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14 The Value-added Tax: A General Equilibrium Look at Its Efficiency and Incidence

Charles L. Ballard, John Karl Scholz, and John B. Shoven

14.1 Introduction

The value-added tax (VAT) is among the most widely used tax instruments in the world, and one which is often lauded for its efficiency, simplicity, and ability to raise revenue. It is a very important source of revenue in Europe, and its adoption is being debated in Japan. The VAT has been considered in the United States on a number of occasions, but has not yet been adopted. However, with the increasing pressures of the budget deficit, the value-added tax is likely to be considered once again in the next few years. The purpose of this paper is to examine the likely consequences of adopting a value-added tax.

Textbook taxes almost always look good relative to taxes in the real world, and this may partially account for the good reputation enjoyed by the VAT. In this paper, we seek to learn more about VATs of various sorts, by performing simulations with a computational general equilibrium model of the United States economy and tax system. Among the questions we want to address are the following: (1) How efficient is a flat, textbook-type VAT? (2) How are those efficiency properties affected when a pattern of exemptions and rate differentials similar to those used in Europe are incorporated? (3) How regressive is the text-

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book VAT, and how much of that regressivity is alleviated by the exemptions and rate differentials? (4) How much of the efficiency advantage of a consumption-type VAT relative to our current income tax is due to its flat rate structure and how much to its consumption base? (5) What are the efficiency and incidence consequences of using the VAT revenue to replace the corporate income tax rather than the personal income tax? (6) How different are the effects of using different tax instruments to increase tax collections by a given amount? (7) If the answers to the above questions suggest that the replacement of some of our existing taxes with a VAT would be regressive but would also be efficient (in the sense that it would result in a positive sum of equivalent variations), for what types of social welfare functions would the replacement be desirable? And finally, (8) How sensitive are our results to some of the key elasticities and functional form assumptions of our model?

We are going to assume that the reader is familiar with the basic operation of a value-added tax. Those who are not are referred to Lindholm (1976) or Aaron (1981). Also, our general equilibrium model is well documented in Ballard et al. (1985). Therefore, in section 14.2 we provide only a very brief outline of the model. In section 14.3, we provide an equally brief survey of the taxes we examine in this paper. Section 14.4 presents our simulation results by examining the efficiency and incidence effects of replacing a portion of the existing personal income tax with a flat consumption-type VAT, a VAT with a European-style rate structure, and a direct progressive expenditure tax. In section 14.5, we discuss simulations using VAT revenue to replace the corporation income tax. In section 14.6, we consider alternative means of increasing total federal tax receipts. Section 14.7 addresses the change in social welfare resulting from the tax swap, while 14.8 reports on some sensitivity analyses with respect to the structure of the underlying utility function and the elasticity of saving with respect to the real interest rate. We conclude with a brief summary of our results.

14.2 The Model

The model is a medium-scale computational general equilibrium model, calibrated to 1973 data for the United States. We model 19 producer-goods 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 fixed coefficient input-output matrix. Tax rates on labor and capital income for each industry are taken from payroll, corporate, and property taxes. The 19 producer goods are used indirectly for consumption through a fixed coefficient matrix of transition. This matrix allows the 19 producer goods to be translated into 15 consumer goods which correspond to consumer demands. There are 12 consumer groups, differentiated by income class, each with an initial endowment of capital and labor. These classifications are summarized in table 14.1.

The data for the model are derived from five major sources. These include the July 1976 *Survey of Current Business*, the Bureau of Economic Analysis Input-Output Matrix, unpublished worksheets of the U.S. Commerce Department's National Income Division, the U.S. Labor Department's 1973 Consumer Expenditure Survey, and the U.S. Treasury Department's Merged Tax Files. Adjustments to these data are made to ensure that each source is consistent with the others. All data on industry and government uses of factors are taken to be fixed,

Table 14.1 Classification of Industries, Consumer Expenditures, and Consumer Groups in the Model

Industries	Consumer Expenditures
1. Agriculture, forestry, and fisheries	1. Food
2. Mining	2. Alcoholic beverages
3. Crude petroleum and gas	3. Tobacco
4. Contract construction	4. Utilities
5. Food and tobacco	5. Housing
6. Textiles, apparel, and leather products	6. Furnishings
7. Paper and printing	7. Appliances
8. Petroleum refining	8. Clothing and jewelry
9. Chemicals and rubber	9. Transportation
10. Lumber, furniture, stone, clay, and glass	10. Motor vehicles, tires, and auto repair
11. Metals, machinery, miscellaneous manufacturing	11. Services
12. Transportation equipment	12. Financial services
13. Motor vehicles	13. Reading, recreation, miscellaneous
14. Transportation, communications, and utilities	14. Nondurable, nonfood household items
15. Trade	15. Gasoline and other fuels
16. Finance and insurance	
17. Real estate	
18. Services	
19. Government enterprise	

Consumer Groups
(Households classified by $thousands of 1973 gross income)

1. 0–3	5. 6–7	9. 12–15
2. 3–4	6. 7–8	10. 15–20
3. 4–5	7. 8–10	11. 20–25
4. 5–6	8. 10–12	12. 25+

while data on consumers' factor incomes and expenditures are correspondingly adjusted. Tax receipts, transfers, and government endowments are fixed, and government expenditures are scaled to balance the budget. Similar adjustments ensure that supply equals demand for every good and factor.

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. 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' behavior are mutually consistent before we evaluate policy changes.

We use a tâtonnement procedure developed by Kimbell and Harrison (1984) to calculate prices which satisfy the following equilibrium conditions: all profits are zero, and supply equals demand for each good and factor. These conditions hold at each point in time. Single-period equilibria are sequenced through endogenous savings decisions which augment the capital stock of the economy. An exogenous labor force growth rate of 2.89% is assumed.

For the benchmark sequence, we calculate a balanced growth path that begins with our replicated data, has constant prices, and implies quantities that all grow at the labor force growth rate. We then alter tax parameters and calculate a revised sequence of equilibria. For both the base case and revised case sequences, we calculate 21 equilibria spaced 5 years apart. Thus, our calculations cover a span of 100 years. At the end of this period, the economy has approached very close to a new steady state in the revised case. We use the steady-state properties of the model to calculate "termination terms" that measure the welfare changes through infinite time. See Ballard et al. (1985, chap. 7) for details.

In the revised case, we hold real exhaustive government expenditure at the same level in every period as in the corresponding period of the base-case sequence. We also hold transfer payments constant in real terms for each of the consumer groups. (Thus, to the extent that the VAT raises gross consumer prices, we protect consumers by increasing their transfer payments.) This assumption that revenue yields are the same period-by-period is a strong one. We do not consider the use of debt finance to smooth the pattern of taxes over time. (See Goulder 1985 for a general equilibrium model with debt.) Another possibility that we rule out is that society would alter the total amount of government spending over time if it were to become wealthier or poorer.

When a VAT is instituted, it raises revenues. In order to maintain equal tax revenue yield in the manner described above, it is necessary to reduce tax rates elsewhere in the economy. We most often do this by reducing marginal income tax rates. We hold the rest of the tax rates in the economy constant. Thus, we rule out the possibility that the states would respond to a federal VAT by changing the configuration of their own taxes.

The model assumes no involuntary unemployment of factors. Markets are perfectly competitive, with no externalities, quantity constraints, or barriers to factor mobility. Since we compute a complete set of prices and quantities under alternative tax policies, we can estimate the change in national income, the changes in utility or income for each consumer group, and new factor allocations among industries.

At any point in time, each household has a nested CES utility function of the form

(1) $$U = U[H(\bar{X}, L), C_F]$$

where H is a CES function determining the allocation of current expenditures between current consumption of goods, $\bar{X}$, and current consumption of leisure, L. The component $\bar{X}$ is itself a composite of the 15 consumer goods, which we shall call the X_i, $i = 1, \ldots, 15$. In earlier applications of the model, purchase decisions on the X_i were determined by a Cobb-Douglas subutility function. In this paper, we make an important change from the standard model by incorporating a Stone-Geary or linear expenditure system of demands. U is another CES function, determining the allocation of income between current expenditures and expected future consumption, C_F. The demand for C_F results in a derived demand for savings.

An important advantage of the structure described here is that the factor supply elasticities can be calibrated exactly to any desired value. The most important of these is the elasticity of savings with respect to the real net rate of return. The savings elasticity is very important in simulating the VAT, because the adoption of a tax on consumption will encourage greater saving. Since some of the largest distortions in the model are those that affect the accumulation and use of capital, a capital-deepening policy change will usually lead to welfare gains. These gains increase as the assumed savings elasticity increases, as we shall see in section 14.8. Thus, it is important to use realistic values for the savings elasticity. We use a value of 0.4 for most of our simulations, and we also consider values of 0.0 and 1.0. Even this range of values may be on the high side. In recent years, real rates of return have been extremely high, and yet savings rates have changed very little. (See Bernheim and Shoven 1985 for a discussion of some of the reasons for the low level of responsiveness.)

It should be noted that there are some limitations with the model structure we have described. Our decisions about intertemporal consumption are governed by equation (1). In each period, our households make a decision which allocates income between the present and the future. There are not any life-cycle aspects incorporated into this decision; in fact, our households are thought to live forever. Households also expect the configuration of prices that exist in any given period to continue throughout time. This assumption of myopic expectations has been relaxed in a paper by Ballard and Goulder (1982). Their paper examines the polar cases of myopic expectations and perfect foresight and intermediate degrees of consumer foresight in a model with a similar structure to that presented here. Ballard and Goulder find the results or policy simulations are quite robust to variations in expectational structure.

In computing the equivalent variation welfare measure with the standard model, we were able to make great use of the homotheticity of the Cobb-Douglas demand function. Here we make similar use of the homotheticity of the Stone-Geary formulation with respect to a "displaced origin." Let γ_i be the ith component of the displaced origin or the minimum required level of consumption for commodity i. Then define

(2) $$\Gamma = \sum_{i=1}^{15} P_i \gamma_i$$

as the cost of the vector γ. The Stone-Geary demand functions are then

(3) $$X_i = \gamma_i + \frac{\beta_i(I_x - \Gamma)}{P_i}$$

where β_i is the marginal propensity to consume commodity i out of discretionary income. Given the Stone-Geary utility function

(4) $$U_x = \prod_{i=1}^{15} (X_i - \gamma_i)^{\beta_i} \, ; \sum_{i=1}^{15} \beta_i = 1.0$$

we calculate the indirect utility function

$$(5) \qquad V_x = (I_x - \Gamma) \prod_{i=1}^{15} \left(\frac{\beta_i}{P_i}\right)^{\beta_i}$$

and expenditure function

$$(6) \qquad I_x = \frac{V_x}{A} + \Gamma$$

where

$$(7) \qquad A = \prod_{i=1}^{15} \left(\frac{\beta_i}{P_i}\right)^{\beta_i}$$

We exploit the homothetic relationship between discretionary income ($I_x - \Gamma$) and the indirect utility from consumption in excess of the requirement. We use

$$(8) \qquad P_{xD} = \prod_{i=1}^{15} \left(\frac{P_i}{\beta_i}\right)^{\beta_i}$$

as the price for the composite of discretionary consumption in the next higher stage of the maximization process. In order to evaluate welfare, we first compare discretionary H in the base case with discretionary H in the revised case. We then compare the base case Γs and revised case Γs.[1]

14.3 Modeling of Taxes

In this paper, our simulations focus on three types of consumption-based taxes. The first is an ideal flat consumption VAT, where the tax base is the value of current period production less investment. All expenditures/goods (other than leisure) are taxed at a uniform rate.

Against this idealized VAT, we model a more politically realistic "stylized European VAT." The primary distinguishing characteristics of the European VATs are the consumption base, the destination basis,[2] and differentiated rate structure. Based on the discussion of rate structures of the European VATs in Aaron (1981) and Cnossen (1982), we model a destination-based, consumption-type VAT with rates ranging from 0 to 15%. The rate differentiation is believed to be caused by a number of political and practical considerations. Food and housing are lightly taxed in an attempt to reduce the regressive nature of the VAT. Services, particularly financial services, are believed to be particularly difficult to tax. In all, as is illustrated in table 14.2, the average European

Table 14.2 Rates of Value-added Tax for the "Stylized European VAT"

Commodity Group	Percentage Rate	Commodity Group	Percentage Rate
Food	5	Motor vehicles, tires, and auto repair	15
Alcoholic beverages	15	Services	0
Tobacco	15	Financial services	0
Utilities	5	Reading, recreation and miscellaneous	10
Housing	0	Nondurable, nonfood household items	10
Furnishings	15	Gasoline and other fuels	15
Appliances	15		
Clothing and jewelry	15		
Transportation	5		

rate structure is far from the flat tax on consumption of an idealized VAT. By comparing the flat VAT with the differentiated VAT, we can determine the magnitude of the distortions in consumption decisions caused by a differentiated rate structure. We can also determine the effect that rate differentiation has on the gains or losses of the various consumer groups.

Our model has a fairly high degree of disaggregation. Nevertheless, at the 19-industry level of disaggregation, we are not able to capture all of the intricacies of the VATs that exist in Europe. The tables presented in Scott and Davis (1985) show the enormously detailed tax structures used in some of the European nations. For example, our model does not distinguish between small firms and large firms in an industry, even though it is often the case that firms of different sizes are treated differently under the European VATs.

The third type of tax we examine is a progressive expenditure tax. In order to compare this tax with a differentiated VAT, we assign the tax rates in such a way that they will collect the same commodity-tax revenue from consumers in the first period. This is achieved by imposing a progressive tax on consumers of consumption goods. Tax rates range from 0.3% for the consumer group with the lowest income to 11.6% for the highest-income group. Under the differentiated VAT, each consumer group faces the same rate schedule, with variation in tax rates by consumption good. Under the progressive expenditure tax, rates differ among the consumer groups, but for each consumer group, tax rates are equal on all consumption goods.

14.4 The Consequences of Rate Differentials

We begin by reporting on the efficiency and equity effects of rate differentiation with a VAT. We also compare the flat VAT with a progressive expenditure tax which has the same first-period yield. Table 14.3 shows the sum of equivalent variations for our 12 household groups for the different policies. In all cases, it is the personal income tax which is scaled back to preserve revenue neutrality relative to the base case tax system. However, we look at two patterns of scaling the personal income tax rates down—a multiplicative one and an additive one. With the multiplicative scaling, each household's marginal tax rate is multiplied by a constant less than unity so that revenue neutrality is achieved. In the additive case, a common number of percentage points is subtracted from each household's marginal tax rate.

The model has the capability of solving for these equal yield adjustment amounts. It also computes the flat VAT rate that is necessary to generate the same first-period commodity tax revenue yield as the differentiated rate structure shown earlier in table 14.2. This rate turns out to be 6.52%. Since the same amount of extra commodity-tax revenue is raised in each case, the amount of reduction in income tax revenue is also the same. The pattern of changes in revenues is almost identical after the first period, as well. In order to save computational cost, we only hold first-period commodity-tax revenue exactly constant. We do preserve overall revenue neutrality, however. If, in ad-

Table 14.3 **Efficiency Gains for Progressive Expenditure Tax, Differentiated VAT, and Flat VAT, for Model with Stone-Geary Commodity Demands**

Type of Tax[a]	Type of Replacement for Equal Yield	
	Additive	Multiplicative
Differentiated rate VAT	0.286% ($142.2)	0.558% ($277.2)
Flat rate VAT (6.52%)	0.490% (243.4)	0.759% ($377.3)
Progressive expenditure tax	0.285% ($141.5)	0.574% ($285.2)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

[a]All taxes raise the same amount of first-period commodity tax revenue from consumers. Personal income tax rates are scaled back so that the pattern of total tax revenue is the same in both the base case and revised case.

dition to overall revenue neutrality, we had held the additional commodity-tax revenue exactly constant in every period, we would have generated nearly identical results.

Our interpretation of the results in table 14.3 is that the potential efficiency gains from introducing a VAT or a progressive expenditure tax are rather large. The gain from a flat 6.52% consumption type VAT is 0.76% of the present value of economic welfare when multiplicative replacement is used. Using a 4% real discount rate, the present discounted value of future consumption plus leisure is $49 trillion, which is definitionally equivalent to the total value of wealth, physical and human, in the economy. Another way to assess the efficiency consequences of the multiplicative replacement with a flat 6.52% VAT is to note that the present value gain of $377 billion is equivalent to 29% of GNP for 1973, the base data year. It should be emphasized that this is a true efficiency gain, with the government having the same resources available to it after the tax switch. Further, this efficiency gain is roughly equivalent to the previously computed gain from integrating the corporate and personal income taxes, and amounts to about two-thirds the gain from completely switching to a progressive expenditure tax (see Ballard et al. 1985, chap. 9).

The multiplicative rate adjustment, emphasized so far, results in larger efficiency improvements than the additive adjustment because it lowers the marginal tax rates for higher-income, higher-tax-rate households more. The households with higher rates have already had the allocation of their resources and labor supply distorted more, and because these distortions increase approximately with the square of the tax rate, their situations improve more per dollar of rate relief than do the situations of those with lower initial tax rates. In fact, table 14.3 indicates that a 6.52% flat VAT would improve efficiency by slightly less than one-half of 1% of the present value of welfare if the personal income tax were scaled back additively (that is, with the same number of percentage points of relief in marginal tax rates for all households). This is just under two-thirds as large as with the multiplicative rate adjustment.

Differentiation also is costly in terms of economic efficiency. In comparing the first two rows of table 14.3, one can see that the present value of the cost of differentiation is just over $100 billion, which amounts to 8% of 1973's GNP and 0.2% of the present value of future welfare. The gain from a differentiated VAT with additive replacement is only about half as great as the gain from a flat VAT with additive replacement, and only about one-third as great as with a flat VAT with multiplicative rate relief.

As we have modeled it, the progressive expenditure tax shares the intersectoral neutrality of a flat VAT, but has a progressive rate structure similar to the current personal income tax. Table 14.3 indicates that a progressive expenditure tax with the same first period revenue as the other two taxes would offer an increase in efficiency of roughly the same magnitude as the differentiated rate VAT. One interpretation of these results, then, is that rate progressivity and rate differentiation cost roughly the same amount in terms of efficiency sacrifice relative to a flat VAT. All of these results use the linear expenditure system to allocate expenditures on commodities, and incorporate our base assumptions of a saving elasticity with respect to the real interest rate of 0.4 and a labor supply elasticity of 0.15. In section 14.8, we examine the sensitivity of some of our results to the saving elasticity and to the LES functional form.

In interpreting the succeeding tables that deal with tax incidence, several factors should be taken into account. Our dynamic model is calibrated with cross-sectional data where households are differentiated only by income. Because of the model structure and the fact that households are not distinguished by age, we are unable to address life-cycle or lifetime tax incidence questions. Rather, our incidence calculations address the long-run gains and losses falling on households in the various income classes. Households clearly move up and down the income scale over the life cycle, so these calculations should not be interpreted as gains or losses which fall on an individual household. It has been suggested that, over the lifetime, our calculations overstate the regressivity of taxes on consumption. This can most easily be seen by noting there is considerably greater variation in the average propensity to consume in a cross-section data set than over consumers' lifetimes. Since saving is more concentrated in higher-income classes, consumption is more concentrated in lower-income classes, and this results in the overstatement of the regressivity of consumption taxes. Furthermore, since age is not an explicit dimension of our model, we are not able to look into problems raised by Auerbach and Kotlikoff (1983) which surround the transition from income-based to consumption-based taxes.

It should be clear, however, that life-cycle or lifetime tax incidence is not without problems of its own. Despite evidence of a great deal of income fluidity among people who fall in and out of poverty, a general consensus has emerged in support of transfer programs such as food stamps and unemployment insurance. Similarly, the fact that low-income people will receive higher earnings at other times in their career should not mitigate the fact that the burden of consumption-based taxes falls on individuals at times when they are least able to afford them, namely when they are young and when they are old. This consideration would obviously be less important if perfect capital markets existed, but until we have capital market perfection we argue that lifetime *and* shorter time horizon (i.e., annual) tax incidence analysis is important for policy makers.

These caveats should be kept in mind when interpreting the following tables on tax incidence. Table 14.4 displays the personal incidence of the six tax replacement policies discussed in table 14.3. The results of table 14.4 show that there is an unpleasant tradeoff between efficiency and equity with a VAT. In addition, the stringency of the tradeoff depends a great deal on the method of personal income-tax rate adjustments for revenue neutrality. The flat VAT is slightly more regressive than the differentiated one. However, for the flat VAT, the multiplicative replacement is significantly more regressive than the additive one. One interpretation of this would be that the design of the rate adjustments in the personal income tax is more crucial in terms of equity than is the exemption of products that are deemed to be necessities. An example of this is to look at two plans that are fairly close in terms of economic efficiency. The flat VAT with additive rate adjustments is much less regressive than the differentiated VAT with a multiplicative method of rate adjustments.

The expenditure tax with a progressive rate structure illustrates many of the same points. Recall that the efficiency gain from introducing a revenue-neutral progressive expenditure tax is about the same as the gain resulting from the differentiated VAT. However, the expenditure tax has a much more progressive incidence. In fact, the progressive expenditure tax with multiplicative relief from the existing income tax yields a Pareto improvement in the sense that all our 12 household classes are better off. As with the VAT introduction, the incidence is very sensitive to the pattern of rate relief.

Table 14.5 shows the efficiency gains of flat VATs with different rate levels. It displays the result that the gain from trading the existing personal income tax for a flat consumption-type VAT exhibits a modest degree of decreasing returns. The improvement from a 15% VAT is somewhat less than three times the gain from a 5% VAT. Table 14.6 finds a similar pattern for the revenue-neutral introduction of a progressive expenditure tax.

14.5 Using the VAT Revenues to Lower the Corporate Income Tax

Despite the fact that economists have not reached a consensus regarding the nature of the corporate income tax, it is fair to say that it is widely criticized. The criticisms are based on several grounds. First, there is the double taxation of the return to capital, where net income generated within the corporate sector is subject to tax at the corporate level and then again at the personal level, either as a tax on dividends or as a tax on capital gains.[3] In addition, the corporate income tax has

Table 14.4 **Welfare Effects of Value-added Taxes and Progressive Expenditure Tax, By Consumer Income Class, for Model with Stone-Geary Commodity Demands**

Household Income (in Thousands of 1973 Dollars)	Differentiated VAT Additive Replacement (%)	Flat VAT Additive Replacement (%)	Progressive Expenditure Tax Additive Replacement (%)[a]	Differentiated VAT Multiplicative Replacement (%)	Flat VAT Multiplicative Replacement (%)	Progressive Expenditure Tax Multiplicative Replacement (%)[a]
0–3	0.009	−0.408	2.759	−2.007	−2.485	0.602
3–4	−0.016	−0.208	2.212	−1.745	−1.928	0.432
4–5	0.081	−0.072	1.806	−1.350	−1.496	0.343
5–6	0.083	−0.003	1.601	−1.174	−1.253	0.324
6–7	−0.052	0.041	1.479	−1.201	−1.101	0.317
7–8	−0.081	0.126	1.239	−1.010	−0.797	0.310
8–10	−0.028	0.219	0.964	−0.683	−0.431	0.321
10–12	−0.070	0.320	0.677	−0.414	−0.021	0.355
12–15	−0.020	0.368	0.526	−0.195	0.194	0.378
15–20	0.119	0.529	0.125	0.443	0.850	0.483
20–25	0.306	0.642	−0.148	0.997	1.328	0.582
25+	1.226	1.136	−1.277	3.682	3.576	1.199

Note: The figures are percentages of the total present value of welfare.

[a]This tax raises from consumers the same amount of first-period commodity tax revenue as the differentiated VAT and the flat 6.52 percent VAT.

Table 14.5 **Efficiency Gains from the Substitution of a Destination-Based Consumption-Type Flat VAT for Some of the Personal Income Tax Revenue (equal yield), for Model with Stone-Geary Commodity Demands**

VAT Rate	Type of Income Tax Scaling	
	Additive	Multiplicative
5%	0.383% ($190.3)	0.596% ($296.2)
10%	0.719% ($357.4)	1.105% ($549.2)
15%	1.016% ($505.1)	1.544% ($767.4)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

Table 14.6 **Efficiency Gains from the Substitution of a Progressive Expenditure Tax for Some of the Personal Income Tax Revenue (equal yield), for Model with Stone-Geary Commodity Demands**

Analog of VAT Rate[a]	Type of Income Tax Scaling	
	Additive[b]	Multiplicative[b]
5%	0.225% ($111.6)	0.415% ($223.9)
10%	0.410% ($203.8)	0.835% ($414.7)
15%	0.564% ($280.2)	1.164% ($578.3)

[a]The progressive expenditure tax raises the same amount of first-period commodity tax revenue as a consumption-type flat VAT of 5, 10, or 15 percent.

[b]Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

been held to reduce overall rates of return and hence inhibit capital accumulation. Perhaps of greatest concern to the public finance economist is the nonneutrality of the CIT. The CIT obviously discriminates against the corporate sector, as the noncorporate sector is free of this form of taxation. Further nonneutralities are introduced by special provisions in the corporate tax law. Finally, the corporate tax has a bias toward debt finance, since only equity returns are subject to it.

Because of the problems with the CIT, various schemes of integrating the corporate and personal tax system have been considered in the past few years.[4] In this section, we examine the welfare effects of replacing the corporate income tax with three different taxes: a flat-rate VAT, a differentiated-rate VAT, and a progressive expenditure tax. One of the first groups to advocate replacing the CIT with a VAT was a business group, the Committee for Economic Development, in 1966. More than a decade later, an extensive partial equilibrium analysis of the CIT-VAT substitution was made by Dresch, Lin, and Stout (1977). Their analysis explicitly concentrates on first-round, or impact, effects of the CIT-VAT switch. Our analysis, being a general equilibrium analysis, takes a somewhat different focus. We calculate the long-run, dynamic welfare effects by consumer group, for three types of corporate tax replacement. Despite the different focus, we are nevertheless able to examine several of the issues raised by Dresch, Lin, and Stout. In particular, they find that multiple-rate VATs do not mitigate the underlying regressivity of the VAT. In fact, they claim that the allocative distortions generated by differentiation eliminate many of the beneficial effects of the CIT-VAT substitution. Finally, they suggest that the substitution of a progessive expenditure tax for the CIT would be worth examination. The progressive expenditure tax would preserve many of the desirable characteristics of the VAT that relate to investment and trade.

In our model, personal taxes combine with corporate taxes to raise effective tax rates in industries that are highly incorporated. Similarly, taxes are reduced to the extent that each industry makes use of credits, deductions, and allowances. It is important to note that, while our model considers intertemporal and intersectoral distortions in the allocation of capital, it does not include endogenous financial decisions regarding debt/equity ratios or dividend payout ratios.

The policy program we investigate involves eliminating the corporate income tax while modifying the personal income tax to tax total shareholder earnings, rather than simply dividends. The increase in the revenue raised by the personal income tax is not sufficient to compensate for the elimination of the CIT. The amount of government revenue is maintained by implementing a flat VAT, a differentiated-rate VAT, and a progressive expenditure tax.

In tables 14.7 and 14.8, we present the efficiency gains in aggregate and by consumer group for the different types of corporate tax replacement. The numbers found in table 14.7 are larger than the previously published estimates for corporate income tax integration where the lost revenue was made up by raising the marginal rates of the personal income tax. This is simply another demonstration that the three tax replacements computed in table 14.7 are more efficient than an incremental increase in the current income tax.

We find that a flat VAT is the most efficient replacement scheme and that the progressive expenditure tax is the least efficient. However, the

Table 14.7 **Efficiency Gains from Replacing the Corporate Income Tax with Different Types of Value-added Taxes (equal yield), for Model with Stone-Geary Commodity Demands**

Type of Replacement	Efficiency Gain
Flat VAT	1.074% ($533.8)
Differentiated VAT	1.021% ($507.6)
Progressive expenditure tax	0.965% ($479.4)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

Table 14.8 **Welfare Effects of Replacing the Corporate Income Tax with a Flat VAT, Differentiated VAT, or Progressive Expenditure Tax, by Consumer Group, for Model with Stone-Geary Commodity Demands**

Household Income (in thousands of 1973 dollars)	Type of Replacement		
	Flat VAT (%)	Differentiated VAT (%)	Progressive Expenditure Tax (%)
0–3	2.399	2.754	4.291
3–4	1.634	1.840	3.058
4–5	1.120	1.296	2.212
5–6	1.025	1.156	1.954
6–7	0.895	0.919	1.724
7–8	0.705	0.662	1.343
8–10	0.422	0.348	0.848
10–12	0.438	0.280	0.644
12–15	0.182	0.016	0.275
15–20	0.201	0.021	−0.019
20–25	0.529	0.385	0.092
25+	3.394	3.510	2.012

The figures are percentages of the total present value of welfare.

differences in efficiency are relatively small. From table 14.8, we see that there are modest distributional differences between the three methods of replacement. It is immediately apparent in all the plans that there is a pronounced U-shape to the welfare results. The reason for the U-shape lies on the sources side of the consumer's budget. The distributional impact of the policy change is driven by the fact that the capital/labor ratio of income is U-shaped across our twelve consumer groups (see table 14.9). Since we eliminate the corporate income tax,

Table 14.9 **Ratio of Capital Income to Labor Income by Consumer Group**

Household Income (in thousands of 1973 dollars)	$\left(\frac{\text{Capital Income}}{\text{Labor Income}}\right)$ in Base Case	Household Income (in thousands of 1973 dollars)	$\left(\frac{\text{Capital Income}}{\text{Labor Income}}\right)$ in Base Case
0–3	.547	8–10	.123
3–4	.337	10–12	.123
4–5	.227	12–15	.106
5–6	.203	15–20	.111
6–7	.178	20–25	.139
7–8	.149	25+	.424

Reproduced from table 8.5 of Ballard et al. (1985).

the net return to capital rises sharply. Capital is also allocated more efficiently, which pushes net returns up even further. The higher return to capital naturally leads to U-shaped gains by consumer groups.

Removal of the CIT also has differing incidence effects arising from the uses side of the consumer's budget. Low-income consumers tend to spend a larger proportion of their income on consumer goods that are produced by lightly taxed, capital-intensive industries, such as agriculture and real estate. For example, the poorest consumer group spends 42% of its income on food and housing, while the wealthiest group spends 27%. Thus, removal of the CIT has a regressive impact on the income distribution when viewed from the uses side of the budget.

Differentiation of the VAT rates generates slightly higher welfare gains for the bottom four income groups (38% of the population) and the highest income group (5% of the population), although it is clear from table 14.8 that the various consumer groups neither gain nor lose much from differentiation. It should also be noted that we have a Pareto improvement under both the VAT and differentiated VAT replacement schemes.

The results for the distribution of welfare under the progressive expenditure tax are quite different. Despite having a smaller total welfare gain than the two VAT replacement schemes, the progressive expenditure tax yields welfare improvements for the first 9 consumer groups (78% of the population) which significantly exceed the gains from the VAT replacement schemes. This is a consequence of the progressive nature of the expenditure tax rate schedule, under which the lowest consumer group faces a marginal tax rate of 0.3%, while the highest consumer group faces a rate of 11.6%. While significantly altering the distribution of welfare results, the progressive expenditure tax yields an aggregate welfare gain that is 0.1 percentage point smaller than the gain that results from the flat VAT.

14.6 The Costs of Using Alternative Taxes to Increase Government Revenues

Even the comparisons we have been presenting regarding the relative efficiency and incidence of alternative forms of consumption-based taxes and the use of the revenues may leave some readers without a good impression of how important these differences are. Another presentation in table 14.10 may clarify the relative magnitudes. What is presented is the private cost of increasing government receipts by 10%. Thus, we have abandoned the revenue neutrality assumption that has prevailed in all the previous results. Rather, the scale of government expenditures and receipts is increased. What we examine is the welfare

Table 14.10 Welfare Effects of Increases in Spending with Different Types of Replacement

	Additive Income Tax Increases	Multiplicative Income Tax Increases	Flat VAT	Differentiated VAT
10% increase in G & T	−5.051%	−5.587%	−4.132%	−4.391%
	($2510.1)	(−$2776.4)	(−$2053.4)	(−$2182.0)
10% increase in G	−4.563%	−4.957%	−3.874%	−4.054%
	($2267.2)	(−$2463.3)	(−$1924.8)	(−$2015.4)
10 increase in T	−0.384%	−0.476%	−0.219%	−0.259%
	(−$190.9)	(−$236.6)	(−$108.7)	(−$128.7)

Note: G = exhaustive government expenditure
T = government transfers

costs of the additional taxes, for different tax instruments. Exhaustive government expenditures do not directly enter the utility functions of our consumers, so consumer welfare is reduced by the higher taxes but not increased due to the additional public goods. Since the extra public goods are the same in the four cases examined, the relative loss in welfare reflects the relative efficiency of the tax instruments. When transfers are increased, the increased revenue is returned to the households. In this model, transfers are treated as lump-sum payments. So, in the case of the third row of table 14.10, what is shown is the true efficiency or resource cost of collecting the revenue.

What strikes us is the magnitude of the differences in the efficiency numbers in table 14.10. The first row shows the figures for a 10% increase in both transfers and exhaustive expenditures. With all four incremental tax measures, the resulting revenue is the same. However, a flat VAT "hurts" more than 25% less than a multiplicative increase in the present income tax. In present-value dollar terms, the cost of the permanent 10% expansion of the government ranges from $2,053 billion to $2,776 billion, depending on the design of the tax increase. This strikes us as a nontrivial choice. The real resource cost of a 10% increase in lump-sum transfers would range between $109 billion and $237 billion, depending on the efficiency of the tax instrument used to finance the increment. So, in this case, there is more than a two-for-one difference. These results accord with the results from the paper by Ballard, Shoven, and Whalley (1985), which used a very similar version of this model to show that marginal excess burdens are fairly large, and that the marginal excess burdens can differ fairly widely among different tax instruments.

Table 14.11 displays the incidence of the cost of government expansion for the four possible incremental taxes of table 14.10. The inci-

Table 14.11 Welfare Effects of 10% Increases in Government and Transfers with Different Types of Financing

Household Income (in thousands of 1973 dollars)	Additive Income Tax Increase (%)	Multiplicative Income Tax Increase (%)	Flat VAT (%)	Differentiated VAT (%)
0–3	−0.577	2.286	−1.039	−0.376
3–4	−1.497	0.895	−1.654	−1.313
4–5	−2.605	−0.616	−2.545	−2.251
5–6	−3.345	−1.601	−3.177	−2.985
6–7	−3.759	−2.170	−3.514	−3.586
7–8	−4.370	−3.095	−3.983	−4.219
8–10	−4.689	−3.808	−4.166	−4.470
10–12	−4.996	−4.570	−4.311	−4.829
12–15	−5.219	−5.040	−4.475	−5.006
15–20	−5.460	−6.024	−4.475	−5.039
20–25	−5.615	−6.736	−4.476	−4.949
25+	−6.262	−10.183	−4.386	−4.234

dence of a flat VAT is not dramatically different from that of an additive surcharge to the income tax (as would be expected), despite the much greater efficiency of the VAT. In this case, all households with incomes greater than $4,000 (in 1973 dollars) would be better off with a flat VAT. A differentiated VAT dominates an additive surcharge, in that all income classes lose less in financing the expanded government.

14.7 Would the Substitution of a VAT Increase Social Welfare?

So far, we have measured the change in economic efficiency by calculating the change in the sum of equivalent variations. The implicit social welfare function is Benthamite, and the measure is in the tradition of cost-benefit analysis. The linearity of the social welfare function means that the social value of a dollar is the same for all households. Of course, the social welfare function may display curvature. Following Atkinson (1970), we look at the family of social welfare functions

$$SW = \frac{\sum_{i=1}^{12} V_i^{1-\rho}}{1-\rho} \qquad (9)$$

where V_i is the indirect utility of household i. We can compute social welfare for both the revised and base distributions of V_i for any particular value of ρ. The form is quite general, in that the limit as ρ goes to infinity is the Rawlsian social welfare function where only the welfare of the poorest household matters. For $\rho = 0$, the social welfare function is Benthamite and therefore corresponds to the measure of economic efficiency that we have been using so far. For $\rho < 0$, the social value of a dollar is higher for those who are richer. Therefore, the range $0 \leq \rho < \infty$ probably includes all values for reasonable social welfare functions.

To examine the social welfare functions for which the tax swap is desirable, we calculate the critical value of ρ for which the change in social welfare is zero. The change in social welfare is given by

$$(10) \qquad \Delta SW = \frac{\sum_{i=1}^{12} {}^{r}V_i^{1-\rho}}{1-\rho} - \frac{\sum_{i=1}^{12} {}^{b}V_i^{1-\rho}}{1-\rho}$$

where ${}^{r}V_i$ is the value of indirect utility with the revised tax plan and ${}^{b}V_i$ is the value in the base case. The tax cases examined are the 6 on which we initially reported in tables 14.3 and 14.4. The results are shown in table 14.12. Two of the 6 cases result in an increase in social welfare for all values of ρ. They are the differentiated VAT with an additive adjustment in the personal income tax rates and the progressive expenditure tax with a multiplicative adjustment. The flat VAT with an additive adjustment results in an increase in social welfare if ρ is less than 1.915. Despite its greater efficiency (gain in social welfare when $\rho = 0$), the flat VAT with a multiplicative adjustment results in an increase in social welfare only in the more limited range of $\rho < 0.73$. The revenue-neutral introduction of a differentiated VAT with a multiplicative replacement not only results in a smaller gain in economic efficiency than a flat VAT with a multiplicative replacement, but it also increases social welfare for a more limited range of social welfare functions. In the case of a differentiated VAT with a multiplicative adjustment, social welfare increases if social welfare is of the form (9) and if ρ is less than 0.60. The progressive expenditure tax, which is unambiguously an improvement with a multiplicative adjustment, also improves social welfare for all reasonable values of ρ in the case of an additive adjustment (for all values exceeding -0.65). Our interpretation of these results is that a progressive expenditure tax would cer-

Table 14.12 **Values of ρ for which the Tax Swap Increases Social Welfare**

	LES Inner Nest	
Type of VAT	Additive	Multiplicative
Differentiated rates	All values	$\rho < .59932$
Flat rate (6.52)	$\rho < 1.9146$	$\rho < .73045$
Progressive expenditure tax	$\rho > -.65095$	All values

tainly increase social welfare. A value-added tax with additive adjustments in income tax rates would increase social welfare for a large range of social welfare functions. The only exception would be in the case of a flat VAT and a social welfare function that displays rapidly decreasing social valuation of a dollar with increasing wealth. The introduction of a VAT with multiplicative replacements, which offers considerable gains in economic efficiency, may or may not increase social welfare depending on the value of ρ.

14.8 Sensitivity Analysis

Up to this point, all of the results presented in this paper have been based upon the model with Stone-Geary commodity demands. In addition, we have assumed that the elasticity of saving with respect to the real net rate of return is 0.4. In this section, we perform sensitivity analysis with respect to these assumptions.

First, as an alternative to the Stone-Geary specification, we present results based on a Cobb-Douglas model of commodity demands. (This Cobb-Douglas formulation was the standard formulation for earlier applications of our model.) In table 14.13, we present the overall efficiency effects of the differentiated VAT, flat VAT, and progressive expenditure tax in the Cobb-Douglas case. Table 14.13 can be compared with table 14.3. For the flat VAT and the progressive expenditure tax, the overall welfare gains with the Cobb-Douglas formulation are only slightly less than the overall welfare gains in the Stone-Geary case. This is not surprising, since these tax replacements have their greatest effects on intertemporal consumption choices rather than on the allocation of consumption among goods within any period. However, when

Table 14.13 Efficiency Gains for Progressive Expenditure Tax, Differentiated VAT, and Flat VAT, for Model with Cobb-Douglas Commodity Demands

	Type of Income Tax Scaling	
Type of Tax[a]	Additive	Multiplicative
Differentiated-rate VAT	0.011%	0.267%
	($5.4)	($132.6)
Flat-rate VAT (6.242%)	0.477%	0.740%
	($236.9)	($367.7)
Progressive expenditure tax	0.280%	0.564%
	($139.2)	($280.3)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

[a]All taxes raise the same amount of first-period commodity tax revenue from consumers.

we consider the VAT with differentiated rates, the choice of model makes a more significant difference. This is because the Cobb-Douglas formulation implies that consumers have more elastic choices among goods than would be implied by the Stone-Geary formulation. Therefore, the rate differentiation causes more damage under the Cobb-Douglas model. With additive replacement for equal yield, the differentiated VAT generates almost no welfare gain in the Cobb-Douglas case, versus a gain of \$142 billion, or 0.28%, of welfare in the Stone-Geary case. With multiplicative replacement, the differentiated VAT does generate modest welfare gains in the Cobb-Douglas case, but these are only about half as great as the gains in the Stone-Geary case.

In table 14.14, we present the distributional results of the simulations presented in table 14.13. Table 14.14 can be compared with table 14.4. Again, the results from the Cobb-Douglas model are very close to those from the Stone-Geary model for the flat VAT and the progressive expenditure tax. In most cases, the welfare effect is slightly less favorable under the Cobb-Douglas model. When we consider the differentiated VAT, however, the differences are somewhat larger for every group, due to the greater elasticity of the Cobb-Douglas form.

Next, we return to the Stone-Geary formulation but incorporate savings elasticities of 0.0 and 1.0. The aggregate welfare effects are shown in tables 14.15 and 14.17, and the effects for the various consumer groups are shown in tables 14.16 and 14.18. As may be expected, the welfare gains are always greater when the responsiveness of savings is greater. For the range of parameter values considered here, the results are moderately sensitive to the savings elasticity. For the flat VAT and the progressive expenditure tax, the welfare gains are in the neighborhood of 15% lower for the zero elasticity than for the elasticity of 0.4, and about 15–20% higher for the elasticity of 1.0 than for the elasticity of 0.4. In the case of the differentiated VAT, the relative differences are somewhat larger, in the vicinity of 25–40%.

Earlier in this paper, we emphasized the point that the method of tax replacement for equal yield is often more important than the tax change experiment itself. This point emerges forcefully once again in tables 14.13, 14.15, and 14.17. In every case we have a substantially greater aggregate improvement in welfare with multiplicative replacement, since this involves relatively larger reductions in the highest personal income tax rates.

The disaggregated results in tables 14.16 and 14.18 are fairly similar to those from table 14.4. Nearly all of the groups do better under these tax policy changes when the elasticity of savings is higher. The difficult equity-efficiency tradeoff that we saw when looking at the VATs in table 14.4 is still very much present in tables 14.16 and 14.18. Once again, even though multiplicative replacement for equal revenue yield leads

Table 14.14 **Welfare Effects of Value-added Taxes and Progressive Expenditure Tax, By Consumer Income Class, for Model with Cobb-Douglas Commodity Demands**

Household Income (in Thousands of 1973 Dollars)	Differentiated VAT Additive Replacement (%)	Flat VAT Additive Replacement (%)	Progressive Expenditure Tax Additive Replacement (%)[a]	Differentiated VAT Multiplicative Replacement (%)	Flat VAT Multiplicative Replacement (%)	Progressive Expenditure Tax Multiplicative Replacement (%)[a]
0–3	−0.132	−0.405	2.719	−2.076	−2.422	0.573
3–4	−0.186	−0.208	2.179	−1.806	−1.896	0.410
4–5	−0.118	−0.073	1.771	−1.460	−1.472	0.325
5–6	−0.136	−0.006	1.571	−1.317	−1.239	0.307
6–7	−0.282	0.037	1.450	−1.358	−1.089	0.302
7–8	−0.324	0.121	1.213	−1.191	−0.788	0.297
8–10	−0.280	0.214	0.943	−0.891	−0.428	0.309
10–12	−0.336	0.313	0.661	−0.656	−0.025	0.345
12–15	−0.291	0.360	0.513	−0.452	0.188	0.368
15–20	−0.165	0.516	0.119	0.138	0.831	0.475
20–25	0.008	0.624	−0.146	0.653	1.296	0.573
25+	0.894	1.106	−1.241	3.198	3.500	1.195

Note: The figures are percentages of the total present value of welfare.

[a]This tax raises from consumers the same amount of first period commodity tax revenue as the differentiated VAT and the flat 6.242 percent VAT.

Table 14.15 Efficiency Gains for Value-added Taxes and Progressive Expenditure Tax, for the Model with Stone-Geary Commodity Demands, for Savings Elasticity of Zero.

	Replacement	
Type of tax[a]	Additive	Multiplicative
Differentiated-rate VAT	0.184%	0.426%
	($91.6)	($211.7)
Flat-rate VAT (6.53%)	0.422%	0.663%
	($209.8)	($329.7)
Progressive expenditure tax	0.230%	0.491%
	($114.3)	($243.9)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.

[a]All taxes raise the same amount of first-period commodity tax revenue from consumers.

to higher aggregate welfare gains than does additive replacement, it does so at the expense of even greater inequality. In addition, we see once again that the progressive expenditure tax is distinctly more progressive than are the VATs.

14.9 Summary and Conclusion

In the introduction to this paper, we posed a series of eight questions which this paper addresses. In this final section, we return to these questions. We find that the adoption of a flat, textbook-type VAT leads to modest welfare gains in the aggregate when equal revenue yield is preserved by reductions in personal income tax rates. For our central case simulations, the aggregate welfare gains are approximately one-half of 1% of the total present value of welfare when additive reductions in marginal income tax rates are used. When multiplicative replacement is used to scale back income tax rates the gains are larger, approximately three-fourths of 1% of the total present value of welfare. This illustrates a recurring theme of the paper, that the method of tax replacement can be just as important as the tax policy change itself.

For political and administrative reasons, the VATs adopted in Europe have differentiated rates. We find that rate differentiation leads to substantial reductions (on the order of 25–40%) in the welfare gains from adoption of a VAT. European governments have instituted differentiated rate schedules for their VATs with the thought that differentiated rates may reduce the regressive effects of the VAT. We find that rate differentiation does indeed produce a less regressive distribution of welfare gains and losses than those of a flat VAT. However, for three of the

Table 14.16 Welfare Effects of Value-added Taxes and Progressive Expenditure Tax, by Consumer Income Class, for the Model with Stone-Geary Commodity Demands, for Savings Elasticity of Zero

Household Income (in Thousands of 1973 Dollars)	Differentiated VAT Additive Replacement (%)	Flat VAT Additive Replacement (%)	Progressive Expenditure Tax Additive Replacement (%)[a]	Differentiated VAT Multiplicative Replacement (%)	Flat VAT Multiplicative Replacement (%)	Progressive Expenditure Tax Multiplicative Replacement (%)[a]
0–3	−0.176	−0.537	2.665	−2.279	−2.645	0.468
3–4	−0.198	−0.336	2.126	−1.966	−2.107	0.287
4–5	−0.101	−0.199	1.721	−1.582	−1.684	0.191
5–6	−0.096	−0.130	1.520	−1.416	−1.452	0.164
6–7	−0.226	−0.083	1.403	−1.446	−1.304	0.155
7–8	−0.251	0.006	1.165	−1.256	−1.000	0.147
8–10	−0.189	0.105	0.894	−0.926	−0.633	0.159
10–12	−0.221	0.214	0.611	−0.652	−0.217	0.197
12–15	−0.155	0.272	0.468	−0.419	0.008	0.227
15–20	−0.001	0.446	0.067	0.245	0.691	0.351
20–25	0.199	0.570	−0.205	0.826	1.196	0.468
25+	1.287	1.197	−1.288	3.897	3.810	1.366

Note: The figures are percentages of the total present value of welfare.

[a]This tax raises from consumers the same amount of first-period commodity tax revenue as the differentiated VAT and the flat 6.53% VAT.

Table 14.17 Efficiency Gains for Value-added Taxes and Progressive Expenditure Tax, for the Model with Stone-Geary Commodity Demands for Savings Elasticity of 1.0

	Replacement	
Type of Tax[a]	Additive	Multiplicative
Differentiated-rate VAT	0.408%	0.714%
	($202.6)	($354.6)
Flat-rate VAT (6.52%)	0.571%	0.874%
	($283.8)	($434.1)
Progressive expenditure tax	0.351%	0.672%
	($174.3)	($333.9)

Note: Figures are percentages of the total present value of welfare. Numbers in parentheses are in billions of 1973 dollars.
[a]All taxes raise the same amount of first-period commodity tax revenue from consumers.

four VAT simulations, the VAT is still a regressive tax-policy change.[5] In addition, rate differentiation leads to a variety of problems in administration and compliance. These problems are discussed at length in Aaron (1981).

A progressive expenditure tax also leads to aggregate welfare gains that are somewhat lower than those associated with a flat VAT. Comparison of these two tax policies suggests that roughly 60% of the efficiency of a consumption-type flat VAT relative to our current income tax is due to its consumption base. We also note that the progressive expenditure tax yields a much more progressive distribution of gains and losses than those generated by either type of VAT. In fact, with multiplicative replacement, all income groups gain under the progressive expenditure tax.

In section 14.5, we considered integrating the corporate and personal income taxes, and replacing the lost revenue with either a flat VAT, a differentiated VAT, or a progressive expenditure tax. This reform reduces both the distortions of the intersectoral allocation of capital and the distortions of capital accumulation over time. We find that this reform produces fairly substantial welfare gains regardless of the type of replacement for equal revenue yield. These gains, in all cases, take a U-shape. Under the flat and differentiated VAT, all groups gain.

When we remove the revenue neutrality assumption and allow the level of government expenditures and receipts to increase, we find large differences in the efficiency of the various tax policies. For example, the cost to households of funding a 10% increase in transfers and exhaustive government expenditures is 25% less if a flat VAT is used rather than a multiplicative income tax surcharge.

Table 14.18 **Welfare Effects of Value-added Taxes and Progressive Expenditure Tax, by Consumer Income Class, For Model with Stone-Geary Commodity Demands, for Savings Elasticity of 1.0**

Household Income (in Thousands of 1973 Dollars)	Differentiated VAT Additive Replacement (%)	Flat VAT Additive Replacement (%)	Progressive Expenditure Tax Additive Replacement (%)[a]	Differentiated VAT Multiplicative Replacement (%)	Flat VAT Multiplicative Replacement (%)	Progressive Expenditure Tax Multiplicative Replacement (%)[a]
0–3	0.236	−0.249	2.872	−1.720	−2.283	0.771
3–4	0.209	−0.050	2.314	−1.458	−1.697	0.620
4–5	0.303	0.085	1.905	−1.049	−1.251	0.541
5–6	0.303	0.154	1.694	−0.854	−0.990	0.533
6–7	0.162	0.195	1.567	−0.876	−0.830	0.523
7–8	0.128	0.276	1.324	−0.683	−0.524	0.526
8–10	0.171	0.362	1.045	−0.359	−0.161	0.534
10–12	0.116	0.454	0.755	−0.098	0.243	0.565
12–15	0.146	0.489	0.595	0.107	0.450	0.581
15–20	0.265	0.632	0.194	0.701	1.062	0.657
20–25	0.433	0.730	−0.079	1.213	1.498	0.726
25+	1.137	1.046	−1.256	3.310	3.195	0.921

Note: The figures are percentages of the total present value of welfare.

[a]This tax raises from consumers the same amount of first-period commodity tax revenue as the differentiated VAT and the flat 6.52% VAT.

The attractiveness of the policies we examine ultimately depends on the social welfare function one uses to evaluate the policies. We find that a Benthamite would favor any of the policies summarized in tables 14.3 and 14.4, while a Rawlsian would advocate a differentiated VAT with additive replacement or the progressive expenditure tax with either additive or multiplicative replacement. Within this spectrum, it appears that a flat VAT with additive replacement has a more progressive distribution than the differentiated or flat VAT with multiplicative replacement.

We performed sensitivity analyses with respect to the specification of commodity demands and with respect to the savings elasticity. The Cobb-Douglas formulation is the more elastic of our two formulations. Thus, we find the welfare cost of rate differentiation is higher than when we assume a Stone-Geary formulation. We also find that, for each of the tax substitution policies we consider, increases in the savings elasticity lead to modest increases in the welfare gains.

Notes

1. For a more detailed discussion of these derivations, see Ballard and Shoven (1985).

2. See Goulder, Shoven, and Whalley (1983) for a discussion of the equivalence between origin-based and destination-based taxes.

3. We reject the argument that the corporate tax is simply a form of risk sharing by the government (Gordon 1981), because it does not share proportionately in the capitalization risk. Our position is consistent with the analysis of Bulow and Summers (1984).

4. For an extensive discussion, see McLure (1979). Corporate tax integration has also been simulated using an earlier version of the simulation model used here. See Fullerton et al. (1981).

5. The differentiated VAT with additive replacement has a U-shaped welfare distribution and the smallest aggregate welfare gain.

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Comment Harvey Galper

The Ballard-Scholz-Shoven paper is very much what we have come to expect from the general equilibrium (GE) modeling work of John Shoven and his colleagues: a useful and clearly presented application of an impressive GE model containing simulation results of a range of policy options, alternative ways of using whatever revenue is gained from these options (maintaining revenue neutrality in today's jargon), sensitivity of the results to alternative specifications of the model, and along the way useful insights into what one learns from the general equilibrium framework that might not otherwise be apparent. All this and more are in this current paper, an examination of the efficiency and incidence effects of various forms of value-added or consumption taxes.

Since the publication of Ballard et al. (1985), the model is now accessible to everyone in full detail. The only significant change in the version used in this paper is that a Stone-Geary linear expenditure system has replaced the Cobb-Douglas commodity demand specification for households (but even here sensitivity analysis of these alternatives has been performed).

Three kinds of consumption taxes are considered in this paper as partial replacements for the current individual income tax: (1) a European-type value-added tax where substantial variations exist in the rate of tax among commodities; (2) a flat-rate VAT designed to raise the same revenue as in (1) at a rate of 6.52%; and (3) a progressive expenditure tax with marginal rates increasing from 0.3% at the lowest consumption level to 11.6% at the top. The main efficiency findings are not surprising.

First, the efficiency gains of these structural tax changes are not trivial, ranging from 0.3% to 0.8% of the total present value of welfare (itself equal to $49 trillion in this model). Second, the flat rate yields the highest efficiency gain with the differentiated rate VAT and the personal expenditure tax of lesser but about equal efficiency. Third, actually one of the insights from GE modeling, how the revenue from a VAT is used to reduce other taxes is as important as the particular kind of consumption tax that raises the revenue in the first place. A proportionate reduction in all income tax rates (multiplicative change) yields greater efficiency gains than a constant absolute rate reduction (additive change) because the very highest and most distorting marginal tax rates are reduced more.[1]

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1. Differential effects depending upon how the government uses the new revenue (or makes up the lost revenue in the case of tax cuts) were also emphasized in GE simulations performed by Fullerton and Gordon (1983).

Up to this point, the results are not dissimilar to those derived from this model earlier—e.g., chapter 9 of Ballard et al. (1985). The new wrinkle here is that with these current simulations the model is used to address directly the efficiency-equity tradeoff of various forms of consumption taxes. Specifically, the simulations display for each alternative tax regime the change in tax incidence for each of the twelve consumer groups in the model. The authors are correct to focus on the equity issue. From a policy perspective, it is *the* critical issue in the consumption tax debate. And yet I feel that the approach adopted here is something of a disservice to the cause of consumption taxes, despite the fact that my own particular favorite—the progressive expenditure tax—seems to score highest on equity grounds.

I will explore in more detail my reasons for this view, but in any event the model makes clear the direct tradeoff between efficiency and equity. Despite overall efficiency gains, the simulations show that a VAT, in general, makes the lowest-income classes worse off and the higher-income classes better off. Only the progressive expenditure tax reverses this pattern, with one variant actually yielding a Pareto-superior outcome that improves the welfare of all income classes.

Other simulations show the efficiency and equity effects of integrating personal and corporate income taxes and making up the revenue lost from this proposal with either the flat or differentiated VAT or a progressive expenditure tax. These changes generally yield efficiency gains approximating 1% of the present value of welfare. On the equity side, gains are realized for all consumer groups, but the key finding is the U-shaped pattern of welfare gains by income class. This reflects the underlying U-shaped distribution of the capital income-labor income ratio, another indication of the problem introduced by the incidence measures used in this paper.

I will make two comments on this work. First, the particular simulations presented here lead me to want to see one more experiment simulated with this model. This is what might be called the European compromise: raising taxes by means of a more regressive tax such as the VAT in order to support more redistributive social spending. Specifically, the simulation I have in mind is to use the proceeds from the VAT to both (1) compensate by direct transfers the lower-income groups who lose from the VAT and (2) reduce income tax rates multiplicatively across the board. One could then show that the redistributive effects shown in the paper are not inevitable; or, even more pointedly, that a specifically redistributive use of the proceeds must accompany any VAT to counteract the tendency to welfare losses among lower-income groups. But even this experiment does not address a fundamental problem of the incidence calculations, my second and more substantive comment.

As Harberger (1978) noted in discussing an earlier version of this model, all models are partial equilibrium models in the sense that they cannot, in fact should not, fully replicate all elements of the economy. The "partial equilibrium" elements of this model have often been alluded to by the authors here and in other work and include the failure to incorporate firm financing decisions, household portfolio choices, and potentially significant international capital flows. Perhaps most important for the current application, however, and indeed the particular point about which Harberger was most concerned, is whether this model tells us anything useful about issues of income distribution. This question is important because the application presented here is the first use of the GE model that attempts to examine specifically the equity-efficiency tradeoff. All earlier applications concentrated on efficiency gains or revenue considerations, and kept equity concerns deep in the background (Ballard et al. 1985, chaps. 8–11).

But with the incidence of alternative tax regimes brought so much to the fore, it is logical to ask whether the distributional measures used are adequate to the task. My answer to this question must be in the negative. The reason for this assessment is that the paper employs a measure of the distribution of income at a single point in time, the year 1973, as the benchmark for determining how particular consumer groups in the economy will fare over a period of sequenced equilibria extending 100 years into the future. In other words a *one-year snapshot* of the income distribution is the standard for determining long-term tax incidence. According to this model, as the economy expands over time due to productivity growth and capital accumulation (forget pure population growth), each taxpayer group simply expands its labor and capital income along the base-case balanced growth path. Neither the ratio of capital to labor income (with an exception to be noted below), nor consumption relative to income exhibit any life-cycle tendencies for the 12 consumer groups. Each income class observed in 1973 is assumed to be in long-run life-cycle equilibrium.

None of this is, of course, true, nor is it news to the authors. They not only recognize this snapshot problem but, in fact, have informed me that they correct for at least one of the most obvious manifestations of it, namely the negative saving of the lowest-income class. If this class were simply continued forward through time for 100 years, it would soon exhaust its capital assets and not be able to continue consumption. To forestall this result, the authors allocate each period's capital accumulation among income classes, not according to each class's *own* saving, but according to its stock of capital. That is, aggregate capital accumulation is equal to the sum of the saving of each income class, but the *distribution* of this new capital is proportional to the distribution of existing capital. The rationale for this assumption is that there is some movement of individuals among income classes so that the 1973 snapshot cannot really represent a long-term income distribution. Despite this ad hoc assumption to deal with one specific aspect of the snapshot problem, the fundamental issue is not addressed.

Basing incidence on a one-year pretax income distribution misses two separate effects: first, an initial cohort or transition effect emphasized by Auerbach and Kotlikoff (1983); second, the long-term incidence of the new tax rules once these rules have been in effect for the entire lifetime of each taxpayer. Even assuming that the two effects can be separated, and the Auerbach-Kotlikoff work does not provide great grounds for optimism here, this model is clearly in the spirit of long-term incidence rather than short-term adjustments. In general, transition issues have not been the focus of the Shoven-Whalley GE work.

The questions then become: how closely does the 1973 income distribution represent lifetime income distributions and how closely does one-year tax incidence represent lifetime tax incidence? There is much evidence suggesting considerable bias in the incidence results and, perhaps more important, bias that makes consumption-based taxes appear much more regressive than they actually are. For this reason, it is particularly important that in the policy debate we move away from one-year incidence measures to lifetime incidence measures, while still recognizing that initial cohort or transitional effects must be carefully considered in any regime change.

The first piece of evidence on the snapshot problem comes from the data used in this model itself. The U-shaped capital-to-labor income share, as noted, and the low and negative saving of the lowest-income classes reflect a mixture of cohort (that is life-cycle) effects and distributional effects within cohorts. Capital income is a relatively high share at the low end of the income scale because these classes are made up in substantial part of retired people with little labor income who are drawing down capital assets to sustain their consumption and hence have low saving. At the top of the income distribution are, those at the peak of their earning years who have also accumulated many financial assets preparatory to retiring a few years hence. In the middle are younger households just starting to accumulate assets.

A few observations from the March 1985 CPS data on 1984 incomes give similar results a decade later. When households are arrayed by 11 income classes by age of head, the following conclusions emerge: (1) For the three lowest-income classes ($0–$5,000, $5,000–$10,000, $10,000–$15,000), the modal age group is 65 and over (with 34%, 43%, and 31%, respectively, of all households in the class). (2) For the next four income classes ($10–$15,000, $15–$20,000, $20–$25,000, and $25–

Table 14.19

Age of Household	Median Household Income (dollars)
15–24	$14,028
25–34	23,735
35–44	29,784
45–54	31,516
55–64	24,094
65 and over	12,799

Source: U.S. Bureau of the Census, Current Population Reports, Series P-60, No. 149, *Money Income and Poverty Status of Families and Persons in the United States: 1984 (Advance Data from the March 1985 Current Population survey)*, (Washington, D.C. USGPO, 1985), table 13, p. 19.

$30,000) the 25–34 age head is the modal class. (3) In contrast, for the top income class ($75,000 and over) the modal age group is 45–54, and for the next two highest-income classes ($40–$50,000 and $50–$75,000) the modal age group is 35–44. (4) Furthermore, for ages up to the age group 45–54, median household income increases substantially before declining for the age groups 55–64 and 65 and over (see table 14.19).

A recent article by Davies, St-Hilaire, and Whalley (1984) makes this same point regarding the contrast between cross-section and life-cycle income distributions in Canada, and the resulting effects on the incidence of consumption-based taxes. They find that income is much more evenly distributed on a lifetime basis than on an annual basis, and the distribution of components of income change markedly as well. For example, the distribution of transfers is much more concentrated in lower-income groups in annual data than in lifetime data, comprising over 44% of income for the lowest two deciles for annual data, but never more than 15% of income for any decile for lifetime data. Similarly, consumption of income is much more evenly distributed on a lifetime than on an annual basis. These results imply, therefore, that the incidence of consumption taxes is much less regressive on a lifetime basis.

What is the solution to this problem for the current model? I am not sure I have a good answer here. In my work with Eric Toder on household portfolio choice (1984), we have much the same problem if we wish to examine distributional effects. Observed portfolio holdings reflect both cohort effects and distributional effects within each cohort. For analytical purposes these two effects must be distinguished.

The most conceptually satisfying procedure is a full overlapping generations model, but, even short of such a major restructuring, some changes are needed if equity-efficiency tradeoffs are to be adequately examined. One possible solution may be to separate out age cohorts, perhaps by the 6 age categories used in the CPS table (14.1), for each household income class. Distributional data can then be displayed separately for each cohort.

In the context of the current GE model, this would still require some care in interpreting the simulations. One would certainly *not* want to interpret the results as representing what a household currently headed by a 25-year old would look like in 100 years when the head is 125. Instead, the results may be taken to represent the taxes a household of age 25 head would pay 100 years from now if regime 2 rather than 1 had been in effect over this entire period. Also, with the results for each age cohort displayed separately, one could either use a particular cohort, such as the 35–45 age group, as the basis for making distributional judgments, or else use a social welfare function that weights each age cohort as well as each income class within an age cohort. In any event, by distinguishing across-cohort and within-cohort distribution effects, incidence measures would be more comprehensive and useful than those presented in this paper.

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