the money stock under any definition. For this reason, the extra transactions demand for money is smaller when GNP rises from government purchases than when it rises the same amount from private purchases.) If the central bank does not provide the extra money, the attempts of households and businesses to obtain it by borrowing or selling securities will raise interest rates; monetary crowding-out will occur.

The most common scenario is that interest rates rise, inducing some economy in cash management and reduction in money demand but also inducing some reduction in investment, and possibly in consumption. Complete crowding out would occur if the money stock were maintained unchanged and if the rise in interest rates induced no economy of money demand.<sup>3/</sup>

Analyses of this kind assume a monetary policy, expressed in terms of money stock or interest rates or some combination, which remains the same regardless of the government budget and its consequences for aggregate demand. Normally, though not invariably, the monetary authority has discretion. The central bank can accommodate or not, as it chooses. Thus the central bank can oppose and offset a fiscal stimulus by restricting the money stock and its growth as necessary. Or the central bank can accommodate the fiscal stimulus by whatever money supply is needed to validate its multiplier. In this sense, whatever crowding out occurs is either accidental and unintentional or is the deliberate

consequence of monetary policy. Leaving aside transient errors of policy, it is possible to attribute decline in investment to an increase in government purchases if, and only if, one takes for granted the path of total national product the central bank is willing to accommodate. The monetary constraint on output then has the same effect as a resource or supply constraint.

In interpreting and appraising monetary crowding-out, several possible cases should be distinguished:

1. The central bank and the fiscal authorities -- Congress and President in the United States -- agree on the desirable path of GNP. The increase in government purchases is not intended to stimulate the economy but only to carry out the government's substantive programs. Here it is quite appropriate that the needed resources be obtained from other uses of GNP. Individual economists and citizens may, of course, disagree either with the macroeconomic policy or with the allocation of resources. But the policies are consistent. The policy-makers may regard a GNP path with unemployed resources as desirable because the government desires to diminish the prevailing inflation rate or to avoid risks of accelerating inflation by a more rapid growth in aggregate demand. Or the government may be unwilling to accept the external consequences, current account deficit, loss of international reserves or exchange depreciation, of a higher GNP path.

2. The central bank and the fiscal authorities differ in their GNP targets, and the central bank has independent power. The government would welcome a higher GNP path, but cannot persuade the central bank to bring it about. The government tries to reach its objective by fiscal stimulus, or at least welcomes the expansionary by-products of budget expenditures adopted on their own merits. The central bank's refusal to accommodate thwarts the fiscal stimulus, and crowding out is a symptom and consequence of this unresolved conflict over macroeconomic policy. Here it is almost inevitable that the composition of output, along whatever aggregate path results from the policy tug-of-war, is less than optimal from the viewpoint of either side. For example, the path will contain less private investment and more government purchases than either would have desired had they compromised in advance on the actually realized GNP path. Even though the central bank has the last word, the realized path is not necessarily its original target. Apart from the inevitable errors of monetary markmanship, the central bank probably modifies its GNP target in the government's direction, for obvious political reasons but also for economic reasons. One reason to give a little on GNP is to avoid large increases in interest rates and to limit the crowding-out of investment.

3. The central bank and the fiscal authority agree that more rapid expansion of aggregate demand is desirable. But the monetary managers are, or feel they are, unable to bring it about. Consequently fiscal stimulus is welcomed by both sets of policy-makers, and the central bank is happy

to accommodate. Why is monetary stimulus impossible? One case is the "liquidity trap," the nominal interest rate floor Keynes detected in the Great Depression. The floor is no problem today, but the economy may be highly liquid even when nominal interest rates are well above zero. In such circumstances expansionary monetary policy may work but only weakly and slowly; as the central bankers say, "you can't push on a string." Another case is that external financial objectives establish a floor for interest rates. In the early 1960s, for example, exchange rates were pegged and U. S. payments deficits threatened losses of gold reserves and of foreign confidence in the dollar. The Federal Reserve and Treasury were committed to hold short-term interest rates competitive with those abroad. Fiscal stimulus was the only tool available for the 1961-65 recovery.

4. The central bank is making policy by reference to its instruments or to intermediate targets, as well as or instead of macroeconomic results. The result of fiscal stimulus then depends on what this policy is. During most of the 1950s and 1960s Federal Reserve policy was "leaning against the wind." The Treasury-Federal Reserve Accord of 1950 released the "Fed" from its wartime commitment to peg interest rates on government securities. Thereafter the central bank supplied only partially the bank reserves required to meet the demands for credit and deposits generated by cyclical expansion of economic activity, and withdrew only partially the reserves released in cyclical contractions. As a result, interest rates moved pro-cyclically. In effect, the policy introduced a short-run positive

interest elasticity to money supply, reinforcing whatever negative interest elasticity there is in money demand. In this monetary environment, expansionary fiscal policy -- like any other autonomous increase in demand -- has a positive multiplier but crowds out some interest-sensitive private expenditure. In the 1970s the Fed has shifted toward money stock targets, specifically to ranges of growth rates for monetary aggregates. They have not gone so far in this direction as to adopt the strict monetarist rule advocated by Milton Friedman, namely growth of money stock at a constant rate invariant to interest rates and other economic events. The result of this policy shift is to increase the procyclical variability of interest rates, to make the short-run "LM" curve steeper, to diminish fiscal policy multipliers, and to increase the degree of crowding out attributable to government expenditures.

#### The Financing of Government Expenditure.

We turn now to the financing of government expenditures for goods and services. Given the volume and composition of government expenditures, does it matter whether they are financed by taxes, debt issues, or printing money? Does it make any difference to aggregate demand? Do tax reductions or increased transfer payments stimulate business activity? Do they increase employment and output when there is slack in the economy? Are they inflationary when resources are fully employed? Do government deficits absorb saving that would otherwise either disappear in unemployment or finance private capital formation?

"Yes" is the traditional Keynesian answer to all these questions. "No" is the new classical answer: only government purchases are a burden or stimulus, and their effect is independent of their financing.

The issue is whether or not households internalize government saving or dissaving and adjust private saving dollar for dollar to realize a desired amount of total national saving. Keynes argues that they do not. In his discussion of the national propensity to save he included the government budget as an independent determinant [19, 1936, Chapter 8, especially pp. 94-95, 98]. In subsequent theoretical and empirical work, this view was rationalized and simplified by relating personal consumption and saving to disposable income, income after taxes and transfer payments (and excluding retained corporate profits). This specification implies that a dollar of tax reduction, for example, increases personal saving from a given pre-tax income only by a fraction of a dollar, the marginal propensity to save.

Real disposable income "explained" extraordinarily well both variations of annual real consumption in the U. S. between the two world wars and variations across households in cross-section surveys. Consequently many theorists, statistical model-builders, and textbook writers embraced this simple consumption function too uncritically. Abba Lerner's doctrine of functional finance [20, 1946, Chapter 24], for example, relied on the premise that consumer spending could be closely controlled by adjusting taxes and transfers.

This position emphasized, if only tacitly, consumers' dependence on income receipts for the cash needed to make purchases. This emphasis is suggested by the very word "disposable." It surely exaggerates the dependence of consumers on contemporaneous receipts as a source of liquid cash. Moreover, disposable income as computed omits some cash inflows and contains some illiquid accruals, e.g. deductions and employer contributions for pensions and other fringe benefits which appear as "other labor income" in U. S. national income accounts. Keynes himself, in expounding the consumption function as a "psychological law," did not regard it as a liquidity-constrained relation between cash inflow and cash outflow.

Over the postwar years the theory and statistical practice of consumption and saving relations have moved toward a longer-run perspective on household behavior. Most households do not live hand-to-mouth, but consciously or unconsciously base consumption outlays on calculation of the standard of living they can afford over a horizon of months or years or decades. They are able to free consumption from slavish conformity to receipts by reducing their current saving, by borrowing, or by drawing down liquid assets. Their budget constraints allow considerable choice between consumption now and at various future dates. From this perspective, wealth -- the sum over the horizon of current net worth and the present value of future after-tax earnings from household labor and of future transfers -- becomes the effective constraint. This modification increases the estimated marginal propensity to save from current disposable income and lowers the tax-cut or transfer multiplier.



According to the permanent income hypothesis of Milton Friedman [17, 1957] current consumption is related to average expected disposable income, permanent income, rather than to contemporaneous disposable income alone. His theoretical development of the hypothesis refers to horizons of expectation varying from infinite to two periods. In empirical applications he seems to have in mind horizons of only three to five years. The claim that the marginal propensity to consume from transient deviations of current from permanent income is zero does not apply strictly to finite horizons. But the hypothesis explains why consumption is less variable than income and why saving is more volatile than either consumption or income. And it predicts that temporary tax reductions or transfers will have much less effect on consumption than permanent changes of equal annual amount.

In similar spirit the life cycle model assumes a lifetime horizon and relates consumption and saving to the present value of lifetime consumable resources. This model also downgrades the effect of temporary tax cuts or transfers. Current consumption and saving are simply one decision variable in a household's multi-period plan designed to spread existing and expected resources over a lifetime in a pattern that maximizes expected utility.

Household horizons can be extended to allow for utility enjoyed by descendants and for intergenerational bequests and gifts. In the extreme, these linkages make the household's horizon infinite. Just as utility allows directly or indirectly for the consumption of descendants, so the effective budget constraint includes their expected earnings dis-

counted to the present. Individuals' concern for the well-being of their parents and grandparents, and gifts from younger to older contemporaries, can also be modeled. The longer the horizon the weaker the connection between consumption and contemporary income, and the greater the influence of remote events on current behavior.

In application of these models to government financial policy, a great deal depends on what expectations current policies generate about future real incomes after taxes. For example, conventional analysis of the effects of temporary tax cuts or transfers assigns them some stimulative power, though less than permanent changes, on the assumption that taxes and transfers will revert to the levels previously anticipated. The multi-period budget constraint faced by a typical household is relaxed; the present value of current and future tax liabilities net of transfers is diminished.

A stronger assumption is that the current fiscal stimulus will be offset by subsequent increases in taxes above the reference path, to pay the interest and/or principal of the currently incurred government debt. Assuming households perceive those liabilities and discount them at the interest rate at which the government borrows, their multi-period budget constraint has not changed, and neither will their behavior. Current fiscal deficits are perceived simply as deferred tax levies, as certain as death and taxes are proverbially reputed to be. This is the new classical or "Ricardian" theory of public debt, supporting the proposition that government finance has no effect on either aggregate demand or its composition.<sup>4/</sup>

The proposition, in its strongest form, is applied both to debt finance and to money finance. When the government shifts from taxes to interest-bearing debt, expectations of additional future taxes of equal present value offset the current tax reduction. When the shift is to money, free of nominal interest, there is no implication that taxes will be higher in the future. What losses, currently incurred or expected, offset the public's increased holdings of money? The losses are losses of purchasing power because of changes in commodity prices, current or expected. To assimilate those losses to explicit taxes, they are metaphorically described as inflation taxes.

These strong assertions of neutrality deserve serious consideration. We shall discuss first the case of debt finance, examining critically the Ricardian theory. This is followed by discussion of monetary finance and by critique of monetarist propositions that real economic outcomes are invariant to changes in the stock of money or its rate of growth. The fourth section of the paper reports the conclusions of our model, formally described in the Appendix, concerning the effects of government fiscal and financial policies. The final section offers some concluding remarks.

## II. DEBT NEUTRALITY: CRITIQUE OF RICARDIAN THEORY

The Ricardian doctrine has strong implications for the short-run effects of government finance, both in unemployment and full employment situations, and for its long-run effects: In short-run underemployment disequilibrium, a shift from tax finance to debt finance is not expansionary. It does not increase consumption demand, or aggregate demand, at

prevailing prices; therefore it will not increase realized output, real income, and employment. In short-run full employment equilibrium, debt finance is not inflationary. Since it leaves aggregate demand unchanged, supply and demand will still balance without any increase in prices or any rise of interest rates. In long-run steady states, debt finance does not reduce the capital intensity of the economy.

The common thread of these propositions is that substitution of government debt for taxation absorbs no saving. That is why it is not expansionary or inflationary. That is why it does not crowd out investment in the short run or displace capital in the long run. That is why the present generation cannot shift the burden of its public expenditures to future generations. If as voters they try to do so by lowering their own taxes and issuing bonds, they will as individuals buy the bonds to enable their heirs to pay the deferred taxes.

As expounded by Robert Barro [2, 1974], the modern Ricardian theory relies on a number of simplifying assumptions: (1) Households so linked to subsequent and past generations by bequests and gifts that their horizons are effectively infinite, (2) Correct beliefs that current deficits imply future taxes of equal present value, (3) Lump-sum taxes, (4) No liquidity constraints, (5) Homogeneity of households, allowing their behavior in aggregate to be represented as that of a single representative household.

Elsewhere in this series one of us presents a model of overlapping generations, which shows that decentralized competitive behavior will not

necessarily produce outcomes invariant to government financial policy, even when intergenerational bequests and gifts are taken into account.

[8, Buiter, 1978]

Here we consider plausible ways in which Barro's assumptions may be violated and argue that realistic departures from his assumptions support modern Keynesian views of the short-run and long-run effects of debt finance.

### The Endless Chain of Intergenerational Gifts and Bequests

Clearly voters always have some incentive to shift the burden of public expenditure to other taxpayers, whose welfare is of no concern. Any citizen with no heirs, or none he cares about, would be glad to defer taxes beyond his own lifetime; and he would consume his gains today. Ricardian theory depends on complete effective intergenerational chains of bequests and gifts. How plausible are they? A chain is broken in any lineal family if any generation is childless or indifferent to the utility of its successor. Though parents may care about their own children, their bequests will be smaller if they know that their great grandchildren will have no children they care about. In particular, they will not adjust their bequests to provide for any increase in taxes to be levied after the break in the chain.

For the neutrality theorem to be valid, bequest and gift motives have to be operative for each and every economic agent affected by the public sector financing policies. Some households in each generation are childless or do not care about their children's well-being. They

consume more as their taxes are shifted to future generations. The remaining households, who have children and care about them, cannot maintain both their own lifetime consumption and that of their children, because the latter will also be liable for the taxes shifted from the childless or indifferent members of the older generation. The net result for the households who care will be an increase in bequests, to be sure, but not enough to pay their children's taxes. Aggregating both kinds of households, the substitution of debt finance for tax finance increases current consumption.

Parents' utility may well depend in some degree on the size of their bequests to their children, independently of the utility or earning potential of the children. The convention of equal division among children, who may differ widely in wealth from other sources, suggests this motivation. To the extent that giving is for the gratification of the giver rather than the welfare of the receiver, bequests are related to the wealth of the parents rather than to the well-being of the child. There is then no presumption that bequests will be increased enough to keep children at the same utility level when taxes are shifted on to the children.

Utility optima at zero bequest "corners" can occur even for households that are concerned with their children's utility. The parents would choose negative bequests if these were an available option. Accordingly, they will not bequeath more but consume more if taxes are shifted to their heirs. Corner solutions are more likely if households'

utility functions place small weight on the future utility of their heirs, if they place large probability weights on the possibilities that the chain will somehow be broken, and if the economy is experiencing productivity growth leading parents to expect their descendants to be much better off than they are.

Dependence of Future Taxes on Current Deficits, and Expectations About Their Relationship

It is an empirical question how individuals' expectations of future real incomes are altered by their perceptions of current fiscal policy. What inferences do taxpayers draw from reading about large budget deficits? These probably differ from time to time and from one individual to another. Future tax policy is rarely announced in advance; and even when tax surcharges or tax credits have been legislated as temporary, everyone knows that expiration dates can be changed and frequently are. It is not obvious that citizens will always assume that a current deficit carries with it future tax liabilities of equal present value. Nor is it necessarily irrational "public debt illusion" if they assume and behave otherwise.

The government's net worth may be considered the present value of its stream of net revenues less its stream of purchases of goods and services. Suppose that to every dollar of currently outstanding public debt corresponds a dollar of discounted value -- at the government's interest rate -- of future tax receipts to pay coupons and principal. Then the

dollar of debt subtracts nothing from the government's net worth. And if purchases are also balanced, in present value, with taxes the net worth of government is zero. But there is no reason that this should always be so or that taxpayers should always believe it to be so. Perhaps the debt will grow with the interest rate, new debt always being issued to service existing debt. Then the net worth of the government is negative, and private citizens would be correct so to estimate it. They could also be correct to expect that current government deficits do not foreshadow future taxes of equivalent present value. It is very likely, and very fortunate, that Americans did not scale their tax expectations up to the debt inherited from World War II.

The sole condition on collective rationality is that basic economy-wide constraints on current and future capacities to produce be respected. The combined present values of government and private consumption cannot exceed the existing capital stock and the present value of future resource endowments. It would be irrational for society to behave, as voters, taxpayers, and private consumers and investors, on expectations which violate these constraints. But it is quite possible for the government to have negative net worth, and the private sector to have correspondingly a net worth exceeding the national wealth, without their joint consumption plans exceeding productive capacity. A well-known example occurs in long-run growth models, where some private saving is diverted from capital formation into acquisition of public debt. In certain circumstances, such diversion is not only feasible but optimal.



Consider, as another example, a deficit incurred in recession either as passive result of revenue shortfall or as active counter-cyclical policy. It is not "public debt illusion" to observe that the economy is operating inside its production possibilities, long-run as well as short-run. If so, taxpayers can rationally believe that the deficits represent a permanent increase in public debt with no implications of higher taxes later -- i.e., a downward adjustment of government's net worth. The public can rationally believe that the adjustment will yield for them higher real incomes, produced by resources otherwise under-utilized. Acting on that belief, they can consume more today and help to confirm their own expectations. It is hard to see how this self-consistent scenario can be ruled out, except by those who deny a priori, indeed tautologically, the possibility that the economy can ever be operating short of capacity. In the present context, they would be saying that prices always adjust to clear markets so that the public buys all the potential output the government does not take, regardless of present and expected taxes, or however large or small the government's net worth.

#### Lump-sum and Conditional Taxes

Ricardian doctrine assumes that all taxes are lump-sum. Our vast array of non-lump-sum indirect and direct taxes, transfers and subsidies, will alter the shapes of private opportunity sets. Such sources of non-neutrality are no less important for being so obvious. The nature of real world tax systems creates a presumption that debt finance of government

spending increases current consumption.

First, taxes induce tax-reducing behavior. Consider, for example, current lump-sum transfer payments financed by debt issues to be serviced by future taxes on wealth or on income from wealth. The combination will surely encourage substitution against saving and capital formation. Wage taxes will have qualitatively similar effects to the extent that they tax the proceeds of human capital investments. They will also induce substitution in favor of leisure and other untaxed uses of time. Anticipating this kind of behavior by his heirs, a Ricardian parent will know that in order to maintain his heirs' utilities it is unnecessary to maintain their real incomes against an expected increase in wage taxes. Labor and leisure substitution will do part of the job and the parent can consume some of his tax reduction without reducing his heirs' utility.

Second, the positive correlation of tax liability with wealth and income means that higher future tax rates reduce the variance of the present value of future consumable resources. At the same time, the current tax cut or transfer maintains the mean. Household saving is in some degree motivated by risk aversion, designed to limit losses of future consumption if earnings are disappointing. To the extent that the tax and transfer system insures this risk, current consumption can be increased.

An individual's expectation of his future tax liabilities depends on his expectations of his tax base, and the taxes are at least as uncertain as the base. If there is no uncertainty about tax incidence, he will discount the future taxes at the same rate at which he discounts the base. For many reasons, some of which will be discussed below, this rate is higher than the interest rate applicable to government securities.

### Liquidity Constraints

The crude Keynesian function relating consumption to disposable income exaggerated the importance of liquidity constraints, but that is no license for ignoring them altogether. Financial markets do not in fact provide unlimited opportunities for consuming future incomes today; they certainly do not provide these opportunities for intertemporal substitution at the interest rates at which governments borrow. Consequently many households may be at "corners." They cannot dissave, or dissave on attractive terms, when the government taxes them even if they perceive the current taxes as substitutes for future taxes on themselves or their heirs. By the same token, they will not save more on their own when tax cuts or transfers increase their current disposable income; they will take advantage of an opportunity, which capital markets do not provide them, for consuming now resources that they or their descendants will have at their disposition later. The government is in effect lending to them at its borrowing rate of interest, an option not available to these households in the private credit markets.

The liquidity effects of deficit finance have considerable importance for countercyclical stabilization policy. Consider a stochastic economy subject to regular cycles in real economic activity. Capital markets are imperfect and the fraction of economic agents that are constrained in their current spending by current cash flow varies countercyclically. The government does not have enough information to single out the cash flow-constrained agents from those that are constrained only by net worth. A lump-sum transfer payment to everyone during the slump, financed by borrowing, will expand real demand during the slump, even if the government announces that it will use tax revenues to service and redeem the bonds during the next boom. During the slump the bonds are bought by those economic agents that are not cash-flow-constrained. The transfers go at least in part to economic agents with marginal spending propensities of unity because of binding cash flow constraints. The future taxes required to service the debt will be levied during the boom on a population that is, on average, less cash-flow-constrained than it was during the slump. To a liquidity-constrained individual, the value of the transfer payments in the slump exceeds the value of the future tax payment of equal actuarial value. The implicit discount rate is higher than the market rate of interest.

Heterogeneity of Households, Portfolio and Distributional Effects

A number of important dimensions in which households differ in circumstances, tastes, and behavior have been discussed under the preceding four points. A further point concerns the role of government securities in private portfolios, in combination with private securities and expected future tax liabilities. The neutrality proposition assumes that government securities are a perfect hedge against tax liabilities, so that the introduction of both into a portfolio would change neither its expected return nor its risk. Given the uncertainties about when, how, and on whom future taxes will be levied, and about future issues of debt to refund maturing issues or finance new deficits, it is hard to see how so perfect a hedge against all contingencies could be constructed. In any case we observe some holders of government securities with little or no taxes to pay in future, and some future taxpayers with no government securities.

The Ricardian theory, however, also assumes that government interest-bearing debt and private debt are perfect substitutes. On this assumption private debt can also be used to hedge tax liabilities. Thus any private economic agent can, by borrowing or lending on personal account (via home-made leverage) construct a portfolio that is equivalent to a portfolio containing any amount of public debt. The menu of assets from which the individual can choose has not been enlarged by the introduction of government debt.

The assumption that households can lend and borrow on the same terms as governments is strictly for classroom use only. The Modigliani-Miller theorem is an unrealistically simplistic description of the relationship between households and corporations, and it is unlikely to apply any better to households vis-à-vis government. The power of the government to tax and to declare its liabilities legal tender is unique. The risk and liquidity properties of central government debt cannot be duplicated by private debtors.

Barro [2, 1974] correctly points out that the effect of government borrowing on the risk composition of private portfolios requires an analysis of both the asset and the liability side of these portfolios. Future tax liabilities, whether they are associated with current public debt or not, should be included in the risk-return analysis of the entire private portfolio. To argue that the effect of public sector borrowing and associated tax expectations on the "total risk" contained in private portfolios might go either way does not warrant an appeal to the principle of insufficient reason to support his neutrality conclusion.

An interesting area for future research is to investigate to what extent or under what circumstances it is possible to represent the effects of uncertainty by applying different subjective discount rates to anticipated future streams of interest income and tax payments. The traditional Keynesian position, as already noted, has been to argue that the discount rate for future taxes is the one appropriate for the streams of income on

which the taxes are levied. Given the uncertainties in those streams (but ignoring additional uncertainty caused by uncertain incidence), that rate is higher than the discount rate for government obligations. The differential means that government bond issue does indeed raise effective net wealth even if taxpayers correctly expect that higher future taxes will match the increased income from the debt.

### III. MONETARY FINANCE: NEUTRALITY AND SUPER-NEUTRALITY

Monetary finance, unlike debt finance, entails no explicit obligations to pay interest or principal. Consequently, it induces no expectations of future explicit taxes to meet such obligations. The argument that substitution of deficit spending for taxation, in the finance of a given government expenditure program, has no real effect, takes different shapes for money and for debt. One difference concerns the role of commodity prices and inflation. The new Ricardian argument for debt neutrality implies that at prevailing prices of commodities and assets, current and expected, aggregate demand for goods and services is unchanged by shifting from tax to debt finance. In short, bond-financed deficits are neither expansionary nor inflationary. This argument does not apply to money finance. Rather the alleged neutrality depends on the argument that price increases, current or expected, deprive monetary issue of any real effects. Unlike bonds, money is inflationary.

### Open Market Operations

The two neutrality arguments, for debt and for money, are logically bound together. The Ricardian story of interest-bearing debt is a necessary premise of monetarism. To see their connection, it is convenient and instructive to analyze open market operations by which the central bank buys publicly held government debt with money. The reverse operation, selling debt for money, would be symmetrical. Substitution of money financing for taxation can be viewed in two steps: substitution of debt issue for taxes, and open market purchases of the debt issue. This is in fact how it occurs in the United States.

Here is the Ricardian-monetarist description of an open market purchase. Replacing interest-bearing public debt in the public's hands with non-interest-bearing money, the central bank wipes the corresponding tax expectations from the minds of taxpayers. The public's net worth is increased by the amount of the operation, just as if the same amount of currency had been dropped by helicopter. At existing prices, households will wish to consume some of these gains. But if the economy was already in equilibrium, additional demand cannot be accommodated by supply. To maintain supply/demand equilibrium, both current and expected prices rise in proportion to the increase in the quantity of money. Real (and nominal) interest rates and other relative prices are unchanged. Port-



folios contain the same asset mixtures as before. True, the real stock of bonds is smaller, but equally so is the real stock of future tax liabilities. These are equivalent but opposite in sign in wealth-owners' portfolios; together they constitute a composite asset whose supply is zero both before and after the open market purchase.

If the initial situation were one of deficient aggregate demand, with excess supplies of labor and other productive resources, the open market purchase would not necessarily be neutral even if the Ricardian theory of public debt holds. Additional demand at prevailing prices could result in additional output and employment, with sticky current prices rising less than the proportionate increase of money stock and possibly less than expected future prices. The monetarist story is still a consistent one: a full price increase would leave the economy in the same real situation -- with the same excess supplies -- as before. The actual outcome depends on the mechanism by which product and factor prices are determined in disequilibrium. Appeal to market-clearing cannot provide the answer; by assumption, the disequilibrium signifies that markets are not clearing.

Here is another critical split in contemporary macroeconomics. Keynesians, econometric model-builders, and students of wage and price determination in imperfectly competitive markets would not expect money wages and prices to jump on the news of central bank open market purchases. They rely on Phillips curves and full cost pricing equations which give great weight to historical trends in wages and prices and some weight

to the tightness of labor and product markets. Monetarists tend to think of the commodity price level as the reciprocal of the price of the asset money and as being determined, both in short run and in long run, in the money "market," along with other assets, rather than in the markets for the commodities being priced. That is, they think of the price level, rather than other arguments in the demand-for-money function, as the variable that immediately adjusts to equate demand for and supply of money.

More fundamental objections to the monetarist scenario apply if for any or all of the reasons advanced above the Ricardian propositions on neutrality of debt fail. It will not be true that tax expectations match debt holdings in aggregate, or that government securities are found in portfolios just as hedges against future tax liabilities. It will not be true that open market purchases annihilate an equal amount of present value of tax obligation. It will not be true that the open market purchase is the equivalent of a helicopter drop of money; the purchase will increase private wealth but by less than 100% of the amount. A proportionate increase in prices will not by itself restore portfolio equilibrium, keep interest rates constant, and avoid changes in real variables. Should a proportionate rise in prices occur and interest rates remain constant, real money balances would be unchanged, but the real value of outstanding government bonds would be smaller relative both to money and to involuntarily held tax debt. Therefore, private net wealth would be less than before the operation, and aggregate real de-

mand would be smaller too. So that scenario is inconsistent. To sustain a full employment equilibrium takes a lesser price increase; thus the real stock of money increases while that of bonds falls. To sustain portfolio balance then requires that the yields on bonds and on real capital fall relative to that on money. The open market purchase alters the composition of output in favor of investment. With full employment, consumption must decline; this requires a net reduction of wealth, engineered by the combination of higher price level and lower nominal bond supply. If there are unemployed resources, part of the adjustment will occur by increase in output and real income. These short run fiscal and monetary effects are formally analyzed below with the help of the model of our Appendix.

#### Money, Government Debt, and Other Assets as Imperfect Substitutes

Some insight as to why open market operations work can be obtained by reflecting on the nature of money, government debt, and other portfolio assets and on the reasons money is held at a lower explicit yield than competing assets. The characteristics of government-issued money are imparted in some degree to the government's debt issues, time obligations to pay its own money. The same reflections, therefore, explain also why government debts provide services which enable them to be held at lower explicit yields than private debts, and accordingly why increasing their supply adds to private wealth and liquidity.

Why do wealth-owners hold money at zero nominal interest when they can earn a positive rate on government bonds? The answer, of course, is that money yields services worth the difference. Large average cash balances mean that people wait a long time, as cash receipts build up, before converting cash into interest-earning assets, and convert those assets into cash long in advance of the payments for which the cash is needed. Conversions cost resources, if only the time and trouble of the investor. Given the volume and pattern of cash transactions, the larger are average money holdings the lower are conversion costs. Marginal saving of conversion costs is one of the services of money that compensates for loss of interest, and it declines with the size of real money holdings. Another service is avoidance of risk: as cash receipts and desired cash outlays are uncertain, holding money lowers the probability of making costly conversions, conversions at unfavorable asset prices, or costly postponements of outlays. The marginal gain from precautionary balances also declines with the size of real money holdings.

The government has a monopoly of issue of legal tender currency generally acceptable throughout its jurisdiction. Additions to the stock of currency, measured in purchasing power equivalent, provide the social gains -- economizing resources and reducing risk -- just mentioned. Holders of currency pay for those gains by accepting a lower interest rate than they would get on government debt or other assets. Taxpayers escape taxes to pay debt interest; their government earns "seignorage" as currency

monopolist. This situation prevails so long as the real supply of money falls short of the amount that would drive to zero the net marginal value of its services, i.e., the difference between the non-pecuniary return from holding an additional dollar of currency and that from holding an extra dollar's worth of an alternative asset. If this implicit advantage of money were zero, the explicit yield of money would have to be equal to that of other assets. In particular, nominal interest rates on the government's time obligations would have to be zero if the nominal zero rate on its demand obligations, money, were maintained.

From this standpoint the bite of monetary policy may be seen to depend on two related facts: First, the public is generally not, save in the exceptional circumstances of the Great Depression described by Keynes as "liquidity trap," saturated with money. Second, other portfolio assets are substitutes, albeit imperfect ones, for money; central bank operations that lower the net marginal advantage of money will lower the explicit yield differentials of substitute assets, including real capital as well as government securities. By open market purchases of securities with money the central bank can, at least in the first instance, lower interest rates on securities and increase the public's wealth. At unchanged commodity prices, this operation increases consumption demand, by increasing wealth and possibly by lowering interest rates. It also increases investment demand; wealth-owners shift from money and bonds, with lower yields but increased joint supply, to real capital. If goods and

labor markets are already in equilibrium, these new demands are excess and generate price increases that in part nullify the central bank's attempt to augment the real value of the public's money holdings. But only in part -- as we have seen above in the previous subsection, the open market operation is not (except in a Ricardian world) neutral in its effects even in full employment environments. It alters the total real wealth of the public, the real supplies of assets available to wealth-owners, the structure of asset yields, and the composition of output.

Why not saturate the economy with cash balances, providing the public the extra services and wealth? It is not easy to do unless the economy is also saturated with capital. So long as capital investment offers a marginal return above the explicit real return on money (its nominal yield of zero less the expected inflation rate), the real stock of money must be consistent with a positive net marginal service value. Open market purchases increasing the nominal money stock can hardly go so far as to saturate the economy with real cash balances; the demand-increasing and price-increasing consequences of such purchases make this an unrealistic option.

A possible way to bring the public closer to saturation would be to move in the opposite direction, progressively diminishing the nominal money stock relative to GNP and generating deflation. But practical consequences, given the slowness of downward price adjustments in modern industrial economies, would be unfavorable to output, employment, and capital formation. The important institutional fact is that the nominal interest rate on money is fixed -- not that it is fixed at zero, although

it would take awkward practical arrangements to set it at any other level on circulating currency. The way to increase the public's holdings of nominal and real cash balances simultaneously is to raise the nominal yield of money at the same time that the nominal stock of money balances is increased.

The explanation of the expansionary and inflationary content of monetary finance applies also, with less force to be sure, to debt finance of government purchases. An analogous argument can be made for government securities which are close substitutes for money, even though the interest on them may burden future government budgets. The government's securities are promises to pay its own currency at specified future dates -- tomorrow, next month, next year, ten or twenty years from now. The government's currency monopoly extends to these future currency contracts as well; no private debtor can print the wherewithal to pay his own debts. Within the class of nominal assets, all of which share risks of changes in commodity prices and market interest rates, government time obligations have advantages in liquidity, marketability, and security against default. Individual citizens choose voluntarily how much, if any, and what kinds of the government's monetary and non-monetary debts to hold. Like holders of money, citizens holding government obligations are willing to pay in interest foregone for liquidity and for risk reduction. Others are as taxpayers in effect borrowing through the government more cheaply than they lend or invest. The government is an efficient financial intermediary connecting

the two groups. As in the case of money, the government is gaining seignorage on its debt obligations, and increasing the outstanding stock adds to public wealth. This is the basic logic underlying the model described below, which shows that debt-financed increases in government purchases and tax reductions expand aggregate demand, raising output in situations of underemployment and raising prices in situations of full employment.

#### Inflation Expectations and Monetary Financing: Short-Run Effects

So far we have argued, contrary to the Ricardian-monetarist position, that government finance is not neutral in its macroeconomic effects. In particular: (1) Substitution of debt finance for taxation raises aggregate demand, and increases output or prices depending on the state of the economy, (2) Substitution of money finance for taxes or debt finance is likewise expansionary or inflationary, and changes the composition of output in favor of investment, (3) The consequences of a one-shot increase in money stock, by open market purchase of outstanding debt, are not confined to price increases; the real state of the economy is altered.

We have not yet considered the effects of fiscal and monetary policies that alter expected and realized rates of price inflation. Those who argue that the financing of public expenditure does not matter have cited inflation as an anticipated cost of money holding which will induce saving in advance. <sup>5/</sup> Anticipation of the "inflation tax," it is



argued, deprives money finance of demand effects in the same way that anticipation of explicit taxes neutralizes debt finance. We turn to this question now.

The analogy is faulty in several respects. (1) The inflation tax falls on those who hold the money the government has printed to finance deficits. Explicit taxes fall on bondholders only to the extent that those who expect to pay additional taxes voluntarily hold bonds. (2) Any individual can diminish his inflation tax by holding less money. It is clearly not a lump-sum tax. Neither are the explicit taxes that might be levied to service interest-bearing debt, but these are harder and costlier to dodge. (3) A one-shot increase in debt carries with it, in the Ricardian scenario, expectations of future taxes. A one-shot increase in money carries with it, in a classical world, the expectation of an immediate equal proportional increase in the general price level. This is analogous to a capital levy, reducing the value of previously acquired money. It is not per se a source of expectations of higher inflation. Those expectations, as monetarists usually tell us, are aroused by anticipations of a sustained increase in growth rates of money stock.

Expectation of higher inflation, however generated, is certainly not neutral in its short-run macroeconomic effects. The basic source of non-neutrality is the institutional fact that the nominal interest rate on currency and other government-issued money (reserve balances in the central bank) is fixed. In the United States system, bank deposits and other

inside moneys, also have legally or conventionally fixed nominal rates. The expected real return on these dollar-denominated assets declines whenever the expected inflation rate rises. This is a real effect, lowering the demand for real money balances in favor of other stores of value. Other real rates will move to balance asset demands and supplies. In general an increase in the expected rate of inflation will lower real rates of interest and encourage capital investment.<sup>6/</sup> While an inflation premium will be added to nominal interest rates, it is less than a point per point of expected inflation.

For this reason, a financial policy that involves more rapid increase of money stock is not neutral. In an underemployment environment, where wage and price trends are dominated by historical inertia, the policy will clearly be expansionary. Its wealth and interest rate effects increase aggregate demand even without any revision of inflationary expectations. If the expectation of higher monetary growth also raises inflationary expectations, the expansionary effect is reinforced. For the reasons given above, real interest rates decline with inflationary expectations, even though nominal rates rise. However, a one-for-one translation of monetary growth rates into expected inflation will not be confirmed by events if actual wage and price trends are sticky and output responds to increased demand. Of course if an easier monetary policy breeds expectations of its own reversal, fears of future recession may deprive the policy of its normal expansionary effects. But in that case it can scarcely be inflationary either.

In a short-run full employment environment, expectation of more rapid monetary growth will raise both inflationary expectations and the current price level. A one-shot jump in the price level is necessary to restrain aggregate demand, to offset the increase in demand due to higher expected inflation. This does not mean that the policy is neutral. The composition of output will be altered; it is not possible to generalize about the nature of the change. Substitution of money for taxes in financing government deficits has, on impact, consumption effects in both directions. The reduction of taxes increases consumption, as does any accompanying increase in the expected rate of inflation, but the rise in the price level works the other way.

Long-Run Effects of Monetary Growth and Steady Inflation: Super-Neutrality?

"Super-neutrality" is the monetarist proposition that long-run equilibria are the same in the magnitudes of real variables, whatever the inflation rate. This means that they are invariant with respect to the rate of growth of the nominal money stock. Whether government financial policies engineer a monetary growth trend of 10 per cent per year, or 0 per cent, or -10 per cent steady-state capital stock, real output, real wage, consumption, and real interest rates will all be the same. (This is a stronger proposition than simple neutrality, which says merely that one-shot variation of the level of the nominal money stock will not alter real economic outcomes. We discussed simple neutrality in the previous section.)

Super-neutrality seems dubious on its face. As we already observed, a change in the expected rate of inflation alters the real interest

rate on monetary assets with fixed nominal rates. This is a real variable, and in general one would not expect the long-run equilibrium values of other real variables to be unaffected [27, Tobin, 1965].

However, one theoretical recipe for long-run super-neutrality, which appears in various guises in the literature, merits comment.<sup>2/</sup> The argument is essentially that asset stocks are not direct substitutes for each other in the long run. Rather, each asset will be independently accumulated until its marginal advantage to the representative consumer just compensates him for postponing consumption. Consumer-savers will hold each asset in whatever quantity provides acceptable payoff in future consumption for refraining from additional consumption today. Capital, in particular, will be held in whatever amount yields a return that compensates consumers for their subjective discount of future consumption. If another asset, money for example, is also available and can also yield such a return, households will simply expand their total wealth holdings to include it. Money too will be held in such quantity, in real terms, that its marginal return compensates consumers for their discount of future consumption. The marginal return on money includes the subjective value of its implicit services in facilitating transactions, providing liquidity, and limiting risk, as well as its objective or explicit yield, positive or negative, from price deflation or inflation. The same argument applies to government debt and other financial assets, except that their explicit returns include nominal interest. The implication is that

variations in explicit returns on financial assets, including the rate of inflation, will be absorbed wholly by changes in the real quantities of these assets held, changes that alter their implicit returns just enough to keep their total returns intact. Consequently the equilibrium capital stock is independent of the stocks of other assets and their explicit returns.

To state the argument more precisely, suppose that the total return to each asset  $j$  can be decomposed into an explicit return  $r_j$  and an implicit service return  $s_j$ . In long-run equilibrium assets are held in such amounts that the total returns  $r_j + s_j$  are all equal, and equal to  $\rho$  consumers' rate of discount of future consumption. Differences in the  $s_j$  make up for the commonly observed differences in  $r_j$ . Now suppose (1) that each  $s_j$  depends only on its own real stock  $X_j$  relative to income or consumption, and not on any other stock; and (2) that the common intertemporal consumption discount  $\rho$  does not vary with total wealth or its composition. These assumptions are necessary and sufficient for the independence and additivity of asset demands described in the previous paragraph. Their necessity makes clear how special and restrictive is the case for super-neutrality. We consider the two assumptions in turn.

(1) Implicit service returns  $s_j$  are to be viewed relative to one another; they are just interest rate differentials by another name. The marginal implicit advantage of bonds over equity, for example, can be expected to decline when the stock of bonds rises; but the same reasons apply

when the equity stock falls. If cross effects are allowed, the demand for capital will not be independent of alternative asset supplies and of the explicit returns on them.

One source of interdependence is that financial stocks, money in particular, may be substitutes for capital and labor in the handling of transactions. The larger the real money stock the less resources are diverted to managing conversions between money and other assets, thus the higher may be the consumption path corresponding to a given capital intensity. However, the corresponding rate of return to capital is not altered if transactions technology uses capital and labor in the same proportions as commodity production. We do not pursue this line of analysis here. A complete story would require not only specification of transactions technology but also consideration of the fiscal alternatives to the "inflation tax" and the deadweight losses they entail.

(2) The second assumption implies that savers' long-run demands for wealth in aggregate and for individual assets are infinitely elastic at the constant rate of return  $\underline{r}$ . Savers will hold whatever quantities of assets yield them that total return, implicit plus explicit. Suppose instead that wealth demand is finite at any rate of return, possibly inelastic or possibly following a schedule along which the required return is greater as wealth is larger. Then imagine, for example, a variation of policy, or some other exogenous change, that lowers the inflation rate and adds to the demand for real money balances. It

may thus add to the total demand for wealth. But if the public will hold more wealth only when its general intertemporal consumption return is higher, other assets -- including capital -- will have to clear a higher hurdle. Therefore their stocks will be cut back to make room for at least some of the additional money desired.

The difference between perfectly and imperfectly elastic wealth demand can be associated with the difference between infinite and finite horizons in household saving behavior. We noted above that infinite horizons are essential for the Ricardian equivalence theorem, and it is not surprising they are also crucial for super-neutrality. Consider steady growth equilibrium of a money-capital model with immortal consumers. Along every possible path the rate of growth of per capita consumption is the same, namely the exogenous rate of labor-augmenting technological progress. There will be some intertemporal discount rate, some terms on which present consumption can be exchanged for future, that will make the typical consumer content with the path, content not to make any intertemporal exchanges that deviate from it. This discount rate  $\rho$  is formally  $\delta + \lambda \epsilon$  where  $\delta$  is the pure rate of time preference,  $\lambda$  the rate of growth of per capita consumption, and  $\epsilon$  the elasticity of the marginal utility of consumption with respect to consumption.<sup>8/</sup> The term  $\delta$  allows for the postponement of consumption and the term  $\lambda \epsilon$  for its declining marginal utility. Both time preference  $\delta$  and the elasticity  $\epsilon$  must be constants, independent of time and consumption level, for a steady state to be possible

at all. This condition also implies that  $\underline{\rho}$  is the same in every steady state, for the steady states differ in level of consumption path and not in  $\underline{\lambda}$ . The equilibrium steady state is the one for which the marginal productivity of capital, net of the rate of population growth  $n$ , is equal to  $\underline{\rho}$ . Immortal consumers, in the form of households who anticipate the number of their descendants and the utilities of each, internalize the capital requirements of population growth.

On the other hand, a life cycle or finite horizon model of saving and wealth demand is also consistent with steady state growth equilibrium. We argued above that for many reasons it is the more realistic model. The life cycle model implies that the aggregate desired wealth-to-consumption ratio is a finite constant along any path of steady growth. Its value depends on: the age distribution of the population and thus on its rate of growth; the typical age-earnings profile, which depends in turn on the rate of technological progress; the age-consumption profile chosen by the typical household, which will in general vary with the returns to saving. There is a definite age sequence of wealth holdings for each household, and by summation over households of various ages a finite aggregate wealth demand at each date. The desired ratio of wealth to labor income or to consumption may be greater when returns to capital and other assets are higher. In any case capital must compete with other assets in the portfolios of life cycle savers. If they decide to hold more money, it will be at least partly at the expense of capital.



Asset interdependence and finite interest-sensitive wealth demand are assumed in our formal model of the appendix, discussed in section IV. We impose some further restrictions on asset and wealth demand functions. The demand for each asset, in relation to income, depends on the entire list of explicit rates of return. So also does the demand for wealth in total. Assets are assumed to be gross substitutes: an increase in the return on any asset, other things equal, raises the demand for that asset and diminishes, or anyway does not increase, the demand for any other. The net effect on demand for wealth is assumed to be positive or zero. Thus expectation of higher inflation may be, as often warned, a disincentive to saving. But it is mainly a disincentive to saving in the form of money and actually a positive incentive to save in other assets, particularly goods and equities in goods. The net effect on total saving might well be negative, but -- other things equal -- it seems likely that a reduction in the real rate of return on money will make savers wish to accumulate more of those assets which have become relatively more attractive. This is why our model implies that higher steady inflation rates, expected and realized, are generally associated with greater capital formation.

in goods. The net effect on total saving might well be negative, but -- other things equal -- it seems likely that a reduction in the real rate of return on money will make savers wish to accumulate more of those assets which have become relatively more attractive. This is why our model implies that higher steady inflation rates, expected and realized, are generally associated with greater capital formation.

To illustrate the mechanism we compare tax finance and money finance in a steadily growing economy with only two assets, money and capital. In this example interest-bearing public debt is ignored for simplicity. The natural growth rate is  $\underline{g}$ , and a constant fraction  $\underline{z}$  of real national output  $\underline{Y}$  is purchased by government. Taxes, net of transfers, are a proportion  $\underline{t}$  of  $\underline{Y}$ . Let  $\underline{H}/\underline{p}$  be the real stock of government-issued high-powered money held by the public. Let  $\underline{i}$  be the actual and expected rate of inflation  $\dot{\underline{p}}/\underline{p}$ , and  $\underline{h}$  be the rate of growth of the nominal money stock  $\dot{\underline{H}}/\underline{H}$ . In a steady state we know that  $\underline{h} = \underline{g} + \underline{i}$ . The government's budget equation is  $\dot{\underline{H}}/\underline{p} = \underline{h}(\underline{H}/\underline{p}) = (\underline{z} - \underline{t})\underline{Y} = (\underline{g} + \underline{i})(\underline{H}/\underline{p})$  or  $\underline{z} = (\underline{g} + \underline{i})(\underline{H}/\underline{pY}) + \underline{t}$ . Now if  $\underline{h} = \underline{g}$  and  $\underline{i} = 0$ ,  $\underline{t}$  must be  $\underline{z} - \underline{gH}/\underline{pY}$ . Compare a more inflationary policy:  $\underline{h}' > \underline{g}$ , yielding  $\underline{i}' > 0$ . Now  $\underline{t}'$  must be  $\underline{z} - \underline{h'H}/\underline{pY}$ , equal to  $\underline{t} - \underline{i'H}/\underline{pY}$  if  $\underline{H}/\underline{pY}$  is the same. The inflation tax  $\underline{i'H}/\underline{pY}$  is substituted for part of the explicit tax  $\underline{t}$ . But it doesn't make sense to assume that  $\underline{H}/\underline{pY}$  remains the same. Presumably it will be smaller, because reduction in the real return on money -- possibly

also increase in the after-tax return on capital -- shifts saving and wealth from money to capital. Capital stock is higher relative to labor force and output, and its before-tax return is accordingly lower.

If the asset substitution elasticity is very high, an inflation tax cannot be substituted for explicit taxation. Indeed a more inflationary policy might be associated with a higher tax rate  $\tau$ . To state the matter the other way round, the only way to have a low real deficit might be to have such a high inflation rate that people are reconciled to the small quantity of money the tight fiscal policy supplies. It would require a value exceeding unity for the total (i.e., not holding other rates of return constant but allowing them to adjust as necessary to restore equilibrium) elasticity of demand for high-powered money with respect to the sum of the inflation rate and the growth rate. Note that this condition could be met, for positive inflation rates, even if the elasticity of money demand with respect to the inflation rate alone is smaller than unity, as conventionally believed.

Notice that we are here comparing two steady states, one with a higher tax take  $\tau$  than the other, and asking which has the higher inflation rate. In theory the answer can go either way. It depends on the relationship of the product  $h(H/pY)$  to  $h$ . The higher the tax rate the lower this product must be. If a reduction in the inflation rate  $i$  lowers the product -- as will be the case if the  $H/pY$  desired by the public is not very sensitive to  $i$  -- then  $i$  will be lower in a steady state with a higher  $\tau$ . If an increase in the inflation rate  $i$  lowers the product -- the  $H/pY$  desired by the public is very sensitive to  $i$  -- then  $i$  will be higher in a steady state with higher  $\tau$ .

These comparisons say nothing about the stability of steady state equilibria. We may well suspect that the second possibility -- higher  $\underline{t}$  associated with higher  $\underline{i}$  -- is unstable. After all, in the short run we expect an increase in tax rate, a tightening of fiscal policy, to slow down inflation. The range of possible outcomes becomes even wider when government interest-bearing debt is included as a third asset.

#### IV. A MODEL OF ASSET MARKETS AND MACROECONOMIC POLICIES

Here we summarize the results of a formal analysis of short-run and long-run effects of government fiscal and financial policies. The mathematical model and analysis are presented in the Appendix.

##### Structure of the Model

The model focusses on the balance of supply and demand in three asset markets: high-powered money, government bonds, and claims to productive capital. In an extension of the model to apply to an open economy, a fourth asset -- securities of foreign issue denominated in foreign currency -- is added.

In the short run, the public begins with initial holdings of the several assets and decides how much to accumulate of each one during a period of time. These decisions are saving and portfolio choices combined. They depend on the rates of return expected of the assets, on income and taxes, and on the initial holdings. On the supply side, the

increments of money and government debt depend on the government's budget deficit and on how it is financed. Also, the central bank can, during any period, engage in open market transactions in money and government securities, and in foreign assets in the open economy model. The incremental supply of capital during the period results from real investment decisions, which are taken to depend on the difference between the expected rate of profit on the commodity cost of capital goods and the market yield on equity claims. The increment to the nation's stock of foreign assets is the surplus in international current-account transactions.

In the long-run steady state, asset stocks are stationary in real terms, or are growing at a common constant rate, the natural rate of growth of the economy, i.e., the sum of the rate of growth of the labor force and the rate of labor-augmenting technical progress. The asset demand/supply equations of the model then refer to stocks that meet the steady-state condition. Stocks are adjustable to savers' preferences in the long run, unconstrained by initial holdings. The parameters of fiscal and financial policy determine the available supplies of money and government debt per unit of output or per efficiency unit of labor. For capital the long-run supply function is the technological relation between capital intensity -- the capital/output ratio or ratio of capital to efficiency labor -- and the rate of return to capital. In an open economy the current account payments surplus must keep the stock of foreign assets, measured in purchasing power over domestic goods, con-

stant relative to output. Long-run asset demands depend on real rates of return including the real return on money, the negative of the inflation rate.

Note that balance of the government budget is not a requirement<sup>9/</sup> of long-run equilibrium, even if the natural rate of growth is zero. A constant real steady-state deficit per unit of output provides for the required growth in the nominal stocks of money and government bonds. The inflation rate is endogenous and can adjust to reconcile a large variety of deficit outcomes to the steady-state conditions of the previous paragraph. In long-run equilibrium the nominal stocks of money and government bonds must grow at the natural rate of growth plus the rate of inflation. Of course, if the deficit is endogenous its equilibrium value might happen to be zero. Or a balanced budget might be a deliberate policy choice. In these cases the stocks of government-issued assets would be constant in nominal amounts in long-run equilibrium, and their real growth at the natural rate would be accomplished by steady deflation. Steady-state budget surpluses would mean dwindling nominal stocks accompanied by price deflation faster than the natural rate.

Applied to the short run, the three asset equations of the closed economy model determine three variables in each period. Two of these within-period endogenous variables are rates of return, on government bonds and capital equity. The third real rate of return, that on money, is not endogenously determined within a period. The expected rate of inflation is taken to be pre-determined from past

history; it varies but only as periods go by and history accumulates. Thus the system of three equations is free to determine a third variable each period. Two obvious choices are real income and price level. These correspond to the two short-run environments discussed throughout the paper: an underemployment case, in which output is demand-determined at historically pre-determined prices, and a full employment situation in which output is supply-constrained and the price level adjusts flexibly within the period. An intermediate case would involve adding a within period price adjustment equation and solving for both price and output. The open economy model adds one equation. The corresponding endogenous variable is either the foreign exchange rate or, for a regime of fixed parities, the quantity of foreign assets purchased or sold by the central bank and government.

In the long run the inflation rate is endogenous, along with the real rates of return on capital and government bonds. The inflation rate, moreover, affects both asset demands and asset supplies, in ways discussed in Section III. No equation is needed for output or the price level. The capital/output ratio follows immediately from the solution value of the return on capital; given this ratio and an initial condition the path of real income is determined. Likewise, once the solution of the system gives the permanent inflation rate, an initial value for any nominal variable suffices to pin down the path of prices.

The short-run system can be viewed as a generalized Keynesian "IS-LM" model. (The IS equation is actually the sum of the asset demand/

supply equations, and we do not use it explicitly in our analysis in the Appendix. The same results could be obtained by dropping one of the asset equations instead and keeping the IS relation.) The major generalization is on the portfolio side. Keynes's assumption of perfect substitutability between long-term bonds and equity is dropped. Instead all the three or four assets are assumed to be gross substitutes, both in short-run saving decisions and in long-run portfolio choice. For the purposes of this paper we retained the simplifying assumption of aggregation, that the economy produces one homogeneous commodity, usable either in consumption or in investment or as exports. It is not, however, the same as the commodity imported from abroad. Conversion of current output into capital is subject to diminishing returns; rapid additions to the capital stock entail adjustment costs. This is why the rate of investment is a finite increasing function of the difference between the marginal efficiency of capital at normal replacement cost and the market yield of equity. Finally, for the purposes of this paper it was not necessary to model the labor market separately.

We deliberately chose to model time in discrete periods, within which variables assume one value and one value only. At each hypothetical set of values of endogenous variables the agents in asset markets formulate demands and supplies related to positions desired at the end of the period. The clearing of the markets determines an "end-of-period" equilibrium [16, Foley, 1974]. This means that the saving decision and the portfolio allocation decision cannot be separated.<sup>10/</sup> In addition, government deficits have time within the period to add to supplies of money or bonds or both, business investment increases the supply of equities in the same period, and



current account surpluses immediately augment the supply of foreign assets. The continuous time IS-LM snapshot has been charged with failure to take account of the stock-increasing effects of the flows its solution generates. These could be handled by dynamic analysis that tracks stocks. Otherwise the IS-LM account of the effects of a deficit-increasing fiscal policy omits the financial consequences of the additions to stocks of money or debt that will occur with the passage of time. Some critics have contended that such neglect of the "government budget constraint" is responsible for misleading conclusions about the effects of fiscal policy. The short run of our model, which does not neglect the government budget identity or any other mechanical flow-stock relationships, does not substantiate this complaint. It shows that standard Keynesian conclusions survive explicit recognition of these phenomena.

#### Short-run Policy Effects

In the short run an increase in public spending or a cut in taxes will stimulate output in the unemployment model or raise the price level in the full employment model. Investment varies positively with current profits per unit of capital and negatively with the rate of return on equity, the required rate of return on capital. In the short run profits per unit of capital increase with the level of output. The positive effect on output of expansionary fiscal policy in the unemployment model will therefore encourage investment. There will be "crowding in".

In the full employment model this effect is absent. The effect of changes in public spending and taxation on the required rate of return on

capital depends crucially on the manner in which the government finances its budget deficits or surpluses. If money financing is chosen, the required rate of return on capital is lowered by an increase in public spending or a tax cut, both in the full employment model and in the unemployment model. In both cases expansionary fiscal policy combined with accommodative monetary policy "crowds in" investment. If mixed financing or bond financing is chosen, the effect on the required rate of return on capital is ambiguous. With bond financed deficits,  $r_K$  is more likely to increase if bonds and equity are close substitutes. If  $r_K$  increases, expansionary fiscal policy definitely "crowds out" private investment in the full employment model. In the unemployment model the negative effect on investment of a higher  $r_K$  will be offset at least partly by higher output and profits.

An open market sale of bonds raises the real rate of return on bonds. It lowers output in the unemployment model and the price level in the full employment model. The rate of return on equity is likely to be increased if bonds and equity are close substitutes, lowered if bonds and money are close substitutes.

There is a widely held view that the combination of contractionary fiscal policy and expansionary monetary policy favors investment. We evaluate this proposition by considering the effect on investment of different combinations of fiscal and financial policy parameters that keep constant real output or the price level. For example, raise taxes or reduce public spending and compensate for the contractionary effect by

raising the share of money in financing the deficit. The traditional view is confirmed for a reduction in public spending combined with an increase in the share of money. A tax increase, however, may by its direct effect on disposable income, have such a strong negative effect on the demand for equity, that  $\underline{r_k}$  increases, discouraging investment.

It is sometimes argued that an increase in public spending, or a tax cut, raises inflation expectations, especially if financed by printing money. The model shows that a rise in inflation expectations will give a boost to investment by encouraging a portfolio shift towards real assets. This conclusion might not hold if the higher expected rate of inflation were systematically accompanied by increased uncertainty about the future. It would not hold if households and businesses have learned to expect severely restrictive monetary and fiscal measures whenever the expected rate of inflation increases.

#### Long-run Policy Effects

Analysis of the long-run effects of fiscal and financial policies proceeds by comparison of balanced growth paths. All real stocks and flows grow at the natural rate of growth, the sum of the rate of growth of the labor force and the rate of labor-augmenting technical change. Expectations are realized. The economy is fully adjusted to the values assumed by the policy instruments.

In Section III above a number of long-run policy issues have already been discussed, especially those concerned with super-neutrality. The propositions advanced there are formally substantiated in the Appendix.

In the three-asset model, the long-run effects of fiscal policy changes on variables like the capital-output ratio and the rate of inflation are complicated and frequently ambiguous without further quantitative information. A number of propositions emerge clearly, however.

Long-run crowding out of private capital by public spending or by a shift from tax financing to bond or money financing is a possibility but not a necessity. The proximate effect of an increase in public spending or a cut in taxes -- for a given rate of inflation and given values of the real rates of return on bonds and capital -- is to increase the steady-state stocks of bonds and money. Ceteris paribus this will stimulate the demand for capital without affecting the supply. There will therefore be a tendency for the required rate of return on capital to go down and for the capital-output ratio to increase. Of course, this is not the complete story. The proximate effect of these same policy changes on the bond market and the money market is to create excess supply. If bonds and equity are close substitutes, this will create upward pressure on  $r_K$ . When we allow for these further substitution and wealth effects, the final outcome can go either way. Neither "crowding out" nor "crowding in" can be ruled out on a priori grounds.

#### Implications of the Analysis for Open Economies

The analysis is extended to an economy that is open to international commodity trade and financial transactions. The home country is large in the market for its exports and small in the market for its imports.

The terms of trade are therefore endogenous. The asset menu is enlarged by adding an internationally traded financial claim, denominated in foreign currency. Domestic government bonds, money and equity are not internationally traded, and the internationally traded asset is a gross substitute, but not a perfect substitute, for the domestic assets. Therefore, both the quantity of money and either the exchange rate or the official settlements deficit in international payments can be controlled by domestic policy.

In both fixed and floating exchange rate régimes, the short-run effects of fiscal and financial policy on output, the required rate of return on capital and the rate of investment are very similar to those in the closed economy. The open economy model, of course, explains a wider set of endogenous variables, including the current account, the capital account, and either the official settlements balance or the exchange rate, depending on the régime. It also includes an additional instrument of financial policy: either the exchange rate or the volume of open market transactions in the internationally traded asset by the monetary authority.

The possibility of long-run "crowding in" of capital by expansionary fiscal policy, discussed above for the closed economy model, also applies to the open economy. Perhaps more important than the sign of these long-run multipliers is the conclusion that changes in fiscal, monetary and financial instruments will have real effects, short run and long run. Properly specified econometric models will not be policy-neutral.

In general, both fiscal and monetary instruments have domestic macro-economic consequences in the expected directions in both exchange rate régimes, fixed and floating. It is also true that floating exchange rates will not insulate the economy from foreign shocks, for example changes in export demand.

#### V. CONCLUDING REMARKS

The economic performance of the United States and other capitalist democracies in the 1970s has been disappointing in many respects. The non-communist world has suffered the deepest recession, the highest general inflation, and the most unemployment of the three decades since the second world war. Until the late 1960s the post-war record had been remarkably good, twenty years of unparalleled stability, prosperity, and growth. Many observers, economists and others, assigned much credit to the active use of government fiscal and financial policies for management of aggregate demand. But with the reverses of the 1970s disillusion and reaction have replaced earlier euphoria, and the same government policies receive much of the blame. Within the economics profession and beyond, intellectual challenges to the neo-Keynesian foundations of macroeconomic policy are increasingly influential.

One dimension of recent economic performance that has evoked widespread concern, particularly in the United States, is the low rate of private non-residential capital formation. The share of potential GNP devoted to this purpose, always low in this country compared to other more rapidly growing economies, has fallen in this decade. A future

capital shortage, inhibiting growth in output and employment, is predicted and feared. One aspect of the disenchantment with government policies is the charge that they inhibit capital formation, overtaxing the earnings of capital, channeling an excessive share of the nation's resources to the public sector, diverting into finance of budget deficits private saving that would otherwise finance private investment. The growth of the federal budget in the last decade and the large deficits realized in recent years of recession and slow recovery have accentuated the charges of "crowding out." At the same time, the inflation of the 1970s has been attributed to government financial policies.

In the economics profession the reaction against neo-Keynesian macroeconomic theory and policy has taken two distinct shapes. Both find the theory mistaken and the policies unsuccessful. One school, following traditional conservative lines, also finds the policies harmful and dangerous, distorting the allocation of resources, crowding out private investment, and causing debilitating inflation. The other school, the new classical macroeconomics, finds the policies ineffectual, harmless except that the public has to go to the trouble of figuring them out and bypassing them.

In this setting our paper has re-examined the theory of the macroeconomic effects of fiscal and financial policies. Our conclusions are intellectually conservative, in the sense that we confirm the general thrust of the neo-Keynesian paradigm. But we hope that our analysis con-

tains some novel features. We reject the neutrality propositions of the new Ricardian theorists who contend that the financing of government expenditure -- whether by taxation, bond issue, or printing money -- makes no difference to real economic outcomes. The conditions required for these neutrality propositions are so special and so unrealistic that it would be foolish and foolhardy to base policy upon them. Thus we agree with the more traditional critics of demand management policies that they are capable of doing harm as well as good. We do not agree that they have done nothing but harm, or all the harm attributed to them.

We share the concerns about the inadequacy of capital formation in the United States in recent years. The federal government should be concerned about it too. The neutrality doctrines that we have criticized in this paper imply that the government need not worry about the nation's economic future because citizens as individuals will take care of it on their own. This is bad advice, whether applied to the conservation of natural resources or to the overall management of the economy. Government is an essential part of the mechanism by which societies provide for their continuity and survival; one big reason for its institution is to make collective provisions for future generations supplementing the provisions individuals make for their own descendants.

It is important to be clear when and how government finance crowds out capital investment and when and how it encourages it, crowds it in. One of the more misguided episodes of recent public economic



discussion was the flurry of anxiety about "crowding out" when the government was running large deficits in 1975 and 1976. The economy had barely begun to recover from the severe recession of 1974-75. The deficits were largely the result of the depressed level of business activity, which lowered taxable income and raised entitlements to unemployment insurance and other transfers. They were partly the result of modest tax rebates and reductions voted by the Congress to stimulate recovery. High unemployment and excess capacity indicated that the economy was operating nowhere near its productive potential. Capital investment was low, not because saving and finance were in short supply, but because excess capacity, low equity prices, and dim prospects of future sales made it unattractive. In these circumstances it was absurd to complain that federal deficits were displacing private investment. Additional government spending or tax reduction probably would have stimulated -- crowded in -- investment. Resources were adequate to increase consumption, government purchases, and investment all at the same time. Certainly the opposite policies, had they been adopted in an effort to trim the deficit, would have slowed the recovery or prolonged the recession and made investment even weaker. As we stressed in previous sections, it is important to distinguish situations in which output is limited by resources and investment is limited by potentially available saving from cases in which output and investment are both limited by demand.

In underemployment situations any crowding out that occurs through financial stringency is the work of the central bank. If the monetary authority refuses to accommodate increases in output in response to fiscal stimulus, then rising interest rates and declining share prices will indeed deter some investment. Only if the central bank's view of the desirable path of total output is accepted can fiscal policy be blamed for substituting consumption, private and public, for investment. In section I we discussed the importance of coordinating fiscal and monetary policy. Unfortunately, the repeated use of fiscal measures for stimulus and of monetary measures for restraint results in a policy mix unfavorable to capital formation in the long run. A mix favorable to investment would involve an easier monetary stance offset by taxes bearing particularly on consumption.

Economists have long debated the optimal trend of prices -- rising, stable, or falling. An advantage of a steadily rising price level is the incentive it gives for investment in real productive capital, by making the holding of wealth in liquid form unrewarding. We examine and formalize this idea in the body of the paper, and we investigate the fiscal and financial implications of policies aimed at high long-run capital/labor ratios. Deficit finance provides the growing nominal stocks of money and debt that sustain steady inflation and, somewhat paradoxially, reduce the real stocks desired by savers. So it

is quite possible that deficit finance, especially if an adequate share of it takes monetary form, "crowds in" capital formation. If so, this effect is purchased at the cost of depriving the society of the services that larger stocks of money and debt, with higher explicit returns, could provide.

A theoretical finding that steady inflation is favorable to capital investment no doubt seems bizarre in the 1970s, when the opposite view has become an unquestioned article of faith in business and financial circles. The reason is that the central bank, government, and public are committed to bring down a rate of inflation generally regarded as intolerable. The only weapons at their command are restrictive financial policies that slow the economy down, causing recessions, or interventions in private price decisions and wage bargains. These weapons all seem to threaten profitability, and that is why inflation news is discouraging to investors. By the same token disinflation would be a good sign, but only if the authorities took advantage of it to aim for higher aggregate output and faster growth.

Is there a long-run investment-oriented strategy that does not rely on deficits and inflation to diminish savers' preferences for liquid forms of wealth? The government could serve more directly and explicitly as a financial intermediary, investing in private sector financial claims the proceeds of issuing its unique monetary and non-monetary obligations. Then the public could enjoy the services these assets provide without tying up in them any net saving at the expense of capital formation.

There is no reason that the assets of Federal Reserve Banks cannot include private debts and even equities, as well as Treasury obligations.

The economic malaise of the 1970s relates at bottom to the intractable inflation/unemployment dilemma, a problem outside the scope of our paper. Government financial policy is the scapegoat for the frustrations bred by stubborn stagflation. No doubt some policy errors, notably the deficit financing of the Vietnam war, contributed to our present plight. But inflationary bias seems to be endemic in the political and economic institutions of modern capitalist democracies. It is naive whistling in the dark to think that the problem will disappear if only central banks and legislatures follow different monetary and fiscal rules. The combinations of inflation and unemployment feasible with existing policy instruments are just not acceptable to the society. Unless we find new instruments to make acceptable combinations feasible, or until we wearily decide that some feasible combination is acceptable, macroeconomic performance will continue to be disappointing and frustrating, and capital formation and other provisions for the future will continue to be inadequate.

# APPENDIX

## A FORMAL MODEL OF SHORT- AND LONG-RUN EFFECTS OF FISCAL AND FINANCIAL POLICIES

### Notation

$r_K$	:real one-period after-tax return on capital.
$r_B$	:real one-period rate of return on government bonds.
$r_H$	:real one-period rate of return on money balances.
$r_A$	:real one-period rate of return on foreign assets.
$r_A^*$	:rate of return on foreign assets in terms of foreign currency.
$p$	:price of domestic output.
$p_f^*$	:price of imports in terms of foreign currency.
$w$	:unit labor cost.
$q_K$	:price of installed capital in terms of current output.
$q_B$	:price of government bonds in dollars.
$e$	:foreign exchange rate (number of dollars per unit of foreign exchange).
$b$	:coupon on the government bond in dollars per period.
$x(p)$	:expected one-period proportional rate of change in $p$ .
$x(q_K)$	:expected one-period proportional rate of change in $q_K$ .
$x(q_B)$	:expected one-period proportional rate of change in $q_B$ .
$x(e)$	:expected one-period proportional rate of change in $e$ .
$H$	:nominal stock of money balances per unit of efficiency labor.
$B$	:number of government bonds per unit of efficiency labor.
$K$	:capital per unit of efficiency labor.
$A$	:value, in foreign exchange, of foreign bonds held by the private sector, per unit of efficiency labor.
$\hat{A}$	:value, in foreign exchange, of foreign bonds held by the public sector, per unit of efficiency labor.
$Y$	:real output per unit of efficiency labor.
$I$	:resources devoted to investment per unit of efficiency labor.
$G$	:government spending on goods and services per unit of efficiency labor.
$X$	:trade balance surplus per unit of efficiency labor.
$R$	:real profits before taxes per unit of capital.
$D$	:real value of public sector deficit per unit of efficiency labor.

- $T$  :real taxes net of transfers per unit of efficiency labor.
- $t$  :proportional tax rate on factor income.
- $\gamma_B$  :share of the public sector deficit or surplus financed by bonds.
- $\gamma_H$  :share of the public sector deficit or surplus financed by money.
- $Z_B$  :dollar value of total net government bond sales, per unit of efficiency labor, minus the value of bond sales associated with the financing of the public sector deficit through the deficit financing rule of our model. A negative value of  $Z_B$  means government purchases of bonds.
- $Z_H$  :dollar value of total net money issues by the government, per unit of efficiency labor, minus the value of money issues associated with the financing of the public sector deficit through the deficit financing rule of our model. A negative value of  $Z_H$  means government purchases of money.
- $Z_A$  :dollar value of total net sales of foreign bonds by the government, per unit of efficiency labor. A negative value of  $Z_A$  means government purchases of foreign bonds.
- $n$  :proportional rate of growth of the labor force.
- $\lambda$  :proportional rate of labor augmenting technical change.
- $g = n + \lambda$
- $i = \Delta p/p$
- $\Delta$  :forward difference operator  $\Delta Z(\tau) \equiv Z(\tau+1) - Z(\tau)$ , where  $\tau$  designates period.
- $\bar{Q}$  :Q per unit of output.

# I. THE CLOSED ECONOMY MODEL

The model is essentially a representation of asset demands and supplies, both stocks and flows. Three assets are available to wealth-owners: government fiat money, perpetual government bonds paying a coupon of  $b$  dollars per period, and equity claims to real capital.

One share of equity represents ownership of one unit of physical capital. One good is produced and can either be used as a private or public consumption good or can be converted, at some cost, into durable productive capital. The real price of a unit of installed capital and the real value of a share of equity,  $q_K$ , is equal to the marginal cost of producing goods and converting them into capital. This cost depends each period on the amount of new investment relative to the existing stock.

"Equity" in our model stands for all claims on the productive capital assets of business enterprises and on the earnings from those assets. In actuality, of course, such claims take a variety of forms, including debts denominated in dollars as well as shares. We do not model those business financial decisions that determine the supplies of the several types of claims or the separate demands of savers for them. Our "equity" stands for the whole package of shares and debts of business. The reader should not identify it with shares alone. Thus the  $q_K$  to which real investment is related below would be empirically approximated by summing the market values of all financial claims on business firms, debts as well as shares, netting out financial assets of firms, and comparing the resulting net market value to the replacement cost of the real capital stock at commodity prices. Likewise the real world counterpart of the return to "equity,"  $r_K$ , would not be the one-period yield of shares alone but a properly weighted average of the yields of the several claims on capital stock and earnings. Interest and appreciation on bonds would enter this calculation.

along with dividends and appreciation on stocks.

While our framework could easily handle a larger menu of assets, e.g., splitting "equity" into shares and business debts, the simpler three-asset model is capable of handling the issues addressed in this paper. The Modigliani-Miller theorem justifies aggregation of financial claims on a business firm into a single asset by showing that, under certain conditions, the value and yield of the aggregate are independent of its composition. The conditions are unrealistically restrictive, and disaggregation would be important and interesting for a number of problems. But for our present purposes, all we need is that the package of claims we call "equity" be a gross substitute for the two government-issued assets in our model. Our treatment implies that corporate bonds and government bonds are not perfect substitutes for each other. If they were, corporations could finance virtually all their capital investment at the government bond rate. Our three-asset model respects the essential distinction between interest-bearing claims on government and claims, of whatever financial form, on private business. But most of our results would stand even if we adopted the frequent convention of macroeconomic models of requiring government bonds to bear the same real return as "equity."

Asset demands are for end-of-period stocks to be carried over to the next period. Market supplies consist of stocks carried over from the previous period and new "production" of assets during the period. Thus current period flows of financial claims--generated by public sector deficits or private sector investment--have immediate effects in asset markets. Equations (A.1), (A.2) and (A.3) represent demand/supply equilibrium for one period for the three assets:



$$F^K - q_K K = I(q_K, K) \quad (A.1)$$

$$F^B - q_B \frac{B}{p} = \gamma_B (G + \frac{b}{p} B - T) + \frac{z_B}{p} \quad (A.2)$$

$$F^H - \frac{H}{p} = \gamma_H (G + \frac{b}{p} B - T) + \frac{z_H}{p}. \quad (A.3)$$

The left-hand sides represent savers' demand for acquisition of the several assets during the period. They are in each case the difference between the market value of the stock desired at the end of the period ( $F^K$ ,  $F^B$ ,  $F^H$ ), each expressed in real terms, and the real value of the beginning-of-period stock ( $K$ ,  $B$ ,  $H$ ). The end-of-period stock demands  $F^K$ ,  $F^B$ ,  $F^H$  are all functions of the same list of variables: the three rates of return  $r_K$ ,  $r_B$ ,  $r_H$ ; the values of the initial stocks  $q_K K$ ,  $q_B B/p$ ,  $H/p$ ; real output  $Y$  and taxes  $T$ . We impose the following restrictions on these demand functions. With respect to rates of return, the assets are gross-substitutes. An increase in any rate of return increases total asset demand  $F^K + F^B + F^H$ . An increase in the value of beginning-of-period asset holdings or current income is allocated over all three assets. An increase in the aggregate value of any initial holding increases total asset demand but by less than the increment in the initial holding; it increases consumption too.

A fourth equilibrium condition, the IS curve, is implied by the other three. Let  $S$  denote real saving:

$$S \equiv F^K + F^B + F^H - (q_K K + q_B \frac{B}{p} + \frac{H}{p}) = I + G + \frac{bB}{p} - T. \quad (A.4)$$

The investment function is given by

$$I = I(q_K, K) \quad (I(1, K) = (n+\lambda)K; I_{q_K} > 0; I_K < 0). \quad (A.5)$$

Taxes, net of transfers, are simply proportional to output:

$$T = tY \quad (0 < t < 1) . \quad (A.6)$$

Coupons on government bonds are free of tax. Capital gains are not taxed.

Earnings of capital are taxed before distribution to share-owners.

The government deficit  $G + (bB)/p - T$  is financed either by printing money or by issuing bonds, in proportions  $\gamma_H$  and  $\gamma_B$  respectively.

Open market operations are swaps of money for bonds of equal value.

Thus

$$\gamma_B + \gamma_H = 1 \quad (\gamma_B, \gamma_H \geq 0) \quad (A.7a)$$

$$Z_B + Z_H = 0. \quad (A.7b)$$

Real one-period rates of return are related to current and expected asset prices as follows:

$$r_B = \frac{b}{q_B} + x(q_B) - x(p) \quad (A.8a)$$

$$r_K = \frac{R(1-t)}{q_K} + x(q_K) \quad (A.8b)$$

$$r_H = -x(p). \quad (A.8c)$$

Profits per unit of capital vary positively with real output and inversely with the capital stock:

$$R = R(K/Y) \quad R' < 0 . \quad (A.9)$$

For the short-run analysis of the model, we consider two versions: one with price  $p$  predetermined for the period and, thanks to unemployment of labor and capital, with output in infinitely elastic supply at the prevailing price; the other with full employment and a price level completely flexible. In the full employment version the capacity constraint is:

$$Y = f(K) \quad (f' > 0; f'' < 0). \quad (A.10a)$$

In the unemployment version price is set for the period by past history. But events of the period determine the next period price, via an augmented price Phillips curve:

$$\frac{\Delta p}{p} = \psi(Y-f(K)) + x(p) \quad \psi' > 0; \psi(0) = 0. \quad (A.10b)$$

$x(p)$  could be interpreted as the expectation of inflation. If so, (A.10b) implies that actual output can differ from full capacity output if and only if there are errors in the inflation forecast. Another interpretation is that  $x(p)$  depends on the past history of prices and stands for all the factors in the economy that give inertia to built-in trends in wages and prices. In either case the first term of (A.10b) could differ systematically and for many periods from zero. With the first interpretation this will be the case if there is gradual adjustment of inflation expectations, as exemplified e.g., by an adaptive expectation mechanism. With the second interpretation, anticipated stabilization policy can have systematic effects on real output even if rational expectations or perfect foresight prevail. (See footnote 1.) The dynamics of the model are provided by changes of assets stocks and of expectations, and by the Phillips curve in the unemployment version.

For most of the analysis, we assume that the expected rates of change of  $q_B$ ,  $q_K$  and  $p$  are predetermined each period. As time passes, they are revised in response to forecast errors.

$$\Delta x(q_B) = \alpha_1 (\Delta q_B / q_B - x(q_B)) \quad (A.11a)$$

$$\Delta x(q_K) = \alpha_2 (\Delta q_K / q_K - x(q_K)) \quad (\alpha_1, \alpha_2, \alpha_3 \geq 0) \quad (A.11b)$$

$$\Delta x(p) = \alpha_3(\Delta p/p - x(p)) = \alpha_3(1 - x(p)). \quad (\text{A.11c})$$

The changes of real asset stocks (per unit of efficiency labor) are given by:

$$\Delta K = \frac{I}{q_K} - gK \quad (\text{A.12})$$

$$\Delta\left(\frac{q_B^B}{p}\right) = \gamma_B(G + \frac{bB}{p} - T) + \frac{Z_B}{p} - (1 + g - \frac{\Delta q_B}{q_B}) \frac{q_B^B}{p} \quad (\text{A.13})$$

$$\Delta\left(\frac{H}{p}\right) = (1 - \gamma_B)(G + \frac{bB}{p} - T) - \frac{Z_B}{p} - (1 + g) \frac{H}{p}. \quad (\text{A.14})$$

The only approximation in (A.13) and (A.14) involves our ignoring capital gains or losses on current-period additions to stocks of money and bonds.

#### Short-run Effects of Fiscal and Financial Policies in the Unemployment Model

The basic equations (A.1), (A.2) and (A.3) can be solved for  $(r_K, r_B, Y)$  after using (A.6), (A.8) and (A.9) to eliminate  $q_K, q_B$  and  $T$ . The system expresses the three endogenous variables as implicit functions of pre-determined variables (stocks, expectations, price level) and of policies. There are four parameters of policy. Fiscal policy is described by  $G$  and  $t$ , financial policy by  $\gamma_B$  ( $\gamma_H = 1 - \gamma_B$ ), and monetary policy by  $Z_B$  ( $Z_H = -Z_B$ ).

The equations for the twelve multipliers with respect to policy parameters are tedious to print and read but, along with other mathematical details not presented here, are available from the authors on request.

The structure of these equations is as follows:

$$(\text{A.15}) \quad \begin{bmatrix} + & - & + (?) \\ - & + & + \\ - & - & + \\ + & + & + \end{bmatrix} \begin{bmatrix} dr_K \\ dr_B \\ dY \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & - (?) \\ \gamma_B & D & \frac{1}{p} & - (?) \\ 1 - \gamma_B & -D & -\frac{1}{p} & - (?) \\ 1 & 0 & 0 & - \end{bmatrix} \begin{bmatrix} dG \\ d\gamma_B \\ dZ_B \\ dt \end{bmatrix}$$

$$D \equiv G + \frac{bB}{p} - tY.$$

Our a priori restrictions on the sum of the elements of each column are given below the columns. An increase in the required rate of return on capital stimulates saving and reduces investment. An increase in the rate of return on bonds stimulates saving. Expansion of real output is assumed to have a stronger effect on saving than on investment (the analogy of the assumption that the IS curve is downward sloping in the simple IS-LM model). If an increase in output creates excess demand in the market for equity, the last column of the Jacobian on the l.h.s. of (A.15) is positive and its determinant is also positive. Even if an increase in output were to create excess supply in the equity market, the determinant of the Jacobian will be positive if the excess demand created in the money market by an increase in  $Y$  is larger.

Another ambiguity is the effect of an increase in the tax rate  $t$  on excess demand in the three asset markets. In aggregate, increasing  $t$  creates excess demand for assets. The deficit declines, and the new government supply of money-cum-bonds is diminished more than the reduction in private saving induced by the decline of disposable income. This is indicated by the negative sign for the sum of the last r.h.s. column in (A.15). But this effect may not prevail for every asset individually. For example, if  $\gamma_B$  is close or equal to zero, the deficit reduction does little or nothing to the supply of bonds, and the general saving-reducing effect of the decline of disposable income may dominate. In the case of equity, the tax effects on demand and supply are somewhat different. Lowering the deficit does not directly diminish the new supply of equity; however, the higher tax rate deters private investment. On the asset flow demand side, the decline in disposable income and the reduction in after-tax returns have negative effects, offset only by the capital loss on equity inflicted by the tax increase.

Table A.1 shows the results for the twelve multipliers, so far as definite signs follow from our assumptions. The final t column assumes that the excess demand effects dominate in all three assets (negative signs throughout the dt column of (A.15)).

The signs shown in the Table A.1 for  $\gamma_B$ , the share of the deficit that is bond-financed, assume a positive deficit. If the budget is initially in surplus, an increase in  $\gamma_B$  would have the opposite effects. Of course a change in  $\gamma_B$  would have no effect if the budget was balanced. An increase in  $Z_B$ , like an increase in  $\gamma_B$  with an initial deficit, involves the sale of bonds for money by the central bank. They both raise the real rate of return on bonds and reduce aggregate demand and output. The after-tax rate of return on equity  $r_K$  is likely to be higher if bonds and equity are close substitutes, lower if bonds and money are close substitutes. If  $r_K$  increases,  $q_K$  will be lower because  $Y$  also declines. Private capital formation is "crowded out." If  $r_K$  declines, the net effect on  $q_K$  is ambiguous.

An increase in public spending  $G$  will raise output. Its effect on  $r_K$  is uncertain. If deficits are exclusively money-financed,  $\gamma_B = 0$ , an increase in  $G$  will lower  $r_K$  and stimulate investment. In that case the stimulating effect on investment of higher current profits is reinforced by a lower required rate of return. Both raise  $q_K$ . With money-financed budget deficits and surpluses, an increase in  $G$  will also lower  $r_B$ . Thus, given idle resources, an increase in public spending coupled with accommodating monetary policy will "crowd in" private investment. This may happen even if  $\gamma_B$  exceeds zero. The monetary share of deficit finance does not have to be 100 percent to prevent  $r_B$  from rising. Furthermore,  $r_B$  can rise -- as will certainly

Table A.1. Signs of One-Period Policy Multipliers, Unemployment Model

Variable \ Policy	G			$\gamma_B$	$Z_B$	$\tau$
	$\gamma_B=0$	$0 < \gamma_B < 1$	$\gamma_B=1$			
$r_K$	-	?	?	?	?	?
$r_B$	-	?	+	+	+	?
$Y$	+	+	+	-	-	-

happen if  $\gamma_B = 1$  -- while  $r_K$  falls. This would occur if bonds are in some sense closer to money than to capital in the chain of asset substitution.

# Short-run Effects of Fiscal and Financial Policies in the Full Employment Model

The solution for the full employment version is obtained by reversing the roles of  $Y$  and  $p$ . Output  $Y$  is predetermined by the capital stock previously accumulated, given of course the exogenous supply of efficiency labor. The price level  $p$  is endogenous within the period. As in the previous section, the system consists of the three basic equations (A.1), (A.2) and (A.3) with extra variables eliminated by use of subsequent equations. In our comparative static analysis of this version of the model we add a fifth exogenous variable  $x(p)$  to the four policy parameters. The structure of the equations for the fifteen multipliers is given in (A.16), and the results are summarized in Table A.2.

$$(A.16) \begin{bmatrix} + & - & ? \\ - & + & + \\ - & - & + \end{bmatrix} \begin{bmatrix} dr_K \\ dr_B \\ dp \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & -(?) & - \\ \gamma_B & D & \frac{1}{p} & -(?) & - \\ 1-\gamma_B & -D & -\frac{1}{p} & -(?) & + \\ +1 & 0 & 0 & - & + \end{bmatrix} \begin{bmatrix} dG \\ d\gamma_B \\ dZ \\ dt \\ dx(p) \end{bmatrix}$$

The Jacobian matrix, on the left-hand side of (A.16), differs from that of (A.15) for the unemployment case only by having a question mark in the third column. In general, an increase in the price level stimulates saving via the "real balance effect." This is the only effect at work;



our assumption that  $x(p)$  is given eliminates any possible substitution effect from a rise in the current price level relative to the future price level. The reduction in the real value of existing holdings of bonds and money is the reason for the plus signs in the second and third entries of the column and in the sum for total saving at the bottom. Does this loss of wealth spill over into more saving in the form of equity too? This is the uncertainty indicated in the first row. But even if the answer is negative, it is likely that the positive effect on saving in the form of money is absolutely larger than the negative effect on equity saving. This is sufficient, but not necessary, to insure that the Jacobian still has a positive determinant, as is assumed in Table A.2. The other assumptions of Table A.2 are the same as for Table A.1.

The policy effects on  $p$  are straightforward. An increase in public spending,  $G$ , raises the price level and a substitution of bonds for money lowers it. As in the unemployment version, the effect of an increase in the income tax rate is complicated by the non lump-sum nature of the tax which directly affects the rate of return on investment and the required rate of return on equity. The tax column of Table A.2 assumes again that an increase in  $t$  causes excess demand for all three assets. To obtain the result that a substitution of bonds for money raises  $r_B$ , it is sufficient (but not necessary) that the effect of an increase in the price level on the bond market is larger, in absolute value, than the effect in the equity market. With that assumption, we can determine the signs of a few more multipliers. First, the substitution of bonds for money will raise  $r_K$  when bonds and equity are close substitutes, lower  $r_K$  if money and bonds are close substitutes. Second, with money financing ( $\gamma_B=0$ ) an increase in  $G$  lowers  $r_K$  and  $r_B$ .

Table A.2. Signs of One-Period Multipliers, Full Employment Model

Variable \ Policy	G			$\gamma_B$	$Z_B$	t	x(p)
	$\gamma_B=0$	$0<\gamma_B<1$	$\gamma_B=1$				
$r_K$	-	?	?	?	?	?	-
$r_B$	-	?	+	+	+	?	-
p	+	+	+	-	-	-	+

Note that whenever real output increases in the unemployment model, the price level rises in the full employment model. In the latter version, private spending is crowded out by public spending dollar for dollar. Resources appropriated by the government may come partially or wholly from private consumption rather than private investment, however. With sufficient money-financing, investment may even be "crowded in" by deficit finance. This is particularly likely if the source of increased deficit is tax reduction rather than exhaustive government purchases.

An autonomous rise in expected inflation is a decline in the real return on money, and by our standard assumption will generate excess supply of money and excess demand for the other two assets. This is reflected in the last column of the r.h.s. matrix of (A.16). The last column of Table A.2 shows the implications: an increase in  $p$  and declines in the other real rates of return  $r_K$  and  $r_B$ . Along with the decline in  $r_K$  goes an increase in capital investment. Room in the economy is made by a decrease in consumption, in response to the wealth losses arising from the price level increase which more than offsets the stimulating effect on consumption of the general reduction in rates of return.

#### The Fiscal-Monetary Policy Mix and Capital Formation

The analysis can be simplified in a number of ways by assuming that the tax is a lump-sum tax,  $T_0$ , rather than a proportional tax on labor and capital income. This simplification will be used to consider the validity of a common proposition about the monetary-fiscal policy mix most likely to favor investment. It is widely held that a combination of expansionary monetary policy and restrictive fiscal policy favors capital formation by keeping interest rates low while taxes discourage private consumption.

In the unemployment version of the model, we shall evaluate this proposition for the short run by investigating what combinations of the tax,  $T_0$ , and of the share of money in the deficit,  $\gamma_H = 1 - \gamma_B$ , keep  $Y$  constant. The analysis is repeated for combinations of  $G$  and  $\gamma_H$ . We then consider the effect of such changes in policy mix on  $r_K$ , and thus on  $q_K$  and  $I$ . In the full employment version of the model we shall consider, by analogy, which combinations of  $T_0$  or  $G$  and  $\gamma_H$  sustain a given price level, and how capital formation varies when the policy mix is altered in a way that preserves the price level. We continue to assume the government budget to be in deficit initially.

We summarize the results verbally. Mathematical details of the analysis are available from the authors.

An increase in  $G$ , with an offsetting change in  $\gamma_H$  that just keeps  $Y$  at its original level, raises  $r_K$ . With  $Y$  constant by assumption,  $q_K$  will fall and investment is crowded out. As one would expect, a downward compensating change in  $\gamma_H$  is needed to keep  $Y$  constant when  $G$  increases. This result supports the view that a combination of expansionary fiscal policy and restrictive financial policy deters investment. The reverse policy, a fall in  $G$  and a rise in  $\gamma_H$ , will favor capital formation.

The case of tax increases and monetary expansion is not completely straightforward, however. Granted that an increase in taxes raises the sum of private and public saving, this policy can, and in our model will, initially reduce saving in the specific form of equity. If this effect is very strong, the excess supply pressure in the equity market could raise  $r_K$ , and thus lower  $q_K$  and investment when taxes increase. This is the less likely to happen the smaller is the income effect on the demand for equity. If this effect is zero, an increase in  $T_0$ , with a compensating change in  $\gamma_H$  to keep  $Y$  constant, unambiguously lowers  $r_K$  and stimulates

investment;  $r_B$  is also lower. The direction of the compensating change in  $\gamma_H$  is unambiguously positive when there is no income effect on the demand for equity because we assume throughout that the mix of bond and money financing is such that ceteris paribus an increase in taxes would create excess demand in both the bond market and the "money market." With both  $r_K$  and  $r_B$  lowered, the demand for money will increase further. To preserve equilibrium,  $\gamma_H$  will have to increase.

The counter-intuitive phenomenon--an increase in taxes reduces the demand for equity to such an extent that the required rate of return on capital is increased--cannot occur in the traditional Keynesian IS-LM model. The reason is that bonds and claims to real reproducible capital are in that model perfect substitutes in private portfolios. The more general portfolio-theoretic structure of our model includes the Keynesian model as a special case but can also generate the nontraditional results just mentioned.

In the full employment version, the relevant fiscal-monetary policy trade-offs are those that keep the price level constant. The analysis is exactly the same as for the unemployment model. In both cases both  $p$  and  $Y$  are formally exogenous, one by policy manipulation and one by assumption regarding the economic environment. The financial parameter  $\gamma_B$ , or  $\gamma_H$ , is formally endogenous. The results just presented apply to either environment.

#### Tax Cuts, Deficits, Inflation Expectations and Investment

In the short-run analysis of our model, we have so far treated expectations as parametric. The expected proportional rates of change of the price of capital, the price of bonds and the general price level are given for any single period. In the long-run steady state of the model,

expectations are always realized. To extend this perfect foresight assumption to the short run is fashionable but probably not very useful in many cases. Instead we shall analyze the impact of a specific combination of tax and financing policies under the assumption that economic agents (or at any rate the portfolio holders whose behavior is modeled in our asset-demand functions) have "crude monetarist" expectations. A cut in taxes will, when deficits are financed mainly or entirely by increased money creation, lead to an increase in the expected rate of inflation. The full employment version of the model will be used to analyze the impact of a tax cut on capital formation under these circumstances. Taxes are again taken to be lump sum.

An increase in the expected rate of inflation will induce substitution out of money balances. With the nominal interest rate on money fixed, the real rate of return declines by the full amount of the increase in the expected rate of inflation. Bonds too are nominally denominated. We would therefore expect substitution out of bonds as well. The portfolio reshuffling consequent on an increase in the expected rate of inflation, however, results in changes in the nominal interest rate on bonds which compensate, although in all likelihood only partly, for the increase in expected inflation. The higher expected rate of inflation will correspondingly lower  $q_B$ , the nominal price of the bonds.

As we have seen above, an increase in the expected rate of inflation will by itself reduce both  $r_K$  and  $r_B$ . (The positive effect on investment implied by this analysis needs to be qualified in real-world application, as we suggested in the text, by allowing for the increased uncertainty, and increased likelihood of subsequent restrictive policy, possibly engendered by higher inflation.) As we also observed above, a tax reduction by itself normally will "crowd in" investment, especially

if the resulting deficit is financed by money; the only reservation is that the resulting rise in the price level and decrease in wealth might tend to diminish saving in equity. Thus if inflationary expectations are enhanced by tax reduction, there is a double reason for expecting favorable effects on capital formation. It is not inflation per se, but rather the future policy responses associated with inflation (monetary contraction, tax increases, etc.) that might discourage investment.

## II. STEADY-STATE EQUILIBRIUM

We now describe the steady-state characteristics of the model. In long-run equilibrium, all real stocks and flows grow at the natural rate of growth,  $g = n + \lambda$ , and expectations are realized. The open market operations parameter,  $Z_B$ , is set equal to zero. Unless we state otherwise, the government is assumed to pursue mixed deficit financing policies ( $0 < \gamma_B < 1$ ). Certain steady-state conditions are set out in equation (A.17).

$$x(q_B) = \frac{\Delta q_B}{q_B} = 0; \quad x(q_K) = \frac{\Delta q_K}{q_K} = 0; \quad x(p) = 1 \quad (\text{A.17a})$$

$$q_K = 1 \quad (\text{A.17b})$$

$$Y = f(K) \quad (\text{A.17c})$$

$$\frac{H}{P} = \frac{(1-\gamma_B)}{\gamma_B} \frac{q_B^B}{P} \quad (\text{A.17d})$$

$$\frac{H}{P} + \frac{q_B^B}{P} = (G + \frac{bB}{P} - tY)/(g+1) \quad (\text{A.17e})$$

$$r_K = R(K/Y)(1-t) \quad (\text{A.17f})$$

$$r_B = \frac{b}{q_B} - 1 \quad (\text{A.17g})$$

$$r_H = -1. \quad (\text{A.17h})$$

Equation (A.17a) states that expectations are realized. Since the nominal coupon on government bonds,  $b$ , is constant, the nominal price of bonds,  $q_B$ , is constant even in an inflationary or deflationary steady state. There are no real capital gains on equity. Equation (A.17b) implies that net investment is at its steady-state value:  $I = gK$ . From (A.17c) we see that output is at the full employment level. The ratio of the value of the money stock to the value of the bond stock is given by  $(1-\gamma_B)/\gamma_B$ , the ratio of the shares of money and bonds in the financing of budget deficits or surpluses (A.17d). The real value of the public sector deficit has to be sufficient to maintain the real value of total government debt per unit of efficiency labor, in the face of price level changes, labor force growth and technical change (A.17e). Equations (A.17f-h) define real rates of return, all constant in a steady state.

Steady states cannot exist at all unless the behavioral and technological relations of the economy satisfy certain homogeneity properties. The production function must be homogeneous in capital and efficiency labor, as already assumed in (A.17e and f). Thus each possible steady state is characterized by a capital/output ratio constant over time. Policies also must be consistent with growth of all real variables at the common natural growth rate of the economy. Thus both  $G$  and  $T$  must be proportional to output  $Y$ . Finally asset portfolio demands must allow all real stocks to grow at the same rate,  $g$ , as  $Y$  and other aggregate real variables. We exploit these homogeneity properties by expressing the steady-state equations in terms of stocks and flows per unit of output, as follows (stocks and flows per unit of output are distinguishable by bars):

$$\bar{K} = \bar{K}(R) \quad \bar{K}' < 0. \quad (A.18a)$$



This is just the inverse of the R function in (A.17f).

Likewise, the steady state supplies  $\bar{H}$  and  $\bar{B}$  depend on fiscal and financial policies and on rates of return. Using (A.17d, e, g) we obtain:

$$\frac{q_B \bar{B}}{p} = \frac{\gamma_B (\bar{G} - t)}{g - (\gamma_B r_B - (1 - \gamma_B) i)} \quad (\text{A.18b})$$

$$\frac{\bar{H}}{p} = \frac{(1 - \gamma_B) (\bar{G} - t)}{g - (\gamma_B r_B - (1 - \gamma_B) i)}. \quad (\text{A.18c})$$

Note that the denominator in these two expressions could be written as  $g - r_D$  where  $r_D$  is the weighted average of the real rates  $r_B$  and  $r_H$  on government debt, with the weights corresponding to the shares of the two kinds of debt in the total.

We write steady state demands for asset stocks proportional to output Y as  $F^{\bar{K}}$ ,  $F^{\bar{B}}$ , and  $F^{\bar{H}}$ . Each is a function of the three rates of return and of the tax rate ( $R(1-t)$ ,  $r_B$ ,  $-i$ ,  $t$ ). Thus the basic equations are:

$$F^{\bar{K}} = \bar{K} \quad (\text{A.19a})$$

$$F^{\bar{B}} = \frac{q_B \bar{B}}{p} \quad (\text{A.19b})$$

$$F^{\bar{H}} = \frac{\bar{H}}{p}. \quad (\text{A.19c})$$

where the r.h.s. variables can be eliminated by use of (A.18). The three equations (A.19) determine the three rates of return ( $R$ ,  $r_B$ ,  $-i$ ) as functions of the policy parameters ( $\bar{G}$ ,  $t$ ,  $\gamma_B$ ). Once the rates of return are determined, (A.18) can be used to find the steady state stocks. In particular (A.18a) gives steady-state capital intensity.

Before looking at some special cases, we make some general observations about the steady-state solutions and the long-run policy multipliers.

### Budget Balance, Asset Growth and Steady-State Inflation

First, the steady state is not in general characterized by a balanced public sector budget (Currie [14, 1978] and Christ [12, 1978]). The long-run balanced budget emerges only under very special circumstances. One trivial circumstance, related to the algebra of steady states, occurs when both nominally denominated debt instruments of the government are demanded by the private sector in non-zero amounts, while the government finances by only a single instrument ( $\gamma_B=0$  or  $\gamma_B=1$ ). If the nominal quantity of one government-issued asset is kept constant at a non-zero level, the nominal quantity of the other liability must be constant in the steady state, so that all real stocks and flows may grow at the common natural rate of growth. In that case the growth of real holdings of nominal public debt is generated exclusively by a steady proportional rate of price level deflation equal to  $g$  (Tobin and Buiter [32, 1976], Buiter [7, 1977]). A second circumstance occurs when the government pursues mixed financing policies ( $0 < \gamma_B < 1$ ). Either by design -- the policy authority fixes the common steady-state rate of growth of  $H$  and  $B$  at zero by appropriately adjusting one or both of its fiscal controls ( $\bar{G}$ ,  $t$ ) -- or by coincidence, the endogenous steady-state budget deficit assumes the value zero. Finally, the steady-state budget will have to be balanced if the price level is fixed even in the long run in a model without growth. (Blinder and Solow [4, 1974] and Tobin and Buiter [32, 1976]).

Second, it is easily seen from equations (A.17d) and (A.17e) that the steady-state rate of inflation equals the excess of the common steady-state rate of growth of the two nominally denominated public sector debt instruments over the natural rate of growth.

$$\frac{\Delta H}{H} - g = \frac{\Delta B}{B} - g = i \quad (A.20)$$

Third, we stress that the role of money is quite different in the long run from the short run. The reason is that its real rate of return is in the long run endogenous. In our short runs, it was exogenous: we took the nominal return on money as constant at zero and the expected rate of inflation as temporarily predetermined. In the long run the nominal rate on money is still fixed, but the assumed flexibilities of prices and their rates of change plus the requirement that expected and actual inflation rates coincide make the real return endogenous. This removes money from its special position and makes it like other assets. If its real supply is to be increased, one way the public can be persuaded to accept it is by an increase in its real rate of return, a decline in inflation. This means that some of the effects customarily associated with money, as compared to government bonds, need not show up in comparison of long-run steady states. For example, steady states with larger deficits or larger monetary shares of deficits need not be more inflationary; wealth-owners may instead be led to accept the larger monetary issues because inflation rates are lower.

#### Crowding Out and Crowding In

In analyzing the long-run effects of government fiscal and financial policies, we will be comparing the steady-state equilibria associated with different values of policy parameters. "Crowding out" in this context means that the steady state associated with a changed value of a policy parameter, say a higher value of  $G$ , has a smaller capital intensity  $K$  than a reference steady-state path associated with another parameter value, say a lower value of  $G$ . "Crowding in" means that the variation of the policy parameter is associated with an increase in capital intensity.

Clearly crowding out means that steady-state private saving, relative to national product  $Y$ , in the specific form of equity capital is decreased,

while crowding in means that it is increased. There are several ways in which the private rate of equity saving may vary. One mechanism is that total private saving is higher relative to output in one steady state than in another and that at least part of the increment goes into equity. Another mechanism is that private saving is diverted from government liabilities into equity even though total private saving is not increased. A policy variation may tend to crowd in via the first mechanism if it generally fosters private saving; this is in our model, for example, one effect of tax reduction. A policy variation may tend to crowd in via the second mechanism if it lowers the real return on government bonds and money and induces savers to shift to equity, even though total private saving is deterred; this is also a possible effect of tax reduction, though as we shall see it could work the other way.

Things are not always what they seem, and policy variations sometimes have long-run consequences that are the reverse of normal intuition and the reverse of their short-run effects. In our model the nominal rate of growth of government liabilities is not itself a policy parameter. It is the endogenous outcome of more basic policy parameters  $G$ ,  $t$ ,  $\gamma_B$ . Another way to state the point is that the rate of inflation  $i$  is an endogenous outcome of the whole system, and the nominal growth of both government bonds and money is necessarily  $g + i$ . It is important to remember also that there is a presumption of generally negative relationship between the nominal growth of these government liabilities and their real stocks. This arises because a high rate of inflation means a low real return on money, and usually on the substitute asset, government bonds, as well. This shifts savers to capital, as discussed in the previous paragraph. The level of prices adjusts to make the high nominal stocks of debt and money the low real stocks that savers wish to hold.

An increase in  $G - t$  appears to be a deficit-increasing policy. But it does not necessarily increase the steady-state real deficit or debt as a percentage of national product. As shown by (A.18b and A.18c), the debt-income ratio is  $(G - t)/(g - r_D)$ . An increase in  $G - t$  may or may not increase this ratio. It may so lower  $r_D$ , by raising the rate of inflation, that the ratio actually declines. Then the fiscal policy looks expansionary, and is inflationary, but it absorbs less rather than more saving. Private saving and wealth are shifted into the more attractive asset, equity, whose rate declines too. Thus there can be "crowding in" by asset substitution and reduction -- ex post -- of the real public sector deficit per unit of output, even though total private saving is smaller. The opposite is also possible: an increase in  $G - t$  may crowd out capital and be counter-inflationary. The outcomes depend on the system as a whole. That is the reason why the analysis is sometimes complex and why the results sometimes cannot be determined, even in sign, without empirical knowledge of the asset demand and supply functions.

#### Neutrality, Super-Neutrality and Other Long-Run Policy Neutrality.

From the short-run equilibrium equations of the full employment model, we can conclude that money is not neutral, but that money and bonds together are neutral. A once-and-for-all increase in  $H$  accompanied by an equal proportional increase in  $p$ --and, as  $x(p)$  is assumed constant, an equal proportional increase in the future expected price level--will not restore the original real equilibrium. The real quantity of bonds would be reduced, necessitating further real adjustments. A hypothetical once-for-all equal proportional increase in  $H$ ,  $B$  and  $p$  will, however, leave the real equilibrium unchanged.

Shifting from level changes to rate of growth changes, we notice from the long-run model that a given percentage point increase in the

rate of growth of  $H$  alone will not be consistent with an equal percentage point increase in the steady-state rate of inflation. Both nominally denominated assets must grow at the same rate in a steady state, and then the rate of inflation will be associated point-for-point with their common growth rate. However, the consequences of changing the common steady-state rate of change of  $H$  and  $B$  are not limited to an equal change in the steady-state rate of inflation. Money and bonds are in general not "superneutral." Changes in the steady-state rate of inflation alter the steady-state real rate of return on money balances. The reason for this is the fact that the nominal interest rate on the monetary base is institutionally fixed (realistically at zero as assumed in this model). A higher rate of inflation will ceteris paribus induce portfolio holders to shift out of money into other assets. These other assets can be real-valued financial claims such as equity, or nominally denominated claims with market-determined rates of return. The portfolio shift out of money into capital and bonds will tend to reduce their real rates of return. This rather informal argument suggests that a steady state characterized by a higher rate of inflation will also have higher capital-labor and capital-output ratios. The formal analysis below demonstrates that this is indeed a possible configuration, but not the only one.

As explained in the text, super-neutrality means formally that real long-run outcomes are independent of the rate of growth of the money supply. We can generalize this to general, long-run policy neutrality, the property that real long-run outcomes are independent of any government fiscal and financial policies. In the context of our model, it means specifically that  $R$  and  $\bar{K}$  are unaffected by the government policies. System (A.18 - A.19) and, in particular, the combination of equations (A.18a) and

(A.19a)  $F^{\bar{K}} = K(R)$  reveals what policy-neutrality necessitates. This equation of equity demand and capital supply must give the same steady-state solution for  $R$ , the pre-tax return on capital, whatever the settings of policy instruments.

Now the only policy parameter directly involved in the equation is  $t$ , the tax rate. So one requirement of super-neutrality is that these direct tax effects on demand for equity be zero. There are two such effects. One is the wedge that taxation of profit income enters between the marginal productivity of capital  $R$  and the after-tax return to savers  $r_K$ . We observed in the text that neutrality propositions evidently assume lump-sum taxation. The other direct tax effect on equity saving, which would apply even to lump-sum taxes, is the disposable income effect on saving and demand for wealth. Assuming it to be zero means that savers will aim at the same ratio of wealth to consumption regardless of the level of consumption. In the text, a rationalization of this assumption is sketched: consumers with infinite horizons make intertemporal choices in accordance with time discounts invariant across steady states.

The other requirement of policy-neutrality, in terms of our model, is that there be no cross-effects of  $r_B$  and  $r_H (= -i)$ , the rates of return on bonds and money, on demand for capital equity  $F^{\bar{K}}$ . This makes the equity-capital equation by itself sufficient to determine  $R$  and thus  $\bar{K}$ . Policy parameters  $(G, t, \gamma_B)$  obviously affect  $r_B$  and  $-i$  in the two other equations, and would indirectly affect  $R$  if the values of the other rates of return make a difference to  $F^{\bar{K}}$ . Assuming those cross-effects to be zero says that any additional demands for bonds and money induced by increases in their yields do not come even partially by diversion of saving from equity but represent wholly additional saving. The special assumptions involved in this zero-substitution theory of saving are examined in the text.

### A Money-Capital Model: Balanced Budget

We now turn to formal analysis of the effect of changes in the policy instruments on the steady-state endogenous variables, with special emphasis on  $R$ . It is instructive to consider first a simplified version of the model that includes only money and capital as assets. The steady-state equations of this simplified model are obtained by setting  $\gamma_B = 0$  in the full model and omitting  $r_B$ ,  $B$  and the bond market equation. The condensed model is as follows:

$$F^{\bar{K}} = \bar{K}(R) \quad (A.21a)$$

$$F^{\bar{H}} = \bar{H}/p. \quad (A.21b)$$

Equation (A.18c) becomes, with  $\gamma_B = 0$ ,

$$\frac{\bar{H}}{p} = \frac{\bar{G}-t}{g+1}. \quad (A.18c')$$

It is instructive to consider first a balanced budget policy:  $\bar{G} = t$ . Imagine, to begin, that no stock of government-issued money is available to the public; capital is the only vehicle for saving and for holding wealth. The equity market equation (A.21a) says that an increase in  $t$ --to finance an increase in  $\bar{G}$ --will increase  $R$  and diminish  $\bar{K}$ . The reasons are straightforward and familiar. The reduction in disposable income diminishes savers' desired wealth relative to pre-tax income  $Y$ . In addition to this income effect, higher taxation of earnings from capital deters equity saving and favors present consumption. This is a very orthodox story. Increasing government consumption and taxation crowds out capital.

An economy without government-issued money is hard to imagine. Suppose there is a fixed nominal stock of such money, inherited from the dis-



tant past, the same throughout every possible steady-state path. Suppose that the government budget is balanced as above, and consider how steady states vary with the size of the budget. All steady states must have the same real rate of return on money, namely  $g$ ; this is accomplished by price deflation at the natural growth rate. Given  $g$ , the two equations (A.21a, b) determine the two variables  $R$  and  $\bar{H}/p$ . The latter is the ratio  $\bar{H}/pY$ , where  $\bar{H}$  is the fixed nominal stock. The price level  $p$  is in any steady state falling at rate  $g$ , but the level of this path can adjust to reconcile  $\bar{H}$  to any  $\bar{H}/p$  that wealth-owners desire. Clearly the outcome is the same as in the previous paragraph. With the deflation rate invariant at  $g$ , the capital equation is independent of the second equation, and for the reasons already given, an increase in  $t$  raises  $R$  and lowers  $\bar{K}$ . Formally, the structure of this system is:

$$\begin{array}{cc} \left[ \begin{array}{cc} + & 0 \\ - & -1 \end{array} \right] \left[ \begin{array}{c} dR \\ d(\frac{\bar{H}}{p}) \end{array} \right] = \left[ \begin{array}{cc} + & + \\ ? & - \end{array} \right] \left[ \begin{array}{c} dt \\ dg \end{array} \right] \end{array} \quad (A.22)$$

$\begin{array}{cc} + & - \end{array} \qquad \begin{array}{cc} + & - \end{array}$

The ? in (A.22) indicates ambiguity about the tax effect on demand for money. The disposable income effect is in the same direction as for capital, but the substitution effect goes the other way, encouraging accumulation of the asset whose yield is untaxed. However, our assumption that the cross-effects of a rate of return will never exceed the own-effect means, in this case, that the overall effect of a tax increase on wealth demand is negative (so that the  $dt$  column on the r.h.s. has a positive sum). Consequently the increase in  $t$  (and  $\bar{G}$ ) will lower  $\bar{H}/p$  as well as  $\bar{K}$ ; in other words, a larger budget spells a generally higher price path.

The natural growth rate  $g$  is not a policy variable, at least within the spectrum of fiscal and financial policies here examined. But it is of some interest to note that, because  $g$  here is also the real rate of return on money, an increase in it will raise  $R$  and  $\bar{H}/p$ , lower  $p$  and  $\bar{K}$ . This conclusion abstracts from any direct effects an increase in the economy's real growth rate might have on desired wealth relative to income.

There is another way in which a long-run balanced budget policy could be reconciled with the need of the economy for governmental money. This is for the government to serve as an intermediary, issuing money and buying private sector assets with the proceeds. In our primitive two-asset model, the government can only buy equities; a more likely mechanism would involve government loans to private borrowers, negative public debt. In the two-asset model this simply means that the supply of capital, relative to  $Y$ , available for private ownership is reduced from  $\bar{K}(R)$  to  $\bar{K}(R) - \bar{H}/p$ , where  $\bar{H}/p$  is now a parameter of government policy, the volume of its equity holdings relative to national product. Equity purchases are not counted in  $\bar{G}$ , purchases for government consumption. The rate of inflation is now endogenous. The formal structure is as follows:

$$\begin{array}{cc} \left[ \begin{array}{cc} + & - \\ - & + \end{array} \right] \left[ \begin{array}{c} dR \\ d(-1) \end{array} \right] & = & \left[ \begin{array}{cc} + & -1 \\ ? & +1 \end{array} \right] \left[ \begin{array}{c} dt \\ d\bar{H}/p \end{array} \right] \end{array} \quad (A.23)$$

$$\begin{array}{cc} + & + & + & 0 \end{array}$$

Analysis easily shows that a balanced-budget increase in  $t$  once again raises  $R$  and lowers  $\bar{K}$ . The effect on the inflation rate is definitely negative if the disposable income effect on demand for money dominates ( $?$  in (A.23) is  $+$ ), and may be negative in the other case. An increase in  $\bar{H}/p$ , providing private portfolio owners with more real money balances

and less capital, naturally lowers the real return on capital  $R$  and raises that of money ( $-i$ ). Such a policy is both counter-inflationary and favorable to capital formation.

However, practical implementation of the intermediary strategy just described would be difficult. The steady-state equilibria of the system (A.23) may well be unstable. The short-run impact of purchases of equities -- or in general other privately owned assets -- with new money is to raise the price level. Only if this leads to a reduction in inflationary expectations can the public be induced to hold larger real money balances. A more reliable way to increase the real return on money, while channeling the public's money holdings into the equity market, would be to raise the nominal yield on money.

#### A Money-Capital Model: Deficit Budget

The government's normal method of providing its money to the economy is to issue money to finance budget deficits. We now consider cases where  $\bar{G}$  exceeds  $t$ , and  $\bar{H}/p$  is determined by (A.18c'). Since  $\bar{H}/p$  is by nature non-negative, we are also assuming that  $g+i$  is positive, i.e., that the real rate of return on money is smaller than the economy's growth rate  $g$ . This does not mean that either  $R$  or  $r_K$ , before- and after-tax returns to capital are less than the growth rate. In general, we expect  $r_K$ , and a fortiori  $R$ , to exceed the return on money for familiar reasons of risk and liquidity.

The equations for the multipliers now have the following structure:

$$\begin{bmatrix} + & - \\ - & ? \end{bmatrix} \begin{bmatrix} dR \\ d(-i) \end{bmatrix} = \begin{bmatrix} 0 & + \\ \frac{1}{g+i} & - \end{bmatrix} \begin{bmatrix} d\bar{G} \\ dt \end{bmatrix} \quad (\text{A.24})$$

$$\begin{matrix} + & ? & \frac{1}{g+i} & - \end{matrix}$$

The ambiguity in the Jacobian arises from the double role of the inflation rate. A lowering of  $i$  increases the demand for money, but it also -- as inspection of the r.h.s. of (A.21b) shows -- increases the supply. We Assume that an increase in the tax rate lowers the sum of  $F^{\bar{K}}$  and  $F^{\bar{H}}$  for given rates of return, but lowers the deficit even more. The previous ambiguity about the effect of a tax increase on the excess demand for money is thus removed; the decline in supply of money reinforces the increase in demand due to substitution of money for capital.

The ambiguity in the Jacobian leaves us with two cases to consider. In what we shall call the standard case, the Jacobian determinant is negative. Demand for money is relatively insensitive to its own real rate of return. The implications of (A.24) are then: (1) An increase in  $\bar{G}$  lowers  $R$  and raises  $\bar{K}$ , "crowding in" capital. It also raises the rate of inflation  $i$ . Although an increase in government purchases takes resources that might be used for capital formation, its financial consequence is to increase the deficit and thus to accelerate the growth of the nominal money supply. The inflationary result makes money a less attractive asset and induces wealth-owners to place savings in equity instead. (2) An increase in  $t$  lowers the rate of inflation and increases  $R$ . Capital intensity is diminished. As might be expected, these results are just the opposite of those for an increase in  $\bar{G}$ . The after-tax return on capital,  $r_K$ , may move either way. It would rise if taxes were lump-sum and did not alter the marginal return on capital. But if the tax is a disincentive to equity investment,  $r_K$  may decline. This does not, however, mean that capital intensity is increased; it will be diminished because the before-tax return  $R$  is higher. (3) An equal increase in  $\bar{G}$  and  $t$ , keeping the real deficit unchanged, can be analyzed by adding the two columns in the r.h.s. matrix of (A.24), so that both entries

are positive. The result of the marginally balanced budget operation is to raise the rate of inflation. It may or may not crowd out capital. The decline in both after-tax rates of return is discouraging to accumulation of wealth and capital, but if the direct tax effects on equity investment are weak, the inflation effect -- substitution of equity for money -- may prevail.

The non-standard case arises if the Jacobian determinant is positive. This means that the elasticity of demand for money with respect to its own real return is high. Or it could occur if the deficit was small. As discussed in the text, the implications reverse the standard case. Higher  $\bar{G}$  is associated with lower  $i$ , higher  $R$ , lower  $\bar{K}$ . Higher  $t$  is associated with higher  $i$ ; the effects on  $R$ ,  $r_K$  and  $\bar{K}$  are not clear. As for a balanced increase in  $\bar{G}$  and  $t$ , both  $i$  and  $\bar{K}$  are reduced.

Figure A.1 illustrates the money-capital model. The horizontal axis measures the real rate of return on money, the negative of the inflation rate. Reading right to left from the vertical line at  $g$ , the horizontal axis shows  $g+i$ , positive values only. The vertical axis measures  $\bar{H}/p$ , the amount of money held relative to income. The hyperbola  $S_0S'_0$  gives  $(\bar{G}_0 - t)/(g+i)$ . Clearly an increase in  $\bar{G}$  from  $\bar{G}_0$  to  $\bar{G}_1$  (or a reduction of  $t$ ) shifts this, the money supply curve, upwards to  $S_1S'_1$ . Now for each value of  $i$  -- and for given  $t$  -- solve the capital equation (A.21a) for  $R$ , and add to  $SS'$  the corresponding amount  $\bar{K}(R)$ . This operation yields the locus  $WW'$ . Along it as  $r_H$  increases from left to right  $R$  is rising too, and  $\bar{K}$  is falling. The curve  $DD'$  shows the demand for money for each value of  $r_H$  and the associated value of  $R$ .  $DD'$  must be steeper than  $WW'$ , but it can be either steeper or flatter than  $S_0S'_0$ . In the standard case, depicted in Figure A.1, it is flatter. As the Figure

shows, an increase in  $\bar{G}$  leads to higher inflation and larger  $\bar{K}$ . The reverse would be true if  $DD'$  crossed  $S_0S_0'$  from below. Graphical analysis of a tax cut is more difficult, because  $DD'$  and  $WW'$  are shifted upward too.

(FIGURE A.1 HERE)

### Policy Effects in the Three-Asset Model

The re-introduction of government bonds as a third asset, providing the government with a third instrument  $\gamma_B$ , widens the range of possible steady-state effects of policy variations. Adding (A.18b) and (A.18c), and recalling the definition of  $r_D$  as the weighted average rate of return on total debt, we note that total debt may be written as  $(\bar{G}-t)/(g-r_D)$ . The analogy to (A.18c') suggests that it might be possible to apply the above analysis of the money-capital model to the three-asset model, making it in effect a two-asset, debt-capital, economy. This could be misleading, however. The composition of the portfolio as between capital and total debt is not independent of the composition of debt between bonds and money.

Analysis of the three-asset model discloses ambiguities of the same nature as those of the money-capital model but greater in number. Once again, a standard case implies that expansionary fiscal policies will be inflationary and "crowd in" capital investment. But there are also "perverse" cases in which restrictive policies and lower deficits are associated with more inflationary steady states and with "crowding in." Numerical information about behavioral parameters is required to obtain unambiguous answers.

It is not possible to generalize about the effects of altering the financing parameter  $\gamma_B$ . Under some circumstances increasing the share



of bond-financing will lead to a higher inflation rate and/or to a lower return on capital and greater capital intensity. This is not really as counter-intuitive as it sounds, or as it would be in the short run. When all rates of return are flexible, it may be that wealth-owners are induced to absorb a larger supply of bonds by reductions in competing rates as well as an increase in the own-rate.

We should emphasize that these are exercises in comparative statics, showing how the characteristics of steady-state paths differ if different policies are steadily pursued. They say nothing about paths of adjustment if policies are changed sequentially. We have not attempted a stability analysis of the non-standard or perverse cases, where the policy variations push the long-run equilibria in different directions from their initial one-period impacts.

### III. OPEN ECONOMY EXTENSION

To study the effects of fiscal and financial policy in an open economy, we extend the model of this Appendix in a number of directions. The major additions and modifications are the following:

A fourth asset market equilibrium condition is added for an internationally traded private bond. This bond has a fixed market value and a fixed rate of return  $r_A^*$  in terms of foreign currency. Domestic supply of the foreign bond consists of private domestic holdings at the end of the previous period,  $A$ ,  $eA$  in home currency value, plus the private capital account deficit of the current period. The private capital account deficit is the sum of the current account surplus and the net sales of foreign assets by the government (the official settlements deficit on the balance of payments). The current account surplus is the trade surplus,  $X$ , plus net interest income (private and public) from abroad. Official holdings of foreign bonds are denoted  $\hat{A}$ .



The exchange rate  $e$  is the domestic currency price of foreign currency. A rise in  $e$  is depreciation, a fall appreciation, of the home currency. There are two channels connecting the exchange rate and the domestic economy: capital account and current account. In the capital account, exchange rate depreciation increases, appreciation decreases, the domestic currency value of net holdings of foreign bonds, the only internationally traded financial claim. Expectations of depreciation increase the return on foreign bonds to domestic holders, and expectations of appreciation lower the return. Domestic money, government bonds and equity are not held by foreigners. To the home country, small in the international financial market,  $r_A^*$  is given; any amount of foreign bonds can be traded at that interest rate. But domestic and foreign bonds are not assumed to be perfect substitutes in private portfolios. Instead the gross substitutes assumption is extended to all four assets.

In the current account, the trade surplus is assumed to vary positively with the ratio of the price of imports to the price of domestic output -- the Marshall-Lerner conditions are satisfied -- and negatively with domestic output  $Y$ . To the home country, the foreign price of imports  $p_f^*$  is parametric. Likewise, to foreign export markets the price of domestic output  $p$  is parametric.

$$X = X(ep_f^*/p, Y) \quad X_{ep_f^*/p} > 0 \quad X_Y < 0. \quad (A.25)$$

The domestic price level,  $p$ , is influenced directly by the cost of imports. We use the simple specification (Buiter [8, 1978]):

$$p = w^\beta (ep_f^*)^{1-\beta} \quad 0 < \beta < 1. \quad (A.26)$$

Here  $w$  is the domestic component of unit costs of production. It con-

sists mainly of labor costs. In the unemployment version of the model,  $w$  is treated as parametric in the short run. Its behavior over time can then be determined by the expectations-augmented Phillips curve  $\frac{\Delta w}{w} = \psi(Y-f(K)) + x(w)$ , or  $\frac{\Delta w}{w} = \psi(Y-f(K)) + x(p)$ . In the full employment version,  $w$  is modeled as a short-run endogenous variable and actual and capacity output are assumed equal:  $Y = f(K)$ . Interest on private and official foreign asset holdings is, in real terms,  $er_f^*(A+\hat{A})/p$ . Government budget receipts now include the interest income on official holdings of foreign bonds. Open market operations now include sales of foreign assets  $Z_A$  as well as domestic bonds and money:

$$Z_H + Z_B + Z_A = 0. \quad (A.27)$$

The real rate of return on foreign assets equals the foreign interest return plus the expected rate of depreciation of the domestic currency minus the expected rate of change of the domestic general price level.

$$r_A = r_A^* + x(e) - x(p). \quad (A.28)$$

### Short-run Effects of Fiscal and Financial Policy

The short-run equilibrium conditions are summarized in equations (A.29).

$$F^K - q_K K = I \quad (A.29a)$$

$$F^B - q_{Bp} \frac{B}{p} = \gamma_B D + \frac{Z_B}{p} \quad (A.29b)$$

$$F^A - \frac{eA}{p} = X\left(\frac{ep_f^*}{p}, Y\right) + er_A^* \left(\frac{A}{p} + \frac{\hat{A}}{p}\right) + \frac{Z_A}{p} \quad (A.29c)$$

$$F^H - \frac{H}{p} = (1-\gamma_B)D - \left(\frac{Z_B + Z_A}{p}\right). \quad (A.29d)$$

The list of variables in the asset demand functions includes those in the closed economy model, and in addition  $r_A$  and  $eA/p$ . The real deficit  $D$

$$\text{is } G + \frac{bB}{p} - tY - \frac{eR_A^* \hat{A}}{p}.$$

These four-asset market equations can be summed to yield the open economy IS curve.

$$S = I + G + \frac{bB}{p} - tY + X + er_{Ap}^* \quad (A.29e)$$

In the unemployment version of the model, the four market-clearing conditions determine the temporary equilibrium values of  $Y$ ,  $r_B$ ,  $r_K$  and one foreign exchange variable. This could be the exchange rate  $e$  if policy fixes  $Z_A$ , or  $Z_A$  if policy holds  $e$  at a predetermined rate. Intermediate regimes could be modeled, but we shall concentrate on the freely floating exchange rate ( $Z_A = 0$ ) and the fixed exchange rate. Under both exchange rate regimes  $H$ ,  $B$ ,  $A$ ,  $\hat{A}$ ,  $K$ ,  $x(q_K)$ ,  $x(q_B)$ ,  $x(p)$ , and  $x(e)$  are short-run predetermined variables. The unemployment model has  $w$  as an additional predetermined variable, while the full-employment model has  $Y$  instead.

In addition to extending the gross substitutes assumption to all four assets, we also extend two other assumptions: An increase in the rate of return on any asset increases total saving. An increase in the value of existing holdings of any asset increases the values demanded for all assets and for current consumption.

To save space we present only the analysis of the unemployment model. Subject to minor qualifications, the results again carry over to the full-employment model, with the price level taking qualitatively the place of real output. A few of the short-run effects of changes in  $(G, t, \gamma_B, Z_B)$  on  $(r_K, r_B, Y)$  are considered both for fixed and floating exchange rate regimes. When considering a fixed exchange rate we shall in addition derive the impact effects of a devaluation. With a market-determined exchange rate the effect of open market sales of foreign bonds by the government can also be considered.

Policy Effects with a Fixed Exchange Rate.

The impact multipliers for the unemployment model under a fixed exchange rate can be found from equations with the structure shown in (A.30). The rows correspond to the asset demand/supply equations for equity, domestic bonds, foreign bonds, and money in that order. It is assumed that the domestic counterpart of official sales or purchases of foreign bonds is always money, i.e., that there is no "sterilization." It is also assumed that the government budget is initially in deficit and that private holdings of foreign bonds are positive.

$$(A.30) \quad \begin{bmatrix} + & - & 0 & + (?) \\ - & + & 0 & + \\ - & - & + & + \\ - & - & - & + \\ + & + & 0 & + \end{bmatrix} \begin{bmatrix} dr_K \\ dr_B \\ d(-Z_A) \\ dY \end{bmatrix} = \begin{bmatrix} 0 & ? & 0 & 0 & + (?) \\ + & - (?) & D & \frac{1}{p} & - (?) \\ 0 & + & 0 & 0 & + (?) \\ + & - (?) & -D & -\frac{1}{p} & - (?) \\ 1 & - (?) & 0 & 0 & ? \end{bmatrix} \begin{bmatrix} dG \\ dt \\ d\gamma_B \\ dZ_B \\ de \end{bmatrix}$$

The Jacobian matrix of (A.30) has a dominant diagonal and positive determinant. We shall consider the effects of changes in  $G$ ,  $\gamma_B$  and  $e$  on the short-run endogenous variables. A cut in  $t$  will, subject to the qualifications mentioned for the closed economy, have effects of the same signs as those of an increase in  $G$ . An increase in  $Z_B$  has the same impact effects as an increase in  $\gamma_B$ .

An increase in  $G$  will raise  $Y$  however it is financed. It will lower the returns on capital and bonds  $r_K$  and  $r_B$  if public sector deficits are wholly money-financed. With mixed financing or exclusively bond-financing, the effect on  $r_K$  is ambiguous. The trade balance and the current account deteriorate as  $Y$  increases, the relative price of imports and exports remaining unchanged. If budget deficits are exclusively money-financed, the official settlements deficit  $Z_A$  on the balance of payments

increases. The lowering of  $r_K$  and  $r_B$  induce portfolio substitution towards domestic money and foreign assets. The deterioration in the trade balance is therefore compounded by an increased deficit on the private capital account. If budget deficits are not exclusively money-financed, either  $r_K$  or  $r_B$  or both may be higher when  $G$  is increased. In that case improvement in the private capital account may accompany and even overcome the deterioration in the current account.

An increase in  $\gamma_B$  or in  $Z_B$  lowers  $Y$  and raises  $r_B$ , as in the closed economy model. Since the rate of return on the foreign asset is fixed, the effect on  $r_K$  depends only on the relative degrees of substitutability among money, domestic bonds and capital. The closer substitutes are bonds and equity, compared to bonds and money, the more likely is  $r_K$  to increase. The decline in  $Y$  improves the trade account. Lower  $Y$  and higher  $r_B$  both reduce demand for foreign bonds. If  $r_K$  also increases, this shift out of foreign assets will be reinforced and the capital account will definitely improve. The official settlements balance will then reflect improvements in both current and capital accounts.

Devaluation will operate through a number of channels. With the foreign currency price of imports determined exogenously and with  $w$  predetermined in the short run, devaluation shifts the terms of trade against the home country. By assumption this will improve the trade balance and thereby stimulate domestic output. This "elasticities effect" will be countered by a "monetary effect," however. Exchange rate depreciation increases the domestic general price level,  $p$ , and reduces the real value of given nominal stocks of money and domestic bonds. This will tend to depress domestic consumption demand for domestic output. As the country is assumed to be a net creditor to the rest

of the world, devaluation will increase the domestic currency value and the real value of foreign currency-denominated assets. This will generate a positive wealth effect on domestic consumption demand. (If the country were a net foreign debtor, the opposite outcome prevails.) If the column sum corresponding to  $de$  in (A.30) is negative, devaluation is on balance contractionary as regards aggregate demand for domestic goods and services, a result consistent with the monetary approach to the balance of payments. A positive column sum favors the elasticities approach. The general scenario suggested by the monetary approach pictures a devaluation increasing  $r_K$  and  $r_B$ , reducing  $Y$ , and improving the official settlements balance. In our model that is a possible scenario, but not the only possible one.

#### Policy Effects with a Floating Exchange Rate

The structure of the matrix equation from which impact multipliers can be derived for the floating exchange rate regime is in (A.11). We shall make the Keynesian, "elasticities approach," assumption that, ceteris paribus, exchange rate depreciation is expansionary in the domestic output market. The column sum of the third column of the Jacobian of (A.31) is therefore negative. The  $de$  column of (A.30) for the fixed rate regime had a positive sum under the same assumption, but now that column is on the l.h.s. We also assume that exchange rate depreciation, augmenting the value of existing holdings of foreign bonds, creates excess supply in that market. This spills over into excess demands for domestic assets, reinforced in the case of bonds and money by the reduction in the real value of existing stocks because of the import component of the domestic price level. We assume the net wealth effect to be non-negative for equity demand as well. A small negative effect on equity demand would not alter our conclusions.

$$(A.31) \quad \begin{bmatrix} + & - & + & +(?) \\ - & + & + & + \\ - & - & - & + \\ - & - & + & + \\ + & + & - & + \end{bmatrix} \begin{bmatrix} dr_K \\ dr_B \\ de \\ dY \end{bmatrix} \quad \begin{bmatrix} 0 & .(?) & 0 & 0 & 0 \\ + & -(?) & D & \frac{1}{P} & 0 \\ 0 & + & 0 & 0 & \frac{1}{P} \\ + & -(?) & -D & -\frac{1}{P} & -\frac{1}{P} \\ 1 & -(?) & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dG \\ dt \\ dy_B \\ dz_B \\ dz_A \end{bmatrix}$$

The determinant of the Jacobian matrix of (A.30) is negative. (If the signs of the  $de$  column were reversed, the matrix would have the familiar standard sign pattern.) We have seen that most of the results derived for the closed economy remain valid in the open economy when the exchange rate was fixed. With a floating exchange rate, there is one new complication: the general price level,  $p$ , becomes a short-run endogenous variable even in the unemployment model. Domestic costs are sticky; import prices in domestic currency are not.

As in all other cases, an increase in public spending will boost real income. If the public sector deficit is financed by money creation ( $\gamma_B = 0$ ), the rate of return on capital equity and the real rate of return on domestic bonds will fall and the exchange rate will depreciate. Domestic capital formation will be stimulated. With mixed public sector deficit financing policies, real rates of return on domestic bonds and/or equity may rise and the exchange rate may appreciate.

An open market sale of foreign assets by the government ( $dz_A > 0$ ) will cause the exchange rate to appreciate and will depress real output. Remember that domestic bonds and foreign bonds are not perfect substitutes in private portfolios and that the rate of return on domestic bonds is not determined in international markets.

# Steady-State Equilibrium.

As in the closed economy case, a long-run steady-state equilibrium requires that all asset stocks grow in real value at the natural growth rate of the economy. For foreign assets, this means that some combination of exchange depreciation, current account surplus and inflation must keep the real stock in constant ratio to national output. This ratio, like those for other asset stocks, will be endogenously determined, partly by portfolio and saving demands that are functions of the several real rates of return.

In a fixed exchange rate regime, two of the four rates of return are exogenously determined. The domestic inflation rate must equal the foreign inflation rate, uninfluenced by events in the small open economy. Otherwise the terms of trade will be continuously changing. The real rate on foreign assets is likewise exogenous. What, then, are the two endogenous variables besides  $R$  and  $r_B$ ? One is the ratio of domestic price to foreign price. This must be such that the trade surplus  $X$  is consistent with growth of foreign assets at the natural rate. The other is one of the policy parameters; the government must adjust one endogenously in order to make the nominal stocks of its bonds and money grow at the predetermined rate  $g+i$  while meeting savers' demands. Among the policy instruments which might be endogenous in this sense is the ratio of official reserves of foreign assets, in real value, to national output. Alternatively, the government might set a target for its foreign exchange reserves, and let one of its domestic fiscal or financial instruments adjust as necessary to achieve this target.

Under a floating exchange rate regime, domestic inflation can differ from the world inflation rate, with steady exchange depreciation or appreciation equal to the difference. The real rate of return on for-



foreign assets is still exogenous, equal to the real rate on such assets abroad. The four basic equations determine the other three rates of return, among them the domestic rate of inflation. As in the fixed exchange rate regime, the terms of trade provide another endogenous variable. Choice of exchange rate regimes is much less momentous in the long run than in the short run. By assumption prices are flexible in the long run, unlike the short run. Price flexibility can accomplish the same adjustments in terms of trade as exchange rate flexibility. The government has no more free policy instruments in one regime than the other; under floating rates official reserve stocks and interventions are constrained to be zero. The opportunity to have a divergent inflation rate may nonetheless be useful. Conceivably some objectives -- regarding the composition of output and the capital intensity of the economy -- might be unattainable if domestic rate of inflation and thus the real return on money were constrained to equal the international rate of inflation.

We have already seen that, even with three assets and a closed economy, it is impossible to generalize about the effects of steady-state policies on equilibrium capital intensity and inflation rates. Naturally the number of possible cases is multiplied by opening the economy and enlarging the asset menu. For example, whether the nation is creditor or debtor to the rest of the world will make an important difference. The relevance of steady-state exercises is in any event, more doubtful for open than closed economies. The trade surplus, for instance, will not have the homogeneity property needed for steady growth equilibrium unless foreign export demand is, for given terms of trade, expanding at the natural rate of growth of the domestic economy. It would also be desirable, of course, to model two or more interacting economies rather than a small economy in a big world. The United States is not powerless to influence inflation rates and interest rates overseas.

We can conclude, anyway, that the major policy issues cannot be solved by theoretical analysis alone but require empirical estimates of economic structure and behavior. No short cuts are available in sweeping a priori claims of neutrality.

# FOOTNOTES

1. The view that the economic system is always at the natural rate of unemployment or the natural level of capacity utilization, except for transient disturbances due to errors in private economic agents' price or wage forecasts was first formalized by Milton Friedman [20, 1968] and Edmund Phelps [24, 1970]. The proposition that the only source of departures from the natural rate are expectational errors, has recently been combined with the "rational expectations" assumption that forecast errors are completely random and cannot be affected by deterministic policy behavior. Jointly, the two hypotheses of the short-run natural rate and rational expectations formation imply that stabilization policy, or at any rate monetary policy, will be powerless. (Robert Lucas [23, 1976], Thomas Sargent and Neil Wallace [27, 1976], Robert Barro [3, 1976]. For an opposing view see James Tobin [31, 1972], Stanley Fischer [16, 1977], Phelps and John Taylor [26, 1977], and Martin Bailey [1, 1978].)

The separate roles of the rational expectations assumption and the market clearing assumption can be brought out with a simple example.  $p_t$  denotes the actual price level in period  $t$ ,  $p_t^*$  the equilibrium price level and  $\hat{p}_{t-1,t}$  the price level anticipated, in period  $t-1$ , for period  $t$  (all in logs),  $Y_t$  is actual output,  $\bar{Y}_t$  full capacity output. Consider the "Lucas supply function"

$$p_t^* = \alpha(Y_t - \bar{Y}_t) + \hat{p}_{t-1,t} \quad \alpha > 0.$$

The actual price level adjusts sluggishly towards the equilibrium price level, according to

$$\Delta p_t \equiv p_t - p_{t-1} = \beta(p_t^* - p_{t-1}) \quad 0 \leq \beta \leq 1.$$

1. (cont'd) Such a partial adjustment function is not implausible for an economic system with no underlying inflationary or deflationary trend. If such trends occurred, the disequilibrium price adjustment mechanism would be likely to involve first or higher differences of  $p_t$  and  $p_t^*$ . Note that instantaneous equilibrium is the special case of our lagged price adjustment equation when  $\beta = 1$ . In that case  $p_t^* \equiv p_t$ . Combining the equilibrium price equation and the disequilibrium price adjustment equation, we obtain:

$$\Delta p_t = \alpha \beta (Y_t - \bar{Y}_t) + \beta (\hat{p}_{t-1,t} - p_{t-1}).$$

Rational expectations, or perfect foresight in this deterministic model, imply  $\hat{p}_{t-1,t} = p_t$ . Thus rational expectations rule out systematic deviations of actual from capacity output if and only if  $\beta = 1$ . If we are not always in temporary Walrasian equilibrium, policy can affect price behavior through the market disequilibrium channel even if price forecasts are rational.

2. For a discussion of the distinction between direct and indirect crowding out, see Willem Buiter [6, 1977].
3. This is the vertical LM "curve" of textbook fame. A less plausible extreme scenario is that private real spending is perfectly elastic with respect to the prevailing interest rate; national product is limited by the volume of transactions the money supply will finance at that rate. This means that the IS "curve" is a horizontal line. It is not the only case that can be so described in the Hicksian diagram. Another case applies to an open economy with perfect international capital mobility, facing a fixed foreign interest rate. If the foreign exchange rate is market-determined without official interventions, the economy's foreign investment, equal to its current account surplus, is perfectly elastic at the fixed interest rate. Given that rate and

# FOOTNOTES

## 3. (cont'd.)

the domestic money stock, additional government purchases crowd out foreign investment 100%, simply by appreciating the home currency and reducing net exports. A third case of horizontal IS can occur when expenditure on national product is less than infinitely elastic with respect to interest rate. Suppose the marginal propensity to spend with respect to national product itself, including investment as well as consumption, happens to be exactly unity. The IS curve is horizontal, but the interest rate level at which it is horizontal will be raised by government purchases or by any other increase in autonomous expenditure. Here complete crowding out will not occur if the higher interest rate will reduce money demand or increase money supply. If the IS locus is given by  $Y = E(Y,r) + G$ , its slope is  $(1-E_Y)/E_r$ , and is zero if  $E_Y = 1$ ,  $E_r < 0$ . However at any given  $Y$ ,  $dr/dg = -1/E_r$ . It is important not to confuse this case with either of the first two.

4. In a recent paper Ray Fair [15, 1978] demonstrates, via simulation experiments with his econometric model, that fiscal policy effects are very sensitive to the behavior of the Federal Reserve.
5. In our paper "Debt Neutrality: A Brief Review of Doctrine and Evidence," in the companion volume Social Security versus Private Saving in Post-Industrial Democracies we point out that while Ricardo clearly stated the proposition that taxation and government borrowing are equivalent in their economic effects, he also refuted this "equivalence theorem." In spite of the injustice to Ricardo, we shall for convenience conform to prevalent usage and refer to the modern revival of neutrality doctrine as Ricardian.
6. For a discussion of inflation effects, see the paper by Paul Wachtel in the present volume.

# FOOTNOTES

7. If this theoretical proposition seems surprisingly unrealistic in the light of the economic history of the 1970s, there are several explanations. The inflation that erupted in 1973-74 was associated with several events and policies discouraging to investment. This definitely does not mean that inflation per se is bad for investment. A dramatic increase in the price of energy relative to product prices reduced estimates of profitability in many industries. It also brought about a severe though temporary inflationary bulge. Anti-inflationary monetary policy engineered a sharp rise in the cost of financial capital and a severe recession. Extrapolating from this history, businessmen and other economic agents now believe that increases of inflation rates will induce similar restrictive policies in future.
8. See, for example, Miguel Sidrauski [28, 1967] and Stanley Fischer [17, 1978]
9. If real money balances are added as an argument in the direct utility function -- a very questionable practice -- as in Sidrauski [28, 1967] and Fischer [17, 1978], the expression for  $c$  is somewhat different.  $c$  denotes real per capita consumption,  $m$  the stock of real per capita money balances,  $a$  real per capita household wealth,  $k$  the stock of capital per unit of efficiency labor,  $L$  the size of the natural labor force  $\tilde{L}$  the size of the labor force in efficiency units,  $p$  the price level,  $T$  lump sum transfers and  $M$  the nominal stock of money.  $\dot{L}/L = n$  and  $\dot{\tilde{L}}/\tilde{L} = n + \lambda$   
The model can be written as:

$$\text{maximize } \int_0^{\infty} u(c, m) e^{-\delta t} dt$$

$$\text{subject to: } m + \frac{\tilde{L}}{L} \tilde{k} = a$$

$$\dot{a} = \frac{\tilde{L}}{L} f(\tilde{k}) + \frac{T}{pL} - c - \frac{\dot{p}}{p} m - na$$

$$\dot{\tilde{k}} = f(\tilde{k}) - \frac{\tilde{L}}{L} c - (n + \lambda) \tilde{k}$$

$$\dot{M} = T$$

## FOOTNOTES

## 9. (cont'd.)

The first two constraints are individual balance sheet and budget constraints, the last two are economy-wide constraints. An interior solution to this problem is given by the four constraints and by

$$u_c(f' + \frac{\dot{p}}{p}) - u_m = 0$$

$$u_c(f' - n - \delta) + u_{cc}\dot{c} + u_{cm}\dot{m} = 0$$

In long-run equilibrium the last equation becomes  $f' = n + \delta + \epsilon\lambda$

where  $-\epsilon = c \frac{u_{cc}}{u_c} + m \frac{u_{cm}}{u_c}$ , the sum of the elasticities of the marginal

utility of consumption with respect to consumption and to real money balances. For a steady state to exist if  $\lambda > 0$  we require not only

that  $\epsilon$  be constant but that  $\frac{u_m}{u_c}$  be constant, i.e., that

$$c \frac{u_{mc}}{u_m} + m \frac{u_{mm}}{u_m} + \epsilon \text{ be constant.}$$

10. Some earlier contributions [11, Carl Christ, 1968; 4, Alan Blinder and Robert Solow, 1973]; [32, Tobin and Buiter, 1976] may have fostered the opposite view. See, however, [25, Edmund S. Phelps and Karl Shell, 1969] and [7, Buiter, 1977], [12, Christ, 1978] and [13, David Currie, 1978; 14, 1978]. It is true that budget balance is an equilibrium condition for stationary economies with fixed price level, as discussed in [4, Blinder and Solow, 1973] and [32, Tobin and Buiter, 1976]. But in general this is not true, and therefore one cannot derive long-run effects of policy measures from a balanced budget equation. All steady-state relations, including long-run portfolio balance equations, enter into determination of the long-run policy multipliers.

## FOOTNOTES

11. This approach is therefore different from the continuous time portfolio balance approach. The latter permits separate treatment of the saving decision -- adding to existing wealth -- and the portfolio allocation decision -- the reshuffling of existing net worth [30, Tobin, 1969].



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