General Equilibrium Computations of the Marginal Welfare Costs of Taxes in the United States

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In recent years, increasing attention has been paid by public finance economists to the marginal excess burden (*MEB*)[1] per additional dollar of tax revenue. Estimates of *MEB*s stand in contrast to estimates of the welfare cost of taxes which are calculated by totally removing existing taxes and replacing them with equal yield lump sum taxes. Instead, an *MEB* estimate measures the incremental welfare costs of raising extra revenues from an already existing distorting tax. Earlier estimates of *MEB*s have either concentrated on particular portions of the tax system, or have employed partial equilibrium methods. Here, we examine the *MEB* of all major taxes in the United States, using a multisector, dynamic computational general equilibrium model. This allows us to calculate simultaneously the marginal welfare effects of individual income taxes, corporate taxes, payroll taxes, sales and excise taxes, and other smaller sources of revenue.

We find that the marginal excess burden of taxes in the United States is large. The welfare loss from a 1 percent increase in all distortionary tax rates is in the range of 17 to 56 cents per dollar of extra revenue, when we use elasticity assumptions that we consider to be plausible. Consequently, a public project must produce marginal benefits of more than \$1.17 per dollar of cost if it is to be welfare improving. This suggests that many projects accepted by government agencies in recent years on the basis of cost-benefit ratios exceeding unity might have been rejected if the additional effects of distortionary taxes had been taken into account. The cost-benefit standard should be more stringent. Another implication of our results is that a tax reform that lowers tax rates by a relatively small amount might significantly reduce the total welfare costs of taxes.

We also calculate the marginal excess burden from increases in various parts of the tax system. Not surprisingly, we find that the *MEB* for a given part of the tax system is greater when the taxed activity is assumed to be more elastic. The *MEB* from capital taxes responds a great deal to the saving elasticity and the *MEB* from labor taxes responds a great deal to the labor supply elasticity. In general, it appears that the *MEB*s are greater for activities which face high or widely varying tax rates. These conclusions are, in general, in accord with those drawn from a simple, partial equilibrium model (see Edgar Browning). Such a model indicates that *MEB*s would be proportional to the elasticity of the taxed activity and proportional to the tax rate.

It is worthwhile to explain our treatment of public goods and the precise tax replacement experiment implicit in our calculations. The literature on the optimal provision of public goods due to Paul Samuelson (1954), Peter Diamond and James Mirrlees (1971a, b), Partha Dasgupta and Joseph Stiglitz (1972), and A. B. Atkinson and N. H. Stern (1974) sets out the conditions for the optimal quantity of a pure public good. Atkinson and Stern modify Samuelson's conditions to account for the excess burden of distortionary taxes used to finance public

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[1]For example, Edgar Browning (1976), Harry Campbell (1975), Ingemar Hansson and Charles Stuart (1983), and Dan Usher (1982).

goods provision. Although Atkinson and Stern are not concerned with calculating *MEB*s as such, their work is closely related to ours. They allow for complementarity between public goods and private goods, and, if complementarity is sufficiently great, their model can call for an even greater level of public goods than the simple Samuelson model. Our model does not allow for such complementarity since public goods do not enter household utility functions in our framework. In our model, the government uses its revenues to provide transfer payments to the household sector, and it makes exhaustive expenditures that do not directly affect consumer utility or the structure of production. If we were to extend our model to account for complementarity, our measure of *MEB* might be reduced.

Regarding the type of tax change experiment we undertake, it is worthwhile emphasizing that the questions we ask are *not* in the realm of what Richard Musgrave (1959) calls "differential incidence." Studies of differential incidence (including previous studies involving this model, such as Don Fullerton et al., 1981, and Fullerton, Shoven, and Whalley, 1983) hold constant the size of the government. When a distortionary tax is increased, there is an offsetting rebate. In this paper, we analyze what Musgrave would term "balanced budget incidence." We raise distortionary taxes and the government in the model uses the additional revenue for exhaustive expenditures. There is no lump sum rebate to consumers. The foregone alternative is a lower level of taxation rather than a lump sum tax.

I. A General Equilibrium Model of the U.S. Economy and Tax System: Structure and Data

To keep the focus of this paper on results and policy implications, only a brief overview of model structure is given here. We provide a detailed description of our model in chapters 3–7 of Ballard et al. (1985). First, we summarize the production side of the model. In any single period, there are 19 producer-good industries that use capital and labor in constant elasticity of substitution (*CES*) value-added functions. They also use the outputs of other industries through a matrix of fixed input-output coefficients. The tax rates on labor for each industry are derived by taking payroll taxes and other contributions as a proportion of labor income, while the tax rates on capital for each industry are derived by taking corporate income, corporate franchise, and property taxes as a proportion of capital income. Each of these 19 producer goods is used directly for investment, for net exports, and for exhaustive government expenditures. In any period, consumers allocate their consumption among 15 consumer goods. The transformation of producer goods into consumer goods is represented by a matrix of fixed coefficients. This procedure is necessary because the goods classification of consumer expenditure data is different from the classification of the outputs of the 19 production sectors.

On the consumer side of the model, we have 12 consumer groups, which are distinguished by their money income[2] in 1973 (the basic data year for the model). Each consumer group has an initial endowment of capital and labor. Consumer decisions regarding factor supplies are made jointly with their consumption decisions. Each household at any point in time has a nested *CES* utility function of the form:

$$(1) \qquad U = U\left[H\left(\prod_{i=1}^{15} X_i^{\lambda_i}, l\right), C_f\right],$$

where H is the instantaneous utility function defined over current consumption commodities X_i and leisure l, and the function U determines the allocation between current welfare and expected incremental future consumption, C_f. The 15 current consumption commodities X_i are aggregated using a Cobb-Douglas function, whereas both U and

[2] These are incomes as defined for the 1973 *Consumer Expenditure Survey*. Money incomes exclude imputed income from home ownership, and sheltered capital income of various kinds. Even though we differentiate among consumers with this restricted definition of income, we do impute all kinds of capital income to every consumer group. Thus, each consumer group's income in our model calculations is greater than its narrowly defined money income.

H are CES functions. Consumers are infinitely lived, so that there are no bequests.

The government collects taxes from the production and demand sides of the economy and uses the revenue in a balanced budget. The government purchases producer goods, makes direct transfer payments to consumers, and subsidizes government enterprises. A simple formulation of international trade closes the model.

In this model, we calculate a dynamic sequence of static equilibria. In essence, we examine a series of single-period equilibria, sequenced through saving decisions which change the time profile of the economy's capital stock. Saving in each period depends on the expected rate of return on saving in future periods. The simulations reported here use the assumption of myopic expectations.[3] Because of this assumption, the current period rate of return on capital and other current prices are all that we require to solve the utility-maximization problem for each household. With myopic expectations, the price of expected future consumption varies inversely with the current period rate of return, which consumers expect will apply to all future periods. Maximizing U, subject to a budget constraint, gives the desired level of C_f for each consumer. The demand of C_f is then translated into a demand for saving in the current period. The latter is, in turn, translated into a vector of investment demands for the 19 industry outputs.

We specify our model by calibrating to the same benchmark equilibrium data set for 1973 that is used in Ballard et al. A full updating of the data set to a more recent year would be costly and has not been done for our calculations; most of the main features of the U.S. tax system have not changed greatly in the last decade. However, the marginal rate of taxation of corporate capital income may now be lower than our data and techniques suggest. The data set uses five major sources. These are the 1973 Department of Labor *Consumer Expenditure Survey*, the July 1976 *Survey of Current Business*, the Bureau of Economic Analysis Input-Output Matrix, unpublished worksheets of the U.S. Department of Commerce National Income Division, and the U.S. Treasury Department's Merged Tax File. In order to generate a consistent data set, a number of adjustments are made. All data on industry and government uses of factors are accepted as given, while the data on consumer factor incomes and expenditures are correspondingly adjusted. Tax receipts, transfers, and government endowments are accepted as given, and government expenditures are adjusted in order to yield a balanced budget. Similar adjustments ensure that supply equals demand for all goods and factors, and that trade is balanced.

The fully consistent data set defines a single-period benchmark equilibrium in transactions terms. These observations on values are then separated into prices and quantities by assuming that a physical unit of a good or factor is the amount that sells for one dollar. All benchmark equilibrium prices are thus \$1, and the observed values are the benchmark quantities.

The equilibrium conditions of the model are then used to determine the behavioral equation parameters consistent with the benchmark data set. This procedure calibrates the model to the benchmark data, in the sense that the benchmark data can be reproduced as an equilibrium solution to the model before any policy changes are considered. In order to implement this procedure, we specify the elasticities of substitution between capital and labor in each industry on the basis of econometric estimates in the literature. We also specify labor supply and saving elasticities (also based on literature sources), to which substitution elasticities in preferences are calibrated. Factor employments by industry are used to derive production function weights, and expenditure data are used to derive utility function weights. This calibration procedure ensures that, given the benchmark data, the various agents' behaviors are mutually consistent before we evaluate policy changes.

The elasticities of labor supply and saving are especially important parameters for our

[3]We have investigated the sensitivity of our results with respect to changes in the assumptions about expectations, using the procedure developed by Ballard and Lawrence Goulder (1982). We find that different expectational structures have little effect on the results.

results. There are a large number of estimates for the uncompensated elasticity of labor supply with respect to the real, net-of-tax wage. Elasticity estimates for males are mostly small and negative, ranging from -0.40 to zero. George Borjas and James Heckman (1978) review these econometric studies and suggest a range between -0.19 and -0.07. The estimates for females are more often positive, and can be large in absolute value. Mark Killingsworth (1982) finds that the elasticity estimates for females are mostly between 0.20 and 0.90 in cross-section studies. We use three values for the uncompensated labor supply elasticity. A value of 0.15 is our central estimate, and we also use elasticities of 0.0 and 0.30. We calibrate these values by specifying the elasticity of substitution between present consumption and present leisure for the H function in equation (1) for each consumer.

The other key parameter is the elasticity of saving with respect to the real, after-tax rate of return, which we use to determine values for the elasticity of substitution between present consumption, H, and future consumption, C_f, for each consumer in the model.

There is considerable literature controversy regarding the value of the uncompensated saving elasticity. For a long time, the consensus appeared to favor a zero value for this elasticity, a proposition termed Denison's Law, after Edward Denison (1958). In more recent work, Michael Boskin (1978) has estimated this elasticity to be approximately 0.3 to 0.4, although Lawrence Summers (1981) has shown that reasonable parameter values in life cycle model may imply saving elasticities between 1.5 and 3.0. Each of these studies has problems of interpretation. In particular, for reasons outlined in the paper by David Starrett (1982), Summers's elasticity figures may be high. We focus on simulations using the values of 0.0 and 0.4 for the saving elasticity. We also consider a high value of 0.8. As might be expected, the marginal excess burden estimates increase as the saving elasticity increases. However, the labor supply elasticity seems to be the more important parameter.

The value used for the real net-of-tax return to capital in the benchmark data is important, since this value is used to calibrate preference parameters under the assumption of intertemporal utility maximization. It also determines the rate of time preference in the benchmark sequence of equilibria. We use 4 percent for the average value of this parameter, but each income class receives a net-of-tax return that depends on its own marginal tax rate.

The dynamic behavior of the model depends on the steady-state growth rate assumed for the benchmark equilibrium sequence. To derive this rate, we compare the amount of observed 1973 saving to the capital stock. This gives us a growth rate of the capital service endowment of 2.89 percent per year. We assume that labor (in effective units) grows at the same rate. Though labor endowments grow at this fixed annual rate in both the benchmark sequence and the revised sequence, the demand for leisure is endogenous. This implies that market labor supply growth may differ when prices change until balanced growth is reestablished. Though the capital stock grows at this rate in the benchmark sequence, endogenous saving implies that, in the revised case, capital services may grow at a different rate. The 2.89 percent labor growth rate is assumed to be equally divided between Harrod-neutral technical change and population growth. Our welfare measures of tax changes are adjusted to account only for the initial population size.

II. Model Treatment of Taxes

The model incorporates each of the major taxes in the United States. In Table 1, we outline how these are modeled; summary information on the tax rates in the model is presented in Table 2. Mean factor and consumer tax rates across industries and commodities are reported, with indications of the dispersion in tax rates.

The treatment of each tax in the model reflects assumptions we make about the operation of the tax system. Thus, we combine the corporate and property taxes to produce an overall tax rate on capital income originating in each industry. We define these capital tax rates as a proportion of net-of-tax income; thus tax rates can exceed unity. The

TABLE 1—U.S. TAXES AND THEIR TREATMENT IN THE MODEL

Tax	Treatment in the Model	Difficulties of Model Treatment
1. Corporate taxes (including state and local) and corporate franchise taxes	Ad valorem tax on use of capital services by industry	Some argue for treatment as a lump sum tax; model treatment ignores role of financial instruments
2. Property taxes	Ad valorem tax on use of capital services by industry	Differential rates across jurisdictions ignored
3. Social Security taxes, Unemployment Insurance and Workmen's Compensation	Ad valorem tax on use of labor services by industry	Benefit related nature of contributions; arbitrary distinction between public and private insurance programs
4. Motor vehicles tax	Ad valorem tax on use of motor vehicles by producers	In practice, a yearly registration fee and not a purchase tax; averaging over jurisdictions
5. Retail sales taxes	Ad valorem taxes on purchase of consumer goods	Averaging of rates over states
6. Excise taxes	Ad valorem taxes on output of producer goods	Taxes often expressed as charge per unit physical measure such as volume
7. Other indirect business taxes and nontax payments to government	Ad valorem tax on output of producer goods	Payments depend on output levels by industry to only limited extent; averaging of rates over states
8. Personal income taxes (including state and local)	Linear function for each consumer where tax on capital affects industry allocation; 30 percent of savings currently deductible	Detailed deductions and exemptions not specifically considered in model

average tax rate on capital income at the industry level is about 0.97, which corresponds to a tax rate on gross capital income of just under 50 percent.[4]

In modeling the corporate tax, we follow the tradition of Arnold Harberger (1962, 1966) who treats it as a partial factor tax, even though more recently this has been the subject of active debate. Stiglitz (1973), for instance, has argued that if all marginal investments by firms are debt financed, the corporate tax operates as a lump sum tax. However, many features of corporate financial behavior remain unexplained, and we follow Harberger's procedure of treating the corporate tax as an ad valorem tax on capital, with average and marginal tax rates the same.

[4]These rate estimates do not incorporate the reductions in capital tax rates which were part of the 1981 Economic Recovery Tax Act and the further changes of the 1982 Tax Equity and Fiscal Responsibility Act. For a study of the effects of these changes in tax rates, see Fullerton and Yolanda Henderson (1983).

As a result, differences in capital income tax rates cause capital to be misallocated across industries.

In addition, the corporate tax affects saving decisions, since savers who acquire corporate equity indirectly pay these taxes on the return to their savings. Further distortions operate through the tax treatment of depreciation. While depreciation allowances operate at rates that are faster than true depreciation, they are calculated on a historical cost basis. Capital tax rates also include the investment tax credit. All these features combine to produce a pattern of tax rates by industry which is discriminatory.

A further key feature of our specification of capital tax rates is the assumption that average and marginal tax rates are the same. Fullerton (1984) has suggested a number of reasons why marginal and average rates need not be the same, and argues that under current laws, marginal rates are probably lower than average rates. Consequently, our specification may overstate marginal excess bur-

TABLE 2—LEVEL AND DISPERSION OF TAX RATES IN THE MODEL

		Weighted Tax Rate Statistics			
Type of Tax	Sectors on Which Tax Is Levied	Weights	Mean of Marginal Tax Rates	Standard Deviation	Coefficient of Variation[b]
Capital Taxes at Industry Level	19 Industries	Capital Use	0.970	0.729	0.752
Labor Taxes at Industry Level	19 Industries	Labor Use	0.101	0.009	0.092
Consumer Purchase Taxes	15 Goods	Total Consumption	0.067	0.140	2.101
Output Taxes	19 Industries	Output	0.008	0.035	4.612
Motor Vehicle Taxes	Intermediate Use of Motor Vehicles in 19 Industries	Use of Motor Vehicles	0.052	0.051	0.992
Personal Income Taxes[a]	12 Consumer Groups	Income	0.239	0.101	0.424

[a] Personal income tax rates are expressed as a proportion of gross income, whereas the other rates are expressed as proportions of net-of-tax capital income by industry, labor income by industry, etc.

[b] Coefficients of variation will not equal the quotients of the corresponding standard deviations and means because of rounding in the standard deviations and means.

dens as far as this portion of the tax system is concerned. The assumption of equality between marginal and average rates is less contentious in the case of tax rates on labor at the industry level, which we calculate using data on Social Security and other contributions.

We treat the property tax as a differential tax on capital by sector (similarly to the corporate tax). This falls most heavily on residential housing, but structures in other capital-using industries in the economy are also liable for the tax. As with the corporate income tax, both static and dynamic distortions occur.

Income tax rates differ substantially among consumers, with each of the 12 consumer groups facing a linear income tax schedule. Marginal tax rates rise from 0.01 for the poorest group to 0.41 for the richest.

The key distortions caused by the income tax affect factor supply decisions. It is widely recognized that the income tax distorts labor supply. In addition, the supply of new capital through saving is affected (by the "double" taxation of saving), although these effects are partially offset by the tax treatment of pensions and housing. We assume that 30 percent of saving is sheltered in this way. (This assumption is based on calculations using the 1976 *Flow of Funds Accounts*.) However, since saving is heavily concentrated in the top tail of the income distribution, much of the saving in the economy occurs where the tax rates are highest.[5]

In addition to distorting factor-supply decisions, the income tax also has important features which distort choices among industries and commodities. The most prominent of these is the preferential treatment of housing that results from the absence of tax on the imputed income of owner-occupied housing. This is compounded by the preferential treatment for capital gains on houses.

Consumer sales and excise tax rates average about 6.7 percent in the model, and rates for most goods are reasonably low. There are three notable exceptions: the tax on alcoholic beverages is 87.5 percent, on tobacco, 95.8 percent, and on gasoline and other fuels, 29.5 percent.

Consumer sales taxes have a variety of effects. Even if the sales tax system covers all commodities evenly, it still distorts labor supply decisions. Additional distortions come from the nontaxation of food and other exempted items. Also, the specific excises on alcohol, tobacco, and gasoline are sharply

[5] Our model exaggerates this effect, since we do not capture life cycle differences among households. However, the evidence provided by Paul Menchik and Martin David (1983) indicates that lifetime saving is also concentrated.

discriminatory in our model, since we treat them (along with sales taxes) as ad valorem taxes. We recognize that this latter treatment is contentious. The taxes on alcohol and tobacco could be defended as Pigovian externality-correcting taxes. The gasoline tax is often viewed as a benefit-related fee for the use of the highway system. Because of these considerations, and because our formulation of the consumer's utility function may overstate the elasticity of demand for these products, we report two sets of results for the *MEB* from increases in consumer sales taxes. In the first, we evaluate the effect of an increase in the tax rate on every commodity. In the second, we raise only the tax rates on commodities other than alcohol, tobacco, and gasoline.

III. Use of the Model in *MEB* Calculations

In our discussion of the various types of taxes, we have distinguished intertemporal distortions (that affect saving decisions) from intersectoral distortions (that affect allocations among industries or consumer goods). Many of the general equilibrium models that exist today can calculate only a single equilibrium. Consequently, they are poorly equipped to analyze the relative importance of intertemporal and intersectoral distortions. Our model allows us to assess intertemporal distortions as well as intersectoral ones. We calculate a sequence of equilibria, covering an arbitrarily long period of time. The equilibria are connected by endogenous saving decisions and exogenous growth of labor endowments.

In each single-period equilibrium, utility-maximizing consumers and profit-maximizing producers reach a competitive equilibrium where all profits are zero and supply equals demand for each good and factor. We use a variant of the Factor Price Revision Rule recently developed by Larry Kimbell and Glenn Harrison (1984) to calculate prices that satisfy these conditions for each time period. Although this algorithm is not guaranteed to converge, we have encountered no convergence problems, and this procedure is substantially faster than O. H. Merrill's (1972) algorithm, which we have used in earlier work on this model.

In each single-period equilibrium, markets are perfectly competitive, and there is no involuntary unemployment of factors, nor are there any externalities, quantity constraints, or barriers to factor mobility. The first equilibrium in the benchmark sequence replicates the 1973 equilibrium data set. In the no-policy-change case, subsequent equilibria are scaled-up versions of the initial equilibrium due to the balanced growth assumption. Prices remain constant, and all quantities grow at the same rate (the exogenous rate of growth of the effective labor force). When we alter tax parameters, we calculate a revised sequence of equilibria by computing a complete set of prices and quantities for each equilibrium in the sequence under an alternative tax policy. We estimate the changes in utility and income for each consumer group, changes in national income, and all new factor allocations among industries between pairs of comparable equilibria in the old (no-policy-change) and revised (after-policy-change) sequences.

Since we cannot compute an infinite sequence of equilibria, we calculate equilibria for a preselected number of years and then use a termination term. The welfare evaluation of the termination term is only correct if the economy is on a steady-state growth path, as is the case in our base-case sequence of equilibria. In a revised-case sequence, the tax change generates a transitional path that approaches a new steady-state growth path and the termination term will only be approximately correct. The accuracy of this approximation becomes better as the economy approaches the new steady-state growth path. In our calculations of marginal excess burden, the changes in relative prices are small since the tax changes are small. We calculate an extremely close approximation by computing our equilibria 100 years into the future. These are spaced five years apart, giving us a sequence of 21 equilibria.

In earlier applications of our model, the government spends any extra tax revenues it receives on both additional transfer payments to consumers and purchases of goods and factors. However, it is easier to interpret the results of this paper if transfer payments do not change. Consequently, for the results reported here, we have changed the model such that the level of real transfer payments of each consumer group remains the same in each period of the revised-case equilibrium sequence compared to the corresponding period of the base-case sequence.

Our objective is to compare the dollar value of the loss of consumer welfare resulting from an increase in distortionary taxes with the amount of revenue that the tax increase generates. For the loss of consumer welfare, we calculate the present value of a stream of Hicksian equivalent variations. Each of these is calculated using contemporaneous utility in comparable base and revise equilibrium calculations, as described in chapter 7 of Ballard et al. It should be noted that our consumer utility functions do not incorporate public goods. The implicit assumption is that public goods enter utility in a separable manner. We want to compare the dollar value of the loss in consumer utility from leisure and goods due to the tax with the revenue collected by the increase in the tax.

In order to get a similar present value figure for the change in revenue, we correct for changes in relative prices over time, since the dollar increase in revenue in one period is not strictly comparable with the dollar increase in revenue in another period. The model assumption is that government purchases of goods and factors are characterized by constant expenditure shares. Instead of using a Laspeyres price index or some other index to correct for relative price changes, we use the expenditure function associated with the implicit Cobb-Douglas utility function of the government. A different assumption about the pattern of government expenditure could alter the results, since the government does not spend marginal tax revenue in the same way that consumers would have spent it if it had been returned to them in lump sum form.

IV. Results

The marginal excess burden calculations produced by the model are shown in Tables 3 and 4. Table 3 shows the *MEB* from raising all marginal tax rates by 1 percent for different saving and labor supply elasticities. Table 4 reports *MEB* estimates from raising

TABLE 3—MARGINAL EXCESS BURDEN PER ADDITIONAL DOLLAR OF REVENUE FOR U.S. TAXES

Labor Supply Elasticity	Saving Elasticity (i) 0.0	(ii) 0.4	(iii) 0.8
(i) 0.0	.170	.206	.238
(ii) 0.15	.274	.332	.383
(iii) 0.30	.391	.477	.559

additional revenue from alternate portions of the tax system for different elasticity configurations.

Estimates of marginal excess burdens in Table 3 are substantial. They indicate that the transfer of an additional dollar to the government causes a deadweight loss in the range of 17 to 56 cents. This means that additional public expenditures ought to be undertaken only if their marginal benefits are at least 17 percent greater than the revenues needed to fund the project, if it has to be financed by additional distorting taxes.

As might be expected, marginal excess burdens are greater when higher elasticity values are used. The results are more sensitive to changes in the uncompensated labor supply elasticity than to changes in the saving elasticity. We would place the most confidence in our estimates using the middle elasticities (.4 and .15). An uncompensated saving elasticity of 0.8 and an uncompensated labor supply elasticity of 0.3 have been added to Table 3 mainly to illustrate the sensitivity of the results to changes in these parameters.

In Table 4, we report *MEB* estimates for cases where additional revenues are raised through the major tax subgroups. For these cases, we only use the labor supply elasticities of 0.0 and 0.15 and saving elasticities of 0.0 and 0.4 as parameter value combinations.

For the most part, the various parts of the tax system do not generate vastly different *MEB*s. However, we can generally say that the more elastic activities have higher *MEB*s. With a saving elasticity of 0.4, capital taxes lead to the greatest *MEB*s. With a labor supply elasticity of zero, the labor taxes at the industry level cause relatively small amounts of marginal distortion. If we focus on our central case (with elasticities of 0.4

TABLE 4—MARGINAL EXCESS BURDEN FROM RAISING EXTRA REVENUE FROM SPECIFIC PORTIONS OF THE TAX SYSTEM

Uncompensated Saving Elasticity: Uncompensated Labor Supply Elasticity:	0.0 0.0	0.4 0.0	0.0 0.15	0.4 0.15
All Taxes	.170	.206	.274	.332
Capital Taxes at Industry Level	.181	.379	.217	.463
Labor Taxes at Industry Level	.121	.112	.234	.230
Consumer Sales Taxes	.256	.251	.384	.388
Sales Taxes on Commodities other than Alcohol, Tobacco, Gasoline	.035	.026	.119	.115
Income Taxes	.163	.179	.282	.314
Output Taxes	.147	.163	.248	.279

for saving and 0.15 for labor supply), we see that capital taxes, consumer sales taxes, and income taxes cause the greatest distortion, followed by output taxes and labor taxes at the industry level. This is almost exactly the same ranking that we found for *average* excess burdens in our earlier study (1982, Table 10).

Simple models would lead us to expect that *MEB*s would be high when activities are taxed at high or widely dispersed rates. This is borne out by our results. The labor tax rates at the industry level are fairly low and rather uniform among sectors, and the *MEB*s associated with these taxes are low. Capital tax rates are high and widely dispersed (see Table 2). Except in the case of a zero saving elasticity and a labor supply elasticity of 0.15, capital taxes have among the highest *MEB*s. We can also see the point about high and dispersed tax rates causing large *MEB*s if we look at the results for consumer sales taxes. When we raise all sales and excise taxes including the very high taxes on alcohol, tobacco, and gasoline, we have high *MEB*s. However, when we raise only the low taxes on the other commodities, we end up with very modest *MEB*s.

V. Conclusion

In this paper we report estimates for the United States of the marginal excess burden of raising additional tax revenues. We use a dynamic sequenced numerical general equilibrium model of the U.S. economy and tax system which we have previously used to analyze specific policy proposals, such as corporate tax integration or a move towards a consumption tax. Estimates are obtained by increasing tax rates for existing distortionary taxes.

The subject of marginal welfare costs of taxes has been discussed in the past by Harry Campbell, Browning, Dan Usher, and Charles Stuart (1984). Our contribution is in investigating this subject through a large-scale numerical general equilibrium model of the U.S. economy and tax system, incorporating all major U.S. taxes.

The central theme emerging from results is that the marginal welfare costs from raising existing distorting taxes in the United States are large, in the range of 17 to 56 cents. This has important implications for a range of policy issues. In the cost-benefit area, if a public project must be financed by distortionary taxes, the additional excess burden of these taxes should be taken into account. If this deadweight loss is as large as we suggest, it is possible that many projects accepted in recent years on the basis of favorable cost-benefit ratios should not have been undertaken. In approaching tax reform, these results suggest that a large portion of the potential welfare gains from removing distortionary taxes can be realized by a modest reduction in tax rates. Tax rate changes may, therefore, be more important than the structural reform of the tax system. In evaluating the redistribution-efficiency tradeoff in policy design, additional transfers financed at the margin by raising distorting taxes become very costly.

The issue of the marginal welfare cost of distortionary taxation has attracted increasing attention during the last decade. Campbell estimated that the marginal excess burden of Canadian commodity taxes is about 24 cents. Browning reached a similar conclusion in a brief discussion of commodity taxes, but focused primarily on labor income taxes. Browning estimated that the *MEB* of these taxes is in the range of 9 to 16 cents. Browning made the conservative assumption that the compensated labor supply elasticity is 0.2. This value of the compensated elasticity is close to the values that we have when we assume that the uncompensated elasticity is zero. When we use the zero elasticity, our *MEB* estimates are only slightly higher than those of Browning. Stuart, like Browning, focuses on distortions of the labor supply decision. In his central simulations, using Browning's elasticity value, he finds *MEB*s in the range of 20.7 to 24.4 cents. Ingemar Hansson and Stuart have calculated a wide range of *MEB*s for Sweden. Their central estimates are much higher than ours or those of Browning, ranging from 69 cents to $1.29. However, the difference can be explained by the fact that their central estimates incorporate the extremely high marginal tax rates (around 70 percent) that exist in Sweden. When Hansson and Stuart leave the rest of their model unchanged but assume marginal tax rates of 40 percent, their central case yields *MEB* estimates of from 7 to 16 cents. We feel that all of these studies point to the general conclusion that marginal excess burdens are fairly substantial. It may be too early to say that there is a consensus on this issue, but we do feel that there is growing evidence that *MEB*s may be in the range of 15 to 50 cents for an economy like that of the United States. We hope that the large estimates we report will contribute to future debate on tax reform in the United States and to a discussion of possibly modifying the cost-benefit criterion for public goods evaluation.

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