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THE MARGINAL EXCESS BURDEN OF DIFFERENT CAPITAL TAX INSTRUMENTS

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ABSTRACT

Marginal excess burden, defined as the change in deadweight loss for an additional dollar of tax revenue, has been measured for labor taxes, output taxes, and capital taxes generally. This paper points out that there is no well-defined way to raise capital taxes in general, because the taxation of income from capital depends on many different policy instruments including the statutory corporate income tax rate, the investment tax credit rate, depreciation lifetimes, declining balance rates for depreciation allowances, and personal tax rates on noncorporate income, interest receipts, dividends, and capital gains. Marginal excess burden is measured for each of these different capital tax instruments, using a general equilibrium model that encompasses distortions in the allocation of real resources over time, among industries, between the corporate and noncorporate sectors, and among diverse types of equipment, structures, inventories, and land.

Although numerical results are sensitive to specifications for key substitution elasticity parameters, important qualitative results are not. We find that an increase in the corporate rate has the highest marginal excess burden, because it distorts intersectoral and interasset decisions as well as intertemporal decisions. At the other extreme, an investment tax credit reduction has negative marginal excess burden because it raises revenue while reducing interasset distortions more than it increases intertemporal distortions. In general, we find that marginal excess burdens of different capital tax instruments vary significantly. They can be more or less than the marginal excess burden of the payroll tax or the progressive personal income tax.

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A substantial literature since Arnold Harberger (1962, 1966) has been devoted to measuring the total excess burden of different major tax instruments.[1] Economic policy, however, rarely contemplates the wholesale replacement of entire tax systems. For this reason, a more recent literature has emphasized measures of "marginal excess burden," the increment to total welfare cost associated with one dollar of additional revenue from each tax source.[2] The concept and measurement of marginal excess burden are important in two respects. First, the marginal benefits of a properly designed public project should cover all social costs, including the marginal dollar expenditure plus the marginal excess burden.[3] Second, for a fixed level of expenditures, the overall efficiency of the tax system can be improved by relying less on taxes with high marginal excess burden and more on taxes with low marginal excess burden. The present paper contributes by providing new measures of marginal excess burden for a variety of capital tax instruments in the U.S. and by comparing them to the marginal excess burdens for other categories of taxation. We find substantial variation in the results for different components of capital taxation, including some examples of marginal excess benefit rather than burden.

I. Introduction

Browning (1976) originally estimated that the addition to excess burden from taxes on labor income ranged from 9 to 16 cents per marginal dollar of revenue. Stuart (1984) employs a fairly simple general equilibrium model to find that excess burden from labor taxes centers around 21 cents per marginal dollar of revenue. Other assumptions generate estimates as low as 7 cents or as high as 99 cents. Ballard, Shoven, and Whalley (BSW, 1985) employ a more complex model that allows them to compare taxes on labor, consumption, and capital income. Overall marginal excess burden centers around 33 cents per dollar of revenue but varies between 17 and 56 cents, depending on assumptions. For most of their combinations of labor supply and savings elasticities, they find that capital taxes are more distorting than proportional labor taxes. Output taxes and progressive income taxes are in between. For Sweden's 70 percent aggregate marginal tax rate, Hansson and Stuart (1985) find excess burdens centering around $1.29 per marginal dollar of revenue. Finally, Judd (1987) uses a stylized model with perfect foresight and infinitely lived individuals to find that a dollar raised by a permanent (a) tax on capital usually costs at least an extra 25 cents, (b) tax on labor usually costs less than 15 cents, and (c) reduction in the investment tax credit generally costs more than a dollar.

None of these studies considers specific ways to raise taxes on income from capital. The BSW model takes average effective tax rates, measured by capital taxes paid as a fraction of capital income for each industry, and assumes that these rates also apply to marginal investment. Yet the future taxes on a marginal investment may differ significantly from the observed taxes on existing investment. They then calculate marginal excess burden from increasing all industries' average effective tax rates, though this effective rate increase does not correspond to any specific policy. The model in this paper employs explicitly marginal effective tax rates -- or, equivalently, user costs of capital. It thus captures distortions in the allocation of capital at the margin, and it allows calculation of excess burden associated with raising revenue through higher statutory corporate tax rates, higher capital gains taxes, slower depreciation allowances, lower investment tax credits, or increased personal taxes on interest or dividend income. For comparison, we also compute marginal excess burden for labor taxes and for progressive personal income taxes.

For any given set of assumptions, differences among these tax instruments are substantial. We find that the range of marginal excess burdens among the various capital tax instruments is larger than the difference found by BSW between labor taxes and capital taxes. In fact, some changes in capital taxation have negative marginal excess burden because they raise revenue while reducing distortions.

All taxes on new investment income have the same distortionary effect on the timing of consumption in our model. They all raise the price of saving and postponing consumption until the future, as opposed to consuming in the present. They therefore increase the intertemporal distortion caused by taxes. However, capital taxes may differ in three other respects. First, some tax instruments apply differentially to investments in different assets. Depreciation allowances that differ from economic depreciation can distort the choice among various types of equipment or structures, while the investment tax credit distorts the allocation between equipment and other types of capital. Raising taxes by reducing depreciation allowances or the investment tax credit would therefore reduce tax-based interasset distortions, ignored by Judd (1987) and others discussed above. Our model includes interasset distortions among 38 individual asset categories.

Second, some tax instruments apply differentially to different sectors of the economy. Capital income in the unincorporated business sector is subject to the personal income tax, while equity-financed capital in the corporate sector pays an additional corporate tax and the imputed net rents in the owner-occupied housing sector go tax-free. A policy of increasing the statutory corporate tax rate, for example, would exacerbate these existing intersectoral distortions, also ignored in studies discussed above.

Third and finally, tax instruments may differ in their impact on capital that has already been put in place. For example, an increase in a statutory rate collects lump-sum revenue from old capital, whereas cutbacks in depreciation allowances or credits confer a lump-sum benefit to old capital relative to new capital. Because it encompasses all of these economic effects, our model is able to distinguish the excess burdens from using different capital tax instruments to raise revenue.

This introduction is followed by sections about the model, results, and conclusions.

II. The Model

Browning (1987) argues that marginal excess burden depends less on the choice between partial and general equilibrium models and more on the choice of specifications for the marginal effective tax rates, the degree of progressivity, the labor supply elasticities, and the government's use of the revenue. Once those dependencies are recognized, however, the results of a partial equilibrium analysis can still be improved by imbedding those specifications in a general equilibrium model. Moreover, Browning looked only at taxes in one market, the labor market. The comparability of taxes on labor and capital requires both markets in a single model, one which must therefore be a general equilibrium model. In this case, to compare capital tax instruments with differential effects on distortions among assets or between sectors, we employ a general equilibrium model where such choices are endogenous.

The general equilibrium model in this paper consists of four major components. First, the household side and part of production are taken from the BSW model, as fully described in the book by Ballard, Fullerton, Shoven, and Whalley (1985). Second, the model of marginal effective tax rates for each asset in the corporate and noncorporate sectors is taken from Fullerton and Henderson (1984). Third, detailed production functions allow endogenous choices among assets and sectors, from Fullerton and Henderson (1986). Finally, the model allows the tax treatment of old capital to differ from that of new capital.

A. <u>The Household Side</u>

In our model, twelve income-differentiated households have initial endowments of labor and capital that can be sold for use in production. As indicated in the top part of figure 1, each household maximizes a nested utility function by making an initial allocation of resources between present and future consumption in a constant elasticity of substitution (CES) form. The elasticity of substitution is set to be consistent with an exogenously specified aggregate estimate for η, the uncompensated saving elasticity with respect to the net rate of return.[4]

The total stock of capital is fixed in any one period, but it is fully mobile among assets, sectors, and industries. In evaluating alternative tax policies, we simulate a sequence of equilibria in which the capital stock increases as a result of saving in the previous period. The current rate of return is the myopically expected future rate of return. Domestic saving is the only vehicle by which investment can be affected, since the model is not open to international capital flows.[5]

With present resources, as indicated in the next level of figure 1, a household can choose to buy some of its own labor endowment for leisure. The constant elasticity of substitution between consumption and leisure is based on an exogenously specified aggregate estimate of ξ, the uncompensated labor supply elasticity with respect to the net-of-tax wage.[6] The twelve income groups face tax rates that range from 1 percent to 40 percent of personal marginal income. Present consumption expenditures are then divided among 15 consumer goods according to a Cobb-Douglas subutility nest. Each consumer good is a fixed-coefficient combination of outputs of the 18 industries. The model includes the entire spectrum of federal, state, and local taxes, typically modeled as _ad valorem_ rates on appropriate products or factors.

B. Costs of Capital and Marginal Effective Tax Rates

For capital costs in production, the BSW model uses average effective tax rates based on observed tax payments by industry. As in Fullerton and Henderson (1984), by contrast, we specify that each sector of each industry faces a Hall-Jorgenson (1967) cost of capital for each asset type.

We model the perfectly competitive corporation contemplating a new investment as follows.[7] An investment tax credit at rate k reduces the net cost of the asset to (1-k). The rental return increases at the constant inflation rate π and decreases because of exponential depreciation at rate

δ. Local property tax at rate w is paid on the asset's value at any point in time, and the return net of property tax is subject to the corporate income tax at statutory rate u. These net returns are discounted at the firm's nominal after-tax discount rate r. The present value of depreciation allowances per dollar of investment is z, so the present value of tax savings is uz. In equilibrium, then, the net outlay must exactly match the present value of net returns. This condition can be used to solve for ρ^c, the real social return in the corporate sector, gross of tax but net of depreciation:

$$(1) \quad \rho^c = \frac{r-\pi+\delta}{1-u}(1-k-uz) + w - \delta.$$

All 38 assets in the corporate sector have the same values for r, π, and u, but each has a specific value for δ, k, z, and w. By replacing u and the corporate discount rate by the noncorporate entrepreneur's personal marginal tax rate and the corresponding discount rate, we derive a similar expression for ρ^{nc}, the pretax return in the noncorporate sector. Finally, owner-occupied housing has an analogous expression that reflects its special tax treatment.

To compute the rates of discount r in each sector, we assume that individuals hold debt and equity issued by all three sectors, and that they arbitrage away any differences in net rates of return. Under our arbitrage assumption, all assets must provide the real net return that individuals could earn on their debt holdings. The resulting discount rate for each sector is a function of the shares and tax rates for the separate sources of finance -- debt, retained earnings, and new share issues. We assume that the financial decision is exogenous.[8] For further details, see the discussion of individual arbitrage in the appendix to Fullerton and Henderson (1984).

Although investment incentives are properly measured in the model by the pretax returns ρ, we present many of our results in terms of marginal effective tax rates:

(2) $t = \frac{\rho - s}{\rho}$,

where s is the return net of all taxes. These effective rates show the portion of capital costs attributable to taxes. They reflect the combination and interaction of corporate taxes, property taxes, and personal taxes.

C. The Production Side

The first two stages of production are similar to the BSW model, as indicated in figure 1. First, producers have fixed requirements of intermediate inputs and value added per unit of output. Second, they can substitute between labor and capital in the CES value-added function. At this stage, however, we depart from the BSW model which constructs capital costs from observed tax payments. As indicated in the bottom of figure 1, the general equilibrium model is supplemented by two new stages of production from Fullerton and Henderson (1986). Once total capital expenditures are determined for each industry, separate cost-of-capital expressions are used to determine the division among the corporate, noncorporate business, and owner-occupied housing sectors. Within each sector of each industry, individual cost-of-capital calculations are used to determine demand for up to 38 different asset types. These assets include 20 types of equipment, 15 types of structures, inventories, and land in each sector.

The user costs for individual asset types depend on exogenous statutory specifications and on the endogenous real after-tax rate of return, s, determined in equilibrium. Composite capital in the corporate sector of each industry, K_j^c, is a CES combination of the 38 assets:[9]

$$(3)\quad K_j^c = \left[\sum_{i=1}^{38} (\alpha_{ij}^c)^{\frac{1}{\varepsilon}} (K_{ij}^c)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} .$$

The elasticity of substitution among assets, ε, is specified exogenously. The α_{ij}^c weights are derived from data on capital stocks by asset and industry in 1984. Cost minimization of (3) based on individual asset costs yields a demand for each asset. It also yields a composite cost of capital:

$$(4)\quad \rho_j^c = \left[\sum_{i=1}^{38} \alpha_{ij}^c \, (\rho_i^c)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} .$$

The noncorporate sector has similar composites of 38 assets in each industry. The owner-occupied housing sector also has composite capital stocks and capital costs, but it is assumed to use only two assets (residential structures and land).

Capital in each industry is another CES function of K_j^c and K_j^{nc}, the composite capital stocks from each sector. (The real estate industry uses a composite of K_j^{nc} and K_j^h, the composite capital from owner-occupied housing.) The elasticity of substitution between corporate and noncorporate capital, σ, is also prespecified.[10] Finally, for each industry, cost minimization based on sectoral composite costs of capital (in equation 4) yields a demand for composite capital in each sector, and it yields a composite cost of capital for the industry.

Each industry has a different mix of assets in each sector, as well as a different mix of sectors, all determined endogenously. Different tax treatments imply that each use of capital has its own pre-tax rate of return, or marginal product, even though they all generate the same after-tax rate of return. Capital is homogeneous and perfectly mobile, so this net rate of return adjusts. When the total use of capital equals the total available supply, we have equilibrium in the capital market; when other markets clear as well, we have a general equilibrium.[11]

This extension of the production side of the model is important because the choices of ε and σ, as well as of η and ξ, have much bearing on the relative size of different distortions and therefore on the relative attractiveness of alternative sources of revenue. If ε is high, for example, then changes in the relative tax treatment of different assets would result in a more significant change in the firm's production. A high value for ε would therefore imply relatively low marginal excess burden from revenue acquired by reducing depreciation allowances or the investment tax credit, since these tax instruments have a differential effect on assets in the baseline. If σ is high, then the sectoral allocation of capital would be quite sensitive to changes in the relative tax treatment of corporations and noncorporate entities, such as through changes in the statutory corporate tax rate. The choice of η, the savings elasticity, matters for aggregate capital accumulation. If η is high, then increased taxation of the return to capital income would result in a higher saving response, and therefore a higher marginal excess burden, than in the case where η is low. Finally, the value of ξ affects primarily labor supply. Together, the pre-specified values for η and ξ determine the relative marginal excess burdens for capital taxes and labor taxes.

D. The Possibility of Lump-Sum Revenue

When minimizing excess burden subject to a revenue requirement, analysts typically assume that lump-sum taxes are not available. This is often a reasonable assumption. Government cannot continue to acquire nondistorting revenue by surprising taxpayers period after period. In the steady state, then, we expect the marginal effective tax rate on capital income to equal the average effective tax rate (the ratio of total taxes collected to total income from capital). Ballard, Shoven, and Whalley (1985) estimate only average effective tax rates and use those for marginal investment, but in Fullerton and Henderson (1986), we estimate marginal effective tax rates and use those to indicate capital tax revenues in the steady state.

Lump-sum revenue effects might be associated with tax changes, however, especially those of the type we consider in this paper. A new higher corporate rate, for example, applies to income from existing assets and can generate more tax than the investors expected when they first put those assets in place. Indeed, tax changes can generate all kinds of windfall redistributions among households and government, as discussed by Auerbach and Kotlikoff (1983), Summers (1985), and Goulder and Summers (1987). These amounts are particularly important for the calculation of marginal excess burden, because they affect revenue change in the denominator but not excess burden in the numerator. They thus necessitate another new feature of our model.[12]

If marginal revenue is acquired through a reduction of investment tax credits, then the increase in the marginal effective tax rate applied to capital in each use would overstate the amount of revenue actually forthcoming. Our model first calculates revenue based on the new higher marginal effective tax rate, but it then calculates for owners of old capital the lump-sum subsidy they receive from government by not having to pay the new higher marginal effective tax rate. They actually receive this subsidy in the form of asset price appreciation, since investors receive a lower investment tax credit for new assets and are therefore willing to pay a little more for old assets of the same type. To calculate this subsidy, our model converts the one-time investment tax credit to an equivalent annual fraction of remaining capital each year, calculates this annualized investment tax credit for each asset both before and after the change, and then obtains the annual lump-sum subsidy as the difference between these rates applied to the original capital of each asset type as it depreciates over time. The present value of this stream is the windfall received by owners at the time of the change.

Depreciation changes are modeled in analogous fashion. We convert the actual sequence of deductions into the present-value-equivalent annual fraction of remaining capital, take the tax effect of the change in this annualized deduction as the annual lump-sum change in revenues (and in capital incomes), and apply this rate to old capital as it depreciates over time. If the marginal dollar of revenue is obtained by lengthening lives or reducing declining balance rates, then the owners of old capital receive this windfall, a subsidy relative to the higher marginal effective tax rate on new investment.

For an increase in corporate or noncorporate statutory rates, the marginal effective tax rate calculation incorrectly indicates revenue for depreciable assets. Since depreciation allowances enter the marginal effective tax rate only through uz in equation (1), those revenue calculations would be correct for any asset that received a deduction for a constant fraction of real income each year. For example, this would be true for deductions based on economic depreciation at replacement cost. The problem arises because actual allowances follow a different time pattern. Even if they have the same present value as economic depreciation at replacement cost, actual allowances tend to be accelerated (frontloaded) rather than indexed (backloaded). Thus, relative to the revenue implied by the marginal effective tax rate, assets already received more of their deductions at the previous lower rate and will receive fewer of their deductions at the new higher rate. For these assets, the rate increase thus acquires more revenue than implied by marginal rates. Therefore, we adjust revenues upward for old capital in each year following the rate change. The extra revenue is the change in the statutory rate applied to the difference between actual deductions and those implied by the marginal rate calculation. Actual deductions in each year are estimated from a constructed history of investment and the time pattern of deductions specified by the tax code.[13]

Finally, an increase in the personal taxation of dividends also can generate lump-sum tax. The shares were issued and the investments were put in place under the expectation of one rate of tax on future distributions, so a new permanently higher rate might be capitalized into the value of the shares. Stockholders experience a windfall loss equal to the present value of the increase in future tax payments. We calculate this lump sum tax by equivalent annual amounts equal to the dividend payments on depreciating old capital times the increase in rate. There is no lump-sum tax adjustment associated with changes in the personal taxation of interest or capital gains in this model.[14]

E. Data and Calibration

Using national income and product accounts from the Commerce Department, we update to 1984 the general equilibrium data set for 1973 used by BSW. For marginal effective capital tax rates, we also use 1984 values for statutory rates, credits, and depreciation allowances as summarized in Fullerton (1987).

Once the crucial elasticity parameters are specified exogenously, the benchmark data set can be used in demand and production functions to solve for other weighting parameters. This calibration ensures that the baseline 1984 data set represents an equilibrium solution to the model using those weighting parameters, elasticities, and 1984 tax rates. Labor force growth also is specified so that the baseline 1984 data set lies on a steady state growth path.

Alternative equilibrium sequences are then generated by slight variations in any 1984 tax or credit rate. At each trial price vector, the model calculates new capital costs and allocations, new labor supplies and demands, and new production and consumption vectors. After an equilibrium is found, all prices and quantities are compared to the baseline by calculating the present value of equivalent variations. Finally, the aggregate welfare change is compared to the corresponding present value revenue change to calculate the excess burden per marginal dollar of revenue.

F. Simulation and Sensitivity

Following BSW, we calculate marginal excess burdens by simulating a one-percent increase in tax rates. Each capital tax instrument, for example, is changed by enough to raise the overall marginal effective tax rate on capital by one percent. In each experiment, 6 equilibria are calculated 10 years apart, so our total simulation interval is 50 years. For comparability with BSW, all our simulations assume that transfers to households are fixed in real terms while marginal revenues are used by government for proportional increases in other expenditures. Implicitly, therefore, public goods enter utility in a separable manner.[15]

The "standard" set of parameters includes $\varepsilon = 1$ and $\sigma = 1$, the Cobb-Douglas case for assets and sectors in production. We also use $\eta = 0.4$, the savings elasticity estimate of Boskin (1978) used by BSW. Finally, $\xi = .15$ is the central value for the uncompensated labor supply elasticity used by BSW. Our strategy in constructing alternatives is to pick combinations that point out the likely range of welfare effects from alternative policies. We consider values of ε and σ between 0.3 and 3, values of η between 0 and 0.8, and values of ξ between 0 and 0.3. As we stressed in our earlier literature review (Fullerton and Henderson, 1986), existing econometric work on subsitution elasticities does not consider the number of assets we include in this model. Neither does it attempt specifically to measure a sectoral substitution elasticity. There remains considerable uncertainty about these parameter values.

III. Results

A. Effective Tax Rates in the Baseline

Before reporting simulation results, it is worth noting levels and differences in effective tax rates in the 1984 baseline. As indicated in table 1, the average marginal effective tax rate on capital income is 33.6 percent, with a standard deviation of 7.6 percentage points. The overall rate in the corporate sector is only 37 percent, despite the combination of corporate and personal taxes, because of the combined effect of credits, allowances, and interest deductions. This rate is only slightly higher than the 35 percent overall rate in the noncorporate sector, because the noncorporate sector uses a higher proportion of highly taxed assets such as land and inventories. Also, the corporate sector receives a subsidy when it uses debt finance, since interest payments are deducted by corporations at a higher rate than they are included in the taxable income of individuals. Owner-occupied housing has a 23 percent effective rate, largely comprised of local property taxes.

Within the corporate sector, effective rates for equipment are near zero, ranging from -4 percent (for office and computing machinery) to +3 percent (for railroad equipment). Effective taxation of structures is much higher, since these do not qualify for the investment tax credit and since depreciation allowances are less generous. These rates lie between 32 and 48 percent. Tax rates for public utility property are generally somewhat lower than those for other structures, since they do receive an investment tax credit. Finally, tax rates for inventories and land are above 48 percent. These assets do not receive special tax incentives (other than the subsidy to corporate debt, which is common to all assets). The noncorporate business sector exhibits similar interasset variations. For further details, see Fullerton and Henderson (1986).

By contrast, the averages for other taxes we consider in our simulations are lower (see table 1). Labor taxes levied on industry include contributions for social insurance, workmen's compensation, and railroad retirement.

Following BSW, we treat these as pure taxes rather than netting out the transfer payments associated with these tax contributions. The average rate for these labor taxes is 12.7 percent, with a standard deviation of 1.2 points. Our twelve household groups face marginal personal income tax rates as high as 40 percent. The income-weighted average of these rates is 25.5 percent, with a comparatively high standard deviation of 9.8 points.

We could also examine the other taxes studied by BSW. We choose not to do so, because our model does not introduce innovations for output or sales taxes, and because the inclusion of labor and personal income tax rates in our experiments appears to provide enough basis for comparison of results.[16]

B. <u>General Equilibrium Simulations</u>

Table 2 presents marginal excess burdens from raising revenues in different ways, using our standard set of assumptions on elasticities. The first column shows results based on revenue given only by marginal effective tax rates, with no adjustment for lump-sum taxes. These may be relevant for steady state comparisons, but not for actual revenue acquired through each of these tax instruments. The second column shows results with lump-sum revenue adjustments, and we will refer primarily to these calculations. We compute for comparison the marginal excess burdens from raising industry tax rates on labor, and from raising personal income tax rates. These marginal excess burdens are 18 and 26 cents, respectively, slightly below the standard estimates of BSW. Progressive personal taxes reach higher rates and are therefore more distorting than proportional labor taxes.

For capital taxes, the overall impression is that the marginal excess burden differs considerably across specific tax instruments. The marginal excess burden may be either higher or lower than that resulting from changes in labor or personal income taxes; it may even be less than zero.[17] We find that increasing the corporate statutory rate has a relatively high excess burden but policies of reducing allowances for capital cost recovery have negative marginal excess burdens. None of these capital taxes in our model has a marginal excess burden as high as the 46-cent figure found by BSW for capital taxation in general. This is not surprising, in that our marginal effective tax rates are lower and less variable than their average effective tax rates.

From an efficiency standpoint, the most favorable policy is reduction of the investment tax credit; under the standard parameters the marginal excess burden is a negative 37 cents. This result contrasts sharply with that of Judd (1987). He found the highest marginal excess burden from reducing the investment tax credit, but his infinite-life model emphasizes intertemporal effects and excludes interasset effects.

Our negative marginal excess burden arises because the values for effective tax rates on equipment are the lowest in our baseline: they average about zero for the corporate sector, and are actually below zero (that is, effectively subsidies) in the noncorporate business sector. The rates for public utilities, which also receive the investment tax credit, are low compared to most other taxes on capital. Thus the efficiency gain from lowering the dispersion in effective tax rates in this manner more than offsets the loss on the intertemporal margin. It should be noted that these results also capture the inefficiency of providing a lump-sum subsidy to old capital. This subsidy alters the marginal excess burden only slightly, however, compared to column 1. Equipment depreciates comparatively rapidly, so the amount of old equipment is significant only in the first equilibrium period.[18]

The next simulations present two alternative methods of tightening up on depreciation allowances: multiplicative scaling of tax lifetimes and multiplicative scaling of declining balance rates for the various assets.[19] These two ways of raising capital tax revenue have comparatively low marginal excess burdens because they increase the taxes paid on depreciable assets relative to the more heavily-taxed nondepreciable assets. Of the two methods, the equiproportional increase in tax lifetimes is more advantageous from the standpoint of efficiency because it causes a comparatively greater increase in the effective taxation of equipment, the lowest taxed asset.

The remaining simulations for capital taxation consider increases in statutory rates. Raising the corporate tax rate results in a relatively high marginal excess burden of 33 cents because it widens the disparity between the effective taxation of the corporate sector and the unincorporated sectors, as well as increasing the distortions on the intertemporal and interasset margins. The reason for the increase in disparity in taxation across assets is that the rise in the statutory rate increases the value of depreciation deductions, thereby conferring a relative benefit to the already low-taxed depreciable assets.

If we raise the statutory rate for owners of noncorporate businesses as well as for corporations, then the marginal excess burden is reduced to 27 cents because of the less unfavorable effect on intersectoral distortions. Still, this change increases the distortion between business capital and housing, relative to our baseline. Also, because we scale up statutory rates in both sectors by the same multiplicative constant, and because the statutory rate in the corporate sector is higher than in the noncorporate sector, the simulation is still not neutral in its comparative effect on these two business sectors.

We also examine the impacts of changing personal tax rates on capital gains, dividends, and interest income. Since the source of finance is exogenous in our model, we do not capture efficiency effects on the choice among financial instruments. Also, we model the capital gains tax as an accrual tax, so we do not capture distortions in decisions to realize gains. Instead, these changes primarily affect the intersectoral and intertemporal margins. The marginal excess burden for the capital gains rate is 22 cents. Like the change in the statutory corporate rate, it raises the effective rate in the corporate sector still further above the effective rates for unincorporated businesses and housing. The efficiency cost is less than that associated with raising the corporate statutory rate, however, because the capital gains tax has more neutral effects on interasset distortions. As noted above, an increase in the statutory corporate rate raises the value of depreciation deductions and therefore lowers the relative increase in the tax on depreciable assets (which are initially taxed at low rates) compared to nondepreciable assets (which are initially taxed at higher rates). By contrast, the change in the capital gains rate does not introduce this new interasset distortion.

As can be seen from column 1 of table 2, the taxation of dividends enters the model in a way similar to the taxation of capital gains. The difference in the calculated excess burdens in column 2 is entirely explained by differential lump-sum effects. Because we model capital gains taxation as an accrual tax, its increase does not affect the entire amount of unrealized gains. Although we were motivated to choose this modeling specification largely for reasons of simplicity, we note that legislation introducing higher tax rates on capital gains typically delays implementation in order to allow investors to realize their existing gains at the previous rate. An increase in the tax rate on dividend income, by contrast, has a large lump-sum component because it affects the full amount of equity that investors have amassed in corporations. This lump-sum element adds to the revenue collected without introducing economic distortions. Therefore we measure that the marginal excess burden from another dollar of dividend taxes is only 4 cents.

The marginal excess burden for interest income also is low. This change increases tax payments of those who hold debt in all three sectors, so we would expect it to be more neutral in its intersectoral effects than increased taxes on dividends or capital gains. In our model, this change in tax policy actually reduces intersectoral distortions because of the arbitrage assumption described in section IIB. Raising the tax rate on interest income raises the interest rate needed for a given after-tax rate of return. This increased interest rate is relatively advantageous to the corporate sector because interest is deducted at a statutory rate that exceeds those in the other two sectors. Therefore, the gap between the effective rate for corporate capital and other types of capital is actually reduced in this simulation.

C. Sensitivity Analysis

One set of sensitivity experiments involves varying factor supply elasticities. Table 3 displays some representative results. As expected, increases in the labor supply elasticity raise the marginal excess burden from the labor tax and personal income tax experiments, while increases in the saving elasticity raise the marginal excess burden from the corporate tax and personal income tax experiments. However, the permutations of labor supply elasticities between 0 and 0.3 and of saving elasticities between 0 and 0.8 do not change the relative rankings of our tax instruments. Under all cases, increases in the statutory corporate income tax rate are always the most distorting, decreases in the investment tax credit are the least distorting, and increases in personal income tax rates and labor tax rates are always in between.

Figure 2 summarizes the results for variations between 0.3 and 3.0 for the asset substitution elasticity, ε, and the sector substitution elasticity, σ. (The appendix shows the underlying numerical findings in detail.) A low value for ε raises the marginal excess burden from reducing the rate of investment tax credit or depreciation allowances, but it generally lowers the marginal excess burden of raising statutory rates. A low value for σ tends to reduce the marginal excess burden for most of our simulated changes in capital tax instruments. Under extreme assumptions for these elasticity parameters, a deceleration of depreciation allowances through a reduction in declining balance rates may have a marginal excess burden higher than that for personal income taxes. Under different extreme assumptions, an increase in the statutory corporate rate may have a marginal excess burden lower than that for personal income taxes. The change in burden associated with reducing the investment tax credit or lengthening tax lives continues to compare favorably with those for other revenue sources. The highest estimated marginal excess burden is 75 cents, from increasing the corporate rate when both ε and σ equal 3.

IV. Conclusion

Our paper has demonstrated a large variation in marginal excess burdens from capital tax instruments. Under our central assumptions for elasticity parameters, and using the 1984 U.S. tax structure as a base, an extra dollar of public spending financed by higher statutory corporate income tax rates would have to produce marginal benefits of at least $1.33 in order to improve social welfare. By contrast, the required marginal benefit for a project financed by reduced investment tax credits would be only 63 cents. These values bound the results for other capital tax instruments, labor tax rates, and personal income tax rates.

It may be argued that a more fully developed model would find similar variation in marginal excess burdens for other tax instruments. In the area of personal income taxation, for example, we might expect that the marginal excess burden from lowering the standard deduction to be different from the marginal excess burden from restricting the deductibility of charitable giving. However, existing simulations of changes in the marginal rate of tax on personal income at least involve a parameter that can be altered by legislation in a well-defined way. By contrast, the marginal effective tax rate on income from capital is inherently an amalgam of separate tax instruments. Our study has measured the marginal excess burdens from each of these instruments, taking into account their individual effects on decisions about asset use and sectoral concentration, as well as effects on old capital relative to new capital.

Footnotes

[1] Taxes can distort labor supply, saving, housing, financing, risk-bearing, trade, and other economic decisions. The voluminous excess burden literature is reviewed in chapters of Auerbach and Feldstein, editors, Handbook of Public Economics (1985).

[2] See, for example, Browning (1976, 1987), Usher (1982), Stuart (1984), Ballard, Shoven, and Whalley (1985), Hansson and Stuart (1985, 1986), and Judd (1987).

[3] See Dasgupta and Stiglitz (1972), Atkinson and Stern (1974), and King (1986).

[4] We do not keep the savings elasticity (η) fixed across policy simulations. Rather, we use econometric estimates of η only to suggest a reasonable value for the elasticity of substitution between present and future consumption. This structural parameter of the utility function does not vary across policies, so the model is not subject to the Lucas (1976) critique. We examine alternative savings elasticities only to suggest reasonable alternative starting points for the structural parameter.

[5] These assumptions affect the results. Ballard and Goulder (1985) show how results depend on static expectations compared to perfect foresight. Summers (1981) shows how results can change with wealth effects and multiperiod planning in a life-cycle model. Judd (1987) uses perfect foresight with infinitely lived consumers. Also, Goulder, Shoven and Whalley (1983) show how international capital flows can alter or even reverse the relative ranking of different tax reforms.

[6] As before, the specified value for the labor supply elasticity is used to find an appropriate value for the elasticity of substitution between consumption and leisure. This structural parameter then remains fixed across policy simulations.

[7] We assume that the firm makes this investment under conditions of certainty, and that it has sufficient tax liability to take associated credits and deductions. The effects of uncertainty and imperfect loss offsets are investigated in Auerbach (1986) and Auerbach and Poterba (1987). We also assume that the firm does not resell the asset. The incentive to churn assets is studied in Gordon, Hines, and Summers (1987).

[8] Marginal excess burden results could be different if highly-taxed assets systematically use more tax-favored debt. Also, our model considers distortions in the allocation of real assets only. With endogenous financial decisions, corporate rate increases would reinforce the tax advantages of debt over equity and thus exacerbate financial distortions.

[9] Actually, this is an allocation over the assets that the firm uses in the baseline data. Firms cannot substitute into assets that were not used in the baseline (where initial $K_{ij}^{C} = 0$). Also, land is one of the 38 assets in equation (3). Any given industry might use more or less land in a new equilibrium, even if land were in fixed total supply. Moreover, the total use of land in the three productive sectors of this model may increase at the expense of vacant or unused land. Finally, we include inventories in equation (3), because some capital must be allocated to stocks of inputs and/or stocks of output in order to provide the final product or service.

[10] Little is known about the incorporation decision of firms. The CES functional form is intended only as a representation of capital allocation, and of the possibility that it is responsive to tax differentials. Furthermore, we treat labor as homogeneous in the sense that it can be combined either with corporate or noncorporate capital in each industry. An alternative structure might combine labor and capital in each sector to make separate corporate and noncorporate outputs.

[11] Imperfect mobility and adjustment costs are investigated, for example, in Goulder and Summers (1987).

[12] Agents in our model are surprised by any tax change but then expect the new tax regime to remain in place forever. Tax changes could generate additional distortions through time consistency problems, however, if they were to increase subjectively held probabilities of subsequent tax changes.

[13] We ignore the fact that some capital existing in 1984 was being depreciated under rules specified by earlier law.

[14] For the tax on interest income, the absence of a lump-sum effect means that all debt is short term. For the capital gains tax, it means that all pre-existing gains are realized before the higher rate takes effect.

[15] Marginal excess burden results could be higher or lower, respectively, if the marginal revenue were used to provide public goods that were complementary to leisure or to labor.

[16] We also choose not to repeat the BSW experiment of raising all tax rates simultaneously. In our model there is no single way to raise capital taxes by the same proportion as labor taxes. Moreover, in neither model is there a single way to define marginal excess burden for the whole tax system. Any combination of changes corresponds to a particular set of weights for the different tax instruments. For example, raising all rates proportionately is different from raising all sources of revenue proportionately.

[17] The interpretation of marginal excess burden can be difficult. Higher tax rates generally increase the marginal excess burden ratio up to the peak of the Laffer curve, where the increment to revenue becomes zero in the denominator. Beyond that point, marginal excess burden is negative because the increment to revenue is negative. In this paper, increments to revenue are always positive, and marginal excess burden is negative only when excess burden falls in the numerator. In all cases, however, efficiency is improved the most by using the tax instrument with the largest negative ratio of marginal excess burden. In the Laffer case, this means acquiring revenue by reducing the tax rate.

[18] Comparing columns 1 and 2 of Table 2, we see that the lump-sum adjustment increases the absolute value of the negative marginal excess burden associated with the investment tax credit, but only because (a) the lump-sum subsidy to owners of old capital implies a loss of revenue, and (b) the distorting investment tax credit must be reduced further to get back the same dollar of revenue.

[19] The law in 1984 allowed 150 percent of the straight line rate for equipment and 175 percent of the straight line rate for structures, where these rates apply to a basis that declines as allowances are taken. Legislators typically consider lowering declining balance rates or increasing lifetimes when they consider raising revenues through a change in depreciation allowances, since these parameters are familiar to them. As the simulation results indicate, however, the effects of changing declining balance percentages may be quite different from the effects of changing lifetimes.

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Table 1

Characteristics of Tax Rates in the Model

	Weighted Mean of Marginal Tax Rates[a]	Weighted Standard Deviation	Coefficient of Variation
Capital Taxes	.336	.076	.227
Labor Taxes	.127	.012	.092
Personal Income Taxes	.255	.098	.386

[a]Tax rates are expressed as a fraction of the appropriate category of gross income.

Table 2

Marginal Excess Burdens of Raising Extra Revenue from Specific Portions of the Tax System
(Standard Elasticities: $\xi=.15$, $\eta=.4$, $\varepsilon=1$, $\sigma=1$)

	Without Adjustment for Lump-Sum Taxes	With Adjustment for Lump-Sum Taxes
I. Capital Tax Instruments		
A. Investment Tax Credit	-.343	-.366
B. Depreciation Allowances		
1. Lifetimes	-.161	-.178
2. Declining Balance Rates	.068	.091
C. Corporate Income Tax Rate	.402	.332
D. Corporate and Noncorporate Income Tax Rates	.344	.271
E. Personal Income Tax Rates		
1. Capital Gains	.217	.217
2. Dividends	.217	.044
3. Interest Income	.037	.037
II. Labor Tax Rates at Industry Level	.175	.175
III. Personal Income Tax Rates	.256	.256

Note: Ballard, Shoven, and Whalley (1985) obtained the following marginal excess burdens for $\xi=.15$ and $\eta=.4$: Capital Tax Rates at Industry Level, .463; Labor Tax Rates at Industry Level, .230; and Personal Increase Tax Rates, .314.

Table 3

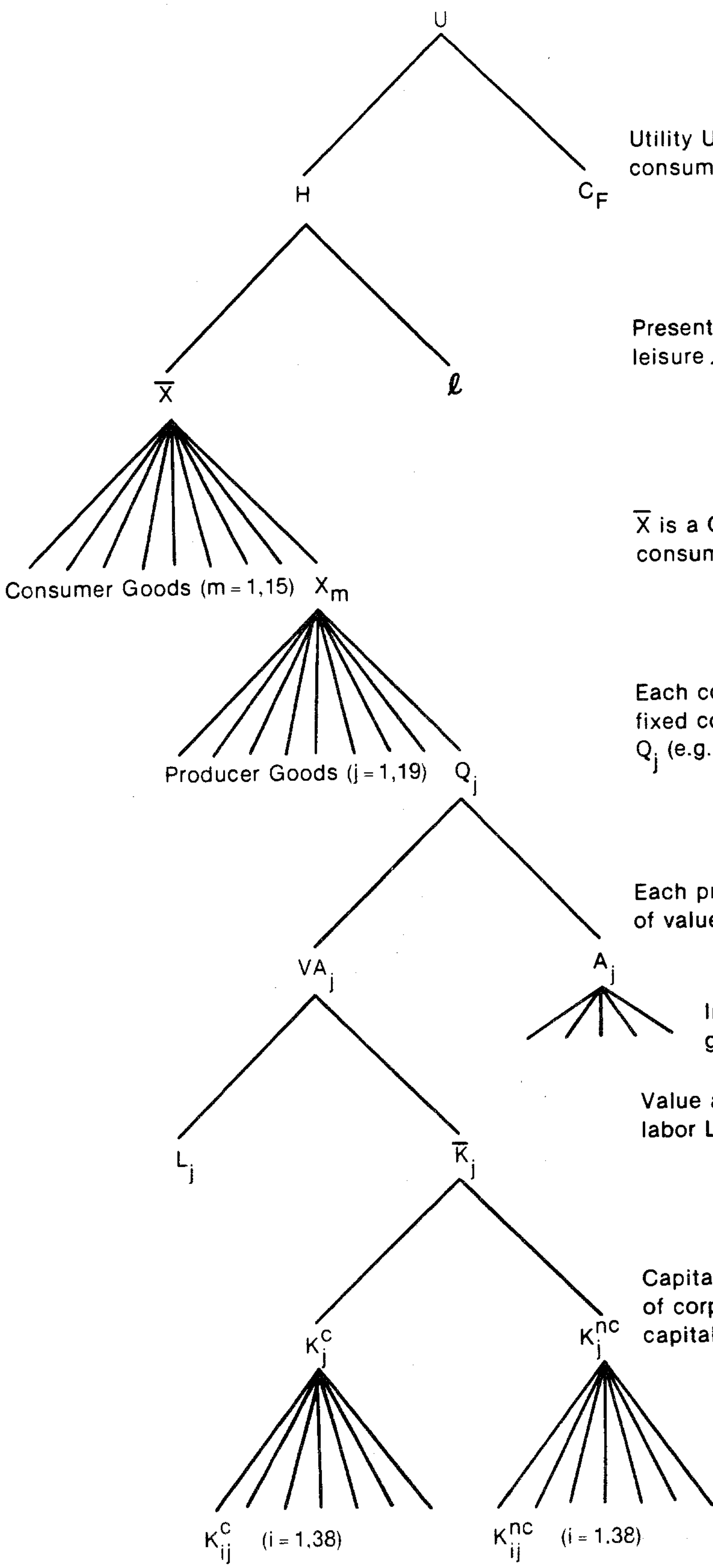
Sensitivity of Marginal Excess Burdens to Factor Supply Elasticities

		Variation in Labor Supply Elasticity[a]		Variation in Saving Elasticity[b]	
		$\xi=0$	$\xi=.3$	$\eta=0$	$\eta=.8$
I.	Capital Tax Instruments				
	A. Investment Tax Credit	-.369	-.363	-.397	-.329
	B. Corporate Income Tax Rate	.280	.383	.239	.433
II.	Labor Tax Rates at Industry Level	.069	.294	.170	.179
III.	Personal Income Tax Rates	.146	.379	.224	.287

[a]Standard value $\eta=.4$ for saving elasticity.

[b]Standard value $\xi=.15$ for labor supply elasticity.

Figure 1
A Diagrammatic Summary of the Model



Utility U is a CES function of present consumption H and future consumption C_F.

Present consumption H is a CES function leisure ℓ and a composite good $\overline{X}$.

$\overline{X}$ is a Cobb-Douglas composite of the 15 consumer goods X_m.

Each consumer good X_m (e.g., appliances) is a fixed coefficient mix of the 19 producer goods Q_j (e.g., metals, transportation, and trade).

Each producer good Q_j uses fixed proportions of value added VA_j and intermediate inputs A_j.

Intermediate inputs are the 19 producer goods, in fixed proportions for each industry.

Value added VA_j is a CES function of labor L_j and capital $\overline{K}_j$.

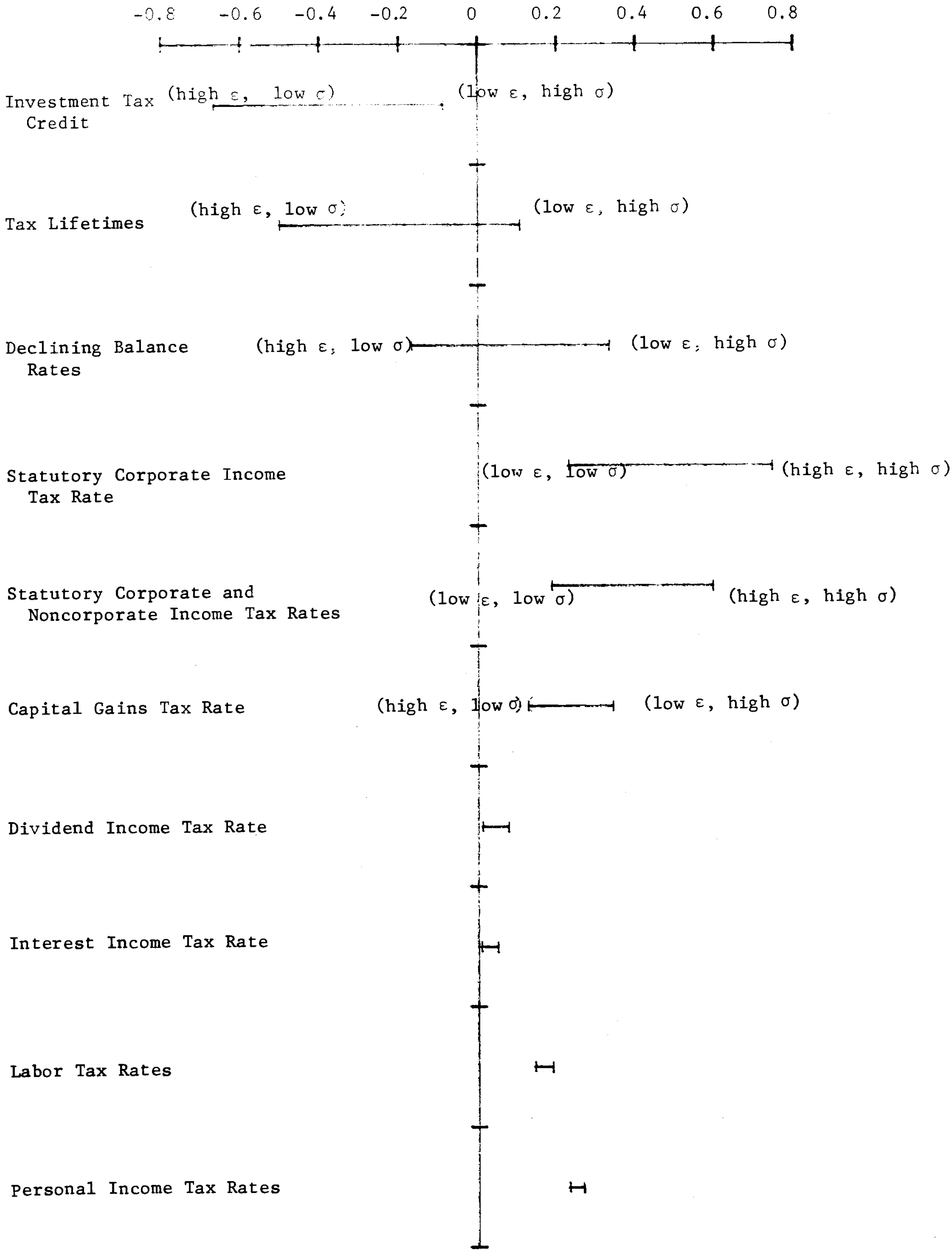
Capital $\overline{K}_j$ in each industry is a CES function 1/ of corporate capital K_j^c and noncorporate capital K_j^{nc}.

Use of capital in each sector is a CES function of the 38 asset types.

1/ In the housing industry, capital is a CES function of owner-occupied housing and noncorporate rental housing.

FIGURE 2

MARGINAL EXCESS BURDENS UNDER ALTERNATIVE ASSET AND SECTOR SUBSTITUTION ELASTICITIES



Appendix

Details of Numerical Results for Figure 2

	Low Capital Substitution Elasticities $\varepsilon=0.3, \sigma=0.3$	High Capital Substitution Elasticities $\varepsilon=3.0, \sigma=3.0$	Low Asset, High Sector Substitution Elasticities $\varepsilon=0.3, \sigma=3.0$	High Asset, Low Sector Substitution Elasticities $\varepsilon=3.0, \sigma=0.3$
I. Capital Tax Instruments				
A. Investment Tax Credit	-.101	-.668	-.087	-.669
B. Depreciation Allowances				
1. Lifetimes	.030	-.484	.107	-.502
2. Declining Balance Rates	.173	-.090	.333	-.169
C. Corporate Income Tax Rate	.229	.747	.370	.525
D. Corporate and Noncorporate Income Tax Rates	.185	.596	.280	.452
E. Personal Income Tax Rates				
1. Capital Gains	.211	.237	.341	.125
2. Dividends	.049	.034	.076	.010
3. Interest Income	.049	.007	.037	.019
II. Labor Tax Rates at Industry Level	.188	.143	.186	.144
III. Personal Income Tax Rates	.266	.230	.263	.233