Incidence of taxes

George R. Zodrow
Rice University

The analysis and measurement of who bears the final burden of a tax.

One of the most fundamental questions addressed by public finance economists is that of who bears the final burden of a tax. The basic issue is that tax-induced changes in individual and firm behavior and the associated changes in commodity prices and factor returns are likely to imply that the final burden or "economic incidence" of a tax will be different from its "statutory incidence"—that is, a tax may be partially or fully "shifted" from one set of economic agents to another. Business taxes are a frequently cited example, as they may be either "shifted forward" as higher consumer prices or "shifted backward" as lower wages or land. The tax incidence literature provides many insights, and has played an important role in the development of tax policy (McLure and Zodrow 1994). Nevertheless, the incidence of many taxes—especially those on capital income, including corporate income taxes and local property taxes—is still a controversial topic. More generally, there is considerable disagreement about various theoretical issues, including the appropriate market structure for incidence analysis and the extent to which capital is mobile internationally; similarly, there is a lack of consensus on various empirical issues, including the parameter values that should be used in numerical simulations of the theoretical models.

Public finance economists have used three basic approaches to analyze tax incidence. The most common method analyzes the effects of taxes in a theoretical model of the economy; these models differ in many dimensions, including the number of markets analyzed, the extent to which factor supplies are assumed to be fixed, the method of capital accumulation, the nature of market competition, and the extent to which transitional issues are addressed. The second approach is closely related to the first, because it involves numerical simulations of tax effects in models that are basically complex variants of the analytical models described above. Finally, several analysts have studied incidence by estimating individual tax burdens directly using large micro-data sets. Each of these approaches, which have become increasingly sophisticated over time, is discussed below. Several excellent surveys of the incidence literature are available for further reference (Mieszkowski 1969; Break 1974; McLure 1975; Atkinson and Stiglitz 1980; Kotlikoff and Summers 1987; Atkinson 1994).

Partial-equilibrium analysis

The simplest type of incidence analysis examines the impact of a tax in a "partial equilibrium" framework—that is, within the context of a single market, neglecting any tax-induced effects on other markets. Although relevant only when such effects can reasonably be assumed to be unimportant, partial-equilibrium models provide many insights. Most important, they demonstrate that incidence is determined primarily by the extent to which individuals or firms are able to change their behavior to avoid the tax; this flexibility is typically measured by price elasticities of demand and supply. For example, the burden of an excise tax tends to be borne by consumers if demand is relatively inelastic—that is, if consumers are unable to substitute away from consumption of the taxed good; by comparison, the burden of an excise tax tends to be borne by producers if supply is fairly inelastic. In limiting cases, the tax is borne fully by a single group; for example, if demand is perfectly inelastic or supply is perfectly elastic (as is the case with constant returns to scale in production), consumers bear the entire burden of the excise tax. In addition, these same factors determine who bears the excess burden of a tax—the efficiency cost attributable to tax-induced distortions of individual and firm behavior. Finally, partial-equilibrium analysis can be used to demonstrate another basic tenet of incidence analysis—that the economic incidence of a tax in a competitive system depends solely on market conditions and is independent of its statutory incidence.

Nevertheless, partial-equilibrium analysis is clearly limited in that most taxes have important effects on markets other than the one in which they are assessed. Moreover, the focus in partial-equilibrium models on incidence in terms of producers and consumers is unsatisfactory, because one would like to go "behind the supply curve" and identify the factor owners who bear the producer portion of the tax burden, and go "behind the demand curve" to determine which types of consumers are adversely affected by tax-induced commodity price increases (McLure 1975).

Static general-equilibrium analysis

These two problems are resolved in general-equilibrium models of tax incidence. Such models account explicitly for market interactions; for example, they consider the effects of tax-induced factor reallocations on all other markets in the economy. In addition, the effects of tax changes on individuals

can be determined explicitly by specifying individual tastes and patterns of factor ownership.

The simplest general-equilibrium models are "static," in that total factor supplies are assumed to be fixed. Much of this research is based on the seminal article by Harberger (1962). (See also Musgrave 1953, 1959.) The Harberger model assumes perfectly competitive markets and zero initial taxes and has a single consumer, two production sectors, and two factors of production—capital and labor—that are perfectly mobile between the sectors, although fixed in total supply. The model is thus ideally suited to analyzing the intermediate-run effects of sector-specific taxes; it was initially used to examine the incidence of the corporate income tax, with the two production sectors representing corporate and noncorporate output.

The primary insight obtained from such models is that general-equilibrium effects in markets other than that in which a tax is introduced are often very important. For example, the imposition of a partial factor tax in the model drives the factor out of the taxed sector into the untaxed sector, tending to depress the overall return to the factor. (Note that the assumption of intersectoral mobility implies that the burden on any factor is shared among all factor owners rather than just the owners of the factor in the taxed sector.) Such models are theoretically characterized by a wide variety of incidence results; for example, the analysis of the corporate tax includes cases in which capital owners bear all (or even more than 100%) of the tax as well as cases in which capital owners benefit from the tax. Nevertheless, Harberger argued that for plausible parameter values, capital owners bear the full burden of the corporate income tax on equity income—a result that was generally confirmed in subsequent numerical simulation models (Shoven 1976).

The two-sector static general-equilibrium model has the significant advantage of being simple enough to be solved analytically for the factors that determine incidence as well as the parameters that establish their magnitudes; such analyses provide considerable insight into the market interactions that determine tax incidence. For example, the effect of the corporate income tax on the return to capital in the Harberger model can be decomposed into two components (Mieszkowski 1967). The first is a "substitution effect," which reflects reduced demand for capital in the taxed corporate sector and has an unambiguously negative effect on the return to capital. The second is an "output effect," which reflects reduced demand for corporate output because of its tax-induced increase in price; this has a negative (positive) effect on the return to capital if the taxed sector is capital (labor) intensive, as the reallocation of production from the taxed to the untaxed sector implies an excess supply of capital (labor), which must be eliminated by a reduction in its price. In general, commodity demand elasticities and the elasticities of substitution in production are the critical factors in determining the magnitudes of these effects.

The analytical static general-equilibrium model constructed by Harberger has been extended in numerous ways. One extension has been to allow consumers with different tastes. In this case, income redistribution affects consumer demands and thus relative consumer and factor prices and net incomes (Mieszkowski 1967). For example, a general tax on labor can be shifted in part to capital owners if the owners of labor consume the capital-intensive good to a disproportionate extent, so that a reduction in their incomes leads to reduced demand for capital. Second, the assumption of perfect factor mobility may be relaxed. In general, as suggested above, the burden of taxes in such cases falls on factors that are relatively immobile (McLure 1970, 1971). Third, the assumption of perfect competition has been questioned, especially for analysis of the corporate tax. Although there is no widely accepted model of imperfect competition, most observers argue that more forward shifting of taxes to consumers is likely in this context (Katz and Rosen 1985). Fourth, because the Harberger model assumes that initial taxes are zero, excess burden effects cannot be analyzed because they are second-order effects and thus do not appear in a differential analysis. The extension to an existing tax structure allows explicit analysis of the burden of the efficiency costs of taxation (Ballentine and Eris 1975; Vandendorpe and Friedlaender 1976); such models are essential for the analysis of the incidence of tax reforms (Feldstein 1976; Zodrow 1981, 1992).

The primary problem associated with the analytical studies described above is that the number of markets and consumers must be severely limited to keep the models tractable. This problem has been attacked by utilizing the basic structure of the Harberger model in the construction of large-scale computable general-equilibrium models that analyze tax incidence in economies with many production sectors and types of consumers; for example, one such model includes 19 business sectors and 12 consumer groups (Ballard et al. 1985). These models have been used to analyze the incidence of differential taxation of industries and types of assets, and to determine the distribution of the tax burden of existing tax systems and potential reforms across various types of individuals. In addition, these numerical

models have been extended to include considerations of risk and endogenous financial behavior (Slemrod 1983; Galper et al. 1988).

The basic static general-equilibrium model can also be used to analyze tax incidence in open economies, in which case one sector represents a small open economy and the second sector represents the rest of the world (or country in the case of a state or regional analysis). In the simplest cases, the main result is that, although capital still tends to bear the overall burden of a tax on capital in the small taxing jurisdiction, the outmigration of capital caused by the tax lowers returns to immobile factors in the jurisdiction by the sum of the tax and its excess burden (Brown 1924; Bradford 1978). The policy implication is that small open economies that face a perfectly elastic supply of a factor should not tax that factor (Slemrod 1988). More generally, increasing international mobility of capital suggests that open economy considerations should play an important role in tax incidence analyses, although the extent of international capital mobility is still a controversial issue (Harberger 1980; Feldstein and Bacchetta 1989).

Finally, the static general-equilibrium model has been used to argue that the property tax is primarily a tax on capital, because capital owners bear the average burden of property taxation in the nation, while tax differentials across jurisdictions cause higher commodity prices and lower factor returns in relatively high tax jurisdictions and the opposite effects in relatively low tax jurisdictions (Mieszkowksi 1972; Zodrow and Mieszkowski 1986). This view has been challenged, however, by those who argue that the property tax, when combined with the appropriate zoning restrictions or by perfect capitalization of fiscal differentials in land prices, is effectively a benefit tax for local public services (Hamilton 1975, 1976).

Dynamic general-equilibrium analysis

The primary problem with the static analyses described above is that tax effects on total factor supplies are ignored; in particular, many observers have argued that this assumption is unreasonable when the incidence of a tax is borne by capital owners (although similar points could be made regarding the supply of labor and the stock of human capital). The following discussion outlines two basic approaches that have been used in analyzing tax incidence from a dynamic perspective—one based on the neoclassical growth model and the other based on the overlapping-generations life-cycle model.

Early approaches to dynamic tax incidence focused on adding taxes to the neoclassical growth model. In this case, capital income taxation reduces saving, which in turn lowers the equilibrium capital-labor ratio; as a result, labor productivity falls and wages decline, implying that the tax has been at least partially shifted from capital to labor. Indeed, in the special case in which capital owners save all their income and workers save none, the burden of a capital income tax is fully shifted to labor; more generally, the extent of shifting varies from about one-third to one-half (Krzyzaniak 1967; Feldstein 1974a). In addition, dynamic incidence analysis has demonstrated that the elasticity of supply of labor has no effect on the incidence of a labor income tax if saving rates, and thus long-run capital intensity, are unaffected by changes in labor supply (Feldstein 1974b).

More recent analyses of dynamic tax incidence have focused on tax effects within the context of overlapping-generations life-cycle models. These analyses have shown that dynamic tax incidence depends critically on how tax revenues are distributed across generations. (Similar issues arise in static models; however, most static analyses simply assume that tax revenues or government services accrue uniformly to all income groups.) For example, suppose that within the context of a two-period life-cycle model, capital income tax revenues are used to finance transfers to the elderly. In this case, saving declines because the elderly are drawing down their savings to finance consumption, and some (perhaps all) of the burden of the tax is shifted from capital to labor (Diamond 1970). However, a markedly different result is obtained if revenues from the capital income tax finance transfers to the younger generation. In this case, the higher income level of the young, who are in the saving portion of their life cycle, implies increases in aggregate saving and capital intensity, such that wages increase and the return to capital falls.

Life-cycle dynamic models have also been used to examine the intergenerational incidence of tax reforms; the key factor in these analyses is the effect of alternative tax policies on the assets held by generations alive at the time of the reform's enactment. For example, under a switch from an income tax to a cash-flow consumption tax, double taxation of existing assets results in a huge welfare loss to the elderly, which in turn implies lower steady-state tax rates; by comparison, a switch to a wage tax confers a windfall gain to the elderly (who expected to be taxed on the income earned by such assets) and implies relatively high steady-state tax rates (Summers 1981a; Auerbach and Kotlikoff 1987).

Finally, both the static and dynamic analyses described above assume that capital reallocations are instantaneous and costless; however, in the pres-

ence of adjustment costs, tax incidence analysis must consider tax-induced changes in asset prices (Summers 1981b). Such asset price changes measure the windfall gains and losses attributable to the enactment of tax reforms and, if the adjustment period is long, may be a more important determinant of incidence than the long-run changes in factor prices stressed in most analyses. Moreover, the nature of such windfall gains and losses may be surprising. For example, the enactment of an investment incentive that applies only to a new investment is likely to result in a loss to the owners of existing capital assets; intuition dictates that equilibrium returns, which accrue to both new and old capital, will decline, because they are determined by the tax treatment of new investment, and these lower returns will be capitalized in the values of existing assets (Auerbach and Kotlikoff 1983).

Empirical incidence analysis

Another approach to determining incidence uses micro-data sets to estimate individual tax burdens and thus estimate their distribution across individuals. These studies draw on the theoretical and empirical literatures to make assumptions about the incidence of various taxes, and typically include calculations for a variety of incidence assumptions. Such studies have generally found—depending on the incidence assumptions made, especially regarding the corporate income tax and property taxes—that the combined federal, state, and local tax structure in the United States is either modestly progressive or modestly regressive (Pechman and Okner 1974; Pechman 1985). The aggregation of all taxes, however, masks the progressivity of the federal income tax; one recent study estimates that effective individual income tax rates increase uniformly from -0.9 percent for the first income decile, to 16.5 percent for the top decile, to 20.8 percent for the top 1 percent of income earners (Pechman 1990).

Such studies have played an important role in tax reform debates; for example, their basic methodology was used by the U.S. Treasury in determining whether the various reform proposals considered before passage of the Tax Reform Act of 1986 satisfied the constraint of "distributional neutrality" (McLure and Zodrow 1987). Nevertheless, they have been criticized on a number of grounds. Although most critiques focus on the nature of the incidence assumptions used in the analyses, a separate issue is the use of annual income as a classifier. Many observers have argued that lifetime income is a better measure of ability to pay taxes, and that the distribution of tax burden should be measured by comparing lifetime income and taxes paid. Such calculations generally indicate that consumption taxes are less regressive and income taxes less progressive than do studies based on annual income (Davies et al. 1984; Poterba 1989; Fullerton and Rogers 1993). The lifetime approach to tax incidence analysis is, however, by no means universally accepted (Barthold 1993).

Additional readings

Atkinson, Anthony B. "The Distribution of the Tax Burden." In *Modern Public Finance,* edited by John M. Quigley and Eugene Smolensky. Cambridge, Mass.: Harvard University Press, 1994.

Atkinson, Anthony B., and Joseph E. Stiglitz. *Lectures on Public Economics.* New York: McGraw-Hill, 1980.

Auerbach, Alan J., and Laurence J. Kotlikoff. "Investment versus Savings Incentives: The Size of the Bang for the Buck and the Potential for Self-Financing Business Tax Cuts." In *The Economic Consequences of Government Deficits,* edited by Lawrence H. Meyer. Boston: Kluwer-Nijhoff, 1983.

Auerbach, Alan J., and Laurence J. Kotlikoff. *Dynamic Fiscal Policy.* Cambridge, U.K.: Cambridge University Press, 1987.

Ballard, Charles A., Don Fullerton, John B. Shoven, and John Whalley. *A General Equilibrium Model for Tax Policy Evaluation.* Chicago: University of Chicago Press, 1985.

Ballentine, J. Gregory, and Ibrahim Eris. "On the General Equilibrium Analysis of Tax Incidence." *Journal of Political Economy* 83 (June 1975): 633–44.

Barthold, Thomas. "How Should We Measure Distribution?" *National Tax Journal* 35 (September 1993): 291–99.

Bradford, David F. "Factor Prices May Be Constant but Factor Returns Are Not." *Economics Letters I* (November 1978): 199–203.

Break, George F. "The Incidence and Economic Effects of Taxation." In *The Economics of Public Finance,* edited by Alan S. Blinder, Robert M. Solow, George F. Break, Peter O. Steiner, and Dick Netzer. Washington, D.C.: The Brookings Institution, 1974.

Brown, Harry G. *The Economics of Taxation.* New York: Holt, 1924.

Davies, James, France St-Hilaire, and John Whalley. "Some Calculations of Lifetime Tax Incidence." *American Economic Review* 74 (September 1984): 633–49.

Diamond, Peter A. "Incidence of an Interest Income Tax." *Journal of Economic Theory* 2 (September 1970): 211–24.

Feldstein, Martin S. "Incidence of a Capital Income Tax in a Growing Economy with Variable Savings Rates." *Review of Economic Studies* 41 (October 1974a): 505–13.

Feldstein, Martin S. "Tax Incidence in a Growing Economy with Variable Factor Supply." *Quarterly Journal of Economics* 88 (November 1974b): 551–73.

Feldstein, Martin S. "On the Theory of Tax Reform." *Journal of Public Economics 6* (July–August 1976): 77–104.

Feldstein, Martin S., and Phillipe Bacchetta. "National Saving and International Investment." National Bureau of Economic Research Working Paper No. 3164, 1989.

Fullerton, Don, and Diane Lim Rogers. *Who Bears the Lifetime Tax Burden?* Washington, D.C.: The Brookings Institution, 1993.

Galper, Harvey, Robert Lucke, and Eric Toder. "A General Equilibrium Analysis of Tax Reform." In *Uneasy Compromise: Problems of a Hybrid Income-Consumption Tax,* edited by Henry J. Aaron, Harvey Galper, and Joseph A. Pechman. Washington, D.C.: The Brookings Institution, 1988.

Hamilton, Bruce W. "Zoning and Property Taxation in a System of Local Governments." *Urban Studies* 12 (June 1975): 205–11.

Hamilton, Bruce W. "Capitalization of Intrajurisdictional Differences in Local Tax Prices." *American Economic Review* 66 (December 1976): 743–53.

Harberger, Arnold C. "The Incidence of the Corporate Income Tax." *Journal of Political Economy* 70 (June 1962): 215–40.

Harberger, Arnold C. "Vignettes on the World Capital Market." *American Economic Review* 70 (May 1980): 331–37.

Katz, Michael L., and Harvey S. Rosen. "Tax Analysis in an Oligopoly Model." *Public Finance Quarterly* 13 (January 1985): 3–19.

Kotlikoff, Laurence J., and Lawrence H. Summers. "Tax Incidence." In *Handbook of Public Economics,* edited by Alan J. Auerbach and Martin Feldstein. Amsterdam: North-Holland, 1987.

Krzyzaniak, Marian. "Long-Run Burden of a General Tax on Profits in a Neoclassical World." *Public Finance* (1967): 472–91.

McLure, Charles E., Jr. "Taxation, Substitution, and Industrial Location." *Journal of Political Economy* 78 (January–February 1970): 112–32.

McLure, Charles E., Jr. "The Theory of Tax Incidence with Imperfect Factor Mobility." *Finanzarchiv* 30 (1971): 27–48.

McLure, Charles E., Jr. "General Equilibrium Incidence Analysis: The Harberger Model after Ten Years." *Journal of Public Economics* 4 (February 1975): 125–61.

McLure, Charles E., and George R. Zodrow. "Treasury I and the Tax Reform Act of 1986: The Economics and Politics of Tax Reform." *Journal of Economic Perspectives* 1 (Summer 1987): 37–58.

McLure, Charles E., Jr., and George R. Zodrow. "The Study and Practice of Income Tax Policy." In *Modern Public Finance,* edited by John M. Quigley and Eugene Smolensky. Cambridge, Mass.: Harvard University Press, 1994.

Mieszkowski, Peter. "On the Theory of Tax Incidence." *Journal of Political Economy* 75 (June 1967): 250–62.

Mieszkowski, Peter. "Tax Incidence Analysis: The Effects of Taxes on the Distribution of Income." *Journal of Economic Literature* (December 1969): 1103–24.

Mieszkowski, Peter. "The Property Tax: An Excise Tax or a Profits Tax?" *Journal of Public Economics* 1 (April 1972):73–96.

Musgrave, Richard A. "General Equilibrium Aspects of Incidence Theory." *American Economic Review* 43 (May 1953): 504–17.

Musgrave, Richard A. *The Theory of Public Finance: A Study in Political Economy.* New York: McGraw-Hill, 1959.

Pechman, Joseph A. *Who Paid the Taxes, 1966–85?* Washington, D.C.: The Brookings Institution, 1985.

Pechman, Joseph A. "The Future of the Income Tax." *American Economic Review* 80 (March 1990): 1–20.

Pechman, Joseph A., and Benjamin A. Okner. *Who Bears the Tax Burden?* Washington, D.C.: The Brookings Institution, 1974.

Poterba, James M. "Lifetime Incidence and the Distributional Burden of Excise Taxes." *American Economic Review* 79 (May 1989): 325–30.

Shoven, John B. "The Incidence and Efficiency Effects of Taxes on Income from Capital." *Journal of Political Economy* 84 (December 1976): 1261–83.

Slemrod, Joel. "A General Equilibrium Model of Taxation with Endogenous Financial Behavior." In *Behavioral Simulation Methods in Tax Policy Analysis,* edited by Martin S. Feldstein. Chicago: University of Chicago Press, 1983.

Slemrod, Joel. "Effect of Taxation with International Capital Mobility." In *Uneasy Compromise: Problems of a Hybrid Income-Consumption Tax,* edited by Henry J. Aaron, Harvey Galper, and Joseph A. Pechman. Washington, D.C.: The Brookings Institution, 1988.

Summers, Lawrence H. "Capital Taxation and Capital Accumulation in a Life Cycle Growth Model." *American Economic Review* 71 (September 1981a): 533–44.

Summers, Lawrence H. "Taxation and Corporate Investment: A q-Theory Approach." *Brookings Papers on Economic Activity.* Washington, D.C.: The Brookings Institution, 1981b, pp. 67–127.

Vandendorpe, Adolph L., and Ann F. Friedlaender. "Differential Incidence in the Presence of Initial Distorting Taxes." *Journal of Public Economics* 6 (October 1976): 205–29.

Zodrow, George R. "Implementing Tax Reform." *National Tax Journal* 34 (December 1981): 401–18.

Zodrow, George R. "Grandfather Rules and the Theory of Optimal Tax Reform." *Journal of Public Economics* 49 (November 1992): 163–90.

Zodrow, George R., and Peter Mieszkowski. "The New View of the Property Tax: A Reformulation." *Regional Science and Urban Economics* 16 (August 1986): 309–27.

Cross references: capital export neutrality; capital import neutrality; elasticity, demand and supply; general-equilibrium models; implicit taxes; life cycle model; lump-sum tax; tax equity analysis.