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TAXATION, SAVING AND THE RATE OF INTEREST

Michael J. Boskin

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TAXATION, SAVING AND THE RATE OF INTEREST: ABSTRACT

Michael J. Boskin
Stanford University and NBER

After exploring both the crucial role of the interest elasticity of the saving rate in the analysis of a wide variety of issues in economic - particularly tax - policy and reasons why previous studies of the effect of interest rates on consumption and saving have biased the estimated elasticity toward zero, this study presents new estimates of consumption functions based on aggregate U.S. time series data. The results are striking: a variety of functional forms, estimation methods and definitions of the real after-tax rate of return invariably lead to the conclusion of a substantial interest elasticity of saving.

The implications of this result for the analysis of the efficiency and equity of the current U.S. tax treatment of income from capital are explored. In reducing the real net rate of return, current tax treatment significantly retards capital accumulation. This in turn causes an enormous waste of resources and redistributes a substantial fraction of <u>gross</u> income from labor to capital. Rough estimates of the lost welfare exceed fifty billion dollars per year (a present value close to a trillion dollars!) and of the redistribution from labor to capital exceed one quarter of capital's share of gross income. This suggests that exempting saving from the tax base (or equivalently, allowing instantaneous depreciation of capital expenditures) could substantially increase national income and welfare without transferring income from workers to owners of capital. It also suggests that the

usual calculations of tax burdens by income class substantially over-estimate both the progressivity of the income tax and the alleged regressivity of consumption taxes.

Taxation, Saving and the Rate of Interest*

Michael J. Boskin**

The effect of interest rates on economic behavior, particularly on saving and consumption, has been a central concern of economists at least since the development of classical macroeconomics. Not only has the rate of interest been viewed as the mechanism for equating saving and investment in pre-Keynesian macroeconomic models, but it also has been at the center of virtually all microeconomic models of intertemporal consumer behavior. It is thus curious that empirical studies of the effects of interest rates on saving are few and far between.[1] Most such studies conclude that interest rates have only a negligible effect on consumption or saving.[2]

The notion that saving is perfectly interest inelastic has received widespread acceptance among empirical and policy oriented macroeconomists. While I shall present below considerable evidence that nothing could be further from the truth, it is worthwhile exploring just how important the interest-elasticity of the saving rate is in the analysis of a wide variety of vital issues of economic policy. In so doing, we hope to point out how costly it has been (and will continue to be) to accept the conjecture - based on evidence which is flimsy at best and dangerously misleading at worst -

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[1]Thus, Break, [1974, p. 151] notes "Unfortunately, empirical evidence on the interest elasticity of the saving rate is rare."

[2]A discussion of why these studies may have biased the estimated interest elasticities toward zero is presented below.

that the interest-elasticity of the saving rate is negligible. This is done in Section 1.

Section 2 discusses several previous studies of saving behavior. We deal with possible biases in previous estimates of the interest-elasticity of the saving rate. Special attention is paid to the notion, which has come to be called "Denison's Law," that the saving rate is essentially constant and unaffected by changes in the tax system or other changes in the real after-tax rate of return to capital. An analysis of data for the United States in Section 3 leads me to conclude that no behavioral significance can be attributed to the conventionally measured gross private saving rate: it measures neither saving nor income in the appropriate manner and attempts to do so reveal a saving rate which can hardly be called constant.

Section 3 also presents detailed sets of estimates of private consumption functions. A variety of functional forms, definitions of the variables and estimation methods all lead to the conclusion that private saving is indeed strongly affected by changes in the real after-tax rate of return. The estimated total (income plus substitution) interest elasticities of private saving cluster around 0.3 to 0.4. While this is hardly an enormous elasticity by conventional standards, it is substantially larger than virtually all previous estimates and the conventional wisdom, and has drastic implications for the effect of tax policy on income, welfare and income distribution.

Section 4 reports estimates from this same body of data of Harrod-neutral CES production functions. Again, a variety of estimation techniques yields similar estimates of the elasticity of substitution of approximately one-half. Combined with our estimates of the interest-elasticity of the saving rate, this immediately implies that policies which raise the after-tax rate of return will increase labor's gross share of income in the long-run.

Section 5 summarizes the implications of the empirical results for the analysis of the effects of various policies on income, welfare and income distribution. Briefly, policies (such as switching from an income tax to a consumption tax) which raise the after-tax rate of return to capital will increase income substantially, remove an enormous deadweight loss to society resulting from the distortion of the consumption-saving choice, and redistribute income from capital to labor.

Section 6 concludes with a discussion of the limitations of the study and avenues for further research.

1. The Issues at Stake

We shall discuss in turn five basic concerns of economic policy: the effects of the income tax on the distribution of income, the differential incidence of a consumption and an income tax, the tax treatment of human and physical capital, the effect of inflation on the capital intensity of the economy, and the debate over whether the saving rate is high enough in the United States. We shall see that the interest elasticity of the saving rate is the key parameter in the analysis of each of these issues. The potential importance of the interest elasticity of saving in the analysis of the effect of monetary policy is obvious and well-enough known so that repitition here is unnecessary.

Virutally all empirical estimates of tax burdens by income class allocate income taxes according to income, i.e., they assume the tax is not shifted.[1] In an economy in which either the private saving rate is sensitive to the real after-tax rate of return, or the marginal propensity of the public sector to invest out of revenues is different from the private sector's marginal propensity to save out of private income, this assumption is incorrect. Since an income tax both decreases the after-tax rate-of-return on capital and transfers resources from the private to public sector, it affects the national saving rate and capital-labor ratio. If saving responds positively to increases in the rate-of-return and/or the public propensity to save falls short of the private propensity to save,[2] an income tax retards capital accumulation and

[1] For example, see Pechman and Okner [1974].

[2] We present evidence to support this position below.

leads to a lower level of income and lower wage/rental ratio than would otherwise exist.[3] Further, labor's share of gross income will fall with increases in income taxation if the elasticity of substitution falls short of unity.[1] In these circumstances, a proportional income tax is quite different than a tax which is borne in proportion to income; indeed, it transfers income from labor to capital, and hence is regressive, relative to such a tax.

A closely related question concerns the differential incidence of an income and a consumption tax. While most economists recognize the efficiency advantages in taxing consumption rather than income, the general argument against a consumption tax has been that it is regressive because it excludes interest income from the tax base. This analysis is correct insofar as it goes, for interest income does accrue disproportionately to the wealthy. However, it overlooks two basic points. First, the rate structure may be set differently under a consumption tax; second, the exemption of interest income from the tax base may increase the saving rate, the capital/labor ratio, the productivity of labor and the wage/rental ratio. This long-run transfer of income from capital to labor must be offset against the short-run gain to capital from the interest income exemption. The net outcome, of course, depends upon the particulars of the two taxes being compared. Again, however, the prevalent view is that of Pechman [1973], "...the differential effect on consumption and saving between an income tax and an equal yield expenditure tax is likely to be small in this country."

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[1] See the analysis in Feldstein [1974ab]. Also see the contributions by Diamond [1970], Hall [1968], Krzyzaniak [1967], and Sato [1967].

[2] We present evidence to this effect in Section 4.

A related issue concerns the realtive tax treatment of physical and human capital. I have argued elsewhere (Boskin [1975]) that the tax system probably biases capital accumulation toward investment in human capital and away from physical investment because most human capital investments are financed out of tax free foregone earnings. This is equivalent to instantaneous depreciation of this component of human investment. Since we do not allow instantaneous write-off of investment in physical capital (except research and development expenditures), the current system of income taxation probably reduces the after-tax rate-of-return on physical capital relative to that on human capital. Hence, the deadweight loss from the misallocation of a given amount of investment in physical and human capital will depend upon, among other things, the interest-elasticity of the saving rate.

Attention has recently been focused on the economic effects of inflation. In a Tobin-type monetary growth model with taxes, Felstein [1975] demonstrates how inflation may decrease the capital intensity of production and hence affect the real economy. Again, a key issue appears to be whether saving responds positively to increases in the real net rate of return.

Finally, we come to the perennial issue of are we saving enough in the United States. A variety of economists and politicians have continually expressed concern over the slower rate of real economic growth in the U.S. than in Japan and Western Europe. Hardly a day goes by when a major speech is not given on "the capital shortage." While the issue is complex and I can hardly hope to deal with it in detail here, suffice it to say that under a not implausible set of assumptions, a major component of the answer reduces to whether or not current taxes, in driving a wedge between the gross marginal social yield and net marginal private yield on investment, distorts the timing of consumption over the life-cycle; a sufficient condition for this to occur is a positive (pure substitution) interest-elasticity of the saving rate.[1]

Thus, if the saving rate displays some interest elasticity, our notions about tax incidence, about the effects of inflation on the real economy, and about intertemporal allocative efficiency will have to be revised drastically. We shall return to a more complete discussion of these issues in Section 5 below.

[1]This question is analyzed in detail in Feldstein [1975].

2. Previous Studies and Data Description

a. Previous Work on Saving Behavior

For several decades, econometric work on saving behavior consisted largely of estimating Keynesian-type consumption functions. The inclusion of an interest rate variable in such analysis was the exception rather than the rule. Further, when interest rates were included, nominal before tax rates rather than real after-tax rates were used. Feldstein [1970] has demonstrated that such a procedure almost certainly biases downward the estimated interest elasticity. Since most of the early work on consumption and saving focused on issues other than the effect of interest rates, perhaps it is not surprising that little attention was paid to the weak, and sometimes negative, relationship between saving and the rate of interest. Musgrave and Musgrave [1974, p. 478] report that "Studies of the relationship between saving and the rate of interest differ in their conclusion. Some hold that there is a substantial negative relationship, while others attribute little weight to the rate of interest in the consumption function." It is curious, however, that little attention is paid to interest rates in consumption functions in the large scale econometric macromodels in widespread use today.

Several recent studies of saving have included interest rates as determinants of saving. Wright [1969] includes a measure of after-tax rates of return on stocks and bonds in estimating consumption functions from U.S. annual time series data. His estimates imply an interest elasticity of saving of approximately 0.2. As he himself notes, this is substantially larger than the usual assumption, and despite his efforts, may be closer to the total than the pure substitution elasticity. However, his measures of consumption and income suffer from several deficiencies and his data refer to the period prior to 1958. Hence, at the very least, his results must be improved and updated.

Weber [1970; 1975] examines the impact of interest rates on aggregate consumption. He finds a positive relationship between consumer expenditures and nominal interest rates. In the second study, he includes the expected inflation rate as a determinant of consumer expenditures but finds no evidence that expected inflation affects consumption.

In a study of quarterly U.S. aggregate postwar data, Taylor [1970] estimates an enormous interest elasticity, approximately 0.8. Since his study is directed toward other issues, he merely reports this result without attempting to explain why his estimate is several times larger than that of other researchers. Perhaps this is because it is unclear that he is estimating a structural equation rather than a reduced form from some larger system.

Finally, in a thought provoking reexamination of "Denison's Law," David and Scadding [1974] document the continued constancy of the gross private saving rate, the constancy of the saving rate augmented to include consumer durables purchases in saving and the rental flow from durables in income, and changes in the composition of private saving between the household and business sectors. They interpret this relative constancy of the gross private saving rate as evidence that taxes - either through a reduction in private income or a reduction in the real net rate of return on capital - do not affect private saving behavior. While this argument also has been made by a large number of other economists, we shall demonstrate below that drawing such behavioral inferences from these data is not warranted.

In brief summary, there is very little empirical evidence upon which to infer a positive relationship (substitution effect outweighing income effect) between saving and the real net rate of return to capital. Surprisingly little attention has been paid to this issue - particularly in light of its key role in answering many important policy questions - and those studies which do attempt to deal with it can be improved substantially.

b. The Data

The data used in this study came from a variety of sources reporting on aggregate U.S. annual time series from 1929 to 1969. Most of the data are derived from the complete - and consistent - accounting system for the pivate sector of the U.S. economy developed by Christensen and Jorgenson [1972]. These data include information on private income, gross saving, wealth, consumer expenditure, labor compensation, property compensation, rates of return on capital disaggregated into four sectors, depreciation, replacement and revaluation of assets. They are worked up from the U.S. national income and product accounts and other sources; Divisia price and quantity indexes are used throughout.

Data are also used directly from the National Income and Produce Accounts, the Statistics of Income, and a variety of miscellaneous sources. The definitions of the main variables used in the study, with emphasis on how they differ from conventional definitions, are as follows:

Gross Private Saving. National income accounts (NIA) gross private saving plus personal expenditures on durable goods plus statistical discrepancy. Christensen and Jorgenson [1972] include the surplus in the social insurance trust funds; for the period under study this makes little difference. We present gross private saving rates with and without the surplus included in Tables 1 and 2 below.

Net Private Saving. Gross private saving less replacement and depreciation. Depreciation is estimated for each type of capital good and assumed to be geometric; while this may or may not be the best form to impose on the data, it is probably a substantial improvement over the NIA depreciation figures (which are reconciled to IRS tax depreciation figures which, in turn, bear no simple relationship to true depreciation). Use of other measures of depreciation does not alter the conclusions reached below.

Disposable Private Income. Unlike the NIA definition, we include retained earnings as part of disposable income. Also includes the rental flow from durables.

National Income (net and gross). Includes the rental flow from consumer durables.

Wealth. Market value of private nonhuman assets.

Rates of Return. Nominal after-tax rates of return from Christensen and Jorgensen [1972]. Also used were the Moody's Aaa bond rate, adjusted for average marginal tax rate on interest income, from Statistics of Income, and Standard and Poor's high grade tax-free municipal bond rate.

Expected Inflation Rate. Estimated from an adaptive expectations model of price expectations, truncated after eight years, with varying speeds of adjustment. Expectations were projected forward to form long run average rates for five, ten and twenty years.

Miscellaneous. Population, unemployment rates, price data, other components of income from NIA or Economic Report of the President. All magnitudes expressed in constant 1958 prices from Christensen and Jorgenson [1972]; aggregate magnitudes expressed in per capita terms.

3. Private Saving

The relative constancy of the gross private saving rate - the ratio of gross private saving to gross national income - so well documented by David and Scadding [1974] fails to reveal a variety of important features of private saving in the U.S. For the sake of comparison, Table 1 presents gross private saving rates for the U.S. economy, 1929-69, with and without the social insurance fund surplus included in the measure of gross saving. Again, the relative constancy of this ratio in years of full employment is obvious. In the postwar period, it ranges from twenty to twenty-four percent, with most of the observations at twenty-two or twenty-three percent.[1]

The gross private saving rate is the product of the saving rate out of disposable income and the ratio of disposable income to total income, i.e.,

$$GPSR = \frac{GPS}{GNP} = \frac{GPS}{DPI} * \frac{DPI}{GNP} . \qquad (3.1)$$

We know that taxes as a percentage of total income have risen substantially over this period. Hence the saving rate out of disposable income must have increased substantially to offset the decline in the ratio of private to total income. Table 2 documents this fact; indeed, the saving rate out of private net-of-tax income has increased by more than fifty percent since the early postwar period. The behavioral interpretation given to these data by David

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[1] Recall the inclusion of consumer durables raises this rate from the 15% to 16% of the conventional measure.

Table 1

Gross Private Saving Rates, U.S. Economy, 1929-1969

YEAR	GPS/GNP	GPSS/GNP
1929	0.222	0.221
1930	0.184	0.183
1931	0.168	0.166
1932	0.102	0.099
1933	0.104	0.102
1934	0.146	0.144
1935	0.173	0.171
1936	0.203	0.199
1937	0.204	0.187
1938	0.176	0.163
1939	0.206	0.193
1940	0.225	0.213
1941	0.255	0.241
1942	0.298	0.282
1943	0.286	0.266
1944	0.307	0.286
1945	0.275	0.253
1946	0.222	0.245
1947	0.212	0.196
1948	0.236	0.224
1949	0.239	0.230
1950	0.243	0.240
1951	0.244	0.232
1952	0.236	0.225
1953	0.237	0.228
1954	0.235	0.228
1955	0.246	0.239
1956	0.238	0.230
1957	0.237	0.230
1958	0.225	0.225
1959	0.227	0.223
1960	0.219	0.212
1961	0.217	0.214
1962	0.228	0.223
1963	0.227	0.219
1964	0.239	0.231
1965	0.243	0.236
1966	0.249	0.236
1967	0.248	0.236
1968	0.240	0.230
1969	0.251	0.237

GPSS: gross private saving as defined in text.
GPS: GPSS plus surplus in social insurance account.
Source: calculated from Christensen and Jorgenson [1972].

Table 2

Saving out of Private Income; and
Net Saving Rate; U.S. Economy, 1929-1969

YEAR	GPS/DPI	NPS/NNP	NPSS/NNP
1929	0.18	0.062	0.061
1930	0.14	-0.005	-0.007
1931	0.11	-0.039	-0.042
1932	0.06	-0.150	-0.153
1933	0.06	-0.131	-0.134
1934	0.08	-0.048	-0.050
1935	0.11	0.010	0.008
1936	0.14	0.068	0.063
1937	0.15	0.069	0.050
1938	0.11	0.017	0.002
1939	0.14	0.067	0.052
1940	0.17	0.099	0.085
1941	0.21	0.147	0.130
1942	0.19	0.199	0.181
1943	0.18	0.200	0.179
1944	0.21	0.229	0.206
1945	0.21	0.195	0.171
1946	0.22	0.130	0.111
1947	0.22	0.108	0.091
1948	0.24	0.126	0.112
1949	0.24	0.116	0.106
1950	0.27	0.122	0.118
1951	0.27	0.119	0.106
1952	0.26	0.106	0.093
1953	0.28	0.108	0.098
1954	0.27	0.099	0.092
1955	0.30	0.118	0.110
1956	0.29	0.099	0.090
1957	0.29	0.992	0.083
1958	0.28	0.072	0.072
1959	0.29	0.083	0.078
1960	0.29	0.074	0.066
1961	0.29	0.071	0.068
1962	0.32	0.093	0.086
1963	0.32	0.092	0.083
1964	0.35	0.109	0.099
1965	0.36	0.116	0.108
1966	0.38	0.126	0.110
1967	0.39	0.119	0.105
1968	0.39	0.110	0.097
1969	0.38	0.096	0.080

Source: Calculated from Christensen and Jorgenson [1972].

and Scadding [1974] is that taxes and present consumption are essentially perfect substitutes; the rise in taxes is offset by an equivalent decline in current consumption. They go on to explore a variety of intriguing conjectures concerning consumer behavior.

Three basic points need to be made concerning this conjecture. First, most theories of consumer behavior relate saving to disposable income. If this is correct, the saving rate varies substantially. A direct test of whether disposable income or total income is the appropriate variable in a private saving function is presented below.

Second, it indeed would be surprising if consumers made the type of rational calculations vis à vis the government and business sectors in terms of gross saving and income. Consumers know their capital depreciates. Again, our economic theories generally relate to how consumers choose their net position. Further, except for some possible embodied technical change, it is net saving that is relevant to the issue of whether taxes affect capital accumulation. Table 2 presents calculations of the net private saving rate - net saving divided by net income. This series exhibits substantially more relative variation than the gross series and can hardly be called constant, even if we confine ourselves to the postwar period.[1] While depreciation series are notoriously unreliable, use of several alternative series based on tax, replacement cost, etc. depreciation still yields substantial variation in the net private saving rate. I take this to be a strong indictment of the structural interpretation of "Denison's Law."

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[1] If we took the broader view of saving as inclusive of human investment, use of Kendrick's [1976] data reveals still more variability in the total saving rate, gross as well as net.

Third, even if total gross income and gross saving are examined, there still may be an independent effect of real net rates of return on saving. Even if taxes and present consumption are perfect substitutes (the public sector is doing its benefit-cost analyses properly, free rider issues are ignored, etc.), the share of private wealth consumed today (publically or privately) will depend upon the net, or after-tax return to saving, whereas gross income is the flow from private wealth at the gross return. Hence, taxes decreasing the net return to saving may cause a decrease in saving.

Before proceeding to a variety of estimates of saving equations, it is perhaps worthwhile to offer a brief conjecture on the apparent constancy of the saving rate. Consider two motives for saving: smoothing of consumption over the life-cycle and bequests. Further, assume bequests (broadly construed to include provision of education as well as pure financial bequests) are luxuries. Hence real income growth would tend to increase saving. However, if saving is also positively related to the real net return on capital, the slight decline in this rate would lead to a decrease in saving. Hence, the two effects offset one another. No doubt many other effects have been at work as well. Thus, I find it extremely difficult to give any structural or behavioral interpretation to the constancy of the gross private saving rate.

Merely pointing out some difficulties in interpretation of some data does not suffice to reject the conjecture outright; nor does it provide an alternative behavioral interpretation. Hence, we turn now to estimates of the effect of taxes on private saving, i.e., to estimates of consumption functions.

Equation (3.2) presents our basic estimate of a (private) consumption function:[1]

$$\underset{}{LGCONSP} = \underset{(1.3)}{-3.8} + \underset{(0.12)}{0.56}\, LGDPI + \underset{(0.08)}{0.18}\, LGDPI(-1) \tag{3.2}$$

$$+ \underset{(0.06)}{0.28}\, LGWLTH(-1) - \underset{(0.01)}{0.003}\, LGUNEM - \underset{(0.31)}{1.07}\, R$$

$R^2 = 0.99$; SSR = 0.00171; SE = 0.0088

where LGCONSP is the natural logarithm of real per capita private consumption, DPI is disposable private income, WLTH is wealth, UNEM is the unemployment rate, R is the real after-tax return on capital, (-1) indicates a one period lag, SE is the estimated standard error of the regression and SSR is the sum of squared residuals. Estimated standard errors appear in parentheses below the estimated coefficients.

The equation performs quite well by conventional standards. The estimated standard error is a tiny fraction of the mean value of the dependent variable. The individual coefficients are measured relatively precisely and have the expected signs. The important thing to note is the positive real rate of return effect; the estimated interest elasticity of <u>saving</u> at mean values of the variables is approximately one-fourth. Also note that the implied income elasticity of saving exceeds unity.

A variety of authors have conjectured on the effect of inflation on saving. For example, Mundell [1963] argues that inflation increases saving as it destroys the value of accumulated wealth and consumers attempt to restore their wealth-

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[1] All equations delete 1941-46. The Cochrane-Orcutt adjustment for serial correlation has been made in this and subsequent equations when necessary.

income position. There is also an uncertainty argument which leads to a similar result: consumers hedge by spreading the loss of income over more than one period. These effects may offset any indirect effects of the rate of inflation acting through the real rate of return. We have thus entered the expected rate of inflation $(\hat{\pi})$ as an additional regressor in the basic equation. This yields:

$$\begin{aligned} \text{LGCONSP} = & \underset{(1.34)}{-0.46} + \underset{(0.12)}{0.57}\ \text{LGDPI} + \underset{(0.08)}{0.18}\ \text{LGDPI}(-1) \\ & + \underset{(0.07)}{0.26}\ \text{LGWLTH}(-1) - \underset{(0.011)}{0.003}\ \text{LGUNEM} - \underset{(0.33)}{1.07}\ \text{R} - \underset{(0.06)}{0.29}\ \hat{\pi} \end{aligned} \tag{3.3}$$

$R^2 = 0.99$; SSR = 0.0017; SE = 0.0091

The estimated real net rate of return elasticity is still substantial, virtually unchanged at about one quarter. The other coefficients are hardly affected, and expected inflation does have the expected negative sign for consumption.

A loglinear specification gives similar results:

$$\begin{aligned} \text{LGCONSP} = & \underset{(1.29)}{-0.60} + \underset{(0.12)}{0.56}\ \text{LGDPI} + \underset{(0.08)}{0.17}\ \text{LGDPI}(-1) \\ & + \underset{(0.06)}{0.28}\ \text{LGWLTH}(-1) - \underset{(0.01)}{0.004}\ \text{LGUNEM} - \underset{(0.011)}{0.041}\ \text{LGR} \end{aligned} \tag{3.4}$$

$R^2 = 0.99$; SSR = 0.0017; SE = 0.0088

Again, the estimated interest elasticity is around one-fourth and the other estimated coefficients are quite similar to those from the semi-log specifications.[1]

The measure of the real net rate of return on capital involves three elements: the nominal rate of return, the tax rate, and the inflation rate. We have experimented not only with alternative methods (lag structure, forward projection, adjustment speed) of estimating the expected inflation rate, but also with alternative measures of the nominal net return. Use of the Moody's Aaa bond rate in an equation analogous to (3.2) yielded an estimated coefficient of -0.6 with an estimated standard error of 0.2. This implies an interest elasticity of slightly less than 0.2. Use of Standard and Poors high grade municipal bond rate makes it unecessary to measure marginal tax rates on capital income; this also yielded an estimated coefficient of -0.6 with an estimated standard error 0.2; this produced an interest elasticity of slightly less than 0.2.

There is always a problem in interpreting saving or consumption functions estimated by single equation methods. It is difficult to believe that the rate of return (or wealth or income) is exogenous. Since the saving function is embodied in a larger model of economic activity - whether a simple growth model or a monetary growth model or a full scale macroeconometric model - the parameter estimates obtained with single equation methods may be biased. Since we do not wish to specify a complete macroeconometric model, we proceed as follows: We estimate consumption functions by an instrumental variable technique using as instruments principal components of the exogenous variables from the Hickman-Coen annual macroeconometric model. We thus reduce the problem to one of manageable proportions. The exogenous variables from which we

[1] Likewise, different adjustment speeds for inflationary expectations, and different length of forward projection of $\hat{\pi}$ produced virtually identical results.

form the principal components include tax <u>rates</u>, monetary instruments (such as the discount rate and reserve ratio), population, time, etc. Use of these principal components as instruments yields consistent estimates of the structural parameters (see Amemiya [1966] and Jorgenson and Brundy [1973]). This procedure yields[1]:

$$\underset{}{LGCONSP} = \underset{(1.55)}{-5.83} + \underset{(0.13)}{0.55}\ LGDPI + \underset{(0.23)}{0.32}\ LGDPI(-1) \qquad (3.5)$$

$$+ \underset{(0.03)}{0.72}\ LGWLTH(-1) - \underset{(0.014)}{0.031}\ LGUNEM - \underset{(0.62)}{2.28}\ R - \underset{(0.21)}{0.36}\ \hat{\pi}$$

$R^2 = 0.99$; $SSR = 0.0087$; $SE = 0.021$

The equation performs quite well by conventional measures. The (consistent) estimate of the interest elasticity is somewhat larger than with ordinary least squares, slightly larger than 0.4. Again, it is measured quite precisely. While much more work with such estimators is necessary, these estimates are preferrable to those reported above.

Finally, the estimated coefficients for the other variables are quite similar to the ordinary least squares estimates except for that on lagged wealth. Allowing different combinations of the real net rates, wealth, and income to be enogeneous produced a range of estimated wealth elasticities spanned by those reported here. It may well be that ordinary least squares estimates of wealth coefficients are substantially biased downward.

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[1]Since the data on the principal components, which were supplied kindly by M. Hurd, go only through 1966, this equation excludes 1967-69.

Since the period 1929-69 includes the depression, the mere inclusion of the unemployment rate may not be sufficient to account for cyclical fluctuations in saving. Hence, we reestimated the basic equation using postwar data only:

$$\begin{aligned} \text{LGCONSP} = &\underset{(1.76)}{-3.85} + \underset{(0.21)}{0.62}\ \text{LGDPI} + \underset{(0.24)}{0.007}\ \text{LGDPI}(-1) \qquad (3.6) \\ &+ \underset{(0.05)}{0.72}\ \text{LGWLTH}(-1) - \underset{(0.02)}{0.003}\ \text{LGUNEM} - \underset{(0.81)}{2.08}\ R + \underset{(0.14)}{0.007}\ \hat{\pi} \end{aligned}$$

$R^2 = 0.99$; SSR = 0.0025; SE = 0.0139

The now familiar pattern of a substantial interest elasticity is repeated with these data. The equation performs less well by the usual measures, since there is somewhat less variation in each of the series and the sample size is reduced sharply when we confine ourselves to the postwar era.

Once again, however, we estimate a substantial elasticity of saving with respect to the real net rate of return, about 0.4.

Alternative measures of permanent income produced similar results. Using the natural logarithm of current and lagged labor income yielded an estimated interest rate coefficient of -3.32 with an estimated standard error of 1.7; this corresponds to an interest elasticity of 0.6. The worse fit and less plausible estimated coefficients on the other variables are typical of this theoretically more appealing specification and leads us to reject these estimates in favor of those reported above.

Finally, the alternative real net rate of return measures yielded estimated interest coefficients of -1.32 (estimated standard error, 0.29) and -1.33

(estimated standard error, 0.29) on the Moody's based real net yield on bonds and the Standard Poor's based real yield on tax-free municipals, respectively; these coefficients correspond to an elasticity of about 0.3.

Table 3 summarizes the empirical results reported above. In brief summary, alternative sample periods, estimation techniques, measures of the real after-tax rate of return on capital and measures of permanent income all lead to the conclusion of a non-negligible interest elasticity of private saving. The range of estimates goes from just under 0.2 to around 0.6 and clusters at about 0.3 to 0.4; the estimate I prefer on statistical grounds is that from equation (3.5), about 0.4.

Table 3

Estimated Real After-Tax Rate of Return
Elasticity of Private Saving

	Ordinary Least Squares	Instrumental Variables
Semi-log, R1	0.3^-	0.4
Log-linear, R1	0.3^-	0.4
Semi-log, R2 and R3	0.2^-	0.3
Semi-log, labor income	---	0.6^-
Semi-log, postwar only	---	0.4

N.B. R1 derived from Jorgenson-Christensen [1972] nominal rate of return.

R2 derived from Moody's Aaa nominal bond yields.

R3 derived from Standard Poor's High-grade Municipal Bond yields.

4. Production

In order to gain further insight into the effects of tax-induced changes in capital accumulation on the distribution of income, we have estimated production functions from the same data used to estimate private saving. Recall that a key issue in our two factor aggregate model is the size of the elasticity of substitution between capital and labor. Increases in the capital labor ratio will lead to increases (decreases) in labor's share of gross income if the elasticity of substitution is less (greater) than unity. Further, the increase in the wage/rental ratio due to an increase in the capital/labor ratio varies inversely with the elasticity of substitution.

Since we are dealing with a two factor model, we estimate a constant elasticity of substitution (CES) production function with Harrod-neutral technological progress[1]:

$$y_t = \gamma[K_t^{-\rho} + (E_L L_t)^{-\rho}]^{-1/\rho} \tag{5.1}$$

where y is output, K capital input, L labor input, t time, $E_L = E_L(0)e^{-\lambda t}$, λ is the exponential labor augmenting rate[2] and σ, the elasticity of substitution, equals $1/(1+\rho)$.

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[1]Diamond [1965] has demonstrated that Harrod neutrality is the only type of technological progress compatible with balanced growth. We interpret our results as derived from a Harrod-neutral CES production function. If technical change, for example, was Hicks neutral, the coefficient of log w is interpretable as a direct estimate of the elasticity of substitution. Indeed, this is the interpretation originally given by Arrow, et. al. [1961]. Note, however, that the estimate of the elasticity of substitution is still about one-half.

[2]This specification thus avoids the "impossibility" problem pointed out by Diamond and McFadden [1965].

Rearranging (4.1) we see that

$$\log\left(\frac{WL}{y}\right) = c + (1-\sigma) \log w + (\sigma-1)\lambda t \qquad (5.2)$$

where c is a constant.

Estimating (4.2) on data for 1929-69, deleting the war years, for the private economy yields:

$$\log\left(\frac{WL}{y}\right) = \underset{(0.06)}{-0.45} + \underset{(0.034)}{0.554} \log w - \underset{(0.0021)}{0.0045} \text{ time} \qquad (5.3)$$

$R^2 = 0.99$; SE = 0.033; SSR = 0.033

The equation fits the data quite well. The standard error of the regression is a small fraction of the mean value of the dependent variable and the estimated coefficients are measured rather precisely. The estimated elasticity of substitution is 0.45, which is quite similar to the usual time series estimates[1]. This immediately implies that labor's share of gross income varies in the same direction as the capital/labor ratio. The derived estimate of λ, the labor augmenting rate, is 0.09[2].

Fit to powtwar data alone, we obtain:

$$\log\left(\frac{WL}{y}\right) = \underset{(0.18)}{-0.42} + \underset{(0.13)}{0.52} \log w - \underset{(0.006)}{0.005} \text{ time} \qquad (5.4)$$

$R^2 = 0.98$; SE = .016; SSR = .0045

[1] See Nerlove [1967] for a survey of estimates of CES production functions. Our estimate is quite similar to usual time series estimates, which in turn are usually smaller than cross section estimates. While time series estimates may be biased downwards because of lagged adjustments, Lucas [1969] rejects this conjecture. Cross section estimates suffer from a variety of problems; See Nerlove [1962] and Lucas [1969].

[2] One might think of this as including some exogenous human investment.

The estimated elasticity of substitution is 0.48; unfortunately, while the point estimate of the labor augmenting rate is quite similar to that for the whole period, its estimated standard error is quite large.

As with the estimates of saving functions, the issue of potential bias in the estimates must be confronted. Possible measurement error and the endogeneity of wages in a full model lead us to follow the same procedure as described above for consumption/saving. We use an instrumental variables estimator, using principal components from the exogenous variables in the Hickman-Coen model as instruments. This yields

$$\log\left(\frac{WL}{y}\right) = \underset{(0.02)}{-0.53} + \underset{(0.04)}{0.56} \log w - \underset{(0.002)}{0.005} \text{ time} \qquad (5.5)$$

$$R^2 = 0.99; \quad SE = 0.034; \quad SSR = 0.032$$

Again, the equation fits quite well. The estimated elasticity of substitution is 0.44, and the estimated labor-augmenting rate is 0.09; both estimates are quite close to those reported above.

While increases in the capital-labor ratio will increase the wage-rental ratio (which is probably a more insightful way to analyze tax incidence in a growing economy than examining factor shares) regardless of the elasticity of substitution, these results suggest that policies which increase capital accumulation will increase labor's gross share of national income.

We now turn to a more detailed examination of the implications of our empirical results.

5. Implications for Income, Welfare and Income Distribution

As discussed in Section 1, these results have striking implications for tax policy. The current tax treatment of income from capital - primarily the personal and corporate income taxes - decreases the net rate of return to capital accumulation; the modest positive real net of interest elasticity thus implies a substantial tax-induced decrease in saving and the capital intensity of production, a reallocation of consumption from the future to the present and a substantial transfer of gross income from labor to capital. To estimates of these effects we now turn.

a. Welfare

The welfare analysis of intertemporal resource allocation involves a variety of complex issues which are beyond the scope of this paper. For example, external benefits to saving and investment (for example, learning by doing) may render the social rate of return higher than the private rate; other distortion (e.g., lack of a complete set of futures markets) may be important. If, however, we proceed in the usual manner and ignore all distortions other than taxes and argue that to a first approximation the saving rate would be efficient in the absence of taxes, we may adopt the usual consumer surplus measure of lost welfare: one-half the product of the tax-induced increase in the price of future consumption and the compensated change in future consumption. Feldstein [1975] shows that this product may be written as

$$\Delta W = -1/2\left(1 + \frac{\varepsilon_{SR}}{rT}\right)\left(\frac{P_1 - P_0}{P_1}\right)^2 S_1 \qquad (5.1)$$

where P_1 and P_0 are the prices of future consumption after and before taxes on capital income are imposed ($e^{(-r/(1-\mu)T)}$ and e^{-rT}), μ is the marginal rate of tax on capital income, r is the net rate of return on capital, T is the length of time between saving and dissaving, S_1 is saving for future consumption, and ε_{Sr} is the compensated interest elasticity of the saving rate.

Recall that since the private sector is a net saver, the income and substitution effects of a change in the rate of return work in opposite directions. Hence, our estimates are lower bounds on the pure substitution elasticity. The real net rate of return, r, averages about three or four percent over our sample period; T, the average length of time between saving and dissaving, is probably around twenty-five years. Hence, examining (5.1), we see that the contribution of the real net rate of return elasticity to lost welfare is magnified by the factor $1/rT \simeq 4/3$.

While μ varies substantially by the type of capital, and the progressive rate structure of the personal income tax makes it difficult to measure marginal, as opposed to average, tax rates, we adopt 50% as a reasonable estimate of μ. Harberger [1969] suggests that 60% is a good approximation; Pechman and Okner [1974] argue that 40% is better. The former figure does not deal adequately with the nonprofit sector, whereas the latter fails to impute any indirect business taxes to capital. Since S_1 is saving for future consumption, total net private saving understates S_1 because of the dissaving of the elderly population during retirement. If the population grows at 1-2% and real income grows at 3% per year, and T = 25 years, S_1 equals about one and one-half times total net private saving, about $200 billion. Estimates of the annual welfare loss resulting from the tax-induced distortion of the timing of consumption over the life cycle for different values of ε_{Sr} and r are reported in Table 4. Our preferred estimate, based on $r = 0.4$ and $\varepsilon_{Sr} = 0.4$, yields an estimate of the annual welfare loss of close to sixty billion dollars! This estimate is rather insensitive to variations in r and only modestly sensitive to variations in ε_{Sr}.

By comparison to previous studies of the welfare loss from differential taxation of different types of capital,[1] these numbers are enormous. They amount to an astounding waste of resources. Recall that these estimates are annual costs to society. The present value of these costs is a large multiple of the annual costs (the exact relation depending upon the assumed rate of discount) and can easily amount to hundreds of billions of dollars. Viewed another way, if we abolished taxes on income from capital this year, by the end of the decade welfare would have increased by close to two hundred billion dollars, or about twice the current annual yield of the individual income tax!

These estimates highlight the fact that the current tax treatment of income from capital induces consumers to save less for consumption later in life - primarily old age - than is socially optimal. It seems strange simultaneously to reduce substantially the return to saving, and hence private provision for retirement, and to attempt to increase provision for retirement publically through social security, which in turn may well decrease private saving.[2] While both the taxation of capital income and the social security system serve other goals, they are in basic conflict in the attempt to provide retirement or old age consumption.

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[1] See Harberger [1966] and Shoven and Whalley [1973].

[2] See Feldstein [1974c] and Munnell [1975].

Table 4

Estimated Annual Welfare Cost
of Current Capital Income Taxation
($ billion)

r	ε_{Sr}		
	0.2	0.3	0.4
0.03	44.6	48.3	52.1
0.04	48.0	52.0	56.0
0.06	48.3	52.3	56.3

Do such enormous welfare costs make sense? First, extrapolating the estimated interest elasticity over a large change in tax induced variations in the real after-tax rate of return may not be warranted. On the other hand, the estimated elasticities are a lower bound on the pure substitution elasticities, since they include a negative income effect of interest rate increases on saving.

Second, substituting taxes on labor income for those in capital income can produce a distortion in labor markets, e.g., in the allocation of work between home and market. While most estimates of labor supply functions suggest an aggregate supply of labor which is quite wage inelastic, it is quite difficult to measure labor supply in the envelope since - subsuming effort and human investment - and taxes affect human investment in a variety of offsetting ways.[1] Since one reason one works early in life is to save for future consumption, cross elasticities as well as own elasticities are important; the interested reader is referred to Feldstein [1975] for a detailed discussion. We merely note that our estimates must be adjusted downward to get the net effect of substituting labor income taxes for capital income taxes.

Finally, one might expect that such enormous inefficiency would result in an intense pressure to revive the tax laws or to provide retirement consumption. Indeed, social insurance benefits have grown rapidly and increasingly generous treatment of income placed in retirement plans has been a key feature of recent tax reform.

b. Income and Its Distribution

The long-run effect of changes in the structure of capital income taxes on income and its distribution depends upon the exact change being considered. For

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[1] See Boskin [1976].

example, integration of corporate and personal income taxes or switching from income to consumption as the base of personal taxation, or both, will increase income substantially if the rise in the real net rate of return is not offset by other policies (government saving, monetary policy, etc.). Assuming no other policies are enacted which affect the real after-tax rate of return and that an equal current yield consumption tax replaces current capital income taxation,[1] the real net rate of return, with $\mu = 0.5$, will double in the short-run. This will lead to an increase in saving, the capital-labor ratio and wage rates, and to a fall in the gross rate of return to capital.

Feldstein [1974b] derives the relationship between the net rate of return to capital and capital income taxes in a one sector growth with factor taxes and variable saving rates. The estimates reported above (real net interest elasticity of saving of 0.4, elasticity of substitution of 0.45, etc.) imply an elasticity of the net rate of return with respect to capital income tax rates of 0.3 (an elasticity of substitution of one would imply 0.6).[2] Hence, a complete abolition of capital income taxation would increase the real net rate of return some thirty (or more if the elasticity of substitution is larger) percent. Since the capital-labor ratio increases in proportion to S/α, where S is net saving and α labor's share of gross income, our estimates imply a new steady-state capital-labor ratio some 15-20% larger than currently.

From the production function, and competitive factor markets,

$$\log \frac{W}{r} = C + (1 + \rho) \log k \qquad (5.2)$$

[1] It is quite likely that a personal consumption tax would have progressive rates; indeed, this often overlooked fact makes the distributional effects of switching from income to consumption taxes much more palatable.

[2] Extrapolations over such a larger range are somewhat hazardous. We present here only illustrative calculations.

where ρ is the substitution parameter in the CES form, i.e., $\rho = \frac{1}{\sigma} - 1$, where σ is the elasticity of substitution. Hence, our estimate of ρ is around 1.2. Thus, a 15-20% increase in k would result in a 33-44% increase in the wage-rental ratio; the abolition of capital income taxation transfers gross income from capital to labor.

Further,

$$\log \frac{wL}{rK} = C + \rho \log k \tag{5.3}$$

so the 15-20% increase in k implies an increase in this ratio of factor shares of about 18-24%. Since the factor share ratio is currently around 3, it would increase to about 3.6. Thus, capital's share of gross income would fall by around 15%.

With the general distributional pattern developed above, we mention briefly two other important tax incidence issues. First, the results presented above imply a substantial shifting of capital income taxes from capital to labor due to the decreased capital-labor ratio caused by current tax treatment. Again, Feldstein [1974b] develops a formula to measure this differential incidence; our estimates imply that capital shifts approximately one half of the burden of capital income taxes onto labor. Failure to account for tax shifting via decreased saving has led many researchers to conclude that taxes on income from capital are much more progressive than they really are in fact; for example, the excellent study by Pechman and Okner [1974] ignores these long run effects: capital income taxes are generally considered borne by capital and general income taxes in proportion to income.[1] The results reported here suggest that each of

[1] Pechman and Okner [1974] do provide careful estimates based on a variety of generally accepted incidence assumptions; however, the case of a large share of capital income taxes being borne by labor is not included.

these procedures may overstate substantially the progressivity of such taxes.

Second, our results on the interest elasticity of the saving rate suggest that proposals to integrate the corporate and personal income tax which are financed by increases in labor income taxation or consumption taxation would increase saving, the capital-labor ratio, welfare, the wage-rental ratio and labor's share of gross income.

These transfers of gross income from capital to labor from tax policies which decrease capital income taxation must be offset against the decrease in taxes on income from capital and possible increase in taxes on labor income to compare after-tax incomes. Further, the full transfer of gross income will take a period of years of occur.

This immediately raises the issue of what to assume about tax revenue and rates along the new growth path. Further, we have ignored government saving. The net increase in the capital-labor ratio must net out any changes in government saving.[1] Since the increased capital-labor ratio will result in a corresponding increase in per capita output, tax revenues at constant rates will increase well above what they would have been before an initial year equal-yield change. We may choose to compare situations with equal revenue year by year, or with equal shares of taxes in gross income; or with the initial rates continuing; or still other scenarios. Hence, to give an accurate picture, we must compare changes in after-tax incomes under some well-defined set of assumptions about the course of tax rates.[2]

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[1] My preliminary estimates reveal a much lower government propensity to invest out of revenues than the private sector's propensity to save out of income.

[2] And other policies.

We shall not attempt to deal with this conceptual issue here. We merely note that in addition to the usual efficiency arguments in favor of abolishing taxes on interest income,[1] and the often overlooked potential horizontal equity arguments in favor of consumption taxation.[2] The analysis and empirical evidence described above cast serious doubt on the usual comparison of the distributional effects of income and consumption taxes.

Again, while the net effect on income and its distribution depends upon the specific set of assumptions made, the general argument remains the same: the modest positive interest elasticity implies that tax policies - from corporate and personal income tax integration or switching to consumption taxes - which lower taxes on income from capital will increase saving, the capital intensity of production, income, and welfare; and further, will transfer gross income from capital to labor.

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[1] See Musgrave [1959], ch. 12.

[2] Since consumption is a more stable function of permanent income than is current income, a consumption tax may improve our ability to tax persons with the same permanent income at the same rate.

6. Conclusion

We have presented a good deal of evidence which suggests that there is a positive relationship between private saving and the rate of return. A variety of definitions of variables, functional forms and estimation methods all led to this conclusion. This relationship has immensely important implications for economic policy. Among the more important are that the current tax treatment of income from capital induces an astounding loss in welfare due to the distortion of the consumption/saving choice and that reducing taxes on interest income would in the long-run raise the level of income and transfer a substantial portion of capital's share of gross income to labor. The overall distributional effects of such a policy combine this long-run effect with that of the exemption of interest income from taxation.

Taken as a whole, the results reported here strengthen substantially the case for reforming the tax treatment of income from capital in the United States, e.g., integration of the corporate and personal income taxes or, better yet, switching from income to consumption taxation.

They also have obvious implications for the potential effectiveness of monetary policy in the short- and long-run.

References

Amemiya, T., "On the Use of Principal Components of Independent Variables in Two-Stage Least Squares Estimation," Int. Econ. Rev., September 1966.

Arrow, K., H. Chenery, B. Minhas and R. Solow, "Capital-Labor Substitution and Economic Efficiency," R.E. Stat., August 1961.

Boskin, M., "Notes on the Tax Treatment of Human Capital," Conference on Tax Policy, U.S. Treasury Department, 1976.

Break, G., "The Incidence and Economic Effects of Taxation," in A. Blinder et al, The Economics of Public Finance, Brookings, 1974.

Christensen, L., and D. Jorgenson, "U.S. Income, Saving and Wealth 1929-69," Rev. Income and Wealth, 1972.

David, P., and J. Scadding, "Private Saving: Ultrarationality, Aggregation and 'Denison's Law'," Jour. Pol. Econ., 1974.

Diamond, P., "Incidence of An Interest Income Tax," J.E.T., September 1970.

__________., "Disembodied Technological Change in a Two-Sector Model," Rev. Econ. Stud., April 1965.

Diamond, P., and D. McFadden, "Identification of the Elasticity of Substitution and the Bias of Technological Change," 1965, unpublished.

Feldstein, M., "The Welfare Costs of Capital Income Taxes," mimeo, 1975.

__________., "Tax Incidence With Growth and Variable Factor Supply," Quar. Jour. Econ., November 1974a.

__________., "Incidence of a Capital Income Tax in a Growing Economy With Variable Savings Rates," R.E. Stud., October 1974b.

__________., "Social Security, Induced Retirement and Aggregate Capital Accumulation," Jour. Pol. Econ., 1974c.

__________., "Inflation, Specification Bias and the Impact of Interest Rates," Jour. Pol. Econ., November 1970.

Hall, R., "Consumption Taxes Versus Income Taxes: Implications for Economic Growth," Proceedings of the National Tax Association, 1968.

Harberger, A., "Introduction," in A. Harberger and M. Bailey, eds., The Taxation of Income From Capital, Brookings, 1969.

__________., "Efficiency Effects of Taxes on Income From Capital," in M. Krzyzaniak, ed., Effects of the Corporation Income Tax, Wayne State University Press, 1966.

Hickman, B., and R. Coen and M. Hurd, "The Hickman-Coen Annual Growth Model: Structural Characteristics and Policy Responses," Int. Econ. Rev., February 1975.

Jorgenson, D., and J. Brundy, "Consistent Efficient Estimation of Systems of Simultaneous Equations by Means of Instrumental Variables," IMSSS Technical Report No. 92, March 1973.

Kendrick, J., The Formation and Stocks of Total Capital, NBER, forthcoming.

Lucas, R., "Labor-Capital Substitution in U.S. Manufacturing," in Harberger and Bailey, eds., The Taxation of Income From Capital, Brookings, 1969.

Mundell, R., "Inflation and Real Interest," Jour. Pol. Econ., June 1963.

Munnell, A., "The Impact of Social Security on Private Savings," Nat. Tax Jour., 1975.

Musgrave, R., The THeory of Public Finance, McGraw-Hill, 1959.

Musgrave, R., and P. Musgrave, Public Finance in Theory and Practice, McGraw-Hill, 1973.

Nerlove, M., "Recent Empirical Studies of the CES and Related Production Functions," in M. Brown, ed., The Theory and Empirical Analysis of Production, NBER, 1967.

Pechman, J., Federal Tax Policy, rev. ed., Brookings, 1971.

Pechman, J., and B. Okner, Who Bears the Tax Burden? Brookings, 1974.

Sato, K., "Taxation and Neoclassical Growth," Finance Publique, 1967.

Shoven, J., and J. Whalley, "A General Equilibrium Calculation of the Effects of Differential Taxation of Income From Capital in the U.S.," Jour. Pub. Econ., November 1972.

Taylor, L., "Saving Out of Different Types of Income," Brookings Paper On Economic Activity, 1970.

Weber, W., "The Impact of Interest Rates on Aggregate Consumption," Amer. Econ. Rev., September 1970.

__________., "Interest Rates, Inflation and Consumer Expenditures," Amer. Econ. Rev., December 1975.

Wright, C., "Saving and the Rate of Interest," in A. Harberger and M. Bailey, eds., The Taxation of Income From Capital, Brookings, 1969.