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GOVERNMENT DEFICITS AND CAPITAL ACCUMULATION

James Tobin

October 10, 1978

GOVERNMENT DEFICITS AND CAPITAL ACCUMULATION*

Do government deficits absorb private saving? Does public debt diminish private demand for stocks of productive capital assets? Can the burden of current government expenditure be shifted to future generations? These are old questions. Today they are once more in the forefront of economic controversy. Few issues of economic theory and fact evoke such polar disagreement. The contesting views carry radically divergent implications for public fiscal and financial policy.

The "Ricardian" doctrine and its implications.

Within our professional fraternity the salience of these issues today reflects in large part the powerful intellectual challenge of "the new classical macroeconomics." That is the term its protagonists (e.g. Sargent, 1976) use to describe a model which explains observed outcomes at every point in time as equilibria in which individual agents are maximizing utility or profits on the basis of "rational expectations" and in which prices are continuously clearing all markets. Among the model's alleged implications are unqualified negative answers to the three questions at the beginning.

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A dramatic summary of the position is this: the burden -- or more neutrally, the effect -- of government is fully measured by the size and content of real public expenditures. It is independent of how those expenditures are financed. Thus the celebrated Modigliani-Miller theorem for corporate finance is extended to government. The common thread is the downgrading of social institutions. The basic preferences of individual agents will prevail, with or without governments and corporations, so long as agents have the option of making transactions without the intermediation of such institutions.

The argument is simple. If government spending is not financed by current taxes, it is financed either by selling interest-bearing time obligations or by printing money. If by nonmonetary debt, the public must know that taxes will be levied in future to pay the interest, perhaps the principal too. To provide for the future taxes, households will save more, precisely enough to purchase the new government securities. Aggregate household wealth is unchanged, and so is aggregate consumption. Deferment of taxes accomplishes nothing, for good or evil. Given the present value of tax liabilities, discounted at the interest rate on government securities, the timing of the taxes makes no difference.

James Buchanan (1976) calls this doctrine Ricardian, and it is true that Ricardo (1871, pp. 146-149) presented the argument with characteristic clarity. However, he also added important qualifications and concluded that deferment of taxes by internal borrowing is bad fiscal policy. In spite of its inaccuracy I shall use Buchanan's term for convenience.

But what if monetary issue is substituted for taxation? This too will have no real effect, it is argued, but for somewhat different reasons from government debt. The new money will, and will be expected to, raise prices -- enough to keep the real quantity of money unchanged. Alternatively, if new money is expected to be regularly issued, rational individuals will expect their cash holdings to be eroded by inflation and will save in anticipation of this tax too.

Let me remind you of some of the implications of these doctrines for macroeconomic theory and policy.

1. The efficacy of fiscal policy in the short run. According to conventional Keynesian theory, tax reductions and increases of transfer payments augment aggregate demand, raising employment and output or prices or both, depending on the state of the economy. Ricardian doctrine denies the potency of deficit-financed compensatory fiscal policy. Note that it does not deny the effectiveness, for good or evil, of an increase in government real expenditure. It says, however, that the effect will be the same whether the expenditure is financed by taxes or by borrowing. The so-called balanced budget multiplier applies either way. In short, supply of government securities creates its own demand. No income expansion, no multiplier process, is needed to generate the saving to buy the government deficit.

2. The evils of government deficits. If deficit finance is ineffectual, it is also innocuous. It does not "crowd out" private capital formation or foreign investment. Nor can timid or profligate legislatures

and Chancellors be blamed for inflation, so long as they are willing to finance their deficits by interest-bearing bonds rather than by printing money. This is why the Ricardian view is as unpalatable to fiscal conservatives like Buchanan as to Keynesians.

3. The long run burden of public debt. Fiscal conservatives, including politicians and laymen as well as economists, have long argued that debt finance irresponsibly burdens future generations for current government programs. In the long standing debate on internal public debt,^{1/} some economists have argued that the burden of diverting resources to public use, the value of the contemporary private uses foregone, cannot be shifted in time. Others (e.g. Modigliani, 1961) have pointed out that future generations can be burdened to the extent that deficit finance diminishes the stocks of human and nonhuman capital they inherit. The revived Ricardian doctrine says, however, that this will not happen, that capital stock will not be crowded out by government debt.

Note the parallelism of short and long run. Keynesians believe that expansionary fiscal policy works in situations of underemployment because deficits absorb saving which, in the absence of sufficient private investment demand, would vanish via contraction of income. By the same token, they believe that in long run full employment states public debt satisfies some demand for wealth and displaces some capital. Ricardians believe that deficit spending is futile in short run and innocuous in the long run.

4. The Pigou effect. Those of you with long memories will recall the debate in the 1940s about the proper base for the "real balance" effect proposed by Professor Pigou (1943, 1947) and elaborated by Patinkin (1948, 1956). See also Tobin (1947, 1952). Does the base include all public debt or only

monetary issue or nothing? The argument about nonmonetary public debt is the one I have been discussing. The Ricardian position would be that a permanent reduction in the price level increases equally the real value of government obligations and the real value of the associated tax liabilities. The "Keynesian" view would support the Pigou effect, reckoning a greater consumption stimulus for the government's creditors than consumption deterrent to future taxpayers.

5. The effects of open market operations. Central bank purchases of government securities extinguish both the stream of interest payments to the public and the associated future taxes. From the Ricardian viewpoint, the transaction increases household wealth by the full amount. It is no different in effect from money creation to finance government outlays, or from that textbook favorite, "money rain." In either case, a monetarist Ricardian might believe that the price level would adjust to keep the real quantity of money unchanged. (Note also that, from the same Ricardian viewpoint, a "bond rain" would have no effect.) Thus the Ricardian equivalence theorem is fundamental, perhaps indispensable, to monetarism.

The Keynesian view would downgrade the wealth gain and consumption stimulus attributable to the expected reduction in future tax liabilities. Therefore an increment of money stock arising from open market transactions would be regarded as less expansionary or inflationary than the same amount arising from deficit finance or "money rain."

6. Social security. Social insurance for retirement, death, and disability is one form of public debt. By compulsory contributions, whether by employee or employer, during working life, citizens build up an immense, if not precise, total of claims on government. Some critics in the United States have estimated and deplored the displacement of productive capital investment which they allege this vast accumulation of claims represents. (Feldstein, 1974) But, of course, the Ricardian calculation tells us that those benefits stimulate consumption no more than the associated stream of anticipated social insurance taxes deters it. Indeed the pay-as-you-go financing of social security in the U. S. cannot in principle yield the participants on average more than the growth rate of the system. As this is less than the rate of return on private investment, rational participants could regard the forced diversion of saving as a net loss.

Critique of Ricardian doctrine as restated by Barro.

The so-called Ricardian argument has recently been forcefully restated and elaborated in an influential article by Robert Barro (1974), one of the new classical macro-economists, entitled "Are Government Bonds Net Wealth?".^{2/} I wish to consider his argument in some detail.

1. Life cycles and bequests. If consumers' horizons do not extend beyond their own lifetimes, if they are indifferent to the living standards of their surviving children, deferment of taxes to the next generation will clearly raise consumption by the current generation. Just as James Buchanan

fears, public debt issue permits the generation in power to shift tax burdens to generations without political voice. At the other extreme, for consumers with infinite horizons, the intertemporal budget constraint is independent of the timing of taxes. (Anyway this is true if the government bonds bear the interest rate at which consumers can make intertemporal shifts of consumption.) Consequently the optimal consumption/saving plan will not be changed by substituting debt finance for current taxation.

Barro's contribution is to show how mortal households can have effectively infinite horizons. The condition is that each generation include in its utility function, along with consumption at various stages of its lifetime, the utility of the next generation. The child's utility is a function -- in indirect form -- of his endowment plus the bequest received from the parent. Within a given present value of taxation, a shift in timing from one generation to the next leaves the parent facing the same budget constraint as before. He will make up for the heavier taxation in store for the child by providing a larger bequest. The chain of overlapping generations behaving in this manner makes the horizon of each generation effectively infinite.

This ingenious construction invites several comments:

- a) The chain is broken if any generation is childless or is indifferent to the utility of its successor. Expecting this in advance, the current generation has incentive to increase its own consumption if taxes are deferred beyond the break in the chain.

- b) As everybody knows, some households in each generation are childless, or indifferent to the lots of their own children. These households will consume more if their taxes are lightened at the expense of later generations. The remaining households, who have children and care about them, perceive that their descendants will bear not only the taxes they are spared but the taxes their childless or indifferent contemporaries are spared. These parents cannot maintain both their own lifetime consumption and the utility of their children; general deferment of taxes tightens their budget constraint. They will give way on both margins; they will increase their bequests but not by enough to pay their children's taxes. Taking both kinds of households together, debt finance increases current consumption.
- c) Parents' utility may well depend in some degree on the size of their bequests to their children, independently of the utility or total endowment of the children. Giving is frequently, perhaps usually, for the gratification of the giver, not just the welfare of the receiver. If so, bequests are related to the wealth of the parents as well as, or more than, to the expected needs of the heirs. Equal division among several children, regardless of differences among them in other endowments, is after all a customary pattern. The thrust of this observation is that bequests will not be increased enough to keep heirs' utility intact when taxes are shifted on to the heirs.

d) Here is a third way in which the infinite chain may be broken. Many households, even those concerned with children's utility, will find utility optima at zero-bequest corners rather than at interior points. They would prefer negative bequests, but these are not within their options. Such families will of course bequeath no more but consume more if their taxes are reduced and those of their heirs correspondingly increased. Corner solutions are likely when households' utility functions place small weight on the future utility of their heirs, or place large probability weight on the possibility that the chain will somehow be broken. Corner solutions are more likely too in progressive economies where parents can normally expect their children and grandchildren to be much better off than they are.

2. Liquidity constraints. Even within the lifetime of one generation, households are generally not able to shift consumption at will from a later date to an earlier date. When such intertemporal substitution is possible, it can be achieved only at a higher rate of interest than can be earned on saving. Even in countries with sophisticated financial institutions and well-developed capital markets, opportunities for borrowing against future earnings from labor are limited. Compulsory or contractual saving, down payment and collateral requirements, illiquidity of future retirement pensions -- these and other "imperfections" -- further limit the inter-

temporal fungibility of lifetime resources, not to mention intergenerational resources.

There are good reasons for all these departures from the theorist's presumptive norm of perfect capital markets, but they are outside my current topic. The implication of these facts of life is that a large fraction of households, even in affluent societies, are liquidity-constrained as well as wealth-constrained. Their horizons for consumption plans are shorter than their lifetimes, let alone the lifetimes of their lineal families. They will not be indifferent to the opportunity to defer tax payments. Even if they themselves must pay the taxes later, they will increase their consumption now. In effect the government lends to them at its borrowing rate of interest, an option not otherwise available in the credit market.

Liquidity constraints also, incidentally, weaken the force of the argument that unfunded social insurance diminishes the total saving of life-cycle consumers. The fear is that taxes to pay for higher benefits will not reduce private consumption but will be used for government consumption. It is not fully justified to the extent that liquidity-constrained workers cannot avoid reducing consumption when their compulsory social insurance contributions are increased. Here the liquidity constraints prevent households from undoing the government's attempt to defer their consumption until they retire. Moreover, some households will, as Barro argues, increase their bequests or gifts to heirs rather than their own lifetime consumption, partially if not wholly alleviating the higher taxes their children must pay

to support their parents' retirement insurance benefits. For a combination of reasons, therefore, Feldstein and others are probably overstating their case that pay-as-you-go social security diminishes capital formation. (Tobin, 1976)

3. Non-lump-sum taxes. So far I have adhered to Barro's assumption of lump-sum taxes, and I have advanced several reasons why consumption/saving plans are not neutral with respect to timing of tax payments. The bias is invariably in one direction: compared to current taxation, debt finance of government expenditure increases current consumption, reduces the saving available to purchase assets other than government securities. These conclusions are reinforced if real-world taxes are considered in place of lump-sum taxes.

There are two senses in which the nature of the tax system is relevant. First, if tax liabilities are not specified amounts levied on named individuals but amounts related to individuals' circumstances -- income, wealth, consumption, family size, etc. -- then anticipated taxes depend on expectations of those circumstances and of tax legislation. Second, of course, non-lump-sum levies generally induce tax-reducing behavior.

To take up the second point first, taxation of wealth or income from wealth provides a gaping hole in the "Ricardian" case, as Ricardo himself well knew. This is most obvious if current transfer payments or per capita tax credits are financed by debt issues to be serviced, at least in part, by future wealth taxes. Few of us would doubt that the combination induces some substitution against saving and capital formation. This will be true

even if consumers are immortal, or, via the Barro inter-generational linkage, have effectively infinite horizons. The same qualitative effect will occur if future wealth taxation is substituted for current wealth taxation, for the reduction in current taxes does not help future accumulation. If the change in timing had been anticipated, the net results over time and generations are not clear but there will be a bulge in consumption for the favored generations.

What about wage taxes? To the extent that they tax proceeds of human capital investments, the above remarks apply. They may also induce substitution in favor of leisure and other uses of time that escape the scrutiny of Inland Revenue or Internal Revenue Service. Anticipating such substitutions by his heirs, a Barro model parent will know that to maintain his heirs' utilities, it is unnecessary to maintain their endowments against expected increases in wage taxes. Substitutions will do part of the job, so the parent may in good conscience consume herself some of the fruits of her tax reductions.

The first point is important even if tax-reducing substitutions are negligible. The reason is that tax liabilities, individual and aggregate, are at least as uncertain as the tax bases on which they depend.

- a) The Barro model parent is, of course, not really certain of his heir's income-earning capacity. The function of bequest is not just to raise the heir's expected utility. It is also to guard against disappointment or disaster in the heir's earning power. A parent so minded will provide a higher bequest the larger his estimate of the variance of the child's endowment. Taxation of income, wealth, or consumption lowers

that variance. Suppose, then, that the expectation of higher taxes for debt service focuses on higher tax rates. The increase in the mean expected tax burden on the heir will tend to raise the parent's bequest; but, given his uncertainty about the heir's other pre-tax endowments, reduction in their after-tax variance tends to diminish bequests.

- b) Essentially the same point can be made without resort to the inter-generation model. The government gives a worker one week's extra wages today while suggesting that he will pay extra taxes of about two weeks' wages in about ten years. However, today's bonus takes the form of a bond to pay him consumption value in ten years. If he accepts he will feel wealthier, i.e., his future consumption is more secure. He will therefore consume more now. The bond makes up for the mean decline in his future after-tax income. Since the bond is sure, the uncertainty of future consumption is reduced. The variance is further reduced by the increase in tax rate. In addition the bond has a liquidity advantage. It will meet interim consumption in emergencies more surely and cheaply than borrowing against future wage income

Keynesians have always argued that the discount rate for future taxes is the one appropriate for the streams of income on which the taxes are levied (Smith, 1969); given the uncertainties in those streams, that rate is higher than the discount for government obligations. The differential

means that government bond issue does indeed raise net wealth even if taxpayers correctly expect that taxes will be increased to service the added debt.

The above argument has been stated for consumption-indexed bonds, but it applies also to currency-denominated bonds. They do not provide the same security in general, but they do hedge the taxes levied to service the debt itself. Uncertainties about inflation make currency and promises to pay currency less attractive relative to real assets. Narrowing of discount differentials means that the gain in wealth due to debt finance is smaller when inflation prospects are more uncertain.

4. Deficits and short-run stabilization policy. So far my discussion of the effects of debt finance has concerned only long-run equilibrium, with full employment. So far my argument supports the view that debt finance does, in some degree, crowd out capital stock, a view shared by Keynesians and by conservative theorists like Buchanan. The same argument, I observed earlier, suggests that Keynesian fiscal policy will work in the short run. That is, substitution of debt issue for current taxation will stimulate current consumption; in conditions of under-employment, the resulting expansion of aggregate real demand will increase output and employment.

All the points previously advanced apply in the short-run context, and they are reinforced by a powerful additional mechanism. If resources are unemployed for lack of demand, their re-employment will augment the stream of actual and expected household incomes. The present value of the

stream will be raised even if households expect eventually to service the additional debt from taxes on their incomes. The Keynesian scenario is entirely consistent with rational expectations.

Is this also true of the Ricardian scenario? The answer is no, if taxes are in fact geared to incomes and are correctly perceived. For suppose that households fail to spend any of their transfers or tax reductions, instead buying government bonds to provide for expected future taxes. Incomes do not increase; deficits continue; public debt, household bond holdings, and expected future taxes grow. But the expectations of higher taxes are never confirmed.

We can imagine fiscal policies and associated expectations under which both Ricardian and Keynesian scenarios are self-consistent. This is not surprising. "Rational expectations" paths are generally not unique when the system is not in equilibrium. If annual budget balance were the objective of fiscal policy, as in the days of your Treasury View and our President Hoover's view, the appearance of a deficit during cyclical recession would lead to expectations of higher taxes and accelerate the recession. If full employment budget balance is the understood objective, tax increases will not be expected during recessions and periods of underemployment. Then tax expectations and related expenditure decisions will support the understood countercyclical policy. Baily (1978) shows that this may well have happened in the United States after the second world war, especially in the 1960s.

I do not discuss today the more fundamental contentions of the new classical macroeconomics, that under-employment disequilibria can never occur, that aggregate demand can never be deficient, that prices and money wages continuously clear product and labor markets, that systematic fiscal and monetary demand management can never alter these equilibria. I do not agree with those propositions -- no surprise ! -- and have discussed them on other occasions (Tobin, 1975 and 1977). In this lecture I simply argue that those strong contentions gain no credibility from the Ricardian strictures about fiscal policy.

Statistical evidence recently offered in support of Ricardian doctrine.

I cannot attempt in this lecture a thorough discussion of the statistical or econometric evidence for the Ricardian equivalence theorem or for the opposing Keynesian position. The relevant literature is enormous. It includes all the competing estimates of the effects of fiscal and monetary policies, in large scale structural models and in single reduced form equations. You are all familiar with this long and continuing empirical controversy. I will simply observe that almost all macro-econometric models for the United States economy continue to show significant multipliers for tax reductions or increases in transfer payments financed by non-monetary debt issue. They imply that such debt issues do absorb private saving. The St. Louis model is an exception in assigning no lasting overall expansionary power to pure fiscal policy, even to exhaustive expenditure. But that model does not support Ricardian doctrine either. The mechanism that nullifies fiscal expansion is crowding out of private investment by higher interest

rates. Under the Ricardian scenario, extra saving to pay future taxes would do the job without any rise of interest rates.

I shall confine myself to a brief comment on some recent calculations inspired by the Ricardian thesis. The most direct attempt is that of Kochin (1974). Encouraged by observing that high personal saving ratios occurred in 1970-71 coincident with record federal deficits, he introduced the deficit as a second explanatory variable in annual time series regression of personal consumption on disposable income (i.e., after-tax personal income) 1952-71. He found negative coefficients for the deficit, two to three times their standard errors. Kochin regarded these findings as confirming the view that consumers rationally save in anticipation of future taxes (either explicit taxes or inflation "taxes" on money balances).

His conceptual and statistical procedures are subject to a number of questions, but for two reasons it is unnecessary to go into them for the purposes of this lecture. First, the coefficients of deficit in his preferred regressions are only one fourth the absolute size of the marginal propensity to consume from disposable income. His equations imply, therefore, that a dollar increase in both disposable income and deficit by tax reduction or transfer payment would be a big stimulus to consumption. Second, the casually observed coincidence that inspired Kochin's regression calculations was reversed after 1971. In the subsequent five years deficits soared to new records, while personal saving rates were unusually low. Statistically, the result of adding the years 1972-76 in calculating Kochin's regression is to deprive the federal deficit of all explanatory power. (Buiter and Tobin, 1979)

David and Scadding (1973) also examine household saving behavior and conclude that deficit spending will not absorb saving in the short or long run. However, their argument is quite different from the Ricardian equivalence theorem that inspired Kochin's regressions. Their point of departure is "Denison's Law," the observed long run constancy of the Gross Private Saving Rate (GPSR), the ratio of private saving, households and businesses combined, to GNP in the United States. Their explanation is "ultra-rationality" -- households internalize the actions of the businesses they own, incorporated and unincorporated, and adjust their own saving to offset dollar for dollar changes in business saving. In short, they extend the Modigliani-Miller theorem beyond finance to accumulation. Whatever the theoretical and empirical merits of this proposition, -- actually, GPSR appears to have slipped by one point since the second world war -- it does not imply public debt neutrality. Rather it implies that a reduction of taxes (net of transfers) diminishes consumption dollar for dollar. So "ultra-rationality" à la David and Scadding clearly implies not that personal saving adjusts to compensate for government deficits but precisely the opposite. Disturbed by this implication, which seems to imply that consumers internalize business behavior but not government actions, the authors propose a way out. Their ultra-rational households, they decide, must regard taxes as financing collective consumption, perfectly equivalent to private consumption, and deficits as financing public investment, 100% substitutable for private capital formation. On this basis they conclude that "an extra dollar of government deficit will

displace a dollar of private investment expenditure" (my italics), a completely gratuitous conclusion unsupported by their empirical study of private saving behavior. It is especially absurd to apply it to short run variations of deficit due either to automatic cyclical variation in revenues and transfers or to discretionary stabilization policies. These do not change the mix of government expenditure between consumption and investment; and no consumer-taxpayers, wherever they fall on the spectrum of rationality, would think they did. Yet David and Scadding, and many who cite their article, evidently believe they have dealt a devastating blow to the use of fiscal policy as an instrument of stabilization.

Taylor (1971), using U. S. quarterly data 1953-1969, finds that the marginal propensities to consume from tax reductions, especially social insurance contributions, and from transfer payments are extraordinarily low relative to those from changes in pre-tax earnings. While his results cast doubt on the effectiveness of tax and transfer changes as instruments of stabilization, they do not support the debt neutrality hypothesis. They are more consistent with the life cycle or permanent income saving models, which imply that temporary fiscal measures are weaker than permanent changes of income. Taylor's results also are consistent with the criticisms of unfunded retirement insurance. In any event, the cyclical multi-collinearity of taxes, transfers, deficits, and pre-tax incomes makes it very difficult to estimate their separate effects on household consumption and saving. Statistically it is hard to improve on the simple short-run relationship of consumption to disposable income.^{3/}

Steady-state effects of fiscal policy: sketch of a model.

I hope that my review of the theoretical and empirical debate has convinced you that government finance cannot be simply swept aside and ignored as irrelevant to real economic outcomes. In conclusion, I would like to sketch a model of the long-run consequences of alternative financing policies for capital formation and inflation. In other papers (Tobin and Buiter, 1978, and Tobin, 1979) similar models are presented in much more detail and their short-run and long-run properties are examined.

The main point I would emphasize here is the following: Deficit financing may cause inflation, or it may crowd out capital formation. But it is unlikely to do both. In the degree it is inflationary, it makes money a less attractive asset and encourages saving in other forms, including productive capital. Under fiscal policies where deficits are a larger share of national income, the actual and expected erosion of stocks of money and nominal debt by inflation makes them smaller fractions of national wealth. The "inflation tax" is not a lump-sum tax, and substitution to avoid it is sufficient reason that money-financed deficits are not neutral. It may seem paradoxical, but it is not really surprising, that larger nominal stocks may turn out to be smaller real stocks, not only relatively but absolutely. In the long run, real stocks must accord with public asset demands; the price level and inflation rate adjust government-issued supplies to those demands.

On the other hand, it is conceivable that deficit financing will be counter-inflationary, in the sense that steady states corresponding to fiscal policies with higher deficits show lower inflation rates. They will also have higher real interest rates and lower capital stocks. But stability is dubious for steady-state solutions of these configurations.

The model I have in mind describes fiscal policy by three parameters: the fraction \underline{e} of net national product purchased by government; the fraction \underline{t} collected in taxes net of transfers; the fraction $\underline{\gamma}$ of the government deficit financed by issue of base money. The remaining fraction $\underline{1-\gamma}$ is financed by issue of interest-bearing obligations, which for convenience I take to be consols bearing a coupon of \underline{i} per year, free of tax. The real rate of return on money is $\underline{-i}$ the negative of the inflation rate. The real rate on bonds, market-determined, is $\underline{r_B}$. The market value of bonds is $\underline{1/(r_B+i)}$, the reciprocal of their nominal rate of return. The real interest cost of new debt (in both forms money and consols) $\underline{r_d}$ is a weighted average of the two real rates, $\underline{r_B(1-\gamma) + (-i)\gamma}$. In a steady state, with $\underline{\gamma}$ constant over time, this is also the real interest cost of existing debt. If \underline{d} is the ratio of total debt to national product, then the government budget identity can be written as:

$$(1) \quad e - t = (g - r_d)d = (g - r_B(1-\gamma) + i\gamma)d,$$

where \underline{g} is the natural growth rate of the economy.

Wealth-owners also can hold capital bearing a real rate $\underline{r_K}$. In

steady state equilibrium the aggregate capital/output ratio is inversely related to this rate by $\underline{k(r_K)}$. I write the steady-state demands for the three assets, relative to aggregate income, as functions $\underline{f^J(r_K(1-t), r_B, -i, t)}$, ($J = K, B, M$), i.e., as functions of the three after-tax rates of return and of the tax rate. These must equal the steady-state asset supplies:

$$(2) \quad f^K(r_K(1-t), r_B, -i, t) = k(r_K)$$

$$(3) \quad f^B(r_K(1-t), r_B, -i, t) = (1-\gamma) \frac{e-t}{g-r_d}$$

$$(4) \quad f^M(r_K(1-t), r_B, -i, t) = \gamma \frac{e-t}{g-r_d}$$

The sum of these three equations gives the wealth/income ratio:

$$(5) \quad f(r_K(1-t), r_B, -i, t) = k + d$$

Equation (5) is the stock equivalent of the "IS" curve, which says that private saving equals capital investment plus the government deficit.

The signs above the arguments in the functions of equations (2)-(5) indicate the assumed impacts. The interest rate effects are taken to be consistent with gross substitutability among the assets, with the own effects dominant. That is, an increase in an interest rate may induce additional saving, but only in the asset whose rate has increased. Taxes, apart from their effect on the after-tax return to capital, are assumed to deter all forms of asset accumulation.

The system (2), (3), (4) -- plus the definition of \underline{r}_d given above -- determines the three rates ($\underline{r}_K, \underline{r}_B, -i$) as functions of the policy parameters ($\underline{e}, \underline{t}, \underline{y}$). Note that in any steady state resources are fully employed and expectations are automatically rational. Expected and actual values of variables coincide and are constant. The question of today's lecture is the effect of \underline{t} on the steady-state profit rate \underline{r}_K and thus on the capital intensity $\underline{k}(\underline{r}_K)$. The debt neutrality proposition is that variation of \underline{t} has no effect.

For the neutrality proposition to hold, the tax rate \underline{t} must not enter \underline{f}^K , the left hand side of (2), either directly or indirectly. This requires several special and implausible assumptions: (a) Taxes do not affect the after-tax return on capital. As I have observed several times in the lecture, the neutrality doctrine assumes lump-sum taxes and ignores substitution effects. (b) Taxes do not affect savings and asset demands in other ways, e.g. by altering lifetime labor income or by altering the bite of liquidity constraints. (c) Demand for capital stock is independent of the yields of alternative assets, here money and bonds. If those partial derivatives of \underline{f}^K are not zero, then changes in \underline{t} will affect the demand for capital indirectly. In equations (3) and (4), \underline{t} necessarily affects asset supplies on the right hand side, even if assumptions (a) and (b) are used to eliminate \underline{t} from asset demands on the left. Reduction of \underline{t} increases debt (assuming \underline{g} exceeds \underline{r}_d) and alters, probably lowers, \underline{r}_B and $\underline{-i}$. Unless those rates are irrelevant to the demand for capital

\underline{f}^K , both \underline{r}_K and $\underline{k}(\underline{r}_K)$ are bound to vary with \underline{t} . From this perspective, the Barro argument and its counterpart for the "inflation tax" on money may be seen as elaborate rationalization of the view that government-issued financial assets are not substitutes, even imperfect substitutes, for real capital.

I will not provide a formal analysis of this model here. (See however Tobin, 1979). With the help of Figure 1 we can see what is going on. The price of using a two-dimensional diagram for a 3-dimensional model is that we relegate to the second order any changes in the relative rates of return on the two types of debt, money and bonds. We keep the composition of the debt unchanged. The horizontal axis measures the composite \underline{r}_d ; leftward from the vertical line at $\underline{r}_d = \underline{g}$, the same axis measures $\underline{g} - \underline{r}_d$. The vertical axis measures \underline{d} , the ratio of public debt to income, $\underline{d} + \underline{k}$, the ratio of wealth to income, and their difference \underline{k} , the capital/output ratio. The curve \underline{WW} indicates that desired wealth \underline{f} is an increasing function of \underline{r}_d , given \underline{r}_K and other variables. Curve \underline{SS} represents the supply of public debt, $(\underline{e} - \underline{t}) / (\underline{g} - \underline{r}_d)$, as a function of \underline{r}_d . It is a rectangular hyperbola, asymptotic to the horizontal axis and to the vertical line at $\underline{r}_d = \underline{g}$, crossing the vertical axis at $(\underline{e} - \underline{t}) / \underline{g}$. In the relevant range, movement up \underline{SS} leaves less (vertical) room for capital \underline{k} in total wealth \underline{WW} . This means that movement up \underline{SS} brings an increase in \underline{r}_K .

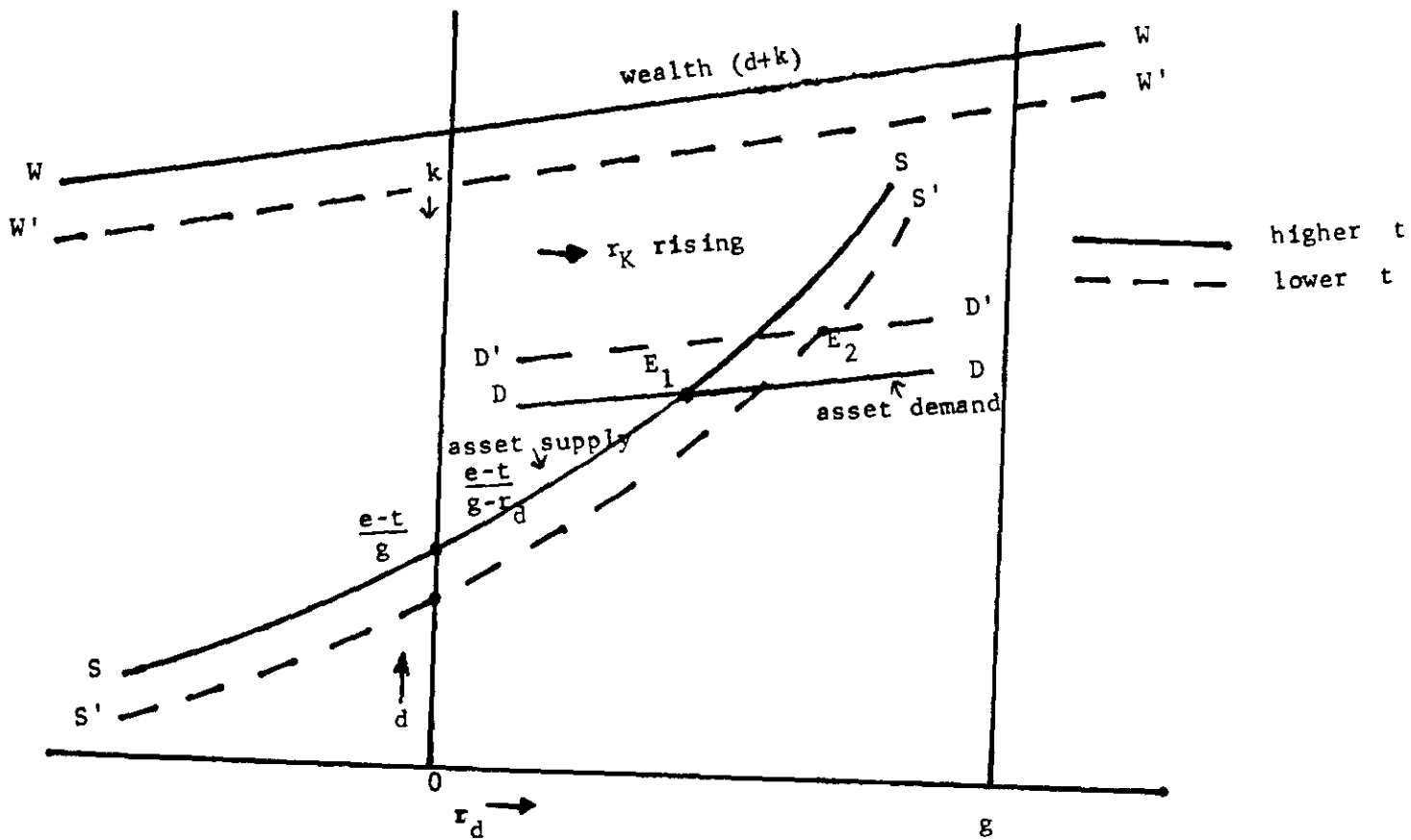


FIGURE 1: Steady state solutions for alternative tax rates.

Curve DD represents portfolio balance, as between public debt of the prescribed composition $(\underline{\gamma}, 1-\underline{\gamma})$ and capital. It shows d and k desired at each value of r_d, assuming the r_K which would be consistent with the supply of public debt, i.e., the difference between WW and SS, at that r_d. Curve DD may or may not be steeper than SS. In Figure 1 it is less steep. Point E_1 is an equilibrium. To its right there is excess supply of debt, excess demand for capital; to its left, the reverse.

The dashed curves W'W', S'S', D'D' illustrate shifts associated with a higher value of t. Greater taxation lowers desired wealth, diminishes the supply of public debt, increases the demand for public debt while lowering the demand for capital. The resulting solution E_2 has higher r_d and r_K, and lower capital intensity k than E_1 . Higher r_d generally means, for given γ, both lower inflation rate i and higher real rate on bonds r_B. Thus a rise in the tax rate is counter-inflationary but "crowds out" capital.

Opposite results would occur if DD were steeper than SS, reflecting very high elasticity of asset demands with respect to rate differentials. The shifts in the curves would be as in Figure 1; E_2 would be southwest of E_1 . The increase in tax rate is good for capital formation and is also inflationary. I repeat the warning that this is a comparative statics exercise. The steady state equilibria being compared may not be stable.

In conclusion, I express the view that answers to the important questions with which I began are not to be found in appeals to first principles that allegedly support sweeping theorems of equivalence and neutrality. Rather they are to be sought in empirical studies of asset choice and saving behavior. I hope that theoretical constructions of the type I have illustrated in my concluding section offer some help in the formulation of those empirical studies.

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FOOTNOTES

- 1/. Summarized in Ferguson (1964).
- 2/. Barro is not and does not claim to be the first modern re-discoverer of the Ricardian equivalence theorem. He cites Tobin (1952, p. 91) and Bailey (1962, pp. 75-77).
- 3/. For further review of evidence, see Buiter and Tobin (1979).

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