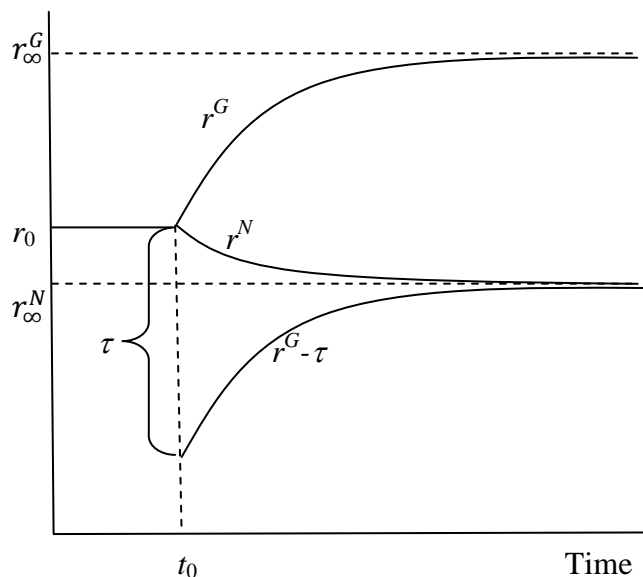


Thus far our analysis of the effects of taxation has been largely within a static context. But there are many relevant issues, such as the role of expectations, the speed of adjustment, and the impact on different generations, that are difficult to consider without an explicit treatment of dynamics, i.e., how tax policy affects the economy over time.

Adding Dynamics to the Harberger Model

One question that arose in the analysis of the Harberger model was how one should think about the assumption that capital and labor fully adjust across production sectors in response to a tax change. Even if one maintains the assumptions of fixed factor supplies, full adjustment, particularly for capital, only makes sense in the long run. In the short run, it might make more sense to assume that labor adjusts but that capital does not. What would the implications be regarding incidence? If we impose a tax on corporate capital and capital does not initially move from the sector, it would seem that corporate capital, being temporarily immobile, bears the whole tax in the short run, and that with gradual adjustment the burden is shifted over time to all capital (for cases in which capital bears 100% of the tax in the long run). We can trace the process in the following graph.



Suppose, at time t_0 , there is an *unannounced* tax, τ , on income from corporate capital. (If the tax change were anticipated, adjustment would begin before t_0 .) Initially, this causes a drop in the after-tax returns to capital in the corporate sector by the same amount as the tax, as the marginal product of capital in both sectors remains at r_0 . Over time, however, as capital shifts into the other sector, the marginal product of capital there falls, and the marginal product of corporate capital rises, until their after-tax returns are equated at some long-run value, r_∞^N . How long the adjustment takes depends on the costs of adjustment.

These changes in the after-tax return to capital over time, however, do not fully capture the incidence of the corporate tax, in terms of *who* bears the tax. It does not make sense to say that owners of noncorporate capital gradually bear more of the tax burden as adjustment occurs, because once the tax has been imposed, capital market equilibrium requires that corporate and noncorporate assets yield the same after-tax market *return*, which is distinct from the after-tax marginal *product* of capital. That is, the value of corporate capital at date t , q_t , must be such that the rate of return per dollar, including the after-tax return and the capital gain, equals that of noncorporate capital. The solution for the equilibrium path of q and capital adjustment will generally be unique once we impose an initial condition that the corporate and noncorporate

capital stocks are initially fixed and a terminal condition that the relative value of corporate capital converges to 1. One can trace out this adjustment path using phase diagrams, as discussed (using a somewhat different model) by Fullerton and Metcalf, pp. 1840-44. The path will be one on which the value of corporate capital initially drops below 1, reflecting the fact that corporate capital initially and for some time has a lower after-tax marginal product. This initial drop in value must be large enough so that the present value of after-tax returns to corporate capital and noncorporate capital are the same, per dollar of capital. That is, the integral of the gap between r^N and $r^G - \tau$ in the above figure must be capitalized as a discount in the initial value of a unit of corporate capital. Thus, a portion of all future corporate taxes is borne by initial shareholders. The remainder, which shows up in the decline over time in r^N , can be said to be borne over time by owners of all capital, since all purchasers of corporate *and* noncorporate capital after t_0 receive this rate of return.

As discussed by Auerbach (2006), there are other factors that will also influence the incidence of the corporate tax beyond what is considered in the Harberger model. These include the deductibility of interest on corporate borrowing and the favorable treatment of dividends and capital gains at the shareholder level – both of which will tend to reduce the tax wedge between corporate and noncorporate investment – and the responsiveness of saving to the after-tax rate of return and the international mobility of capital – both of which can shift the tax burden away from capital and toward labor. We will consider the last of these issues, capital mobility, in a later lecture.

Lifetime Incidence and Generational Accounting

Very often, conclusions we draw about incidence of taxes may be misleading if they are based on annual calculations. For example, it is common to assess tax burdens of different individuals by looking at the taxes they bear relative to current income. But current income may not be a particularly good indicator of an individual's ability to pay, as the following examples illustrate.

1. Under the permanent income/life-cycle models of consumption behavior, individuals smooth consumption – consumption fluctuates less than income. This means that the consumption-income ratio will fall with income in any given year, even if consumption is a constant share of permanent or lifetime income. Thus, assessments using annual data will tend to overstate the regressivity of consumption taxes.
2. Like many old-age pension systems, the US social security system imposes payroll taxes during working years and pays benefits after retirement. As incomes fall in retirement, using annual income to assess ability to pay will make the system look very progressive, as it is taxing “high-income” workers to fund transfer payments to “low-income” retirees. But, on a lifetime basis, one's conclusions might be very different, as the retirees might have been as affluent while working as those being taxed to finance their benefits.

As the second illustration shows, a further complication arises when different generations are involved, because even if we use a longer-run measure of ability to pay, we still have a problem of assessing burdens when there may be transfers among generations. How can we say whether the social security system is progressive if the taxes and transfers within one generation do not

balance? Clearly, we need to take into account the distribution of tax burdens not only within generations, but also across them. This is what generational accounting endeavors to do.

Typically, we use accumulations of national debt as a shorthand indicator of the extent to which fiscal burdens are being transferred from current generations to future ones. But this is not a very accurate indicator, and the growing importance of age-based government policies (such as old-age pensions and medical care) further limits its usefulness.

Consider again the US social security system. This system is run largely on a pay-as-you-go (PAYG) basis, meaning that today's taxes go to pay today's benefits; even though it is often described as a contributory pension scheme, individuals are not funding their own future benefits. A trust fund has been accumulated through the years, standing (according to the July, 2014 Social Security Trustees Report) at \$2.8 trillion at the beginning of 2014, but it is small relative to the system's remaining, unfunded liability (equal to the present value of benefits less taxes – the so-called open group liability of the system – and less trust fund assets) under current rules, which was \$24.9 trillion, up from \$23.1 trillion one year earlier. Yet, the current year's budget of the social security system shows a small budget *surplus* of \$32 billion, not a deficit of \$1.8 trillion, because the trust fund increases over the course of the year; the increase in expected future benefits net of taxes, amounting in this case to nearly two trillion dollars, is ignored. As first pointed out by Feldstein (*JPE* 1974), this implicit liability is like national debt in another important respect; we would expect individuals to perceive the right to receive social security benefits as an addition to wealth, just as ownership of government bonds would. (In each case, the wealth effect presumes that individuals do not view future taxes on subsequent generations as if they were taxes on themselves, as they would under Ricardian equivalence.) Note that if the social security system were run differently, for example if individuals were issued government bonds in exchange for their payroll taxes and could redeem the bonds to provide a income flow during their retirement, the implicit liability would be converted into an explicit one.

The construction of generational accounts is intended to overcome the ambiguity of government debt as a measure of intergenerational transfers. We start with the identity relating government debt at the beginning of period t and the components of annual deficits, government purchases, G_t , taxes net of transfer payments, T_t , and interest on the national debt, rD_t (where for simplicity we assume that r is constant over time):

$$(1) \quad D_{t+1} = G_t - T_t + (1 + r)D_t$$

Solving this difference equation forward and imposing the terminal condition that the government cannot run a Ponzi game (that is, $(1+r)^T D_{t+T} \rightarrow 0$ as $T \rightarrow \infty$), we get the government intertemporal budget constraint (GIBC):

$$(2) \quad \sum_{s=t}^{\infty} (1+r)^{-(s-t+1)} T_s = D_t + \sum_{s=t}^{\infty} (1+r)^{-(s-t+1)} G_s$$

Now, break the components of T_t at each date into values for each cohort alive at that time,

$$(3) \quad T_t = \sum_{k=t-D}^t T_t^k$$

where k indexes the cohort's year of birth and D is lifespan. Finally for each cohort, k , take the present value of these annual terms, from either the current year or the cohort's year of birth, whichever is later, to form that cohort's generational account:

$$(4) \quad N_{t,k} = \sum_{j=t}^{k+D} (1+r)^{-(j-t+1)} T_j^k \quad \forall k \leq t; \quad N_{k,k} = \sum_{j=k}^{k+D} (1+r)^{-(j-k+1)} T_j^k \quad \forall k > t$$

Note that the terms $N_{t,k}$ and $N_{k,k}$ in (4) account for all components of taxes from date t forward, so we can rewrite the GIBC:

$$(5) \quad \sum_{k=t-D}^t N_{t,k} + \sum_{k=t+1}^{\infty} (1+r)^{-(k-t)} N_{k,k} = D_t + \sum_{s=t}^{\infty} (1+r)^{-(s-t+1)} G_s$$

(Here, we've assumed that government purchases are not allocated to generational accounts, but an alternative would be to allocate components of G as well.)

Returning to the issue of implicit liabilities, note that if we changed the accounting for social security, treating payroll taxes and purchases of government bonds and benefits as receipts of interest and principal on these bonds, then the value of D_t would increase, the values of $N_{t,k}$ for current generations would decrease by the same amount in present value, but the generational accounts for future generations would be unaffected.

We can measure the government's fiscal imbalance by assuming that current policy is maintained for all existing generations and asking by what fraction the generational accounts of future generations would have to be inflated, relative to current policy, to ensure that the equality in (5) is satisfied. Note that this calculation would not be affected, for example, by a change in accounting convention that converted implicit liabilities to explicit ones.

Illustration: Bush's 2005 private accounts proposal