MARGINAL TAX RATES ON EARNINGS OF FACTOR INPUTS:

ESTIMATES FOR FIVE OECD NATIONS

William B. Shear
U.S. General Accounting Office

George S. Tolley
University of Chicago

This paper is to be presented at the ASSA Meetings under the Society for Government Economists on December 28, 1983, in San Francisco. This research was financed, in part, by the Office of Tax Analysis at the U.S. Department of the Treasury. The opinions are strictly those of the authors and do not reflect the opinions of their current employers nor past funding sources. Prior to completion of this paper we benefitted from helpful discussions with Gerry Godshaw, Chuck Hulten, Gene Steuerle, and Eric Toder.

The effects of taxes on economic activity is a major concern shared by economists, policy analysts, and many others interested in determinants of national economic performance. Two major areas of interest in this regard are (1) the resource misallocations created by non-neutral taxation of capital across industries and asset groups and (2) the effects of tax policy on the total supply of factor inputs. This paper represents a contribution to the literature dealing with the latter interest.

When analyzing the effects of taxation on total factor supply, one is concerned with the relevant marginal tax rate. This paper approaches the measurement of such tax rates and refers to them as effective tax rates. This paper is part of a larger research project studying determinants of income determination and income growth. Work is well under way in the development of the capital stock approach to income determination. The model holds ramifications for a number of policy issues including issues associated with tax policy. Both effective tax rates and their changes over time are of interest. This represents the focus of

this paper.

Factor supplies are affected by after-tax factor returns. The calculation of the relevant marginal tax rates is therefore necessary to analyze factor supplies. The following sections present past approaches to estimate effective tax rates, conceptual problems in the measurement of effective tax rates, proposed methods to deal with the problems, and estimates of effective tax rates for five OECD nations. These estimates are from the 1960-1980 time period in the United States and from the 1970s in the United Kingdom, France, West Germany, and Japan. Estimates of effective tax rates for the earnings of labor and capital in this paper are calculated using a flow of funds approach. Estimates of effective tax rates for the earnings of internationally mobile capital are also based on a flow of funds approach.

PAST APPROACHES

A number of studies have addressed non-neutral taxation of industries due to corporate income taxation. Harberger (1966) was among the first. Both he and Shoven (1976) use average tax rate measures in the analysis of differential taxation of corporate and non-corporate activities. More recently Feldstein and Summers (1979) have examined how inflation raises tax liabilities in the corporate sector. They also calculate average tax

rates, but in addition to measurement of corporate income taxation as Harberger and Shoven undertake, they also measure individual income taxation of capital income originating in the corporate sector.

A recent paper by Gravelle (1981) treats non-neutral taxation of asset types due to corporate income taxation. She uses the cost of capital approach to measurement of tax rates developed by Hall and Jorgenson (1971). King and Fullerton (1983) apply the cost of capital approach to industry groups. They analyze taxation of income from capital originating in the corporate sector from both corporate and individual income taxation. In another recent study, Hulten and Robertson (1982) apply the cost of capital approach to corporate taxation.

The cost of capital approach provides a possibly richer form of analysis than use of average tax rates, because it is conceptually designed to estimate marginal tax rates and account for the entire stream of cash flows, including tax credits and tax payments, over the lifetime of an asset's lifetime. In related research into sources of income growth, Fraumeni and Jorgenson (1981) also use the cost of capital approach.

Another method to estimate effective (i.e., marginal) tax rates is the flow of funds approach. Fullerton, King, Shoven, and Whalley (1981) use this approach to estimate effective tax rates by industry. The flow of funds approach is also used by Joines (1981) and Tolley and Shear (1984). These two studies analyze overall effective tax rates on factor earnings resulting from an economy-wide tax system. Both studies also develop the concept of average-marginal tax rates. The two studies differ significantly, however, in their capital and labor income base estimates and in their treatment of individual income tax exemptions, deductions, and exclusions.

The following section addresses conceptual problems in the estimation of effective (i.e., marginal) tax rates. Part of the discussion deals with issues addressed by Bradford and Fullerton (1981), but other issues are also introduced. Among the key concerns are (1) the information requirements of each approach, (2) the treatment of tax preference items, (3) the treatment of exemptions, deductions, and exclusions, (4) the distinguishing of income from substitution effects, and (5) the treatment of risk.

CONCEPTUAL PROBLEMS

Marginal tax rates drive a wedge between before- and after-tax returns. Therefore, an approach to measure these rates is more desirable than the use of tax revenue statistics to calculate average tax rates.

Bradford and Fullerton (1981) illustrate three points to be considered with regard to the cost of capital approach to estimation of effective tax rates:

(1) the effective tax rate estimate is sensitive to the discount rate used;

(2) with subsidies before-subsidy returns can be small, zero, or negative; and

(3) an assumption about how inflation affects nominal interest rates must be made.

The first point is especially important with regard to discounting the delay in tax liability introduced by accelerated depreciation. The second point leads to the result that the effective tax rate is undefined when the before-tax rate of return is zero. With regard to the third point, Jorgenson and Sullivan (1981) assume a rise of the nominal interest rate by $\pi/(1-u)$ where π is the inflation rate and u the corporate income tax rate. Many

other economists argue Fisher's Law; the real before-tax interest rate is invariant. Bradford and Fullerton, as well as others using the cost of capital approach, find that estimates are sensitive to assumptions regarding points one and three. Furthermore, in a recent presentation Fraumeni (1983) argues that the use of a uniform after-tax return across industries by past researchers applying the cost of capital approach is incorrect. In that she has not offered a solution to date, it becomes questionable what assumptions and information are necessary for such a correction.

Consider in more detail Bradford and Fullerton's second point concerning subsidized capital investments. Some may debate the seriousness of this problem in studies to date using the cost of capital approach. The problem, however, becomes more serious when one attempts estimation of economy-wide effective tax rates. Of special concern in this regard is the stock of owner-occupied housing which receives an implicit subsidy and represents a large share of the U.S. capital stock.

The cost of capital approach suffers from other shortcomings, especially with regard to estimation of economy-wide effective tax rates. It requires information on the share of total capital stock accounted for by each type of capital (i.e., by industry or asset type). The use of investment shares as weights to reduce informational requirements can be misleading if industries with low and falling effective tax rates undergo greater stock adjustments.

Another shortcoming results generally from the different tax treatment of alternative types of financial capital and specifically from tax preference items such as pension funds. Steuerle (1982, 1983) uses national income

account data to illustrate the magnitude of capital income receiving special tax treatment. With the cost of capital approach, one must make an assumption about the form of financing at the margin. While similar assumptions must be made with regard to flow of funds approaches, in the latter case estimates are not as sensitive to these assumptions. With the cost of capital approach one characterizes typical tax treatment of each particular type of capital income. In the estimation process one therefore tends to lose sight of the dollar magnitudes involved in tax preference items of income.

Hulten and Robertson (1983) have introduced another complication involved in use of the cost of capital approach. The complication is caused by risky investments, and they apply it to high technology industries. They observe the presence of a large number of losers and a small number of large winners in these industries. A firm's decision as whether to invest in a high technology activity should be modelled in terms of certainty equivalents. The expected premium received if the investment is a winner must be sufficient to justify the expected losses if the investment is a loser to justify its undertaking. Hulten and Robertson indicate that if an investment becomes a loser firms are constrained with respect to their tax offsets. If an investment becomes a winner, corporate taxation is applied to the premium as well as the normal risk-free return (e.g., a 4 percent real rate of return). Therefore, the cost of capital approach understates the effective tax rate because the premium is subject to the full statutory corporate tax rate. One conclusion that can be drawn from their analysis is that a flow of funds approach reflects the stream of taxes borne and income received from such investments.

The above discussion has been cast in a skeptical light with regard to the cost of capital approach. Now we will address conceptual problems with the flow of funds approach and remain skeptical in tone. A discussion that compares problems with the two approaches and offers suggested analyses in a positive tone will then follow.

The flow of funds approach uses observed flows of earnings and tax revenue. National income accounts, tax revenue, and tax return statistics provide the data. Auerbach (1983) states that the use of currently observed figures rather than hypothetical future figures may be an inaccurate measure of effective tax rates, especially in the presence of accelerated depreciation and investment tax credits. The problem mainly results from tax revenues generated by returns from past investments. These tax revenues generated may not be indicative of revenues to be generated by new investments. Furthermore, he states that the measure of capital income includes economic rents which are not relevant to how taxes affect behavior at the margin.

Auerbach singles out accelerated depreciation and investment tax credits for good reason. Both act to shift the payment of taxes forward in time with respect to any given investment. Expensing schemes have a similar effect in that the investor receives positive cash flow from government when an investment is undertaken followed by tax payments to government. With flow of funds analysis the benefits associated with shifting the timing of tax burden is lost amidst the different vintages of capital creating income flows and subsequent tax payments. Therefore, effective tax rates tend to be overstated.

The flow of funds approach also understates the magnitude of effective tax rate changes when tax policy changes, because tax revenue generated by income from past investments subject to past tax policy enter into the calculations. Therefore, the analyst should observe a long time projection of estimates after changes in tax policy occur.

The discussion has elaborated upon problems with the cost of capital and flow of funds approaches to estimation of effective tax rates. The major problems with the cost of capital approach center on information requirements, the treatment of tax preference items, and the treatment of risk. The major problems with the flow of funds approach center on delays in tax payments introduced by accelerated depreciation and the investment tax credit, expensing, and changes in tax policy. Since both approaches are both instructive and limitted, neither one should be completely excluded in favor of the other. The question becomes one of relevance in relation to the analysis being performed.

First consider an industry by industry analysis of effective tax rates on income from capital. The ages of capital equipment vary greatly by industry. Furthermore, changes in the tax environment are more pronounced among individual industries than among the aggregate economy. Therefore, in this case the cost of capital approach is attractive.

Now turn to a polar case considering overall effective tax rates on income from capital. Effective tax rates for individual industries requires extensive information, especially if after tax rates of return do not equalize. Among the paramount problems is the establishment of an effective tax rate on housing capital. Weights used in the aggregation process require information on the share of capital stock in each industry. Furthermore,

extensive assumptions are necessary in the analysis of tax preference items. These items differ by industry and by individual taxpayer. Assumptions regarding these items are also necessary in flow of funds analysis but not in as crucial a way. With a flow of funds approach, the analyst relates all estimates to particular flows of funds. In this way, when assumptions are changed regarding any particular income or tax item, it is possible to associate the change in assumption to a change in the effective tax rate estimate. This association is made possible by the analyst's closeness to flow of funds data.

The debate between those who advocate cost of capital and flow of funds approaches is controversial and has not been resolved. The discussion, however has established shortcomings with each approach and demonstrated how these problems vary by the level of aggregation of the analysis. In the present study, the interest is to determine estimates of overall effective tax rates based on the economy-wide tax system. We therefore choose the flow of funds approach. Major concerns are the extent to which investment tax credits, accelerated depreciation, and tax policy changes bias the estimates. With respect to tax policy changes, one should be particularly concerned with changes in corporate taxation, since these changes are likely to create a larger dichotomy between tax treatment of new and old investments more than changes in individual income or other taxes.

Even after one decides on a flow of funds approach, conceptual questions must be resolved. In the present study, the method used is the same as the one we developed in Tolley and Shear (1984). This method is similar to those of Wright (1969) and Barro and Sahasakul (1983). These methods differ significantly

from the method used by Joines (1981). The studies by Joines and by Tolley and Shear estimate effective tax rates on the earnings of capital and labor. Tolley and Shear also estimate effective tax rates on the earnings of human and R&D capital, but a flow of funds approach is not used in this analysis. The major differences between the methods arise in the estimation of average marginal tax rates from the individual income tax and of the capital and labor income bases used to compute overall effective tax rates.

Joines uses national income account data to calculate the income bases for capital and labor earnings. This method creates a bias introduced by inflation in the estimation of the effective tax rate on capital. One is interested in the effective tax rate on real rather than nominal earnings. By using national income account data, which represent nominal returns, to calculate the income base Joines underestimates the effective tax rate. The bias increases with the level of inflation. The estimating equation has tax revenues in the numerator and the tax base in the denominator. The numerator should reflect taxation of nominal gains, but the denominator should only reflect real gains. Tolley and Shear (1984) use an estimate of real gains in the denominator.

Joines' calculation of the numerators in the equations for effective tax rates include the computation of average marginal tax rates from the individual income tax. Barro and Sahasakul refer to the equation $dT/dY=T'(1-dD/dY)$ where T is personal income tax liability, Y is total income, T' is the explicit (tax table) tax rate, D is the level of deductions, and d signifies derivative. Barro and Sahasakul use T' in thier calculations. They indicate that Joines estimates dT/dY and uses

adjusted gross income as his measure of total income. They state that dD/dY is positive because as income rises so does tax avoidance behavior (which entails costs) and expenditures on consumption goods favored by the tax system (e.g., housing). They indicate that over the 1961 through 1980 period dD/dY was in the interval between .16 and .18 for returns with over $10,000 adjusted gross income.

We have replicated (subject to small estimation error) Joines' estimates by calculating dT/dY in the years 1960, 1965, 1970, and 1975 as suggested by Barro and Sahasakul's definition of his method. We differ with them, however, in our interpretation of Joines' method. He refers to the share of income subject to nonproportional tax. This implies an average concept such as D/Y rather than dD/dY, although he never explicitly states this. Steuerle and Hartzmark (1981) find that since the early 1950s personal exemptions fell from over 24 percent to less than 10 percent of personal income. In that exemptions are not operative at the margin, one must question any average deduction measure.

Barro and Sahasakul indicate that dD/dY is positive because as income rises so does tax avoidance behavior (which entails costs) and expenditures on consumption goods favored by the tax system (e.g., housing). They refer to T' as the tax rate relevant to substitution between ordinary goods (i.e., non-favored goods) and work while a lower tax rate is relevant to substitution between favored goods and work. They argue that Joines' estimate is almost a weighted average of the two tax rates if avoidance does not occur and favored consumption is unit income elastic. The following discussion questions and expands upon this point. We view this issue as

one related to the distributional question involving capital income taxation addressed by Galper and Toder (1983).

Tax Preference Items

The U.S. tax system grants preferential treatment to the holding of particular assets such as municipal bonds, owner-occupied housing, and other consumer durables. Galper and Toder's analysis accounts for systematic changes in before-tax returns induced by the tax system. With regard to owner-occupied housing and other consumer durables, households balance benefits in the form of tax-exempt returns and tax-deductible interest against diminishing before-tax returns from additional holdings of the assets. Galper and Toder report, "... on the average, households with wealth less than $1 million earn a higher before-tax return on their wealth because of the tax system; households with wealth over $1 million earn a lower before-tax return." Their simulation results indicate that when the changes in before-tax returns induced by the tax system are considered, the tax system is shown to be more progressive than what is shown by traditional flow of funds analyses. Their results also indicate, however, that the progressivity of the tax system is much milder at the top than it would be in the absence of preferences.

In accepting Galper and Toder's analysis, the question becomes how it relates to the estimation of average marginal tax rates. First consider the effective tax rate on income from capital, the subject of their analysis. Their correction for the effect of the tax system on before-tax returns cause lower effective tax rates for lower-income households and higher

effective tax rates for higher-income households. The process of weighting these effective tax rates to get an average becomes important. Weights could be chosen so that the Galper/Toder correction did not affect the average. When we used our 1980 income weights for dividends the Galper/Toder correction leads to a higher average marginal tax rate. While our purpose here is not to devise the appropriate weights, the analysis by Galper and Toder does not suggest that tax preference items systematically lower average marginal tax rates. Their analysis certainly warrants merit and should be extended.

Now relate the analysis of Galper and Toder more fully to the estimation of effective tax rates on total personal income, labor income, and capital income. Tax preference items can lower effective tax rates, especially among particular households. One must account for, however, the diminishing before-tax returns from additional holdings of the assets. With regard to effective tax rates on capital income, the weighting scheme used to average marginal tax rates is important. In that capital income comprises part of total personal income, tax preference items can affect effective tax rates on total personal income.

Now consider whether tax preference items should affect estimates of the effective tax rate on labor income. Recipients of labor income expend on average and at the margin income for tax preference items such as housing, and tax treatment of these goods lower relative prices. Since the present study relates income to factor inputs, we relate the expenditure of

income on output to the after-tax demand for labor. The preferential tax treatment given housing, as an example, increases the demand for labor, just as it does for capital, to produce this asset thus raising the price of labor to other activities. One can thus proceed with a Galper/Toder type analysis of the effective tax rate on labor income. Again, although distributional effects are present, it is questionable whether average marginal tax rates will be affected.

As a final consideration with regard to tax preference items, think of a hypothetical case where a non-durable consumption good is favored. In reality such items are relatively insignificant in the United States and other advanced economies with regard to tax preferences. If expenditures on these goods increased at the margin, we would concede that estimates of effective tax rates on total personal income, labor income, and capital income should be adjusted. We just question the relevance of this case.

Most tax preference items represent capital goods. While we encourage development of analysis by Galper and Toder, such development is not a purpose in the present study. Therefore some rule of thumb treatment of particular assets that yield capital income will be made. As an example, we exclude interest income from municipal bonds when applying the average marginal tax rate on interest income. Assumptions of this type will have little effect on the results. The argument that tax preference items should affect estimation of effective tax rates on labor income is even more removed and will not receive attention.

Income Versus Substitution Effects

Turning to another issue, Hausman (1981) is among a group of labor economists who have recently integrated piecewise linear budget constraints into the empirical analysis of labor supply. The budget constraint relevant to the labor-leisure tradeoff is piecewise linear because of progressive individual income tax schedules. Overtime wages are another possible source that can cause endogeneity between hours of work and the after-tax wage rate received by the worker.

Hausman's analysis holds special implications for changes in tax rates among particular income segments. A change in a marginal tax rate for one income segment entails no change in tax liabilities for lower-income segments and inframarginal changes in tax rates for higher-income segments. In other words, higher-income segments are only subject to an income effect.

Although analysis involving piecewise linear budget constraints has not been applied to capital holdings, such an analysis could be performed. In light of piecewise linear budget constraints, one could argue that average marginal tax rates should not be computed and that the income and substitution effects associated with each income group should be explicitly considered. In the present study the concept of an average marginal tax rate will be retained. Attention now turns to this concept in light of Hausman's analysis.

For the purpose of exposition, consider the example of a cut in the marginal tax rate along a particular income segment. Assume that each dollar of government expenditure is valued at one dollar by the public and taxes finance government expenditures. Income recipients with total income that does not reach the particular income segment will realize a loss of in-kind income from the decline in government spending as will the higher-income recipients. Income recipients with total income that falls along the particular income segment will experience a very slight increase in income from the tax cut itself but more importantly an increase in the after-tax wage at the margin relevant to the substitution effect. Income recipients with higher incomes will only experience an increase in income from the tax cut itself.

Is the use of an average marginal tax rate appropriate in such a case? The estimate of this tax rate will decline by the fall in the marginal tax rate along the particular income segment times the share of total income earned by recipients whos total incomes fall along the segment. The change in the average marginal tax rate is therefore applicable to analyzing substitution effects from the tax cut if all of the income effects cancel. We accept this condition in light of a lack of evidence showing that income elasticities associated with the supply of factor inputs change with income level. Hopefully future analyses will address this aggregation question as well as the determination of income effects associated with changes in

tax deductions and credits.

This concludes the discussion of conceptual problems associated with the estimation of effective tax rates. The following section describes the procedure used to estimate effective tax rates.

ESTIMATION PROCEDURE

First, flow of funds analysis is used to estimate effective tax rates on the earnings of labor and capital. After these estimates are presented, adjustments based on flow of funds analysis are calculated to arrive at effective tax rates on the earnings of internationally mobile capital. Estimates are calculated for the United States in 1960, 1965, 1970, 1975, and 1980. Estimates using the same approach for the United Kingdom, France, West Germany, and Japan in 1970, 1973, and 1977 are also reported. Of these latter estimates, those relating to labor and capital also appear in Tolley and Shear (1984). In all of the analyses, taxes at all levels of government, federal, state, and municipal are considered.

The income base from which the income shares of labor and capital are estimated is net national product (NNP). From NNP the before-tax (real) returns are estimated, therefore all taxes are stated in relation to the before-tax returns. The estimates of the before-tax (real) returns to labor and capital use the factor share calculations of Denison (1967) and Denison and Chung (1976). The respective shares for labor

and capital are .84 and .16 for the United States, .82 and .18 for the United Kingdom, .79 and .21 for France, .75 and .25 for West Germany, and .73 and .27 for Japan. The resulting income shares, whether expressed in dollars, pounds, francs, marks, or yen, represent the denominators in the estimating equations. All calculations involving marginal tax rates and income subject to them appear in the numerators of the estimated equations. All taxes except the individual income tax are treated as proportional. Therefore, tax revenue data can be used directly in many of the calculations.

Since the individual income tax received extensive treatment above, consider it first. The approach is similar to those of Wright (1969) and Barro and Sahasakul (1983). For each income segment the partial derivative of tax payments with respect to taxable income is calculated.

Statistics of Income records average tax liabilities and amounts of specific components of income earned for each adjusted gross income class. Tax rates from the tax tables apply to taxable income which is less than adjusted gross income.

Furthermore, tax rates from tax tables depend on whether a single or joint return is filed. One could use tax rates from tax tables and make assumptions concerning percentages of recipients filing single or joint returns and the dichotomy between adjusted gross income and taxable income.

This study makes an alternative but closely related calculation. Statistics of Income also reports income subject to each marginal tax rate for each adjusted gross income class. For each adjusted gross income class, the top marginal tax rate is chosen as being most applicable to an extra dollar of income. Returns constituting outliers are excluded. For each average marginal tax rate, the sum of products is calculated. Each product equals the marginal tax rate for the adjusted gross income class times the share of the specific component of income (e.g., wages and salaries, dividends, interest, etc.) earned by recipients in the adjusted gross income class.

Individual Income Tax

Due to the progressivity of the individual income tax, average marginal tax rates are calculated for each dollar of earnings. Labor income includes wages and salaries and estimates of the labor share of proprietors' income. Capital income includes dividend, interest, rental, and capital's share of proprietors' income. The respective shares of proprietors' income allocated to labor and capital are 63 and 37 percent

for the United States, the United Kingdom, France, and West Germany and 89 and 11 percent in Japan. These estimates are from Denison (1967) and Denison and Chung (1976).

In the United Kingdom, France, and West Germany, individuals receiving dividends receive a tax credit (i.e., an imputation) in paying personal income taxes based on taxes payed by the corporation. The imputation lowers the effective tax rate on dividend income from the individual income tax.

Average marginal tax rates for the United States calculated from Statistics of Income appear below.

	1960	1965	1970	1975	1980
Labor	27	31	33	36	42
Dividend	55	51	53	54	58
Interest	37	36	38	40	46

In the calculations for labor, 3 percent is added for state and municipal taxes. The corresponding additions for dividends and interest is 5 percent. The same average marginal tax rate is used for interest, rental, and proprietors' income based on the similarity of their distributions among earners of different marginal tax brackets. The figures suggest that bracket creep, whether caused by rising real incomes or inflation, is most noticeable for labor and interest earnings.

As an added note of interest, the Office of Tax Analysis at the U.S. Department of the Treasury estimated an average marginal tax rate on labor income for us ùsing the Treasury Tax Model. The model is based on a sample of individual

income tax returns and only includes federal individual income taxes. The model was run on 1982 income returns using 1984 tax law. The estimate came to 26 percent. How does this compare to our 42 percent estimate for 1980 prior to the Reagan tax cuts? First subtract 3 percent attributable to state and municipal taxes. Second, the Treasury Tax Model uses a procedure similar to ours, but it does not rely on the aggregated form of data in Statistics of Income. For the 1970s this model makes predictions about 3 percent below ours. Subtracting this 3 percent leaves our estimate at 36 percent. Therefore, changes between 1980 and 1984 tax law are attributed to a 10 percent fall in the average marginal tax rate on labor income from 36 to 26 percent.

For the other four countries, secondary sources are used to calculate average marginal tax rates for the period of the 1970s. These sources include publications by OECD (1981a, 1981b). Based on information in Kay and King (1978), it appears that individual income tax rates in the United Kingdom are comparable to those in the United States, but tax rates in West Germany tend to be higher and the schedule more progressive. Based on Price Waterhouse (1976) information, individual income tax rates are lower in France and Japan. Furthermore, information in Hayashi (1978) indicates that favorable treatment of dividend and interest income by the individual income tax in Japan causes extremely low average marginal tax rates. Use of these

information sources lead to the following estimates for average marginal tax rates.

	United Kingdom	France	West Germany	Japan
Labor	31	30	45	20
Dividends	60	33	60	5
Interest	40	30	50	5

France had an imputation system with regard to dividends throughout the 1970s. The United Kingdom implemented an imputation system relevant to our 1973 and 1977 estimates and West Germany implemented one relevant to our 1977 estimates. In all three countries, a tax credit is allowed in calculating individual income tax liabilities, with individual income grossed up by the amount of the tax credit. Since these credits apply to dividends from past and future investment projects, the changes in the United Kingdom and West Germany are not expected to create biased estimates due to the flow of funds approach. In France the credit is equivalent to a rate of imputation of one-third; therefore the subtraction causes an average marginal tax rate of zero. In the United Kingdom the rate of imputation was .34 which gives a net tax reduction of .4 times .34/(1-.34) or 20 percent to be subtracted from the 60 percent figure. (The .4 comes from the 100 percent minus 60 percent equal to 40 percent of the tax credit not subject to tax.) The rate of imputation in West Germany was 36/64, and .4 times 36/64 equals 23 percent. Therefore, 60 percent minus 23 percent leads to use of a 37 percent average marginal tax rate.

The estimated average marginal tax rate measures are then multiplied by their respective income levels reported in the National Income Accounts reported by the United Nations. For the United States, an estimate of interest income from municipal bonds was subtracted from total interest income, but the effect on the estimates is less than one percent.

Corporate Income Tax

Differences between flow of funds and cost of capital approaches with regard to corporate income taxation have been previously discussed. The flow of funds approach used here depends on four assumptions. First, it is assumed that each corporation's average and marginal tax rates are equal. (We assume that the effect of the lower tax rates on the first $100,000 of income is small.) Second, it is assumed that at the margin a corporation's form of financing is the same as it is on inframarginal investments. Third, it is assumed that any one dollar increase in capital income will be distributed among non-corporate enterprises and corporations with different debt to equity ratios in the same proportion as existing capital income. Fourth, it is assumed that the incidence of the corporate income tax is on capital. The first two assumptions are necessary to use individual firm tax revenue data to compute marginal tax rates. The third assumption is necessary to retain the appropriate weights in the aggregation process. The fourth assumption is

necessary to attribute these taxes to capital earnings. Therefore corporate income tax liabilities are added to taxes on capital. All tax revenue data in this study are published by OECD (1979, 1981a).

This calculation is less precise for the United Kingdom, West Germany, and Japan. In the United Kingdom, capital goods eligible for expensing were increasing over the 1960s and 1970s. Therefore, estimates for the United Kingdom are likely to be biased upward and changes over the 1970s are likely to be biased downward in absolute terms.

Payroll and Social Security Taxes

These taxes are treated as proportional taxes on labor earnings. For the higher estimates where social security is treated purely as a tax, the entire component of tax revenue is added to taxes on labor. To account for the extent to which social security may be viewed as deferred saving or regressive tax rates cause marginal tax rates to lie below average tax rates, for the intermediate estimates half of the component of tax revenue is added.

Sales, Excise, Value-Added and Property Taxes

Sales, excise, and value-added taxes are taxes on output and are treated as proportional taxes. The calculation treats an x percent tax on output as equivalent to an x percent tax on labor and capital inputs. Tax revenues are allocated in proportion to shares in NNP.

With regard to consumption based output taxes, a distinction must be made between taxes on existing capital and taxes on flows of saving. When a dollar is transfered from consumption to saving, tax liabilities from these taxes fall. Therefore, the addition to taxes on capital should not be added to taxes on saving if the latter calculation is made.

Controversy is present concerning the incidence of property taxes on housing and real estate. Some analysts view them as user fees, others view them as excise taxes, and still others view them as taxes on capital. In this study they are treated the same as excise taxes.

Capital Gains Tax

In a non-inflationary economy, capital gains taxation grants defered tax payments at a prefered tax rate. Bailey (1969) finds that the present value equivalent of the effective tax rate on capital gains accruals is less than 8 percent. In this study retentions are treated as if they lead to capital gains which Bailey considers a good first approximation. The United States, the United Kingdom, France, and West Germany have similar tax provisions with regard to capital gains taxation.

In these countries 8 percent of corporate retained earnings are added to taxes on capital. In Japan capital gains are taxed upon realization at the same rate as ordinary income. For this reason, 10 percent of retentions are added. These additions add less than 2 percent to the overall estimates in each country.

Feldstein and Slemrod (1978) analyze the effect of inflation on capital gains tax liabilities. They find that in 1973 capital gains tax liabilities were nearly doubled over what they would have been in the absence of inflation. In this study, due to the small proportion of capital earnings that are subject to capital gains taxation, an inflation adjustment would have little effect on the results.

Likewise, we applied a similar methodology to estate and inheritance taxes and taxes on dividend and interest income from assets in private pension funds. The additions added less than 1 percent to the estimates.

Summary

Estimates of effective tax rates on labor, capital, and saving for the United States appear below. The estimates for labor income represent the higher estimates based on treating social security and payroll taxes purely as a tax.

	1960	1965	1970	1975	1980
Labor	42	45	50	56	63
Capital	65	61	62	62	78
Saving	55	51	52	52	68

The estimates reflect an upward trend for labor taxation. Capital and saving taxation fell in the early 1960s and remained fairly constant until 1980. Future analyses are necessary to reveal if the 1980 increases are permanent or transitory.

The figures below illustrate the more important components added in reaching the estimates.

TAXES ON LABOR

	1960	1965	1970	1975	1980
Individual Income	27	31	33	36	42
Social Security	5	5	7	10	11
Goods and Services	6	6	6	5	5
Property	4	3	4	5	5

TAXES ON CAPITAL

	1960	1965	1970	1975	1980
Individual Income					
Dividend	10	10	9	8	8
Interest	10	11	15	18	27
Corporate Income	32	28	26	23	31
Goods and Services	6	6	6	5	5
Property	4	3	4	5	5

Estimates of effective tax rates on the earnings of labor for the other four countries appear below.

TAXES ON LABOR

	United Kingdom	France	West Germany	Japan
1970	60	63	78	34
1973	57	63	80	35
1977	61	67	82	38

The figures below are averages among the three years to illustrate the more important components added to reach the above estimates. One can easily observe the greater

	United Kingdom	France	West Germany	Japan
Individual Income	31	30	45	20
Social Security	9	21	18	8

importance of social security in France and West Germany.

Estimates of effective tax rates on the earnings of capital for these countries appear below.

TAXES ON CAPITAL

	United Kingdom	France	West Germany	Japan
1970	62	48	48	35
1973	49	50	46	36
1977	50	48	47	29

Again averages of major components added appear below.

	United Kingdom	France	West Germany	Japan
Individual Income	18	14	22	2
Corporate Income	16	12	9	18

The results are of particular interest with regard to U.S. tax policy. Effective tax rates on the earnings of capital are highest in the U.S., especially when the likely overestimates for the United Kingdom are considered. In looking at changes in effective tax rates over time in the U.S., it appears that outside of 1980 only the effective tax rate on labor has been rising.

Internationally Mobile Capital

One need only look at the U.S. balance of payments capital account to realize that large flows of capital across national boundaries are present. Such flows are even more important in analyzing smaller national economies. International capital mobility breaks the link between domestic saving and investment. In terms of our capital stock model, international capital mobility breaks the link between capital held by domestic residents and capital employed in the domestic economy. (Residents hold financial capital that represents claims on

earnings of physical capital.) In such a world, concern turns to the effective tax rate on international capital.

Tax reciprocity agreements between countries represent one factor causing tax rates on international capital to differ from tax rates on domestic capital. It appears that most multinational corporations do not pay corporate income tax to their home nation on their non-expropriated foreign earnings. They are subject to corporate taxation, however, in their foreign host nations. A number of tax reciprocity agreements including a system of tax credits also govern individuals with earnings from foreign financial investments. It appears that most individuals are subject to their own nation's individual income tax with regard to earnings from international capital.

Since the payment of the domestic individual income tax is given, in a world with international capital investors are motivated to invest where their return gross of the individual income tax but net of all other taxes is maximized. This analysis does not address the issue of tax conflicts among nations but rather addresses the tax impacts of what is actually observed. Based on this analysis the effective tax rate on international capital is calculated as the effective tax rate on domestic capital net of that portion attributed to the individual income tax.

Estimates of these effective tax rates for the United States appear below.

TAXES ON INTERNATIONAL CAPITAL

UNITED STATES

1960	1965	1970	1975	1980
45	40	38	36	43

Estimates for the other four nations follow and are based on averages across the three years analyzed.

TAXES ON INTERNATIONAL CAPITAL

United Kingdom	France	West Germany	Japan
35	35	25	31

The United States has the highest rates, but for the 1970s these rates are close to those in the United Kingdom and France and are lower than U.S. rates in the 1960s. A striking result is that West Germany, the nation with the largest public sector in relation to NNP for the five nations, has the lowest effective tax rate. Of particular note is West Germany's large reliance on the individual income tax and France's large reliance on indirect taxation. This analysis is of special significance in the debate between income and consumption based taxes.

CONCLUSIONS

This paper first presents concerns associated with estimation of effective tax rates. The cost of capital approach has been used in numerous studies of effective tax rates across industries and asset groups. This approach is especially attractive in considering tax treatment of new investments, especially in the presence of investment tax credits and accelerated depreciation. This approach, however, is extremely limited when analyzing an economy-wide tax system. Of particular concern are the informational requirements and the treatment of owner-occupied housing. The flow of funds approach is more attractive than the cost of capital approach when analyzing an economy-wide tax system. A particularly severe problem, however, occurs when corporate tax policy changes; the flow of funds approach creates estimates based on tax treatment of old investments as well as tax treatment of new investments.

Using the flow of funds approach, estimates of effective tax rates on the earnings of labor, capital, and internationally mobile capital are presented for five OECD nations, the United States, the United Kingdom, France, West Germany, and Japan. This analysis can be grouped with other similar studies arguing that tax preference items have a larger impact on the distribution of tax burdens than on effective tax rates. In this regard, we would argue that attempts to broaden the tax base and lower marginal tax rates would lower effective (i.e., marginal) tax rates even while keeping government tax revenues constant.

We find that the United States taxes capital more heavily than the other four nations. Since the time period for this paper ends in 1980, the estimates do not reflect the tax changes introduced by the Reagan nor Thatcher administrations in the United States and the United Kingdom.

In light of the increased attention given to international capital mobility, the estimates of the effective tax rates on the earnings of international capital are of particular significance. These estimates draw attention toward needs to refine analyses of taxes in such an environment.

REFERENCES

Auerbach, Alan J., "Taxation, Corporate Financial Policy and the Cost of Capital," Journal of Economic Literature 21 (September 1983) 905-940.

Bailey, Martin J., "Capital Gains and Income Taxation," in Harberger, Arnold C. and Martin J. Bailey, eds., The Taxation of Income from Capital, The Brookings Institution, 1969.

Barro, Robert J. and Chaipat Sahasakul, "Measuring the Average Marginal Tax Rate from the Individual Income Tax," Journal of Business 56 (October 1983) 419-452.

Bradford, David F. and Don Fullerton, "Pitfalls in the Construction and Use of Effective Tax Rates," in Hulten, Charles R., ed., Depreciation, Inflation, and the Taxation of Income from Capital," The Urban Institute Press, 1981.

Denison, Edward F., Why Growth Rates Differ: Postwar Experience in Nine Western Countries, The Brookings Institution, 1967.

Denison, Edward F. and William K. Chung, How Japan's Economy Grew So Fast, The Brookings Institution, 1976.

Feldstein, Martin and Joel Slemrod, "Inflation and the Excess Taxation of Capital Gains on Corporate Stock," National Tax Journal 31 (June 1978) 107-118.

Feldstein, Martin and Lawrence Summers, "Inflation and the Taxation of Capital Income in the Corporate Sector," National Tax Journal 32 (December 1979) 445-470.

Fraumeni, Barbara M., "The Cost of Capital as a Guide to Tax Policy," presentation at the Meetings of the Southern Economic Association, November 1983.

Fraumeni, Barbara M. and Dale W. Jorgenson, "Capital Formation and U.S. Productivity Growth, 1948-1976," in Dogramaci, Ali, ed., Productivity Analysis: A Range of Perspectives, Martinus Nijhoff Publishing, 1981.

Fullerton, Don, A. Thomas King, John B. Shoven, and John Whalley, "Corporate Tax Integration in the United States: A General Equilibrium Approach," American Economic Review 71 (September 1981) 677-691.

Galper, Harvey and Eric Toder, "Measuring the Incidence of Taxation of Income from Capital," Brookings Technical Series Reprint T-026, 1983.

Gravelle, Jane G., "The Social Cost of Nonneutral Taxation: Estimates for Nonresidential Capital," in Depreciation, Inflation, and the Taxation of Income from Capital, opt. cit.

Hall, Robert E. and Dale W. Jorgenson, "Application of the Theory of Optimum Capital Accumulation," in Fromm, Gary, ed., Tax Incentives and Capital Spending, the Brookings Institution, 1971.

Harberger, Arnold C., "Efficiency Effects of Taxes on Income from Capital," in Krzyzuniak, M., ed., Effects of Corporation Income Tax, Wayne State University Press, 1966.

Hausman, Jerry A., "Labor Supply," in Aaron, Henry J. and Joseph A. Pechman, eds., How Taxes Affect Economic Behavior, The Brookings Institution, 1981.

Hayashi, Taizo, Guide to Japanese Taxes, 1978-79, Zaikei Shoho Sha, Tokyo, 1978.

Hulten, Charles R. and James W. Robertson, "Corporate Tax Policy and Economic Growth: An Analysis of the 1981 and 1982 Tax Acts," Urban Institute Discussion Paper, 1982.

Hulten, Charles R. and James W. Robertson, "The Taxation of High Technology Industries," Urban Institute Discussion Paper, 1983.

Joines, Douglas H., "Estimates of Effective Marginal Tax Rates on Factor Incomes," Journal of Business 54 (April 1981) 191-225.

Jorgenson, Dale W. and Martin A. Sullivan, "Inflation and Corporate Capital Recovery," in Depreciation, Inflation, and the Taxation of Income from Capital, opt. cit.

Kay, J. A. and M. A. King, The British Tax System, Oxford University Press, 1978.

King, Mervyn A. and Don Fullerton, Eds., The Taxation of Income from Capital: A Comparative Study of the U.S., U.K., Sweden and West Germany, University of Chicago Press, 1983.

Organization for Economic Co-operation and Development, Revenue Statistics of OECD Member Countries: 1965-1978, OECD, Paris, 1979.

OECD, Long-Term Trends in Tax Revenues of OECD Member Countries, 1955-1980, OECD, 1981a.

OECD, Income Tax Schedules: Distribution of Taxpayers and Revenues, OECD, 1981b.

Price Waterhouse, Individual Taxes in 80 Countries, Washington, 1976.

Price Waterhouse, Corporate Taxes in 80 Countries, Washington, 1976.

Price Waterhouse, Doing Business in the United Kingdom, 1975.

Price Waterhouse, Doing Business in Germany, 1978.

Price Waterhouse, Doing Business in France, 1978.

Shoven, John B., "The Incidence and Efficiency Effects of Taxes on Income from Capital," Journal of Political Economy 84 (December 1976) 1261-1280.

Steuerle, Eugene, "Is Income from Capital Subject to Individual Income Taxation?," Public Finance Quarterly (July 1982) 283-303.

Steuerle, Eugene, "Tax Arbitrage, Inflation, and the Taxation of Interest Payments and Receipts," Paper presented at a Conference of Wayne State University Law School, September 1983.

Steuerle, Eugene and Michael Hartzmark, "Individual Income Taxation, 1947-79," National Tax Journal 34 (June 1981) 145-166.

Tolley, George S. and William B. Shear, "International Comparison of Tax Rates and Their Effects on National Incomes," in Kendrick, John W., ed., International Comparison of Productivity and Causes of the Slowdown, Ballinger Publishing, forthcoming 1984.

Wright, Colin, "Saving and the Rate of Interest," in The Taxation of Income from Capital, opt. cit.