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12 Concluding Remarks

Any attempt to evaluate national tax policy must deal with at least three major problems. First, when looking at a particular tax or proposed reform, we must account for interactions among different tax instruments. The distributional and efficiency effects of one tax reform depend fundamentally on other taxes that might be levied on other transactions or by other units of government. Second, if the reform applies to a broad-based tax, we must account for other reactions of economic agents. A particular excise tax might be evaluated in a partial equilibrium framework, for example, but the corporate income tax requires a general equilibrium model. Third, if the reform is more than incremental, we must calculate a whole new counterfactual equilibrium rather than rely upon local approximations around the initial equilibrium.

This book presents the structure of a numerical general equilibrium model designed to deal with these problems. The model includes many features of the U.S. economy, including all major taxes, savings and investment behavior, production, consumption, government transactions, and trade. The model can be used to evaluate particular proposals or to study other more general tax issues. Production is disaggregated in the model in order to capture the efficiency effects of factor reallocations, and consumers are disaggregated in order to capture distributional effects. The book contains considerable detail on all of these specifications and on all of the data used. We also provide results from a number of applications.

This modeling activity is part of a broader range of developments, both within public finance and within the applied general equilibrium literature. Most recent tax policy evaluations have been based on the pioneering work of Arnold Harberger (1962, 1966), who first included both efficiency and distributional considerations in a general equilibrium

model. Many applications and extensions of this approach are described in the survey by Charles McLure (1975). These analytical models were limited to few production sectors, however, and can only consider incremental changes. With the development of computer methods and techniques such as the algorithm of Scarf (1973), more detailed and sophisticated models began to appear. These models have been applied not only to U.S. tax policy, but to other countries and other issues such as trade or development policy. Some of these models are reviewed in Fullerton, Henderson, and Shoven (1984), and in Shoven and Whalley (1984). This book fits squarely into this public finance and modeling literature.

The original Harberger approach considered the allocation of fixed factor supplies in a single equilibrium period. In our model, we disaggregate production in order to capture more of these static effects, and we allow for endogenous supply of labor in each period. One of the major features of our model, however, is its capability of analyzing dynamic effects through a sequencing of equilibria. An endogenous supply of savings in any one period is added to the capital stock for the next period, and a time profile for the economy is calculated. Welfare implications proceed from the comparison of alternative intertemporal consumption profiles that are generated by alternative tax regimes. This approach has the further advantage that it does not just compare steady-state growth paths, but considers the transition from one to another.

12.1 Results from the Model

One of the major applications of our model involves the integration of corporate and personal income taxes (chapter 8). In fact, many features of the model were designed with this application in mind. We include in our model the personal factor tax, described in section 3.5 above, because the features of the corporate tax which discriminate among industries might be offset or exacerbated by the industry-discriminating features of personal taxes on interest, dividends, and noncorporate income. We find that significant welfare gains can be obtained by undertaking this kind of reform, and that the size of this gain depends on the specifics of the policy. Also in chapter 8 we discuss the distributional effects of corporate tax integration.

Other features of the model were designed in order to evaluate the move to a progressive consumption tax. Labor/leisure choices are required for second-best evaluation of a comprehensive consumption tax, as is consideration of intertemporal effects. Chapter 9 shows that the welfare gain from this reform is of the same order of magnitude as the gains arising from corporate tax integration. Moreover, in this model, either reform could provide individual welfare gains to every one of our twelve income classes. We do not capture possible redistributions among

groups based on age or other demographic characteristics, but this Pareto improvement for our twelve income groups is still a significant finding. Other distributional considerations are discussed below.

Besides particular policy proposals, the model can be used to evaluate more conceptual tax policy problems. In chapter 10, for example, we use the model to plot the total government revenue that results from each possible tax rate on labor income. The resulting Laffer curve, for our standard elasticity parameters, is sharply upward sloping for our estimate of the existing tax rate on labor, and it continues to increase up to a 70 percent overall marginal tax rate. Higher labor supply elasticities imply that the curve peaks at lower marginal tax rates, but the aggregate elasticity would have to be unreasonably high (about 3.0) before existing tax rates would put us on the downward-sloping segment of the curve.

All of the results can be sensitive to assumptions and specifications in the model. One of our most important assumptions, however, is that the United States has a fixed supply of capital. If instead capital is internationally mobile, as many have argued, then the impact of taxes could be substantially different. For this reason, chapter 11 goes on to investigate four alternatives. In the specification where capital services are highly mobile across boundaries, investment incentives (such as corporate tax integration) can be associated with additional investment, capital inflows, and welfare gains to the United States, while savings incentives (such as the switch to a consumption tax) can be associated with additional savings, capital outflows, and welfare losses to the United States.

Elsewhere, the model has been used to evaluate many other policy problems. Fullerton and Henderson (1983), for instance, examine the major features of President Reagan's tax policy program, including both the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982. Ballard, Shoven, and Whalley (1985) measure the overall efficiency effects of every United States tax instrument. For each instrument they simulate its complete removal in order to measure average excess burden (the ratio of total excess burden to total revenue), and they simulate a small change in the rate in order to measure the marginal excess burden (the ratio of the change in excess burden to the change in revenue). One of the main themes to emerge from this analysis involves highlighting the efficiency costs of the tax system in general. Whereas Harberger first suggested that some of these costs were about one-half of 1 percent of GNP, the results from this model indicate that the costs are more significant. Ballard, Shoven, and Whalley find that excess burden is in the range of 20 percent of total revenue, but can easily approach 50 percent of marginal revenue.

We emphasize that these results are not specific forecasts of the U.S. economy under alternative policy regimes. Rather, the model should be viewed as providing a numerical approach to economic theory and policy.

We use the numerical equilibrium model to provide the same kind of economic insight that a theoretical model would provide for a simpler problem that could be solved analytically. We do not use it to predict actual responses. We look at tax changes with a strong ceteris paribus assumption, so we do not consider any of the myriad possible nontax changes that can affect the actual development of the economy.

12.2 Strengths and Weaknesses of the Approach

On many occasions throughout this book we have discussed the strengths and weaknesses of the computational general equilibrium approach, as well as of our particular model. At this point it is appropriate to review these strengths and weaknesses, and mention some others. This will help to place our results in perspective.

As a part of this discussion we will refer to many authors who have relaxed certain assumptions and explored issues that we have not addressed directly in this book. The field of computational general equilibrium (CGE) has grown enormously in recent years, probably because of a widespread feeling that it has many important advantages. The greatest advantage of these models is that they are able simultaneously to consider all interactions in a complex model economy, without ignoring income effects. This allows us to obtain quantitative answers to questions that cannot even be posed in a partial equilibrium framework. Policy analysts who use partial equilibrium techniques are often forced to make a large number of ceteris paribus qualifications to their results. The CGE approach allows us to reduce the number of such qualifications that must be made.

Further advantages of the CGE approach can be seen when it is compared with the simpler model of general equilibrium popularized, in the public finance field, by Harberger. As pointed out in chapter 2, the Harberger model can only be used to analyze changes within a very small number of sectors, and, strictly speaking, its results are only valid for small changes in the relevant parameters. The CGE approach allows us to consider model economies with many dimensions, and it allows us to look at a tremendously wide range of tax policy changes.

As with any form of economic analysis, our applied general equilibrium analysis has its difficulties. These range from general problems implicit in competitive analysis to specific problems in the choice of functional form. Let us consider these problems, beginning with the broader, more general ones.

We assume that all markets are perfectly competitive, that all economic agents have complete information about current prices, and that production is characterized by constant returns to scale. Obviously, each of these assumptions is contrary to many of our everyday observations

about the real-world economy. However, we feel that they can be defended in three ways. First, our model is designed to investigate long-run questions of economic efficiency. There may be long-run tendencies toward perfect competition and complete information, even if at any moment these assumptions do not hold throughout the economy. Second, these assumptions give us analytical and computational tractability—the capability to work with a structure that incorporates the main elements of the economic system but at the same time provides a mechanism for analyzing policy issues. Third, these assumptions are used widely in the theoretical literature. Our model stands in clear relation to the existing theoretical literature, and its results can be better understood in light of that theory.

We also assume full employment of productive factors in a long-run equilibrium, without any money supply or macroeconomic fluctuations. This approach seems patently unrealistic, but it allows us to concentrate on real allocation and distribution problems. Our results are not predictions of any near-term effects or even of long-run occurrences. Instead, our results should be seen as indicating the effects of one important set of economic forces that operate in the long run (namely, taxes), while abstracting from a number of other forces that might be felt in the interim. In this sense our results are clearly counterfactual. The only macroeconomic effects that might be relevant would be those that somehow affect long-run tendencies.

In general, an important difficulty is the problem of *model preselection*, that is, the need to select a particular form for the model before the analysis can proceed. The results depend crucially on these choices, but no systematic method exists for making them. The literature simply does not provide clearly defined specification tests for discriminating among alternative model variants.

An example of this difficulty arises when we have to choose an assumption about consumer expectations regarding future prices and tax rates. Expectations might be myopic, as in this model, or perfectly accurate as in Auerbach and Kotlikoff (1983). Ballard and Goulder (1982) investigate the importance of this issue by varying the degree of consumer foresight in an otherwise unchanged version of the model in this book, and they find reasonable robustness in our results.

Another example of model preselection involves the assumption about international capital flows. In analyzing the incidence of the corporate tax, Harberger (1962) assumed a fixed domestic capital stock. He found that, in spite of intersectoral differences in tax rates and the ability of capital to shift between sectors, capital bears the full burden of the tax. Other authors have pointed out, however, that alternative assumptions can totally change the conclusion. If we assume that capital is internationally mobile and that the economy under consideration is small rela-

tive to world capital markets, then the supply function for capital is perfectly elastic. The price of capital cannot change as taxes are reformed, so domestic capital owners are unaffected. Tax burdens are borne instead by internationally immobile factors such as labor.

We place our model in the original Harberger tradition by assuming that capital is immobile between nations but perfectly mobile among sectors. The first assumption is relaxed in chapter 11, and we find sensitivity in the results as suggested above. The second assumption, about intersectoral mobility, is relaxed by Fullerton (1983). The welfare gain from corporate tax integration is somewhat diminished in this alternative model where capital takes time to relocate, but the basic results are fairly robust.

Some particularly important structural problems involve the ways in which the various taxes are modeled. Any particular tax must be represented in model-equivalent form, and there are generally several acceptable ways to do this. In our model we represent each tax as an ad valorem tax, and these rates are built into the model structure. Yet the public finance literature generally suggests alternative analyses of nearly all of the major taxes that make up our tax system. The corporate income tax, for example, has been treated as a partial factor tax by Harberger (1962), as a lump-sum tax by Stiglitz (1973), and as an instrument of risk sharing by Gordon (1981). Whichever of these treatments is adopted will influence the conclusions from the model. When Fullerton and Gordon (1983) build the risk-sharing view into a model that is otherwise identical to the one in this book, they obtain substantially different results. Instead of providing welfare gains, the integration of corporate and personal taxes results in a net welfare loss. (More discussion of this alternative is provided in section 3.2.)

The property tax, as another example, has been viewed as an excise tax on housing and more recently as a tax on the return to capital employed in particular industries. We adopt this new view of the state and local property tax, and our equilibrium model allows the partial factor tax to have excise effects on the price of output in any industry where the property tax is higher than average (e.g., the housing industry). However, the tax may be systematically related to benefits. If individuals and firms are mobile among a large number of local jurisdictions, and if local public goods provide no spillover benefits to other jurisdictions, as in a Teibout (1956) equilibrium, then tax payments would be exactly matched by benefits received. The tax in this analysis is a payment for services, not a distorting wedge.

In spite of these many difficulties, it still is necessary to analyze the tax system so that tax policies can be formulated more intelligently. We believe that a major contribution of this book is the explicit discussion of

the various modeling choices. The reader can then consider these choices in evaluating our conclusions.

Even more specific are the problems involved in choosing functional forms and parameter values. We have chosen CES functions because they are analytically tractable and because they allow us to incorporate key elasticity parameters easily. In the absence of substantial agreement in the literature about the values of some of these parameters, we want to be able to vary them in sensitivity analysis. The best we are able to do is to use the existing literature to choose a single best-guess value, as well as a wider range of values that might be deemed reasonable. Through the use of alternative values, we assess whether the policy conclusions are robust.

For many tax reforms, such as corporate tax integration, we find that the welfare gains are an upward-sloping function of the assumed saving elasticity (described in section 6.4.3). No single reform always dominates all other reforms when we compare them on the basis of the welfare gain. Fullerton and Lyon (1983) find that, even within a fairly narrow range, the choice for the saving elasticity parameter value is directly linked to the choice of reform (if that choice is based on welfare gains).

It might be argued that the range of estimates for some of the parameters is so great that our model can only be of limited use as a guide to policy. We would respond to this claim in two ways. First, the main themes of our results are not altered by changes in the elasticities. Corporate tax integration and the consumption tax generate substantial welfare gains, regardless of the saving elasticity. Second, the need to make policy decisions leads us to do the best we can, given currently available estimates and techniques. We would very much like to have improved elasticity values on which to base our calculations, but in the absence of more reliable estimates, our sensitivity analyses give a good feel for the likely range of responses to the policy change.

12.3 Directions for Future Research

The ultimate value of a model such as this one hinges both on the believability of the calculations and on their usefulness to policy analysts. It is easy to dismiss such exercises as worthless on the grounds that the assumptions are crude, the data are poor, and the model is preselected (i.e., the particular treatment of each policy instrument has been adopted before the calculations have been made). Nevertheless, we are faced with a policy environment where decisions must be made. If little or no modeling activity takes place, then the analytical structure of conventional economic theory is not being brought to bear fully in making policy decisions. We suggest that our model, and other models like it, have an important role in the policy-making process.

Still, much is left to be done. For example, the numerical specifications of these models are unpalatable to many econometricians. The models are not estimated with any statistical techniques, and no tests apply to the choice of specification. As a consequence, one major contribution would be the econometric estimation of a complete model of this type. Jorgenson (1984) has embarked on one such econometric specification of a general equilibrium model. Mansur and Whalley (1984) discuss this estimation issue, and they conclude that it may well be impossible to estimate an applied general equilibrium model of large dimension using a complete estimation procedure that incorporates all restrictions on parameters. They suggest that such models will never be estimated without some partitioning of the parameter values. As a consequence, the state of the art will probably continue to include some recourse to extraneous parameter estimation or specification through literature search.

The dynamic structure of these models is another area in which considerable research is now taking place. The models developed thus far have predominately been static. Although we have gone further in this book in examining sequenced general equilibrium models, we still assume a world in which consumers live forever. Adoption of an explicit life-cycle structure would be a welcome addition to the analysis of many intertemporal issues. The work of Auerbach and Kotlikoff (1983) provided this type of structure for the first time. Ballard (1983) has continued by extending the model used in this book to include overlapping generations of life-cycle consumers. Each generation receives inheritances, and each gains utility from bequests. The generations are of different sizes, reflecting the baby boom phenomenon. Ballard finds that the consumption tax leads to welfare gains for every cohort, although the gains are generally somewhat less than the gains found in this book. Although Auerbach-Kotlikoff and Ballard differentiate among consumers of different ages, no CGE model has yet differentiated among consumers of the same age across different levels of income or wealth.

Another important research priority is to improve the specification of tax rate parameters, since these can affect the results crucially. A more complete incorporation of recent work on effective tax rates would therefore be an advance. (A summary review of such studies is provided in Fullerton 1984).

Finally, at this point, we note a number of researchers who are currently suggesting areas for further study. Feltenstein (1984), for example, is working on a general equilibrium model with money and bonds. Many researchers find bonds to be a useful addition to an otherwise real equilibrium model, because their existence allows the government to spend more real resources than it collects in real taxes. An example is the model of Mexico by Serra-Puche (1984), a model that also includes unemployment of labor. Willig (1983) has begun to investigate imperfect

competition in an equilibrium model, and Bovenberg (1983) is working further on a model of imperfectly mobile capital with installation costs.

Even within the competitive equilibrium framework, one can learn from the disaggregation of productive factors, as in Keller (1980), or of sectors, as in Dixon, Parmenter, and Rimmer (1984). Other studies have emphasized detailed treatments of particular sectors such as the energy sector in Jorgenson (1984) or Borges and Goulder (1984). One could proceed to study the allocative significance of particular deductions in the personal tax, public goods that are nonrival in consumption, or externalities as additional distortions in production or consumption. In addition, we are always in need of more recent data or evidence on producer behavior, consumer behavior, saving behavior, and expectations.

This is only a partial list of the many avenues along which research is now being carried out. Many more exciting areas of research have not yet been explored. Ultimately, these models will prove worthwhile if they shed light on economic questions previously not well understood, and if they contribute to the rational formulation of economic policy. We believe that these models have been successful on both counts, and that the use of these models not only will continue but will expand.