NBER WORKING PAPERS SERIES

PUBLIC SECTOR DYNAMICS

Alan J. Auerbach

Working Paper No. 3508

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 1990

This paper was prepared for the conference on "Modern Public Finance" held at the University of California, Berkeley, on April 27-28, 1990 in honor of George Break, Richard Musgrave and the memory of Joseph Pechman. Like all with an interest in public finance today, I owe a great intellectual debt to all three. As a student of Richard Musgrave's, it is a pleasure to acknowledge his indirect contribution to this work, as well as the comments of conference participants, including my discussants Don Fullerton and David Romer. This paper is part of NBER's research program in Taxation. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

Using Musgrave's The Theory of Public Finance as a starting point, this paper reviews the scholarly developments in Public Sector Dynamics during the past three decades, placing emphasis not only on accomplishments but also areas in need of additional research.

The review is organized into sections covering research on the public debt, its measurement and impact; the fiscal determinants of savings and the choice of tax base; the effects of taxation on investment and risk-taking; dynamic tax incidence; and dynamic inconsistency and public choice.

Among the specific research topics considered are the Ricardian equivalence proposition, the incidence of the corporation income tax, the choice between income and consumption taxes, and political business cycles.

Alan J. Auerbach
University of Pennsylvania
Department of Economics
3718 Locust Walk
Philadelphia, PA 19104-6297

I. Introduction

Since the publication of Richard Musgrave's The Theory of Public Finance in 1959, there has been considerable research on topics relating to fiscal policy in a dynamic setting. Using The Theory of Public Finance as a starting point, this paper reviews the scholarly developments in Public Sector Dynamics during the past three decades.

Dynamic issues are those in which time occupies a serious role that cannot be eliminated through the convention of Arrow-Debreu markets; the role of the public sector is a relevant subject whenever governments do or ought to become involved to alter market outcomes. This naturally includes questions of investment, saving, growth and risk-taking, all of which have figured prominently in fiscal analysis, but also other central topics such as tax incidence. The discussion below is organized around subjects that have a dynamic aspect and have been important in the literature, either since 1959 or historically, but no claim to comprehensiveness is made; the choice of topics is based in large part on personal interest. A very helpful guide to the development of this literature during the first part of the post-1959 period is provided in Break's (1974) comprehensive survey, to which I will often refer.

II. The Public Debt

The Theory of Public Finance reflected the thinking of its time in analyzing the role of budget size and budget deficits in the Keynesian stabilization of aggregate economic activity. In the years since, the literature on the public debt has moved away from the Keynesian paradigm. In general, Musgrave's classic division of the functions of government into three "branches," respectivley encompassing allocation, distribution, and

stabilization activities, has largely been replaced by one with only the first two branches, as stabilization policy has come to be viewed more as one aspect of government intervention to alleviate market failure.

Much of the subsequent research on the public debt explored the implications of a more neoclassical approach. More recently, there has been a move toward trying to understand debt policy as the result of the political process.

A. The Ricardian Equivalence Proposition

There is probably no fiscal policy issue on which there has been more controversy in the recent literature than the "Ricardian Equivalence" proposition. Spurred by Barro's (1974) paper demonstrating that altruistic agents in an overlapping generations model will not perceive government debt as wealth and hence will offset government dissaving with private saving, economists have sought to determine the theoretical conditions under which Ricardian Equivalence would hold and conducted empirical tests of the hypothesis.

The implications of the Ricardian equivalence proposition for such important questions as the impact of pay-as-you-go social security schemes are quite strong. Indeed, the Ricardian equivalence proposition has even been used by politicians, perhaps somewhat cynically, in dismissing the significance of large fiscal deficits.

As its name suggests, this proposition has historical roots, and it is accorded due notice in The Theory of Public Finance in language that is not at all dated:

> In a perfect market system, with rational taxpayer behavior and a pure credit market, it will be equally advantageous for the government to use tax or loan finance. If the taxpayer wishes to spread his burden, he may secure a tax or consumer loan and thus obtain command over resources that otherwise would have gone into capital formation. The outcome will be similar to that of public loan finance, the only difference being that private rather than public debt is issued.
>
> (p. 559)

However, the passage continues,

> In the real world, where credit facilities are not available on equal terms to all taxpayers, this equality does not apply. Public loan finance may then be thought of as a means of enabling individual taxpayers to secure tax credit at equal terms. By placing payment on a pay-as-you-use basis, loan finance remains a significant instrument of policy, even though it does not increase the total availability of resources.

The discussion then turns to the remaining issue of the intergenerational burden of deficit finance, without really countenancing the possiblity of its being undone by offseting bequest behavior.

There are several possible interpretations of the much greater subsequent preoccupation with Ricardian Equivalence. One is the profession's general movement toward rigorous demonstration of results that might have been implicitly accepted in the past. A vast literature[1] has focused on which types of altruism suffice and the types of taxes for which Ricardian equivalence would hold. For example, we have learned that Barro's assumption of a type of altruism that transformed the problem of a sequence of overlapping generations into that of an infinite horizon family was not necessary to generate the result. What is crucial is an unbroken intergenerational link, even if bequests generate externalities (Warr and Wright 1981) or the links are circuitous (Bagwell and Bernheim 1988). If future taxes are imposed on risky activities and act as insurance, they are

not equivalent to taxes today which provide no such insurance (Barsky et al 1986).

A related explanation of the Ricardian Equivalence phenomenon is the increasing willingness of economists to suspend disbelief, to accept very extreme propositions until they are positively refuted empirically. Given the vagaries of empirical research, this is rarely an easy task, regardless of the hypothesis or its merits. Tests of some implications of the Ricardian Equivalence proposition, such as the absence of of a relationship between interest rates and public debt, have failed to reject the hypothesis (e.g. Evans 1987). However, a recent and much more specific test of the Ricardian Equivalence proposition, that the consumption levels of different generations of a family will respond together to shocks to the income of any given family member (Altonji et al 1989) clearly rejects the hypothesis.

If one summarizes the findings of this literature to date, they are that Ricardian equivalence can hold under a variety of conditions satisfied by at least some part of the population, but that its empirical importance remains to be demonstrated. This uncertainty will undoubtedly sustain the Ricardian Equivalence industry for years to come, and the results will be helpful in addressing questions of long-run incidence. However, for questions of fiscal policy relating to the short-run impact of deficits, the intergenerational aspect of the Ricardian Equivalance proposition is not especially relevant.

As emphasized in the above quote from The Theory of Public Finance, Ricardian Equivalence also fails if there are capital market imperfections. Indeed, the wealth effects of deficits on consumption in a pure life cycle model without bequests but with perfect capital markets are very small (Auerbach and Kotlikoff 1987, Poterba and Summers 1987); the distinction

between a very long horizon and an infinite horizon is small as far as current consumption behavior is concerned. Any important impact of fiscal deficits on short-run behavior must come from other factors, such as credit market imperfections and liquidity constraints. However, the nature of these credit market imperfections must be carefully specified, as one can argue that future tax liabilities financed by current deficits will reduce the amount that liquidity constrained households can borrow, thereby negating the potential liquidity the debt might provide to constrained households (Hayashi 1987). The recent literature attempting to characterize the nature of credit market imperfections[2] therefore promises to be quite relevant to understanding the short-run effects of deficits.

B. Crowding Out and Maturity Structure

The traditional Keynesian analysis of deficit finance emphasized the importance of the deficit's liquidity and maturity structure in determining the extent of aggregate stimulus and crowding out. While this approach continued to be refined in the years after 1959 (e.g Tobin 1962, B. Friedman 1978), there have also been contributions challenging the ability of open market operations to effect real changes without there also being a change in the underlying pattern of real government activity (Chamley and Polemarchakis 1984). As with the Ricardian equivalence proposition, the demand for aggregate analysis to be supported by rigorous microfoundations has left us in the uncomfortable position of lacking a fully satisfactory model for the real effects of the composition of the debt that policy-makers still believe exists.

More recently, the issue of maturity structure has arisen in a different context, explored more fully below in section VI, having to do with the

government's commitment to a stated policy and the problem of dynamic inconsistency.

A clarification that the literature has produced regarding crowding out is that one cannot view a current deficit in isolation when considering its effects. Even ignoring the issue of monetization, one cannot talk about "the" crowding out effects of a current deficit, because current taxes and spending provide an incomplete description of current fiscal policy. Future fiscal actions are tied to current ones by the government's intertemporal budget constraint, so that a reduction in taxes today implies compensatory fiscal actions in the future (Blinder and Solow 1974). The effects of current deficits therefore depend on the path of future actions with which they are associated. Even in a strictly neoclassical model without money, one can generate a wide variety of economic responses to deficit increases, including short-run crowding in of private investment, by varying the future levels and types of compensating tax increases (Auerbach and Kotlikoff 1987).

C. The Positive Theory of Debt

Belief in the Ricardian Equivalence proposition deprives one of two important potential explanations for the determination of the public debt, namely as a vehicle for spreading the burden of expenditures across generations and altering the level of aggregate economic activity. This helps to explain the recent focus on other theories to explain observed public debt levels.

Even without the ability to use debt to smooth the burden of taxation, the benevolent government still has an incentive to use debt to smooth tax rates, a lesson from the theory of optimal taxation that developed during the post-1959 period (e.g. Diamond and Mirrlees 1971). Under restrictive

conditions, the desire to minimize the deadweight loss of taxation implies that tax rates should follow a random walk, and has other implications for the evolution of the public debt (Barro 1979), and the relationship among different taxes, including the inflation tax (Mankiw 1987). The tax-smoothing and burden-smoothing hypotheses are, of course related. For a given tax structure, one cannot change tax rates without altering the level of taxation, and this theory has little to say about changes in the degree of tax progressivity that would break the connection.

However, as the events of the 1980s have demonstrated, the model of the benevolent social planner seems particularly inappropriate for characterizing public debt policy. The large U.S. budget deficits of the 1980s seem to correspond much better to a model of budget determination by competing political interests. Here, one may distinguish arguments relating to different tastes for public spending within generations from struggles among generations regarding the allocation of the fiscal burden.

The argument that one can reduce spending by running deficits is not a new one, having been put quite succintly by M. Friedman (1962) and having often been given by policy-makers as an explanation for recent deficit policy. Recent contributions have provided a theoretical model for such a view, founded on the idea of a government running deficits in order to abridge the power of future governments to tax (Persson and Svensson 1989, Tabellini and Alesina, 1990). The intuition is that, by increasing the fraction of future budgets that must be devoted to debt service, the government reduces the feasible size of future primary (i.e. excluding interest) deficits and, given the limitation on its ability or desire to tax, future spending as well. Whether this strategy "works" is an important empirical question.

The relative political strength of different generations may also play a role in allocating the fiscal burden. Perhaps the best case to consider in exploring this issue is the pay-as-you-go social security system, since the intergenerational transfers of this program are so clear. Some recent research has considered how social security systems are maintained in political equilibrium (Sjoblom 1985, Kotlikoff et al 1988).[3]

Debt policy as an element of strategy has also characterized the burgeoning literature on developing country indebtedness and the role of default[4], a discussion of which is not attempted here. Clearly, however, the direction of research has moved away from describing the behavior of a single social planner to that of agents with conflicting interests who behave strategically. As a characterization of reality, this approach holds promise.

D. The Measurement of Debt

How should one measure the deficit? The distinction between full and primary deficits, which exclude interest payments, has already arisen in the discussion above. The Theory of Public Finance discussed the use of capital budgeting for public projects and the traditional notion that debt should be matched to capital spending to ensure the matching of fiscal burdens and public services. It also noted the need to adjust deficits for the level of economic activity to obtain a measure of fiscal stimulus. While Full-Employment deficits are still regularly calculated, their inadequacy even within the Keynesian framework were noted long ago (e.g. Blinder and Solow 1974). The absence of a capital budget, and other accounting problems with reported deficits, have led to several careful attempts to measure the deficit "correctly," (e.g. Eisner and Pieper 1984).

But there is a much more fundamental problem with reported debt and deficits as measures of fiscal thrust or burden-shifting. Put simply, for countries such as the United States, the national debt is largely internal debt, an obligation to itself. Once one subtracts external debt, which is an obligation of the country as a whole, one is left with a net "debt" of zero; the language often used to make this point is that "we owe it to ourselves". That is, the present value of the stock of debt equals to present value of the future primary surplusses needed to service it.[5] It is customary to think of the level of internal debt as a meaningful indicator of the intergenerational distribution of the fiscal burden, but it should be immediately obvious that one will have difficulty using a single number as a measure of the distribution of the fiscal burden across several generations of individuals.

Pay-as-you-go social security may illustrate this point best. The current United States budget shows the social security pension system to be running huge surplusses, measured as they are on a cash-flow basis. Yet these surplusses are being generated to pay for future benefits already being accrued. If one converted the social security system of accounting from a cash basis to an accrual basis, the measured debt and deficits would change markedly (see Kotlikoff 1986) without there being any change in the intergenerational burden of the system. The national debt would still equal the present value of future primary surplusses but each would be different in magnitude; there would be offsetting adjustments to current and future deficits without any net impact on the intergenerational distribution of the tax burden.

This example suggests a close analogy to the private sector where, for example, the accounting treatment of unfunded pension liabilities has been an

important issue. The key difference is that we can observe the value of a traded company's liabilities, or at least the public's estimate of them, in its market value.[6] Changes in accounting treatment that do not alter a compnay's perceived liabilities will not alter its market value. However, we do not have such market values for future government claims and liabilities, except in cases where these claims and liabilities involve transactions with private firms and are capitalized in the values these firms.[7]

The inability of any deficit accounting rule to produce a measure of intergenerational burden shifting has several interesting implications. First, it casts doubt on tests of Ricardian Equivalence based on reported debt measures. Second, it suggests that it would be useful to derive estimates of the intergenerational fiscal burden[8] and determine the relationship between such measures and reported deficits. Finally, it would be interesting to study changes in government accounting conventions, particularly in reaction to deficit reduction and balanced-budget measures such as the Gramm-Rudman-Hollings legislation recently in force in the United States. While there may be considerable information about changes in the distribution of the fiscal burden conveyed by annual deficit measures if the tax structure and accounting conventions are stable over time, it is certainly possible to make the deficit entirely meaningless.

III. Savings and the Choice of Tax Base

In his posthumous presidential presentation to the American Economic Association, Joseph Pechman (1990) reiterated his long-standing support for a comprehensive, progressive income tax. Yet Pechman also conceded at the start that academic support for alternatives to the income tax had grown:

> At one time, support for the expenditure tax was confined to a few members of our profession...Today, it is fair to say that many, if not most, economists favor the expenditure tax or a flat rate income tax.
>
> (p. 1)

Some who favor a comprehensive expenditure tax do so largely on administrative grounds (e.g. Bradford 1986). However, in the economics literature, most of the discussion of the relative merits of consumption and income taxes has focused on two issues: the distributional effects of a change in the tax base and the impact on economic efficiency and capital formation of changes in the tax treatment of saving. Indeed, the issue of intragenerational distribution that concerned such early proponents of the expenditure tax as Kaldor (1955) as well as many opponents who view consumption taxes as regressive, has occupied a less important place in the recent literature.

A. Optimal Taxation and the Consumption Tax

In the sense that it involves time, dynamics played a part even in some of the traditional support for a consumption tax. For example, Fisher (1939) argued that, viewed from a lifetime perspective, the income tax was unfair because it taxed unconsumed labor income twice, once when earned and again when producing interest income. However, this position was criticized in The Theory of Public Finance:

> The only meaningful way in which the terms **double taxation** or **undertaxation** can be used in connection with equity is to indicate discrimination for or aginst particular taxpayers in terms of a given index of equality. It is this index that must be decided upon **first** to prove that double taxation or undertaxation occurs, rather than the reverse order. By the same token, the concept of double taxation as **taxing a thing more than once** is fallacious. If three taxes on product X add up to an ad valorem rate which is less than that of a single rate on Y, X is undertaxed, not double-taxed.
>
> (p.163)

Indeed, the subsequent literature did move toward analyzing consumption and income taxes in terms of their effective tax rates on different commodities, in this case consumption at different dates.

As discussed in the Theory of Public Finance (chapter 12), one can view the consumption-saving decision as a current-consumption-future consumption choice. In a simple two-period model with first-period labor earnings, we can write the lifetime budget constraint as:

$$(1) \qquad \frac{1}{w} C_1 + \frac{1}{w(1+r)} C_2 = L$$

where w is the wage rate, r the interest rate, C_i is period i's consumption, and L is labor supply. As long as labor supply is not fixed, it is a second-best problem of optimal taxation to determine the appropriate relative burden on taxation in the two periods. However, if conditions are such that one would wish to tax first- and second-period consumption at the same rate, this implies that a consumption tax, which in this case is equivalent to a tax on labor income, is to be preferred to a tax on capital and labor income, which would raise the relative price of second-period consumption.

Even when there is a heterogeneous population and progressive taxation, there are relatively weak conditions under which a progressive labor income tax alone, equivalent to a progressive tax on lifetime consumption, is optimal (Atkinson and Stiglitz 1976). Such theoretical results led to arguments for the consumption tax based on efficiency grounds (e.g., Feldstein 1978, Boskin 1978).

B. Transition to a Consumption Tax

The foregoing results based on the taxation of a single individual or generation of individuals appears at first to be at odds with findings that the tax structure appropriate for maximizing steady state utility or a discounted sum of present and future generations' utilities depends not only on efficiency concerns but also on "Golden Rule" considerations based on the relationship between the economy's interest and growth rates (Auerbach 1979b, Atkinson and Sandmo 1980). However, the results are consistent and their differences are informative about the distinction between tax design and tax reform.

This distinction has many dimensions, some of which have been discussed in Feldstein (1976). In the present context, the relevant point (as discussed in Auerbach and Kotlikoff 1987) is that changes in tax structure affect different generations differently. While a labor income tax and a consumption tax collecting a given amount of revenue in present value from a single generation may be equivalent, the same two tax bases, applied at a given date to different generations, have quite different effects.

First, by taxing consumption out of previously accumulated wealth, the consumption tax is a more efficient tax, equivalent to a tax on labor income plus a capital levy.[9] Second, because the ownership of capital is very much related to age, the consumption tax imposes more of the fiscal burden on older current generations and less on the young and on future generations than does a labor income tax. Thus, a shift from labor income taxation to consumption taxation would, efficiency considerations aside, represent a transfer from the old to the young, like a fiscal surplus or the elimination of a pay-as-you-go social security scheme. In a dynamically efficient overlapping generations

economy, this will raise steady state utility (Diamond 1965), but through intergenerational transfers, not a reduction in deadweight loss.

Calculations reported in Auerbach and Kotlikoff (1987) suggest a sizable difference between the long-run effects of moving from income tax to a consumption tax and moving from an income tax to a labor income tax. More than half of this difference is attributable to differences in intergenerational burdens; the rest is due to the greater efficiency of the consumption tax due to its inclusion of an implicit capital levy. Neither of these differences appears in the single-generation comparison of the two tax bases.

C. Fiscal Policy and Saving

The importance of considering transitions explicitly can be illustrated using the example of the Individual Retirement Account, a vehicle introduced for most households in the United States in 1981. Under the scheme, households could deduct contributions to such accounts, being taxable on subsequent withdrawls after retirement. The scheme appears to have the characteristic of a consumption tax, which could be implemented under an income tax through a deduction for new saving. Indeed, the view that IRAs had moved the United States closer to a consumption tax was common.

Yet as it actually worked, the IRA system allowed the transfer of previously accumulated funds into the accounts, thus eliminating the capital levy component of the consumption tax. Moreover, because interest on borrowed funds remained tax-deductible, one could obtain a refund for the capital levy even if one had no capital! Finally, because there was a ceiling on contributions, the availability of the IRA amounted to a lump-sum transfer to the many who were constrained at the ceiling.

How much IRAs have influenced saving in the United States remains controversial[10], and this illustrates a more general problem of finding the "right" model of saving behavior. The Theory of Public Finance is agnostic on this point, considering the effects of taxation on saving in several models (pp. 260-8). Since then, however, most of the theoretical analysis of various tax bases and schemes has assumed the life-cycle model of saving, with or without bequests. Even within this model, it has been difficult to find any responsiveness of saving to the after-tax interest rate. In his 1974 survey, Break concluded that:

> Empirical estimates of this pure substitution effect are sufficiently rare, and those that exist sufficiently small, to justify its classification, for most purposes, in the second-order-of-importance category.
>
> (p. 192)

Since the arrival of Euler-equation estimation techniques, empirical estimates of the degree of intertemporal substitution are now less rare, but they have not gotten much larger. In one recent study, Hall (1988) finds an intertemporal substitution elasticity near zero, for example.

However, as already indicated, many papers have found considerable excess sensitivity of consumption to predictable movements in contemporaneous income, suggesting the presence of liquidity constraints. There is also cross-country evidence showing a strong positive relation between growth rates and saving rates that appears to be inconsistent with the life-cycle model (Carroll and Summers 1989). Likewise, there remains some controversy over whether business saving is, in itself, important, or whether private households "pierce the corporate veil" and eliminate any influence of business saving on national saving.[11]

Knowing how to model saving behavior is crucial in the design of tax policy, as was clear in 1959. However, most of the sophisticated theoretical analysis to date assumes a model of saving for which the evidence does not offer great support. Alternative models would suggest different responses to particular changes in taxation and, of equal importance, would also lead to different welfare conclusions. Finding the right model empirically, as well as exploring this model's theoretical implications for the design of tax policy, should be an important item on the public finance research agenda.

IV. Investment Incentives and Risk-Taking

A chapter of The Theory of Public Finance is devoted to the effects of taxation on investment and risk-taking. Despite the intervening years, many of its points, and certainly its choice of topics, are consistent with the approach taken in much of the subsequent literature.

A. Investment Incentives

The accelerated depreciation allowances of the Internal Revenue Code of 1954 were already in place in 1959, and so was the profession's concern with investment incentives. The Theory of Public Finance discusses the impact of different depreciation schedules on the "effective tax rate", defined as it has been in the subsequent literature (e.g. King and Fullerton 1984) as the difference between gross of tax and net of tax internal rates of return.

While the nature of "economic depreciation" had not yet been clarified by Samuelson's (1964) concise contribution, Musgrave goes through Brown's (1948) classic demonstration that the extreme form of accelerated depreciation, immediate expensing of investment, produces a zero effective tax rate. The

concluding paragraph of this discussion is particularly relevant, in light of the subsequent literature:

> This argument, to be sure, relates to the case of a tax on new investment only. A profits tax (limited to old investment) or a capital levy, are different matters. Where depreciation has been taken in the past, while current profits continue to accrue, the tax involves a loss to the investor and a gain to the Treasury, even though instantaneous depreciation is permitted for new investment.
>
> (p. 344)

The capital levy that distinguishes investment incentives from tax cuts also appeared above in the comparison of taxes on consumption and labor income. Indeed, taxing business profits and allowing an immediate write-off for investment amounts to a "cash-flow" tax on business that has the same form as a consumption tax, in this case a tax on distributions from business rather than on consumption (Institute for Fiscal Studies 1978).

That investment incentives were seen to provide greater "bang for the buck" than general tax cuts was another way of putting the point that reductions in taxes on old capital income represent "leakages" that have no effects on incentives. The attractiveness of such incentives was supported by the important empirical work on investment theory initiated by Jorgenson in the 1960s (e.g., Jorgenson 1963, Hall and Jorgenson 1967). As observed by Break (1974):

> When the parameters of the basic Jorgenson model are estimated empirically, the effects on gross investment of such tax policies as accelerated depreciation and investment credits turn out to be substantial. To policy makers, always eager to find effective ways of influencing the behavior of the economy, the attractiveness of such findings is obvious. Their usefulness for that purpose, however, is subject to important qualifications.
>
> (p. 207)

This last caveat notwithstanding, investment incentives, including investment tax credits and accelerated depreciation, remained popular into the 1980s,

steadily increasing the distinction between the tax treatment of old and new capital (Auerbach 1983). However, the applicability of investment equations for policy analysis came to be criticized on more fundamental grounds, having to do with the validity of the estimated equations.

In his celebrated critique of policy design based on econometric models, Lucas (1976) used the investment credit as an example of the problem of using models estimated in one policy environment to predict the effects of different policy rules. Investors ought to respond not only to the current level of the investment tax credit, but also what it is expected to be in the future. For example, if a model relating investment to the contemporaneous investment tax credit is estimated in an environment in which the credit is infrequently changed, one cannot use this model to forecast the effects of an active countercyclical investment tax credit policy. The investment response to a temporary tax credit will be larger than that predicted by a model based on the behavior of investors viewing the credit as permanent.

One can view the sharper investment response to a temporary investment tax credit in terms of the capital levy it implicitly incorporates. Today's new capital is tomorrow's old capital. A future removal of the credit amounts to a windfall to existing capital, a reverse capital levy, the anticipation of which encourages current investment. But, it is the anticipation of the capital levy that matters, for once it occurs it is a lump sum tax.

This distinction raises another important point about activist policy that was made during the 1970s, that of dynamic inconsistency. Again using the investment tax credit as an example, Kydland and Prescott (1977) showed that the optimal policy rule for the government was not time consisent: reoptimization at each date produced different results than once-and-for-all

optimization, because there was an incentive ex post to use an "unannounced' investment tax credit to induce a capital levy on investment that had been made in the expectation that such a levy would not be imposed.

Policy analysis of investment incentives remains in a somewhat confused state. The trend has been away from a direct empirical estimation of the relationship of investment and tax incentives and toward simulation analysis, in which a combination of estimated and assumed parameters of taste and technology are used to generate predictions of the impact of tax policy (e.g. Summers 1981, Shapiro 1984). This more recent approach has the appeal that it does not involve the estimation of ad hoc models subject to the Lucas critique, but it sidesteps the "important qualifications" cited by Break in his survey of the earlier literature: the need to know the right structural model of investment behavior.

Questions about the heterogeneity of capital goods, the elasticity of substitution in production, and the imperfection of capital markets and hence the relevance of internal cash flow were all central to the investment literature of the 1960s and early 1970s and the associated analysis of policy. The recent renewal of interest in liquidity constraints has brought cash-flow back into the investment equation (Fazzari et al 1988), but still in the ad hoc form in which it previously appeared. Our ability to analyze policy, given the model of behavior, has outstripped our ability to identify the right model.

B. Taxation and Risk-Taking

The basic analysis of the impact of taxation on risk-taking goes back to the seminal paper by Domar and Musgrave (1944), reviewed in detail in The Theory of Public Finance, which also made note of Tobin's (1958) important

piece. Though the subsequent literature (surveyed in Sandmo 1985) made significant refinements to the theory, the basic message has not changed.

By sharing some of the gains and losses from risky projects, an income tax reduces the risk borne by private investors. In this way, government can encourage investment in risky projects. The social benefits of this depend on whether risk is efficiently pooled in private capital markets, and the incentives for risk-taking depend on whether there is a "loss offset", the "negative" tax payment for negative income for which a symmetric tax system would call but which is generally not provided. As noted by Musgrave, "[t]he idea of positive loss refunds sounds shocking" (p. 320), and this element of tax policy has not changed.

In part, limited loss offsets serve to limit the tax arbitrage possiblities that are present in the tax system (e.g. Stiglitz 1983). Also, as in the distinction between investment incentives and tax rate cuts, one must distinguish between old and new capital when considering the impact of a limited loss offset; a deduction of current losses is just a transfer to existing capital, and may actually discourage investment by making new investment taxable at the margin, even if that investment is also provided with a prospective deduction of losses (Auerbach 1986).

One type of tax that often comes up in discussions of taxation and risk-taking is the capital gains tax, because risky projects are typically those with the potential to provide significant capital gains. Through deferral and, in the United States until 1986, a lower rate of tax, capital gains have been given favorable tax treatment relative to that of income from other assets. Break's analysis of the potential reasons probably still applies:

> Presumably a major justification for this kind of nonneutral tax structure is the fear that full taxation of all gains would unduly impair investor incentives to hold risky assets. These fears, insofar as they are not simply a convenient rationalization for less progressive income taxation in general, are probably more illusory than real.
>
> (p. 201)

However, the effects of capital gains taxes on risk-taking behavior and the potential social benefits to be derived from such behavior are still not very well understood. One justification for providing a lower capital gains tax rates on risky projects is the limited loss offset that is provided. Moreover, there have long been arguments that certain types of risky projects provide social spillover benefits well in excess of the private returns to investors.

This type of externality has formed the basis for the recently renewed interest in growth theory (e.g. Romer 1986), and provides a clear reason for policy intervention. But whether such intervention should take the form of lower taxes on risky activities is less clear. As Stern (1990) argues, "[t]he design of policy is, however, limited not only by our ability to model the processes but also the empirical knowledge of how ideas are generated and used." Similar arguments to those made today to encourage risk-taking were made in the past in support of an investment tax credit that applied only to investment in machinery and equipment and not in other types of business investment. These arguments are less in fashion now, but there has not really been any change in our empirical knowledge about the process of technological innovation.

V. Dynamic Tax Incidence

There are many respects in which tax incidence research has emphasized economic dynamics during the past three decades. First, there has been a

greater attention to lifetime rather than annual fiscal burdens. Second, research has continued to focus on the incidence of taxes associated with capital accumulation, notably the corporate tax. Third, growth models have been used to study the long-run incidence of taxes. Finally, much more attention has been given to the analysis of incidence in the transition from the short run to the long run and the associated question of tax capitalization.

A. Measuring Tax Incidence

The Theory of Public Finance made several influential contributions to tax incidence analysis. One was a clarification of the relationship between the measurement of incidence on the sources (income) side and the uses (expenditures) side and, in general, the shift in emphasis from the functional distribution to the size distribution of income. Actually measuring the distributional incidence of different taxes was an empirical question of significant difficulty, and the work of both Musgrave and Pechman looms large on this topic (for example, Musgrave et al 1974, Pechman 1985).

What has been referred to as the "Pechman-Musgrave" approach (Devarajan et al 1980) measures the distribution of tax burdens by income class using tax return data and other information to characterize the income sources and consumption choices of individuals in different income classes, and then applies particular shifting assumptions to allocate taxes to individuals. Aside from the partial-equilibrium nature of the shifting assumption, a particular problem with this approach is its use of one year's income and expenditures to measure the incidence of taxation.

This is hardly an unknown problem; as Break points out in his survey, lifetime incomes would represent a better measure than annual incomes. The

use of annual income and expenditure measures has arisen not from an ignorance of the problem, but rather from data and computational limitations, both of which one might hope will be smaller obstacles in the future.

For example, it is commonly concluded that consumption taxes are regressive, because the average propensity to consume rises with income. However, since the important postwar empirical work on consumption behavior, it has been recognized that a household's consumption may vary less than its income, so a longer-term perspective is clearly warranted. A recent paper by Poterba (1989) that takes this approach confirms that consumption taxes appear less regressive when several years' income are used to classify households.

The social security system provides another illustration of the problem. If one estimates the annual income distribution of social security benefits and taxes, the system appears far more progressive than it is, since retired persons receiving benefits have lower current income than the working population paying for the benefits. Surely a more accurate picture would come from looking at the lifetime burden of the system for individuals in different income classes, but this still involves comparing members of different generations. In an economy not in steady state equilibrium, one needs to consider redistribution across generations.

B. The Incidence of the Corporate Tax

The corporate tax is but one of many taxes on capital income, but its central role in incidence analysis and the controversy surrounding the conclusions of such analysis make it worthy of special attention. The most significant contribution on this subject was Harberger's (1962) two-sector general equilbrium model, which characterized the corporation income tax as a tax on the normal return to capital in one of the model's two sectors.

The elegance of the model and the intuitive nature of its results gave it a central role in the literature for many years to come. Even after the introduction of sophisticated numerical general equilibrium simulation models, one of the first major studies (Shoven 1976) was a reconsideration of Harberger's analysis that was less restrictive in many ways but did not alter the basic characterization of the corporate tax as a sector-specific tax on the normal return to capital. Yet this description suffers from many shortcomings.

While The Theory of Public Finance noted in general terms the effects of the corporate tax insofar as it taxed normal returns, it devoted further attention to the nature of the income being taxed, including competitive and noncompetitive rents. This concern with the nature of competition in the corporate sector and its relation to incidence was common in the literature around that time, as Break's survey indicates. Indeed, the empirical study by Krzyzaniak and Musgrave (1963) reported results indicating that corporations shifted more than 100% of corporate taxes in the short run, when the Harberger model would have predicted little shifting, regardless of parameter assumptions, because of the short-run immobility of capital.

Unfortunately, this thread of the literature has not flourished, even though in recent years the analysis of imperfect competition has come a long way, particularly in modelling the dynamic interactions of firms. One noteworthy exception is a paper by Davidson and Martin (1985), who alter the Harberger model to include a noncompetitive sector and consider the equilibrium of a repeated game in which cheating is punished by permanent reversion to a Nash equilibrium. However, this paper does not focus specifically on the effects of a tax similar to the corporate tax. Indeed,

even in this model, a tax on pure, noncompetitive rents would have the standard result (i.e., no impact effect), since both the penalty and the gain from cheating would be scaled down by the same rate of tax. Thus, we are still without a model to justify the Krzyzaniak-Musgrave results.

Even among competitive firms, the corporate tax has different components, the incidence of which ought to differ. The tax on inframarginal returns exceeding the normal return to capital is a classic tax on pure rent, borne by the shareholders, while a tax on the normal return may be shifted a la Harberger. In his influential paper, Stiglitz (1973) argued that the entire tax base should be inframarginal, for tax factors favor the use of debt finance at the margin. Under this view, returns to marginal investment pass from the corporate sector as tax-deductible interest.[12] However, there are few questions in the literature still subject to so much dispute and uncertainty as the impact of taxes on corporate financial policy. The question of market imperfections arises here as well, in potential explanations of debt policy (e.g. Myers 1977, Ross 1977).

Aside from pure rent, another fixed source of corporate income is the quasirents on existing capital. As already noted in the discussion of investment incentives above, The Theory of Public Finance recognized that when there are investment incentives for new capital alone, the higher taxes on income from old capital have the effect of a capital levy.

Pure rent and quasirents undoubtedly account for a significant part of the corporate tax base. In recent years, before 1986, the corporate income tax had very low marginal tax rates, taking account of accelerated depreciation and the degree of interest finance observed; marginal corporate

tax rates were essentially zero, taking account of the interest deduction (Auerbach 1983).

The incidence of the corporate tax depends on the nature of competition among corporations, the determinants of corporate financial policy and the structure of investment incentives, as well as the general equilibrium response to a tax on the normal return to corporate capital. There is little point in considering the incidence of "the" corporate tax; the incidence of some its important components is still poorly understood.

C. Long-Run Incidence[13]

One might view the Harberger model as applying in the "long run", after the capital stock can adjust and the net rate of return in corporate and noncorporate sectors is equalized. In the "short run", with capital fixed, the entire tax is borne by corporate capital via a reduction in its net rate of return. That is, if r_{nt} is the net-of-tax marginal product of a unit of capital in the corporate sector at time t, r_t is the rate of return in the noncorporate sector, and τ is the constant rate of tax on corporate income, $r_{n_t} = r_t (1 - \tau)$ in the short run and $r_{n_t} = r_t$ in the long run. However, if one looks at instantaneous effects on asset prices, the short and long runs are connected by capitalization. The value of a unit of corporate capital will be less than one, but greater than $(1 - \tau)$, when the tax is imposed.

The Theory of Public Finance discusses this capitalization of sector-specific capital income taxes. In the past several years the literature has considered the adjustment process in greater detail. For example, the q-theory of investment provides a concrete model which can be used to measure asset price effects of changes in tax policy (e.g. Summers 1981, Abel 1982 Auerbach 1989). The literature has also identified new contexts in which

complete capitalization might be observed, as with a tax on corporate distributions (Auerbach 1979a, Bradford 1981, King 1977). However, one would change little from Musgrave's discussion of the problems that capitalization pose for reform of the corporate tax:

> These considerations bear on the problem of integrating the corporation tax with the personal income tax...It has been pointed out that the inequity of past overtaxation cannot be remedied by repeal, since the benefit would not go to those who suffered the initial loss; rather, it would give windfalls to new owners...The basic problem is not solved by pointing to the inequities of transition, which might be avoided or limited by taxing the windfalls to new owners at a special rate of capital-gains taxation.
>
> (p. 385)

Recent experience has suggested that such taxes on windfalls may not be so easy to implement, in part because of attempts to adopt rules aimed at reducing the problem of dynamic inconsistency. I return to this topic below.

Taking account of capitalization leads one to distiguish not only among types of corporate income, but also among recipients of this income in considering the incidence of the corporate tax. Even taxes on the normal return to capital, which may be shifted in the long run, will be partially capitalized upon announcement. The most important distributional effects of a change in corporate taxation may not be between capital to labor or rich and poor, but between generations.

For example, the Tax Reform Act of 1986 shifted the tax burden in the United States from households to business, raising the effective tax rate on marginal corporate investment.[14] In the long run, this might depress the return to capital and be borne by those with capital income. The distributional effects of these corporate tax changes have been carefully analyzed using the Pechman-Musgrave methodology by Feldstein (1987). However, because of a sharp reduction in the distinction between old and new capital,

the Act's immediate effect should have been to increase corporate values,[15] having a quite different effect on those currently receiving capital income.

In addition to the shifting of capital away from the corporate tax, another aspect of the "long run" is that total factor supplies can adjust to changes in after-tax returns. Imposition of the requirements of steady state growth leads to some unexpected outcomes. For example, consider the Solow (1956) growth model. The condition for balanced long-run growth is:

$$(2) \qquad s \cdot f(k) = n \cdot k$$

where k is the capital-labor ratio (with labor measured in efficiency units), n is the growth rate of augmented labor, and s is the national saving rate (including government saving). Since the returns to labor and capital depend only on k, taxes will alter the before-tax wage-rental ratio only to the extent that the national saving rate is changed. In particular, a tax on labor income that alters labor supply will be entirely reflected in lower after-tax wages unless the propensities to save out of different forms of income differ (Feldstein 1974). Of course, in a life-cycle model, these savings propensities will differ (Kotlikoff and Summers 1987).

Transitions to such long-run results may take a long time, however, and behavior during a transition may be very important. Break (1974) concluded that:

> It may be, then, that dynamic incidence models are of only limited policy interest and that future research can best concentrate on the nature and speed of the adjustment process by which the economy moves to a new dynamic steady-state equilibrium whenever a given tax change disturbs the old equilibrium.
>
> (p. 173)

In the years since, this has been very much the nature of research on incidence. However, the focus on perturbations from a steady-state has led us away from some of the interesting incidence questions that were posed in The Theory of Public Finance, such as the interaction of the distribution of income and the rate of growth. One would hope that the "new" growth theory, which emphasizes the potential dependence of long run growth rates on transition paths, will permit a renewed interest in such questions. Some initial attempts have been made in this direction (e.g. Barro 1989, King and Robson 1989).

VI. Dynamic Inconsistency and Public Choice

Throughout the discussion in the previous sections, the issue of tax reform and the treatment of existing assets has come up in many forms: the difference between a consumption tax and a tax on labor income; investment incentives versus tax cuts; capitalization of tax changes. Seen as once and for all tax changes, one can consider the incidence and efficiency effects of policies that include capital levies. But this begs the question of how such policies are determined and the response of rational agents to the policy process. It also provokes one to consider changes in the policy process that might reduce the problems of dynamic inconsistency that might characterize the government's optimal plans.

A. Reducing Dynamic Inconsistency

The dynamic inconsistency of optimal government plans was first modelled formally by Phelps and Pollak (1968), but the idea itself is at least as old as the unannounced capital levy. The problem is that a government acting in the best interests of its constitutents may wish to dissemble about

its future plans. There are many examples in the literature, including Kydland and Prescott's (1977) discussion of investment tax credits, Fischer's (1980) discussion of capital income taxation, Barro and Gordon's (1983) analysis of inflation and the Phillips curve, and Rogers' (1987) comparison of labor and consumption taxes.

How should government respond to this problem? Doing nothing leads to a dynamically consistent but inferior outcome. While the government would like from the current perspective to impose low capital income taxes or inflation in the future, it cannot credibly promise to do so. Agents take for granted that the government will make the expedient choice when the time comes, and indeed it has no incentive to do otherwise.

One solution is to use a combination of government instruments to make the optimal policy time consistent. For example, Lucas and Stokey (1983) and Persson et al (1987) show how to use the maturity structure and mix of indexed and nominal debt to make taxes on labor income and money balances (inflation) time consistent. However, neither provides a solution to the time inconsistency of capital income taxation or default on debt. Some help may come from the availability of investment incentives. If, for example, a government cannot help but levy a high capital income tax in the future, it can mitigate the effect of this higher than optimal tax rate by providing investment incentives in the form of immediate credits or grants (Hansson and Stuart 1989). As long as there is some limit on the rate of the capital income tax, government can use investment incentives to limit the capital levy to the initial capital stock.

Rather than seeking a solution based on the careful use of fiscal instruments themselves, alternative approaches have enriched the behavioral

model, either by adding additional government tools or by considering other equilibria. In addition to instruments of fiscal policy, government can adjust the costs of changing these instruments. If, for example, government can force itself to incur costs when changing its policy, this will lessen the time consistency problem.

Unfortunately, in this case of rules versus discretion, there are costs as well as benefits to the use of rules, even if there is some mechanism for making the rules credible or enforceable. First, it may be difficult to define rules that adequately protect against time-inconsistent behavior; it is difficult to define a "retroactive" policy (Graetz 1977). Second, the rules may constrain the government from responding to realizations in a stochastic economic environment, i.e., instituting a capital levy in times of severe fiscal need, or making the transition from an income to a consumption tax after it has been discovered on the basis of definitive economic research that the latter is superior. Third, policies imposed to enforce the "rules" may themseleves be costly, as when governments fail to index against the uncontrollable component of inflation in order to discourage themselves from overusing the component that they do control (Fischer and Summers 1989). Fourth, by instituting rules that reduce the advantages of deviating from the announced policy, government may distort private behavior. For example, requiring that full compensation be paid when property is taken by eminent domain can lead to overdevelopment of land subject to be taken in the future (Blume, Rubinfeld and Shapiro, 1984). All of these costs relate to the difficulty of defining rules that distinguish finely enough among states of the world, a problem due perhaps in part to the lack of clever design, but

also to the inability of private agents to distinguish among states of the world, even ex post.

There is also the possibility of reputational equilibria, in which the government has the incentive not to deviate from the optimal policy because once it does the economy will revert to the inferior time consistent path. This was discussed by Barro and Gordon (1983) in their paper on the inflation tax, as well as in subsequent related literature (e.g, Rogoff 1989).[16] As in other contexts, this "solution" to the time-consistency problem is not without its problems, notably the multiplicity of equilibria. It also does not take into account a major reason why policymakers may care about their reputation, namely their desire to remain in office.

B. Modelling Political Behavior

The Theory of Public Finance devotes considerable attention to the role of voting behavior in the revelation of preferences for public goods and the determination of fiscal policy, although there is little discussion of the behavior of politicians and bureaucrates who administer fiscal policies. The incentives of bureaucrats and politicians have been a subject of concern for many years (e.g. Niskanen 1975; Brennan and Buchanan 1980), and more recently there have been several attempts to consider the dynamic effects of the political process on fiscal policy.

One hypothesis growing out of the view of government as an aborbing "Leviathan", associated with Buchanan (1977), is that under a progressive tax government expenditures grow faster than the economy, a perverse result of the "fiscal dividend" of rowth.[17] However, much of the recent literature has focused on the interaction of voters and politicians by studying the dynamics of monetary and fiscal policy associated with the election cycle. Nordhaus

(1975) modelled the behavior of policiticans who seek reelection by manipulating the economy. By stimulating the economy just before an election, the controlling party can produce a short-run expansion without an immediate worsening of the inflation rate. The key to politicians' success is the failure of voters to understand the true model of the economy, i.e, that they are being tricked.

While the evidence on the economic concerns of voters lends some credibility to such an approach (e.g. Fair 1978), more recent models of the political business cycle have stressed informational asymmetries. For example, Alesina (1987) considers the reputational monetary policy equilibria in a two-party system, in which the party policies differ from each other due to differences in their own preferences and voters are unsure which party will prevail in the election. Since the outcome of each election is uncertain, the election will always be followed by a shock to the inflation rate, whichever party prevails.

In an alternative model, Rogoff (1990) considers signalling equilibria in which politicians differ in their abilities to manage the economy. In order to distinguish themselves before an election from lower ability types for whom such behavior would be very costly (in terms of their own future utility), high-ability bureaucrats spend more and tax less than they would in a full-information context. This model therefore offers an alternative explanation for why politicians might systematically engage in expansionary policy actions before elections, with different policy implications. While we would like to prevent politicians from manipulating voters by inducing socially costly business cycles, restraining fiscal actions that act as signals may also

prevent voters from distinghishing good from bad managers and thus worsen the performance of the electoral process.

We thus have a number of recent theories of why self-serving governments may run deficits. They may wish to appropriate the spending power of future governments, trick voters, who believe in a long-run Phillips curve, with a short-run economic expansion, or signal their ability to produce public goods and services efficiently by making it difficult for themselves to do so. One can form ones own judgment about the relative merits of these hypotheses, (and their associated implications for policy) which still await serious empirical evaluation.

VII. Conclusions

The literature since 1959 has provided enlightening insights about the incidence and efficiency effects of fiscal policies, in recent years giving us a better understanding of the connection of the long- and short-runs and the distinction between tax design and tax reform. This greater concern with fiscal policy changes (and associated problems such as dynmaic inconsistency) has helped motivate recent attempts to model the dynamics of government behavior and the political process.

By its very nature, the study of dynamic fiscal policy and its determinants is influenced by the fiscal policies actually practiced. It is no coincidence that a considerable part of the literature in recent years has studied the public debt. Therefore, in addition to all the unresolved research questions evident from a review of the literature, one can expect new and interesting ones to be provided by fiscal policy itself and the new economic problems likely to occur in the years to come. One question likely to generate considerable research is the effects of the coming demographic

transition on the welfare of different generations and the size and financing methods of the public sector.[18] Another is the openness of economies, and the impact of greater factor mobility on growth and income inequality and fiscal policy coordination.

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Footnotes

1. See Bernheim (1987) for a recent survey.

2. See, for example, Stiglitz and Weiss (1981).

3. From the normative perspective, there has also been interesting contributions on the role of deficits and social security in spreading risks across generations. See, for example, Green (1977) and Merton (1983).

4. See, e.g., Eaton and Gersovitz (1981) and Bulow and Rogoff (1989).

5. This assumes that the economy is efficient and on a sustainable path. Otherwise, it would be possible for it to create additional wealth through the creation of additional debt. The recent literature has feasured tests for the sustainability of government policy (e.g. Hamilton and Flavin 1986, Wilcox 1989)

6. Indeed, evidence presented in Feldstein and Morck (1983) suggests that these liabilities are fairly accurately valued by the market.

7. Such a case arises when there are deferred capital income taxes, associated with such items and accelerated depreciation and, perhaps, dividends taxes. In this situation, discussed more fully below in the section on incidence, changes in market values may reflect changes in future government taxes.

8. See Kotlikoff (1989)

9. This characteristic holds even in an infinite horizon model (Judd 1987), since the consumption tax is imposed after "the" generation has accumulated some assets.

10. See, for example, Venti and Wise (1986), Feenberg and Skinner (1989), and Gale and Scholz (1990).

11. See Bhatia (1972), Feldstein (1983), Poterba (1987), and Auerbach and Hassett (1991).

12. The result holds even if the expected return on the marginal investment exeeds the deductible interest rate because of risk, as the tax on the risk premium itself imposes no cost on the firm and, in an efficient capital market, has no real effects either (Gordon 1985).

13. A useful discussion of this topic may be found in Kotlikoff and Summers (1987).

14. See Auerbach (1987) for further description of the Act's corporate provisions.

15. See Auerbach (1989). Empirical tests of this hypothesis (Cutler 1988) yield some support but are not conclusive.

16. The same approach has been applied to the case of capital income taxation in an overlapping generations model by Kotlikoff et al 198?, in which the social contract forbidding capital levies is sold by each generation to the next, and once broken cannot be replaced.

17. However, Feenberg and Rosen (1987) find little empirical support for this proposition.

18. For some preliminary analysis in this direction, see Auerbach and Kotlikoff (1987), chapter 11, and Auerbach et al 1989.