



TAX INCIDENCE, TAX BURDEN, AND TAX SHIFTING: WHO REALLY PAYS THE TAX?

EXECUTIVE SUMMARY

The current tax system imposes heavier taxes on income used for saving and investment, and on the formation of human capital, than on income used for consumption. These tax disincentives to save and invest, to work and take risks have consequences. They lead people to under-save and over-consume, and to work less and play more. These adverse effects strongly urge us to dispose of the current income tax structure and replace it with a flat rate tax that is neutral in its treatment of saving and consumption. A tax system that is saving-consumption neutral would lead to a significant increase in income across the board.

The tax biases against saving and investment and the current system's steeply graduated tax rate structure were introduced for the purpose of improving "social equity". It has been assumed that the added layers of tax on income used for capital formation would do little economic damage, would harm only the wealthy, and would provide significant income redistribution. It has become apparent, however, that most of the taxes that seem to fall on those who supply physical capital, intellectual capital, or special talents to the production process may actually be shifted to ordinary workers and lower income retirees in the form of reduced pre-tax and after-tax incomes.

The political battles over proposed tax changes often turn on the question of who would gain and who would lose. Answers to such questions are supposedly presented in so-called "burden tables" prepared by the Treasury, the Joint Committee on Taxation, the Congressional Budget Office, and tax researchers. The adverse economic consequences of non-neutral taxation and graduated tax rates, and the resulting adverse impact on "social equity", are not displayed in the burden tables. With bad information, the public and the Congress are left with a bad tax system and a sub-optimal economy.

The burden tables claim to show the distribution of the tax burden across taxpayers or households of varying income levels. In fact, the tables try only to show the initial incidence of a tax or a tax change on the after-tax incomes of those assumed to pay it. They do not examine

its ultimate burden, which depends upon the subsequent reactions of the initial taxpayers, who may change how much they work, save, consume, invest, or hire, all of which affect the incomes of other people in the society.

The true measure of the burden of a tax is the change in people's economic situations as a result of the tax after all economic adjustments are taken into account. Unfortunately, the burden tables are based on static economic assumptions that ignore most of the economic consequences of taxation. These assumptions are often adopted more for ease of computation than for economic accuracy. No burden table ever published has been based on how taxes truly affect incomes.

Burden tables ignore the fact that the tax on one factor of production can hurt another factor of production. A tax imposed on a truck owner's returns on his fleet, which reduces the number of trucks he can afford to run, hurts the truck drivers who are laid off. If a tax is imposed on the truck drivers' wages, the fleet owner must pay them extra or risk their dropping out of the labor force, which would leave trucks idle in the garage, earning nothing.

Burden table analysts assume that the corporate income tax is borne by the owners of capital, and that income taxes on the earnings of saving are borne by the savers. However, capital is very sensitive to taxation and to the after-tax rate of return. Taxation of corporate and other capital income results in a reduction in capital formation, which restores the normal rate of return to the remaining capital, but which reduces the productivity of workers and lowers their wages. The tax on capital income is largely shifted to labor. Indeed, a significant body of tax literature makes the case that workers would have a higher after-tax wage if capital income were not taxed, even if the workers had to pay a higher tax rate to pick up the initial revenue cost to the government of eliminating taxes on capital income.

High graduated marginal tax rates supposedly hurt the rich, and the burden tables reflect that assumption. However, high tax rates discourage the efforts of people with the greatest human capital and sharpest entrepreneurial skills. As these individuals reduce their activity, other people who would normally work with them become less productive and lose income as well. Some of the tax on skilled workers and entrepreneurs is shifted to the unskilled. For example, high graduated marginal tax rate on physicians' incomes may induce some doctors to retire, or to work shorter hours by sharing a practice, and inevitably lead to higher medical fees. Fewer doctors mean fewer jobs for nurses and support staff, longer waits for patients, and higher medical costs for patients and government health programs.

Burden tables even do a bad job of showing the initial incidence of a tax. Burden tables assume that income taxes are borne solely by the workers, savers, and investors on whom the tax is initially imposed (the tax is completely "passed back" to suppliers of labor and capital, and

none falls on the consumers of their products), while consumption taxes, such as excise and sales taxes, are borne by the consumers of the products (the tax is completely "passed forward" to buyers, and none falls on the producers of the product). These contrary assumptions are at odds with basic economics, which clearly reveals that all taxes are split in some fashion between producers and consumers except in the rare cases of perfectly inelastic supply or demand for goods or inputs.

Burden tables are snapshots in time. They do not reveal that people move up and down in the income distribution over time. They show the incidence of a tax change only on those affected today, and ignore gains or losses to other taxpayers in the future. For example, the burden tables report that the recent reduction in the taxation of dividends and capital gains is of benefit to current shareholders and sellers of assets. The tables do not reveal that millions of people who do not own shares or sell assets in the year in question will do so later in their lives, and that the long run benefits of the tax change are far more widely distributed than a one year snapshot indicates. Furthermore, the tables make no estimate of how the reduced taxation of capital income will boost capital formation and raise wages for those who never own shares or sell businesses.

Because burden tables do not show how taxes affect economic activity, employment, and investment, they do not provide policy makers with a realistic picture of what taxes do to people's incomes and welfare. By ignoring the widespread benefits of incentive-enhancing tax reduction, the tables fuel class warfare and impede the adoption of major tax reforms that would increase capital formation, raise labor productivity, and raise incomes across the board.

A better understanding of the economic consequences of taxation would benefit the Treasury and the Congress as they plan the federal budget and as they contemplate changes in the tax system. The same information needed to produce accurate burden tables, tables that correctly project the consequences of tax changes for people's incomes, is also needed to correctly forecast the effect of a tax change on the federal budget. Dynamic scoring of tax changes would show that pro-growth tax changes would cost less than static analysis indicates, and that anti-growth tax rate increases would raise less revenue than expected.

A more rational system of calculating and displaying the real tax burden, one that took full account of how taxes are shifted, would make it easier to explain and adopt a more rational tax system. A more rational tax system, in turn, would maximize the efficiency of the economy as a whole, and would enable every individual to maximize his or her potential lifetime productivity and income.

TAX INCIDENCE, TAX BURDEN, AND TAX SHIFTING: WHO REALLY PAYS THE TAX?

I. Introduction

Who pays the income tax, the payroll tax, the estate and gift taxes? Who bears the burden of the gasoline and tobacco taxes? If Congress were to raise this tax rate, or lower that tax deduction, who would gain and who would lose? The outcomes of the political battles over changes to the tax system often hinge on the answers to such questions.

To demonstrate who pays current taxes or who would be the winners and losers from a tax change, the Joint Committee on Taxation of the Congress (JCT) produces "burden tables" showing how much money everyone sends, or would send, to the Treasury. Winners and losers are grouped by their adjusted gross income class, and the distributional impacts of a tax, or a tax change, are displayed. Burden tables are also prepared on occasion by the Treasury and the Congressional Budget Office, as well as private research groups, using sometimes similar, sometimes different assumptions and methods of display (such as by "income quintile"). (See examples in Appendix C.) The burden tables are supposed to shed light on the tax system or the effect of a new tax proposal, but they often do more to obfuscate than to illuminate the facts.

The true measure of the burden of a tax is the change in people's economic situations as a result of the tax. The changes should be measured as the effects on everyone's net-of-tax income after all economic adjustments have run their courses. The burden measure should include not only changes in people's after-tax incomes in a single year, but the lifetime consequences of the tax change as well. Unfortunately, policy makers are not presented with this type of comprehensive information on the true burden of taxation, and must make policy judgments based on incomplete and misleading statistics.

One cannot tell the true burden of a tax just by looking at where or on whom it is initially imposed, or at what it is called. Taxes affect taxpayers' behavior, triggering economic changes that regularly shift some or even the entire economic burden of a tax to other parties, and alter total output and incomes. Taxes reduce and distort the mix of what people are willing to produce in their roles as workers, savers, and investors. Taxes increase what these producers seek to charge for their services or products. Changes in the prices and quantities of output in turn affect people in their roles as consumers when they try to spend their incomes. The lost output and other consequences of taxation impose additional costs on the taxpayers that are not reflected in the mere dollar amounts of the tax collections.

The Treasury put these problems well in its 1991 study on ending the double taxation of corporate income, writing that "The economic burden of a tax, however, frequently does not rest with the person or business who has the statutory liability for paying the tax to the government.

This burden, or incidence, of a tax refers to the change in real incomes that results from the imposition of a change in a tax."¹

These ultimate effects and burdens of taxation are explored in a corner of the economic literature, but they are nowhere to be found in the "burden tables" that are prepared by the government agencies and scrutinized in tax debates. Instead, the burden tables are constructed using crude assumptions and over-simplified rules of thumb to assign various taxes to suppliers of labor or capital, or to consumers. These assumptions and rules are often adopted more for ease of computation than for economic accuracy. In fact, no burden table ever published has been based on how taxes truly affect incomes.

What price do we pay for glossing over the true economic burden of a tax? Failure to understand and take account of the economic consequences of taxation leads to a gross misrepresentation of the distribution of the tax burden. This, in turn, has led to a tax system that, while supposedly promoting social justice, is actually harmful to lower income workers and savers, as well as damaging to the population as a whole. A better understanding of the economic consequences and real burdens of taxation is indispensable to achieving an optimal tax system, one that minimizes the economic and social damage associated with financing government outlays.

A better understanding of the economic consequences of taxation would also benefit the Treasury and the Congress as they plan the federal budget and contemplate changes in the tax system. It should lead to more accurate revenue forecasting. It might also encourage the adoption of tax bills that are more concerned with increasing national and individual income, and less concerned with redistributing the existing level of national product.

This paper will discuss the economic consequences of taxation and the factors that influence where the burden of various taxes really falls. It will review some of the discussions in the economic literature. Finally, it will suggest that a shift to a markedly different type of tax system would benefit all players in the economy.

II. Sorting out some terminology

The terms "tax incidence" and "tax burden" are thrown around rather loosely in the economic literature and in the popular press. Some authors use them interchangeably for any of several concepts of the effect of a tax. Some authors use them for separate concepts, but different authors do not agree as to which term means which concept. This paper will seek to distinguish clearly among several distinct concepts of "incidence" of a tax, and to reserve a single term for each. We define three concepts:

¹ U.S. Department of the Treasury, "Report of the Department of the Treasury on Integration of the Individual and Corporate Tax Systems: Taxing Business Income Once," January 1992, p. 146.

- 1) the "statutory" or "legal obligation", which refers to the person on whom the law says that the tax obligation falls (which may bear little relationship to who actually feels the pain);²
- 2) the "initial economic incidence" (or "incidence", for short), which is how the economic supply and demand conditions *in the market for the taxed product or service or factor of production* allocate the tax among suppliers and consumers of the taxed item (which allocation may be different in the short run and the long run); and,
- 3) the "ultimate economic burden" (or "burden", for short), which measures the changes in people's after-tax incomes after all the economic adjustments to the tax have occurred *across all affected markets* as consumption behavior, resource use, and incomes shift to their new patterns.

These definitions distinguish between the terms "incidence" and "burden". "Incidence" is defined as the partial own-market economic effects of the tax, which may also be thought of as **partial equilibrium** analysis. "Burden" is defined as the **general equilibrium** economic results involving all markets. When the paper quotes other sources that employ the terms differently, the reader must perform the required mental translation.³

² Statutory obligation is not the same thing as the obligation to remit, which involves the tax collection laws and process. A tax is in a sense "paid" by whoever is legally responsible for remitting the money to the taxing authority, whether that is the U.S. Treasury or one of the various state and local tax departments or offices. Most people are sophisticated enough to realize that who sends in the check does not indicate who pays the tax. Income tax withholding is a good example. A worker's employer by law must transmit income taxes withheld from a worker's paycheck to the Treasury each pay period, but the tax actually falls according to statute on the worker's wages, not on the employer's income. "Remittance" is not the same thing as "statutory obligation".

³ See Don Fullerton and Gilbert E. Metcalf, *The Distribution of Tax Burdens*, International Library of Critical Writing in Economics, 155, Edward Elgar Publishing, Inc., Northampton, MA, March 1, 2003. Fullerton and Metcalf use the term "statutory incidence" to refer to the statutory obligation as defined by the tax law (what is here called "statutory obligation"). They use the term "economic incidence" to refer to the changes in people's economic welfare brought about by the tax, in that the tax changes equilibrium prices, with wide-ranging consequences, what is here called "ultimate economic burden". For example, a tax on a particular product induces consumers to alter their purchases, which in turn affects the prices or returns paid to each input, thereby affecting the welfare of consumers, workers, and suppliers of capital.

Two terms are not really enough, however. There is still the need to distinguish between the economic incidence revealed by "partial analysis," which involves the changes in the price of the taxed product and its effect on that product's consumers and producers (and which must further be broken down into the short and longer run effects), and "general equilibrium analysis," which must include all the subsequent adjustments as consumers switch to other products, and factors shift to other uses, including leisure, or are reallocated between consumption and capital accumulation, altering the capital stock over time and affecting wages throughout the economy. The Fullerton-Metcalf anthology contains many seminal papers on tax incidence that explore these different facets of the analytical spectrum.

III. The simple example of a selective excise tax: statutory obligation, initial incidence, ultimate burden.

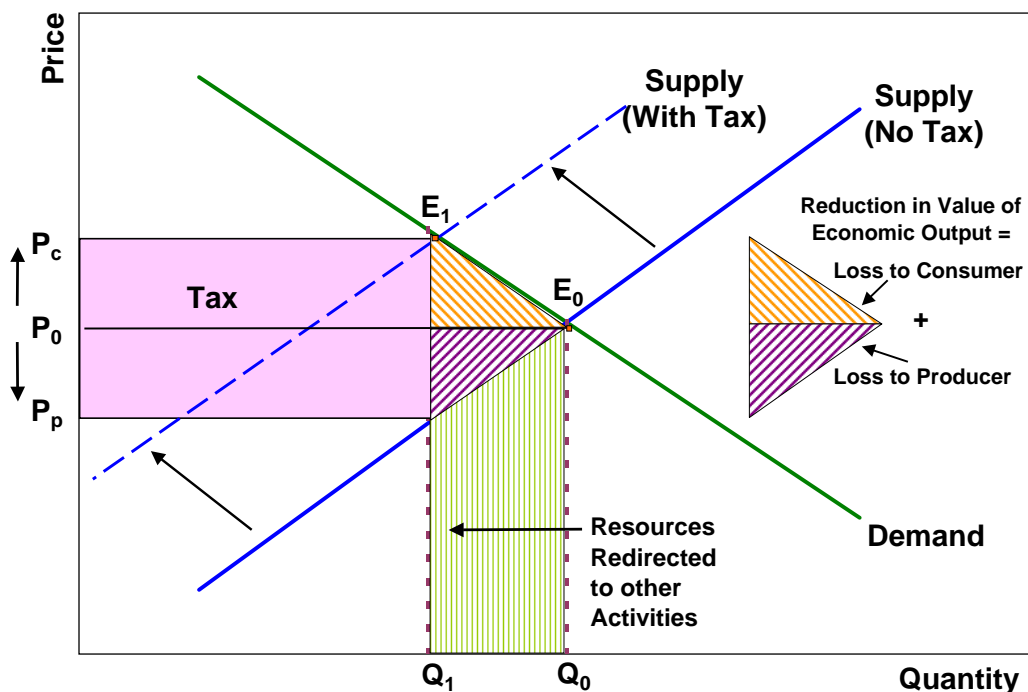
Charting a simple excise tax

Consider the imposition of a selective excise tax, such as the cigarette tax or the gasoline tax (see Chart 1). In the absence of the tax, supply would equal demand at the equilibrium point E_0 , with a unit price of P_0 and a quantity of Q_0 units.

Imposing a per unit tax of $t=(P_c-P_p)$ drives a wedge between the price paid by the consumer (P_c) and the price received by the producer (P_p). As the gross price to the buyer is driven up, the quantity demanded shrinks (movement along the demand curve). As the net price received by the seller falls, less is supplied (movement along the supply curve). The quantity of output falls from its original value (Q_0) to its new value (Q_1). Market equilibrium shifts from E_0 to E_1 .

Tax revenue is $t \times Q_1$ (the shaded area, unit tax times quantity). Note that the revenue is not equal to t times the original quantity of the product in the absence of the tax; it is t times the *reduced* output brought about by the tax. In usual parlance, the upper portion of the revenue rectangle, $(P_c-P_0) \times Q_1$, is considered to be the share of the tax that falls on the consumer, because he now pays a higher tax-inclusive price. The bottom portion of the rectangle, $(P_0-P_p) \times Q_1$, is

Chart 1 Imposition Of A Tax



considered to be the share of the tax that falls on the producer in the form of a lower net-of-tax price and revenue received for selling the product.

The reduction in output deprives the consumer of the value he places on the lost output, the taller trapezoidal area under the demand curve between Q_0 and Q_1 . The reduction in output frees up resources for other uses equal to the shorter trapezoidal area under the supply curve between Q_0 and Q_1 . The shaded triangle between the supply and demand curves is the dead weight social cost of the tax, representing the excess value of the lost product over its resource cost, split between the consumer and the producer.

The imposition of the tax is sometimes illustrated as a backward shift in the supply curve (shifting the tax-inclusive supply curve to pass through point E_1 , labeled "supply with tax" in the diagram). This can be viewed as showing the tax to be a cost of calling forth the product. Alternatively, it is described as a representation of a tax imposed on the consumer, emphasizing the higher gross price paid as the result of the tax. The tax may also be drawn as a backward shift in the demand curve, shifting it to pass through the point where price equals P_p and quantity equals Q_1 . This is sometimes described as illustrating a tax imposed on the producer, emphasizing the receipt by the producer of the lower net-of-tax price.

Whether the tax is *described* as being paid by the producer or by the consumer, the *outcome* is the same: the rise in the price to the buyer to P_c , the drop in the price to the seller to P_p , and the drop in production to Q_1 , are identical whichever view is taken, and depend entirely on the rate of the tax and the slopes (elasticities) of the supply and demand curves. Elasticity will be discussed in greater detail below.

Statutory or legal obligation of an excise tax

Who pays a selective excise tax? The legal obligation to pay would depend on the wording of the statute. It might be called either a consumer-level tax (e.g. the gasoline excise tax, collected at the pump) or a producer-level tax (e.g. the alcohol and tobacco taxes, collected from manufacturers). As the diagram shows, the distinction is economically meaningless, and does not reflect the economic division of the tax burden. Consumers and producers are both affected to some degree, regardless of the statutory label. How they share the incidence of the tax depends entirely on their responsiveness to the price changes, the slopes of the supply and demand curves, not on whether the wording of the statute charges the consumer with the tax and it is merely collected by the seller and forwarded to the government, or whether the statute names the seller as being charged with the tax directly.

Economic incidence of an excise tax

The initial economic incidence is properly calculated as partly falling on consumers to the extent of the revenues they pay plus their share of the deadweight loss triangle, and partly falling on producers to the extent of the revenues they pay plus their share of the deadweight loss. Producers are the workers who supply labor and the investors who supply capital to a business.

What do we mean by saying that part of the excise tax falls on producers? When a tax is imposed on a final product, the reduction in demand for and output of the product in turn reduces the demand for the inputs used to produce the product, which reduces workers' wages and investors' returns on saving.

Note that most consumers are also workers and/or suppliers of capital (unless they are living entirely on welfare or other transfer payments). The excise tax, insofar as consumers pay it or insofar as it leads them to reallocate their resources to second-best choices, reduces the quantity and value of what they can buy with an extra dollar of income. The tax devalues their earnings from labor or saving. That is, insofar as the tax is "passed forward" to consumers, it is ultimately a tax on their labor and capital income. All taxes are ultimately taxes on income, which is to say, on producers. An excise tax falls either on the labor and capital employed in the taxed industry, or on the consumers, who happen to provide labor and capital services in other industries.

Incidence and elasticity How buyers and sellers share the initial incidence of a tax depends on their market behavior. The portion of the tax presumed to be paid by the buyer or the seller varies depending on the responsiveness of the demand for and the supply of the product or input as the price changes. In the chart, this is reflected in the steepness of the demand and supply curves.

"Elasticity" is the percent change in the quantity of a product (or factor of production - labor, capital, land, etc.) supplied or demanded divided by the percent change in its price (or wage or rate of return). For example, if people are easily discouraged from buying a particular product (or employing a particular factor) as its price rises, then that ratio will be high, the demand for the product (or for the factor) is said to be elastic, and the demand curve is rather flat. If people are unwilling to give up much of the product (or factor) even if the price rises sharply, the ratio will be low, the demand is said to be inelastic, and the demand curve is steep.

The elasticities of demand and supply tend to be greater in the long run than the short run. It may take some time for people fully to adapt to a tax change. For example, in the short run, a rise in the tax on gasoline may encourage people to drive their existing cars less by taking fewer trips, by car pooling, or by switching to public transportation. Longer term, people may replace their existing cars with models that offer higher fuel economy, or may move closer to their work. The long run demand for gasoline should be more elastic than the short run demand.

Four extreme cases of elasticity There are four extreme or limiting cases — not generally seen in the real world — that illustrate the concept of elasticity and its implications:

- Perfectly elastic supply (chart 2a). If a product is easily reproduced or obtained at the same cost per unit, no matter how many units are sought, then the supply curve is horizontal and the net-of-tax price is fixed at that marginal cost. (Example: the supply in a small town of a commodity sold nationally (say, Budweiser?). If the buyers in the town are willing to pay the market price, they can get a virtually unlimited supply (or at least all they can hold). If they are

Chart 2a Perfectly Elastic Supply

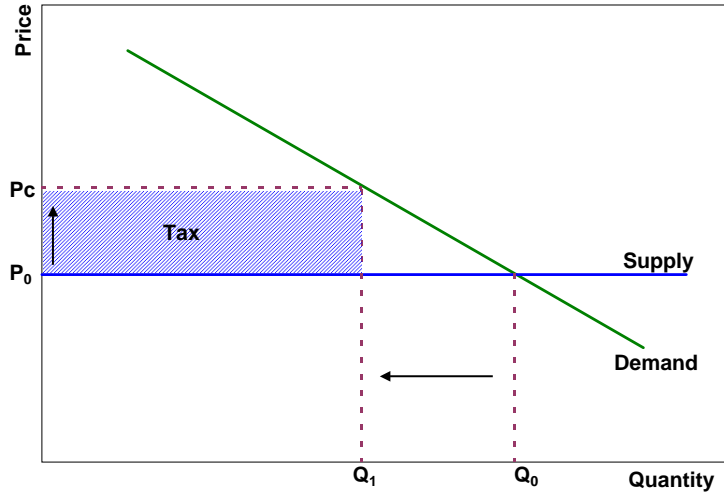


Chart 2b Perfectly Elastic Demand

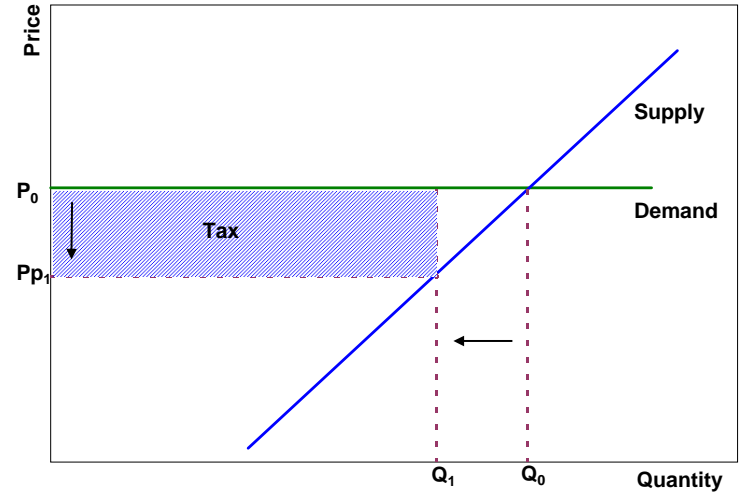


Chart 2c Perfectly Inelastic Supply

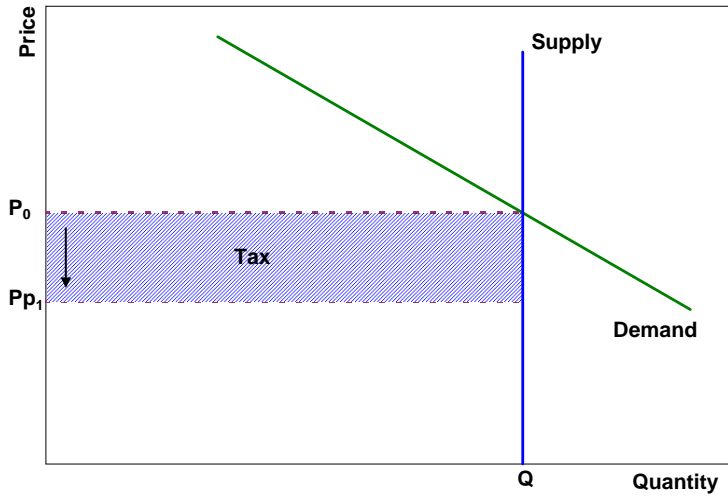
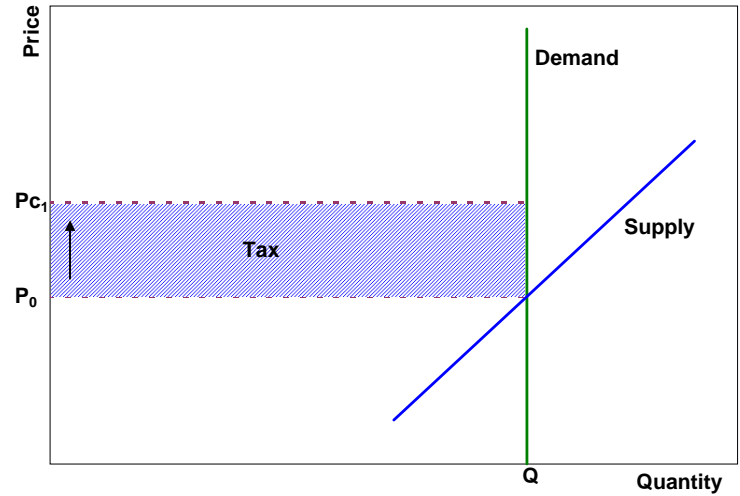


Chart 2d Perfectly Inelastic Demand



not willing to pay that price, they'll get none.) Any tax is borne by the consumer. Output or availability will fall if demand is price sensitive.

- Perfectly elastic demand (chart 2b). If demand is perfectly elastic, any rise in the price would cause a collapse in consumption. (Example: the demand for beer at one out of twelve concession stands at a stadium. If one stand tries to charge more than the others, it will lose all its business to the other stands.) The demand curve is horizontal, and the market price is fixed. Any tax imposed (on that one beer outlet) will simply lower the net-of-tax price to the producer, who must bear the whole tax. Output will fall if supply is price sensitive.

- Perfectly inelastic supply (chart 2c). If supply is perfectly inelastic, the same quantity of product must be offered regardless of the price. (Example: perishable strawberries at a farmers' market late in the day.) The supply curve is vertical. The price is fixed by demand (what consumers are willing to pay). Any tax imposed will result in a lower net-of-tax price to the seller, who must bear the tax. Output is unchanged. (The strawberries are a short run example. Repeated inability to sell the fruit will result in less being grown next season.)

- Perfectly inelastic demand (chart 2d). If demand is completely insensitive to price, people insist on the same quantity of output regardless of what must be paid. (Example: addictive drugs. Addicts in need of a fix will demand the drugs up to the full amount of their resources.) The demand curve is vertical, and any tax will be borne by the consumers. Output is unchanged. (Of course, this is tongue in cheek. A dealer in illegal drugs is no more likely to collect and remit a hypothetical sales tax than he is to report his illegal profits to the IRS under the income tax. Substituting a national sales tax for the income tax would not eliminate tax evasion in the underground economy.)

The perfect non-distorting tax base? Politicians eagerly seek these last two situations of perfectly inelastic supply and demand in their quest for the perfect tax base. No matter how high they might push the tax on such a product, the tax base would not collapse, and revenues would keep climbing. In particular, politicians like to believe that the demand curves for cigarettes, liquor, and gambling are perfectly inelastic. They are wrong, but they keep pushing tobacco and alcohol tax rates higher, hoping for a miracle. They also get stingy with the payout ratios on state-sponsored lotteries. In this case, it is those who buy lottery tickets who are hoping for a miracle. In theory, governments could reduce economic distortions and minimize dead weight losses by putting the highest tax rates on the products or inputs that are in most inelastic demand or supply. The ultimate example of a non-distorting tax would be a head tax or poll tax that is owed just for being alive and is totally unrelated to any incremental earnings or the amount of one's economic activity. Such a tax, however, might not pass the "equity" test, unless it could be shown that all parties would share in the resulting improvement in national output and income.

Economic burden of an excise tax

The ultimate economic burden of an excise tax would be found by carrying the analysis one step further. It is not only the consumers and producers of the taxed product who are affected by the tax. Resources driven from the production of the taxed items must seek alternative employment, and will generally earn lower returns in these second-best uses. They will compete with and affect resources in these other uses. For example, land taken out of the production of tobacco because of higher cigarette taxes may be used to produce vegetables instead, lowering the price of vegetables. Both the displaced tobacco farmers and the existing truck farmers who now face added competition are injured, while consumers of vegetables benefit.

The impact of the tax may shift over time. A new tax on wine may simply hit the wineries initially, because their vines, fermenting vats, and bottling machinery are still in place, and will earn more being used than being shut down if the reduced after-tax revenues at least cover the labor costs. Later, however, the vines may be dug up and the land shifted to other crops that now yield a higher return. The machinery may wear out and not be replaced. As supply falls, the excise tax will be shifted to consumers longer term. They will have to pay more for a bottle of wine. They may switch some of their spending to other goods and services, affecting other industries.

Human capital may bear part of the cost. If a tax on wine causes a vineyard to convert to growing table grapes or avocados, the vineyard workers may be kept on to tend and pick the new crops; if their skills are transferable, they will face little damage. It would be different for the technical experts responsible for the fermenting, testing, and tasting of the wines; they may have no alternative use for these highly specialized skills, which become redundant. Such specialists who are forced into other occupations will lose the wage premium their skills commanded. The caves in which the wines were stored, and the slopes with microclimates peculiarly suited to wine production, will lose their advantage and some of the rent they commanded in wine production.

The need to consider these economy-wide and long term ramifications, called "general equilibrium" analysis, is not a new idea in tax theory. Alfred Marshall's classic discussion of the incidence of taxation in his *Principles of Economics* is as valid today as it was roughly a hundred years ago. Taxes on inputs are borne largely by the suppliers of the inputs if those inputs have no good alternative uses (inelastic supply), but are borne largely by the consumers of the product if the inputs are readily shifted to other uses (elastic supply). A new tax imposed on existing capital will be borne by the capital in the short run, but may discourage renewal of the capital stock as it wears out, causing the tax to be shifted to the consumers in the long run (and to any other immobile inputs that would have worked with the lost capital). A nationwide tax may impact producers and consumers of the product, but a local tax will simply drive the producers to move their inputs to another part of the country. In Marshall's words:

It is a general principle that if a tax impinges on anything used by one set of persons in the production of goods or services to be disposed of to other persons, the tax tends to check production. This tends to shift a large part of the burden of

the tax forwards on to consumers, and a small part backwards on to those who supply the requirements of this set of producers. Similarly, a tax on the consumption of anything is shifted in a greater or less degree backwards on to its producer.

For instance, an unexpected and heavy tax upon printing would strike hard upon those engaged in the trade, for if they attempted to raise prices much, demand would fall off quickly: but the blow would bear unevenly on various classes engaged in the trade. Since printing machines and compositors cannot easily find employment out of the trade, the prices of printing machines and wages of compositors would be kept low for some time. On the other hand, the buildings and steam engines, the porters, engineers, and clerks would not wait for their numbers to be adjusted by the slow process of natural decay to the diminished demand; some of them would be quickly at work in other trades, and very little of the burden would stay long on those of them who remained in the trade. A considerable part of the burden, again, would fall on subsidiary industries, such as those engaged in making paper and type; because the market for their products would be curtailed... Authors and publishers [and] booksellers... would suffer a little...

[I]f the tax were only local, the compositors would migrate beyond its reach; and the owners of printing houses might bear a larger ... proportionate share of the burden than those whose resources were more mobile...

Next, suppose the tax to be levied on printing presses instead of on printed matter. In that case, if the printers had no semi-obsolete presses which they were inclined to destroy or to leave idle, the tax would not strike at marginal production: it would not immediately affect the output of printing, nor therefore its price. It would merely intercept some of the earnings of the presses on the way to the owners, and lower the quasi-rents of the presses. But it would not affect the rate of net profits which was needed to induce people to invest fluid capital in presses: and therefore, as the old presses wore out, the tax would add to marginal expenses... [T]he supply of printing would be curtailed; its price would rise: and new presses would be introduced only up to the margin at which they would be able ... to pay the tax and yet yield normal profits on the outlay. When this stage had been reached the distribution of the burden of a tax upon presses would henceforth be nearly the same as that of a tax upon printing...⁴

⁴ Alfred Marshall, *Principles of Economics*, Eighth Edition (1920) (Philadelphia, PA: Porcupine Press, reprinted 1982), Chapter IX, pp. 343-345. The first edition was printed in 1890. Tax incidence and tax shifting are not new notions.

Burden tables botch excise tax "incidence" and "burden"

Burden tables use the least meaningful of all the above concepts of incidence and burden to allocate the impact of excise taxes. Burden tables assume that all excise taxes, whether labeled consumers' or manufacturers' excise taxes, are paid entirely by the consumers of the products (as under the statutory obligation concept of a consumer-level tax). The "distribution" of the tax across income levels is calculated by taking the average amount spent on the product by people in various adjusted gross income classes times the tax rate. The tables ignore the split between producers and consumers that must occur in any market with normal elasticities. Furthermore, they look only at the revenues collected, $t \times Q_1$, and ignore the deadweight loss, so that, even ignoring the split, they do not measure the total initial incidence correctly.

An excise tax analyst at the JCT or Treasury will use the long run elasticities of demand and supply for the taxed good to estimate the eventual change in consumption (the drop from Q_0 to Q_1), and will estimate the tax revenue that the Treasury will receive at the new, reduced level of consumption. In constructing a burden table, he will attribute all of the incidence of the tax to the consumers. However, the analyst will assume no loss in total output or efficiency for the economy as a whole, and no loss of revenue from other taxes, because he assumes that resources driven out of producing the taxed good find alternative employment at virtually unchanged earnings. He ignores any shifting of the economic burden to producers as resources are shifted to alternative, lower-paid uses. Burden table analysis thus gets both the total and the distribution of excise taxes wrong except in the extreme case of a product in absolutely inelastic demand.

IV. Extending the analysis: income and payroll taxes on capital and labor

The same sort of diagram may be applied to any tax. The tax may be a general sales tax, or a payroll or personal income tax on wages or on capital income, or the corporate income tax. In the case of a tax on labor income, the price becomes the wage, and the quantity becomes hours worked or the level of employment or some other measure of the services of labor. In the case of capital services, the price becomes the rate of return on capital, and the quantity is the amount of capital services forthcoming from the stock of plant, equipment, structures, and land.

The demand for labor and capital reflects the value to the employer of using additional units of labor and capital. The added output obtained by employing one more worker or machine is the "marginal product of labor" or "marginal product of capital". The added physical output times the price it sells for (marginal value product) is the most that a firm will pay to hire an additional worker or pay for the services of an additional machine or building.

As more of any one factor is added, other factors held constant, output rises, but at a diminishing rate. This is the famous "law of diminishing returns". The gradual decline in the marginal products of labor or capital as more of one of them is employed is why the demand curves for the factors slope downward.

Charts 3 and 4 illustrate the supply and demand conditions generally assumed for broadly defined labor and capital inputs, respectively, and the different effects one might expect from taxing these factors.

Labor market

The supply of labor. The supply of labor is rather inelastic. It was fashionable in the 1950s and 1960s to assert that the supply of labor was nearly perfectly inelastic with respect to the wage (or after-tax wage). That is, workers did not vary their labor supply very much in response to changes in the after-tax wage. The thinking was that adult males were the bulk of the work force, and, as their families' sole breadwinners, they were very attached to the work force. Furthermore, they were generally employees of corporations or other businesses that set their hours, giving them virtually no option but to work a forty hour week, unless there was overtime, which was typically mandatory, or they were willing to take on second jobs. With limited ability to vary their hours worked or participation in the work force, such workers were assumed to bear any taxes imposed on labor, including the income tax and the entire payroll tax, both the employee and employer shares. This is the convention still used in burden tables.

Over time, most married women and many teenagers have entered the work force, and a growing number of "retirees" hold part-time jobs. Many of these workers are less tightly "attached" to the work force than prime age males. Since the 1980s and 1990s, a larger portion of the work force has become self-employed, or is seeking to work part time. These workers have far more flexibility to set their own hours and display a less rigid attachment to the work force than adult males. Also, as two-earner couples have become the norm, men have had more opportunity to work less, courtesy of their wives' incomes. Although the men may have worked less as family income rose, the couple may have worked more, taking both spouses' efforts together. One should expect higher elasticities for upper income workers, whose income and wealth give them added flexibility to alter their hours while maintaining a high living standard. Modern consensus estimates of labor force elasticity, while still low, are generally non-zero. For example, a survey of 65 labor economists produced estimates of the labor supply elasticity for men of .1 (mean estimate) and zero (median estimate). For women, the survey gave estimates of .45 (mean) and .3 (median).⁵

The demand for labor. The demand for labor is moderately elastic. Its large share of the national income makes it a major expense for employers, and the marginal product of labor declines only gradually as the work force increases. To some extent, capital can be substituted for

⁵ Victor R. Fuchs, Alan B. Krueger, James M. Poterba, "Economists Views about Parameters, Values, and Policies: Survey Results in Labor and Public Economics," *Journal of Economic Literature*, Vol. 36, September 1998. Some writers believe that the empirical evidence points to a labor supply elasticity of zero or less, which could lead to more work effort at higher tax rates and "reverse" tax shifting. For a number of reasons, that outcome is highly unlikely, as discussed in Appendix B. For a more sympathetic view, see Jane Gravelle, "Labor Supply Elasticity and Dynamic Scoring," Congressional Research Service Memorandum, Washington, D.C., August 21, 2002.

Chart 3 Effect of Tax On Labor

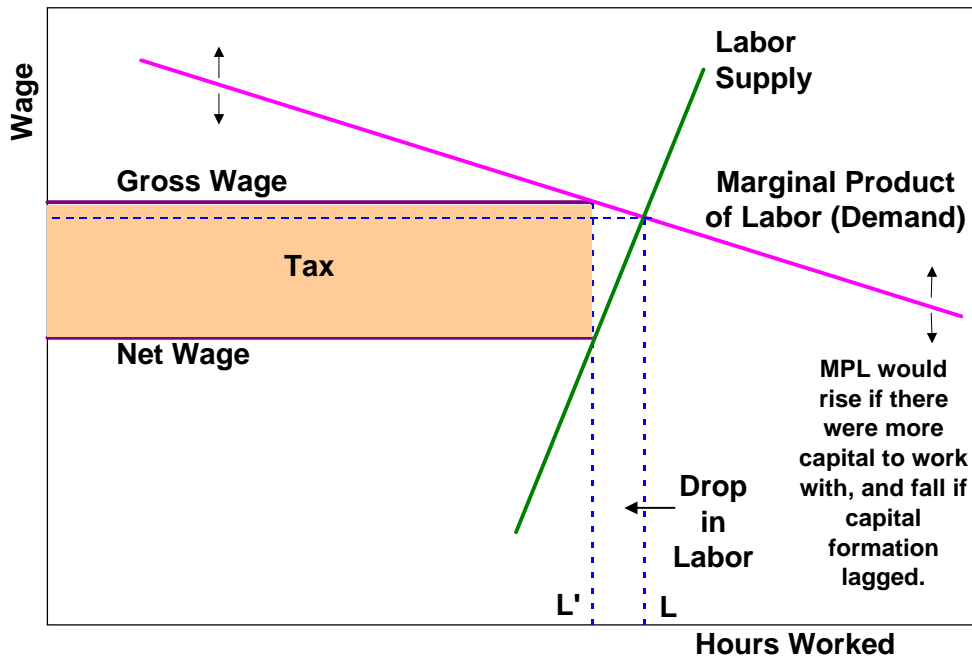
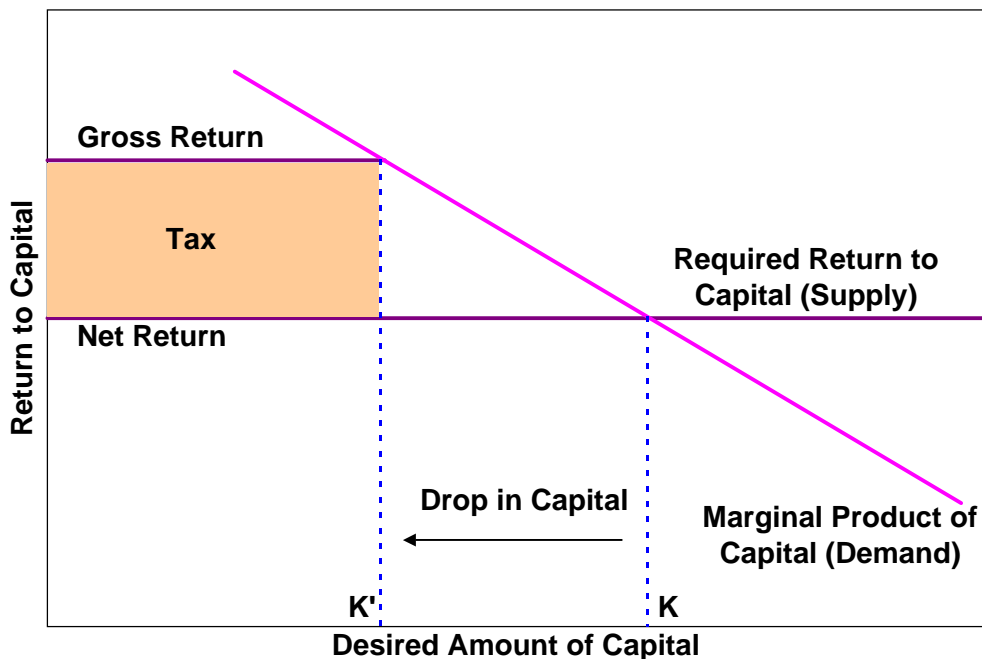


Chart 4 Effect of Tax On Desired Capital Stock



labor if labor costs rise. There is also the possibility of shifting labor-intensive production abroad to take advantage of lower labor costs, if the foreign labor is sufficiently productive to make a difference in unit labor costs. (See Appendix A, which lays out a typical "Cobb-Douglas" production function for illustration.)

Capital market

The supply of capital. The supply of capital is highly elastic. Physical capital (equipment, plus industrial, commercial and residential structures) can be easily reproduced or expanded (given a bit of time). Furthermore, investors seem willing to construct and employ additional plant, equipment, and buildings whenever the after-tax risk-adjusted rate of return approaches about 3% (again, given a bit of time).⁶ Put another way, savers will readily finance (buy claims to the earnings of) capital assets at about a 3 percent after-tax risk-adjusted rate of return, substituting additional saving for additional consumption. Thus, the supply of investment goods and the supply of saving to pay for it are both fairly elastic over time. Conversely, when rates of return on physical capital fall below that level, old assets are not replaced when they wear out. Investors and savers use a bit more of their income for consumption instead, which is, at the margin, virtually as attractive as the foregone investment.

The demand for capital. The demand for capital is fairly elastic, because the marginal product of capital declines only gradually as the stock increases. Years of real world observations suggest that it takes a significant rise in the quantity of capital and the capital labor ratio to depress returns and discourage further investment. (See Appendix A.)

Incidence of taxes on labor and capital

Incidence of labor taxes. The relatively elastic demand for labor, coupled with the assumption of a highly inelastic supply of labor, mean that labor bears most of the initial economic incidence of taxes on labor income. It has become common to assert that all taxes on labor income fall on the worker, including the employers' share of the payroll tax, the employees' share of the payroll tax, the unemployment compensation tax, and the portion of the income tax that falls on wages and salaries.

However, the modern work force is seen to display some elasticity of supply, and to that extent it must be assumed that workers will respond to higher tax rates by taking more leisure, and the quantity of labor supplied would fall. A reduced work force would lower the productivity of the capital stock, suggesting that some of the ultimate burden of a tax on labor would fall on capital owners. (Just as the productivity of a given number of workers is enhanced if they have more capital to work with, the productivity of a given amount of capital is enhanced if there are

⁶ Gary Robbins and Aldona Robbins, "Capital Taxes and Growth," National Center for Policy Analysis, *Policy Report*, No. 169, January 1992; and Gary Robbins and Aldona Robbins, "Eating Out Our Substance (II): How Taxation Affects Investment," Institute for Policy Innovation, *TaxAction Analysis Policy Report*, No. 134, November 1995.

more workers, particularly more skilled workers, to utilize it. Conversely, if fewer skilled workers were available, the productivity of capital would decline. Think of what would happen to the earnings of the fifth truck at a small trucking company if one of the five truck drivers called in sick.) However, the capital stock may contract in response to a drop in its productivity and rate of return in order to restore its former rate of earnings (see below), which would shift the burden back onto the work force.

Incidence of taxes on capital income. The incidence of a tax on capital income depends greatly on the time frame. Physical capital cannot disappear overnight (in the event of a tax increase) and it takes time to add to the stock of plant, equipment, and buildings (in the event of a tax reduction). Immediately after a tax increase is imposed on businesses or savers, their after-tax returns on old assets would be depressed. Financial market adjustments would come swiftly. Bond and stock prices would fall, restoring after-tax returns for new buyers, and forcing new borrowers to offer higher interest rates and rates of return to new investors.

Over time, investors in physical capital can adapt. The high long run elasticity of supply of capital suggests that a tax imposed on capital will reduce the capital stock until the gross return rises to cover the tax, leaving the after-tax return about where it was before the tax was imposed. Because of the high elasticities of supply and demand for capital, the reduction in the capital stock may have to be substantial to increase its return by enough to cover the tax. As a result, taxes on the earnings of capital assets or on saving may result in sharp reductions in the stock of capital available for production. Downward adjustments in the physical capital stock may take time, because capital takes some years to wear out. Eventually, the reduction in the capital stock (or slower than normal growth), will bring it back into balance with the growth in demand for capital associated with population growth. Adjustment to an adverse shock may take a few years for equipment, a decade or two for structures. (For example, in the 1988-1990 period, Japan instituted an "anti-tax reform" that sharply raised taxes on capital income, including interest and capital gains from stocks, and increased taxes on buildings and land. The result was a particularly severe economic shock that not only affected the returns to physical capital but threw much of the Japanese financial sector into chaos as stock and land prices plunged. It has taken nearly fifteen years to sort out the mess. Most shocks are not that severe, and most adjustment periods are not that long.) Positive shocks may be easier to deal with. New equipment can be ordered and placed in service in a few months, new housing constructed within a few quarters, and new commercial or office buildings put up within two or three years.

Implications of incidence for the tax base

The differences in the elasticities of supply and demand for labor and capital suggest that a tax imposed evenly on labor and capital income will reduce the stock of capital by more than the quantity of labor supplied. (Compare charts 3 and 4.) Such a tax is more distorting of economic behavior than a tax imposed chiefly on labor income. This suggests an economic advantage from moving away from the so-called broad-based income tax, which actually taxes income used for saving and capital formation *more heavily* than income used for consumption, to

various taxes that are saving-consumption neutral.⁷ Such neutral taxes are often labeled as consumption-based or consumed-income based, and are often, somewhat erroneously, described as taxing labor and exempting returns on capital income. These taxes do, in fact, tax quasi-rents and other abnormal returns to capital that exceed the cost of the saving required to obtain the assets.

One argument against major reform of the tax system (moving to a saving-consumption neutral tax) is that, if labor is truly in highly inelastic supply, sweeping tax rate reductions would do little to boost labor force participation and hours worked, and would have only limited economic benefits. Advocates of the tax status quo, or of higher tax rates on upper income workers, should be careful in making such arguments. A highly inelastic supply of labor would also mean that there is a relatively small reduction in employment from taxes on labor income at all levels, which would make such taxes relatively non-distorting of economic activity. In theory, for those public finance graduates who put great stock on avoiding "economic distortion" and maximizing "economic efficiency", this should make labor income the ideal tax base. One

⁷ Federal and state revenue systems tax income that is saved more heavily than income that is used for consumption. At the federal level there are at least four layers of possible tax on income that is saved.

1) Income is taxed when first earned (the initial layer of tax). If one uses the after-tax income to buy food, clothing, or a television, one can generally eat, stay warm, and enjoy the entertainment with no additional federal tax (except for a few federal excise taxes).

2) But if one buys a bond or stock or invest in a small business with that after-tax income there is another layer of personal income tax on the stream of interest, dividends, profits or capital gains received on the saving (which is a tax on the "enjoyment" that one "buys" when one saves). The added layer of tax on these purchased income streams is the *basic income tax bias against saving*.

3) If the saving is in corporate stock, there is also the corporate tax to be paid before any distribution to the shareholder, or any reinvestment of retained after-tax earnings to increase the value of the business. (Whether the after-tax corporate income is paid as a dividend, or reinvested to raise the value of the business and create a capital gain, corporate income is taxed twice — *the double taxation of corporate income*.)

4) If a modest amount is left at death (beyond an exempt amount that is barely enough to keep a couple in an assisted living facility for a decade), it is taxed again by *the estate and gift tax (the "death tax")*.

Eliminating the estate and gift tax and the corporate tax would remove two layers of bias. Granting all saving the same treatment as is given to pensions or IRAs, either by deferring tax on saving until the money is withdrawn for consumption (as in a regular IRA), or by taxing income before it is saved and not taxing the subsequent returns (as in a Roth IRA), would remove the basic bias. Saving-deferred taxes, the Flat Tax, VATs and retail sales taxes are examples of saving-consumption neutral taxes.

For a further explanation of the biases against saving in the current income tax, see Stephen J. Entin, "Fixing the Saving Problem: How the Tax System Depresses Saving and What To Do About It," *IRET Policy Bulletin*, No. 85, August 6, 2001, p. 15 ff, Institute for Research on the Economics of Taxation, available at www.iret.org. Also see David F. Bradford and the U.S. Treasury Tax Policy Staff, *Blueprints for Basic Tax Reform*, second edition, revised (Arlington, VA: Tax Analysts, 1985).

suspects, however, that people who oppose fundamental tax reform proposals on the grounds that they may appear superficially to be regressive and shift the tax burden from capital income to labor income would not favor heavy taxes on labor income as an alternative.

The ultimate burden: further tax shifting in a general equilibrium framework

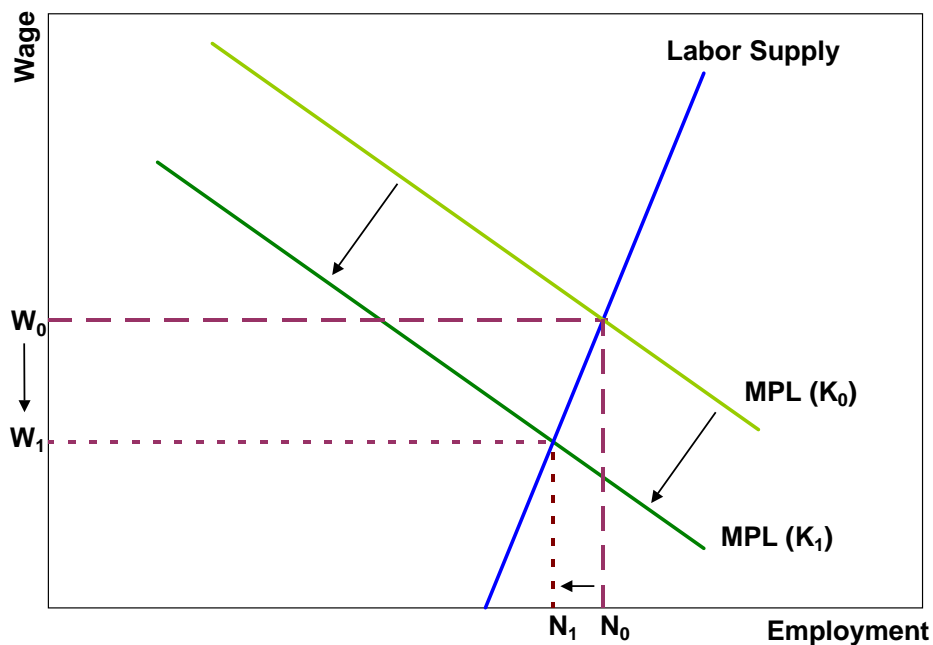
Labor and capital: complements more than substitutes. Output and incomes are at their highest when optimal amounts of labor and capital work together to create the goods and services on which consumers place the greatest value. Depending on the production process, there may be some room to substitute labor for capital (or vice versa), or to substitute skilled labor for unskilled labor. For the economy as a whole, however, and in most situations, the various skills and talents of the work force, managers, and entrepreneurs, and the services of various types of capital are complements in production, not substitutes. That is, the more there is of any one type of factor, the higher will be the productivity and incomes of the other factors that work with it and gain from its presence. If there is more capital for labor to work with, wages rise. If an increase in the skilled work force makes capital more productive, the returns on capital go up.

Taxes matter "at the margin". Taxes affect the willingness of labor and capital to participate in production, or, put another way, taxes affect the cost of labor and capital services, and therefore the cost of production. Supply decisions are not usually all or nothing. One chooses to work a little bit more or less, or to save a little more or less, or to employ a slightly higher or lower number of machines, or slightly more or less powerful or modern ones, on the factory floor. The tax rates that affect such decisions are the marginal tax rates that apply to the last or next dollar to be earned from small reductions or increases in one's economic activity. Taxes that fall at the margin on incremental activity reduce the quantity of resources available for production. With fewer inputs, there will be less output and income, according to the characteristics of the production process.

Lump sum taxes, such as a head tax, involve a fixed dollar amount owed regardless of income, and so have no impact on decisions about increasing one's earnings. Likewise, one-time retroactive tax hits do not apply to future income, although they may make taxpayers suspicious that they will be repeated. Such taxes are not "at the margin", meaning that they do not affect the last or next dollar earned, and are the only kind of tax that do not reduce incentives and curtail activity. Similarly, rebates of taxes on income of past years, such as President Ford's 1975 tax rebate on 1974 income tax liability, give no incentive to increase output in the future.

Taxing one factor hurts the other. If a tax falls "at the margin", it depresses the reward to the taxed factor of production, and less of that factor's services will be offered and employed. Because there is less of that input, all the other factors that work with it suffer a loss of productivity and income. They, too, bear some of the burden of the tax. For example, a tax that reduces the quantity of capital lowers the wages of labor. Labor thus bears much of the burden of the tax on capital. (See Chart 5.)

Chart 5 A Smaller Stock Of Capital Reduces Wages



Taxing capital hurts labor a lot. Insofar as some inputs are more affected by the taxes than others, they may withdraw their services to a greater or lesser extent than others do. As some inputs withdraw heavily from the market, their relative scarcity affects the productivity, employment and income of other productive inputs with which they would normally work. Because capital is more sensitive to taxation than labor, a tax on capital will have a relatively large adverse impact on the quantity of capital, which will then cause a relatively large drop in the marginal product and compensation of labor. Taxes on labor hurt capital as well, but because labor is less elastic in supply, and withdraws less from the market, the effect is less pronounced.

Consider a small trucking company with five vehicles. Suppose that the rules for depreciating trucks for tax purposes change, with the government demanding that the trucks be written off over five years instead of three. The owner has had enough business to run four trucks flat out, and a fifth part time. He is barely breaking even on the fifth truck under old law. It is now time to replace one of the trucks. Under the new tax regime, it does not quite pay to maintain the fifth truck. The owner decides not to replace it, and his income is only slightly affected. But what happens to the wages of the fifth truck driver? If he is laid off, who bears the burden of the tax increase on the capital?

Consider another example, involving human capital, specifically, medical training. Suppose the imposition of a progressive income tax were to discourage the supply of physicians by inducing some doctors to retire, by causing others to work fewer weeks per year, and by dissuading people

from applying to medical school. One result would be fewer jobs available and lower levels of productivity and incomes for nurses and support staff in medical offices and hospitals. Another would be a rise in the price of health care for consumers (including the government).

For example, assume that four doctors have been operating separate practices in a large town. Each has been taking off one month a year, during which time the other three cover for him. Following the tax hike, they decide to merge their offices, with each doctor taking off three months a year, and with a fourth of the support personnel let go as redundant. The doctors prefer an extra two months of leisure to the lowered after-tax cash earnings they would have earned by working their regular work-year. The laid off support staff have experienced a less voluntary and potentially more damaging shock. Doctors' rates in the region rise marginally. Patients experience longer waits, or must seek out doctors in the next town. Who bears the brunt of the tax on the doctors' incomes?

Such effects may seem small or unlikely at current tax rates, but they are certainly pronounced when tax rates are very high. Historical examples abound. The 1954 tax overhaul in the United States did little to reduce the top World War II tax rates. The top rate went from 92 percent to 91 percent, where it remained until the Kennedy tax rate cuts, which lowered the top marginal rate in stages to 70 percent in 1964 and 1965. President Reagan often remarked that at such extreme tax rates it did not pay him to make more than one or two movies a year. There were obvious adverse effects on the U.S. labor markets from the inflation-induced "bracket creep" of the 1970s, which pushed marginal tax rates higher across the board. The top tax rate in Britain before Margaret Thatcher's reforms in 1979 was 98 percent. The infamous British "brain drain" was one result.⁸

In short, taxes on capital reduce the wages of labor; taxes on labor reduce the rates of return on capital (at least in the short run, until the capital stock shrinks); taxes on certain types of labor reduce the wages of other types of labor; taxes on certain types of capital reduce the returns on other types of capital. The repercussions of a tax on one factor of production on the income of other factors, or of a tax on one sector of the economy on other sectors, are "general equilibrium" effects. They occur outside of the immediate market for the factor or product being taxed, and represent impacts that go beyond the initial economic incidence of the tax. Such effects are part of the ultimate economic burden of the tax and represent some of the shifting of the tax burden from the taxed factors or products to other factors and sectors.

⁸ Another result was conspicuous consumption. That is, saving was affected as well. At the 20 percent interest rates then prevailing in Britain (reflecting high tax rate and high inflation), one could invest £50,000 in a government note, earn £10,000 in interest, pay £9,800 in tax, and have £200 a year left over. Alternatively, one could give up the bond and the interest to buy a Rolls Royce for £50,000 pounds and enjoy the car. Was driving a Rolls Royce worth £200 a year? Many people thought so.

Implications of burden shifting for the tax base

Even for labor, the optimal tax on capital is zero. Several studies in the economic literature illustrate that a zero tax rate on capital income would raise the after-tax income of labor, in present value terms, even if labor must pick up the tab for the lost tax revenue. That is, a tax on capital is effectively shifted to labor, which pays more than the full value of the tax.

In a 1974 paper⁹, Martin Feldstein explored the consequences of a variable capital stock for the distribution of the tax burden. Previous studies that generally assumed no change in the capital stock had concluded that the burden or benefit of a tax increase or decrease on capital was borne by capital. (See the discussion of the corporate income tax, below.) Feldstein showed the importance of allowing for the capital stock to vary.

Feldstein assumed the tax on capital income was eliminated and that on labor was increased in a revenue neutral manner. He then looked at the least favorable case for labor, in which people were either savers who had no wage income, or were workers who did no saving. In a "statutory obligation" or burden table or static sense, the savers would enjoy all of the benefit from the initial tax cut on capital income. All workers would face an initial tax increase on wages equal to the dollar amount of the tax cut on capital.

However, Feldstein argued, cutting the tax on the savers would enable them to save more, at the given propensity to save that they display, by leaving them more after-tax income. The added saving would cause the capital stock to rise to a new equilibrium level at which the added saving was just sufficient to cover the added depreciation so as to maintain the incremental stock.

At the higher capital-labor ratio, the productivity of labor and the wage would both be higher (Chart 5 in reverse), leaving the workers with higher gross wages and more after-tax income in the steady state despite the higher tax rate on wages. Feldstein showed that, under plausible assumptions, the present value of the increase in future after-tax wages due to the rise in gross wages would be greater than the near-term reduction in after-tax wages due to the rise in the tax rate on wages. Workers would be better off in present value terms with no taxation of capital.

A 1986 study by Christophe Chamley showed that the optimal tax rate on capital is zero in the long run under a narrow set of assumptions, including a fixed growth rate not affected by taxes, a closed economy, and identical consumers living infinite lives.¹⁰ Many other studies on the shifting of taxes on capital to labor have expanded on this work by easing a number of Feldstein's and Chamley's restrictions and using different types of models, showing it to be a more

⁹ Martin Feldstein, "Incidence of a Capital Income Tax in a Growing Economy with Variable Savings Rates," *The Review of Economic Studies*, 41(4), 1974, pp. 505-513.

¹⁰ Christophe Chamley, "Optimal Taxation of Capital Income in General Equilibrium with Infinite Lives," *Econometrica*, 54, May 1986, pp. 607-22.

general proposition.¹¹ For example, a 1999 study by Atkeson, Chari, and Kehoe demonstrated that Chamley's result holds under greatly relaxed assumptions, including heterogeneous consumers in overlapping generations, an open economy, and a growth rate that is affected by taxes.¹²

Speed of adjustment is critical. The results in many of these studies are sensitive to the speed of adjustment of the capital stock. In a 1979 paper¹³, Professor Robin Boadway questioned the conclusion that labor would gain in present value by eliminating the tax on capital. He suggested that a low elasticity of saving could slow the rise in the capital stock and delay the expected rise in after-tax incomes. If the added capital formation took long enough, the higher tax rate on labor in the not-so-short short run would then outweigh, in present value, the rise in after-tax incomes in the long run, and workers would be worse off. Similarly, a rise in the tax on capital and a reduction in the tax on labor might make labor better off for many years before the reduction in the capital stock lowered workers' before and after-tax wages by enough to make them worse off in present value. He suggested that labor might gain from a tax on capital for as long as 65 years before the steady state was reached.

Many of these presentations involve stylized models of a highly simplified economy or population. They achieve the change in national saving and the capital stock solely on the basis of mechanically moving disposable income from those who do not save to those who do, at constant propensities to save (fixed rates of saving out of labor and capital income), and let the change in saving, which is only a fraction of the shifted income in this approach, determine the change in the capital stock. By contrast, in the real world, a tax change affects the cost of capital and the returns to saving, which in turn alter the desired capital stock and level of saving. These changes in saving and the capital stock can be much larger than the dollar amounts of the tax change. Mankiw and Weinzierl have illustrated this more dynamic type of model in "Dynamic Scoring: A Back-Of-The-Envelope Guide"¹⁴. The mechanical models generally assume a closed economy (not open to trade and international capital flows), limiting the supply of saving available to boost domestic investment. Most assume their elasticities without deriving them from a general equilibrium model tested against actual experience. Hence, they cannot be considered robust pictures of the real world. These studies, of which the Boadway study is a good example, produce

¹¹ Kenneth L. Judd, "Redistributive Taxation in a Simple Perfect Foresight Model," *Journal of Public Economics*, 28, October 1985, pp. 59-83. Also, see Kenneth L. Judd, "A Dynamic Theory of Factor Taxation," *American Economic Review*, 77, May 1987, pp. 42-48; H. Greg Mankiw, "The Savers-Spenders Theory of Fiscal Policy," *American Economic Review*, 90(2), 2000, pp. 120-125; and Casey B. Mulligan, "Capital Tax Incidence: First Impressions from the Time Series," NBER Working Paper 9374, National Bureau of Economic Research, Cambridge, MA, December 2002.

¹² Andrew Atkeson, V.V. Chari, and Patrick J. Kehoe, "Taxing Capital Income: A Bad Idea," *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 23, No. 3, Summer 1999, pp. 3-17.

¹³ Robin Boadway, "Long Run Tax Incidence: A Comparative Dynamic Approach," *The Review of Economic Studies*, 46(3), July 1979, pp. 505-511.

¹⁴ N. Gregory Mankiw and Matthew Weinzierl, "Dynamic Scoring: A Back-Of-The-Envelope Guide," Working Paper 11000, National Bureau Of Economic Research, Cambridge, MA, December 2004.

unduly pessimistic estimates of the length of time it takes to increase the capital stock following a reduction in the tax rate, and of the amount by which the capital stock would rise.

Reality check. Traditional economists are used to thinking in terms of a fairly constant "propensity to save" and an inelastic supply of saving. They may be skeptical that the quantity of domestic saving can increase by enough to allow for a strong burst of capital formation needed to bring about a rapid adjustment of the capital stock to a tax shock. Their focus on the channels by which the needed investment is financed is misplaced. They should look first at the speed of adjustment in the historical record of the real world, and then worry about how it happens, rather than declaring an observed phenomenon to be impossible.¹⁵

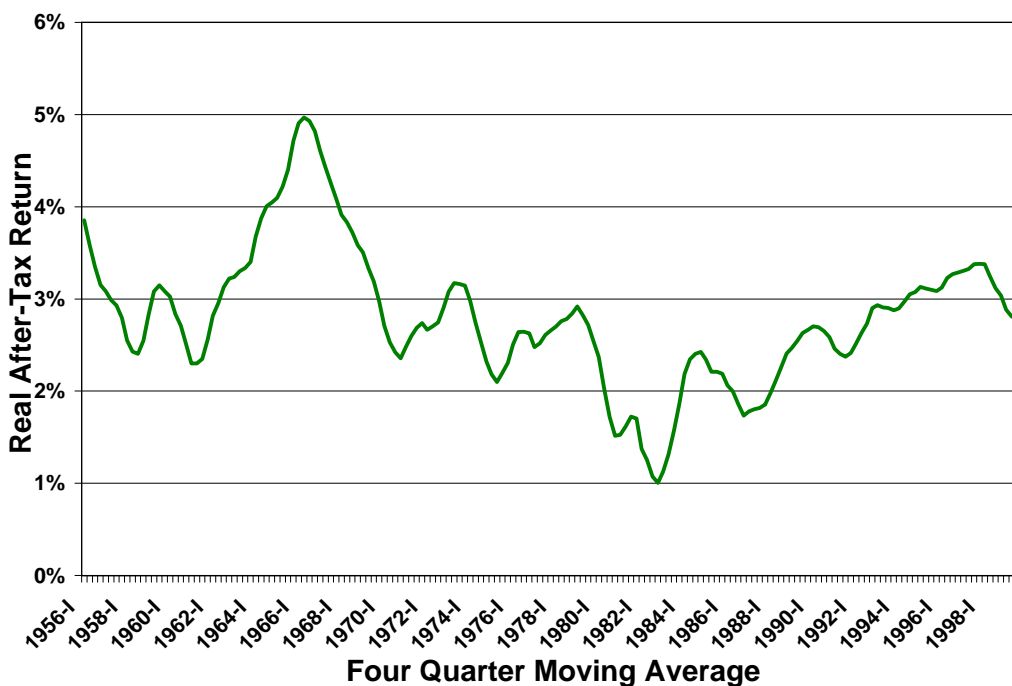
How rapidly the economy will invest or disinvest to reach the new equilibrium level of capital depends on several factors, such as the elasticity of saving with respect to the rate of return, the ease with which existing saving flows can be redirected across national borders, the elasticity of the global supply of investment goods and their resulting cost, and the rate at which existing capital wears out (in the case of disinvestment). Although these sources of financing and the production streams of physical capital are flows, they are part of a complex stock adjustment process.

One could try to imagine or to measure separately how flexible these flows may be. Alternatively, one could review the changes in the capital stock that have occurred in the past following shocks to the after-tax rate of return. The latter approach gives an important reality check. If adjustment of the capital stock has proceeded more rapidly in the past than can be accounted for by the flows of saving and investment predicted by some current models, then there may be additional or deeper channels for capital flows in the real world that are not recognized by the models. "It's fine in practice, but it will never work in theory!" is an indictment of the theory, not of the real phenomenon.

Rapid adjustment of capital is the norm. How fast the capital stock adjusts, which is to say, how quickly the return on capital is restored to normal levels after a shock, is really an empirical question, not a theoretical one. Many events, such as technological change, a shift in tax policy, or a shift in inflation, can change the expected returns on capital investment or alter the user cost of capital. The result will be a shift in the desired stock of capital, toward which the economy will move over a number of years.

¹⁵ Before van Leeuwenhoek invented the microscope, physicians knew that arteries carried blood from the heart, and veins returned it, but they had no way to see the capillaries that connected the arteries to the veins. They were unable to map the full circulatory system, and many people were skeptical of the concept of a circular flow of blood. It would have been logical to assume that it was a single system in flow equilibrium, but that concept had not been invented yet. Today, many economists doubt the country's ability to finance federal deficits and the investment that is increasing the stock of capital, and to balance saving and investment, because they cannot see where the financing is to come from. They will never be able precisely to predict or trace the flow of trillions of dollars of funds throughout the complex world financial system, but the funds do flow nonetheless.

**Chart 6 Economy-Wide Real Aftertax
Return to Business Capital**



Are changes in the rate of return to capital merely consequences of business cycles, or are they independent factors that drive savers and investors to adjust the size of the capital stock to conform to new economic conditions, causing changes in the rate of investment that generate business cycles? Gary Robbins of Fiscal Associates and the Heritage Foundation Center for Data Analysis has plotted after-tax rates of return to business capital over time. He finds that the movements in the return to capital, in the desired capital stock, and in the resulting swings in investment activity are seen to lead the business cycle up and down. They are therefore most likely to be a cause, not a result, of the business cycle. (See Chart 6.)

Robbins also finds that the rates of return have tended strongly to remain in the neighborhood of three percent. Between 1956 and 2000, the four quarter moving average rate averaged 2.76 percent, and was within half a percentage point of this average sixty percent of the time. Not only do the returns on capital remain within a fairly narrow band over time, they tend to revert to the band fairly quickly. This implies that, each time there was a major shock to the rate of return, whether traceable to tax, inflation, or technological changes, the quantity of capital has adjusted rapidly, and the rate of return was restored soon to its long run average.¹⁶

¹⁶ Unpublished preliminary figures for a forthcoming study from the Heritage Foundation. See Gary and Aldona Robbins's earlier work for the Institute for Policy Innovation, "Eating Out Our Substance (II): How Taxation Affects Investment," *TaxAction Analysis Policy Report*, No. 134, November 1995, available at

Robbins has tested the speed of adjustment by running regressions looking at implied desired stocks versus the actual deliveries of capital using various distributed lags. He finds that roughly half of the investment in equipment and structures needed to move to the new desired capital stock will occur in the first three years following the shock, and that nearly all of the adjustment is completed within five to ten years (with structures taking a bit longer than equipment). If the bulk of the increase in the capital stock occurs in the first decade following the tax change, as Robbins has found by looking at historical experience, then the case for eliminating the tax on capital is quite strong.

An open economy and flexibility of saving speed the adjustment of capital. The observed stability in the real after-tax rate of return in the United States and the speed of adjustment of the capital stock to shocks make sense, because, in a global economy, the risk-adjusted rate of return in any sub-region should be kept in rough alignment with global returns. Put another way, the size of the capital stock in any one country is not merely sensitive to the innate desired rate of return that humans display (the "marginal rate of time preference"), but also to its relative rate of return compared to that available on capital abroad. The elasticity of the capital stock in a region is much higher than for the world as a whole.

In a closed economy, net national saving (net of government dissaving) equals private investment, and the speed of adjustment to a new desired equilibrium capital stock following a shock is limited by the change in the national saving rate. In the case of a tax change in the closed economy, the change in national saving and investment will depend on the immediate effect of the tax change on the government deficit (which is the only effect considered in fixed-GDP "static" analysis used by government officials) and on the subsequent dynamic effects of the tax change on the nation's own domestic private saving, investment, and income, which in turn depends on the elasticity of domestic saving and investment with respect to the after-tax rate of return. However, the limitation imposed by the flexibility of own-country saving does not hold in an integrated world economy with international capital flows.

In today's world, it would be a great mistake to assert that the progress of any one nation toward a new equilibrium capital stock following a tax or technological change is limited by its own saving elasticity or by the static tax-induced change in its own national saving rate. Changes in the flow of capital across national borders can have a major impact on the speed of adjustment.

www.ipi.org. In the IPI study, using earlier Commerce Department data that has since been revised for the period 1954-1994, the authors found that "the rate of return to new investment, after taxes, depreciation, and inflation, has been remarkably stable over the last forty years. The reason is that investors quickly counter shocks that cause their after-tax return to go up or down by changing their investment behavior. In short, increases in the after-tax return have led to an increase in the rate of capital formation until the return was driven back down to its long-run, economy-wide average of 3.4 percent [old data]. Conversely, decreases in the after-tax return have been followed by a decrease in investment until the after-tax return went back to 3.4 percent. And the adjustment generally takes five years or less. A major source of "shock" is changes in tax policy." The revisions appear to have affected the level of the rate of return, but not the pattern of year-to-year changes or the conclusion that the public restores its desired rate of return to capital by adjusting the quantity of the capital stock it employs, and does so quickly.

For example, following the major tax and monetary policy changes of the early 1980s, new U.S. bank lending abroad dropped from roughly \$120 billion in 1982 to under \$20 billion in 1984. The drop in U.S. capital outflow of \$100 billion more than covered the 1982-1984 change in the government deficit following the 1980 and 1981-82 recessions and the 1981, 1982, and 1984 tax changes. The shift to domestic lending was large enough to finance a large portion of the increase in private investment in the first half of the decade. In addition, the private saving rate increased. There was only a modest rise in foreign capital flows to the United States in that period. (They rose further later in the decade).

Longer time horizons reinforce the importance of international capital flows and of how a nation treats foreign investment. From the first Spanish and English settlements in Florida (St. Augustine, 1565) and Virginia (Jamestown, 1607) until World War I, a period of over three hundred years, the region that became the United States experienced a massive inflow of population and capital from Europe, Africa, and Asia. The capital inflow allowed the country to run current account deficits for most of that period. (There was a brief period of current account surplus for about a dozen years after the Civil War, when the U.S. was deflating and importing gold to restore the dollar to the gold standard at the pre-war parity. Being money, the gold inflow was not considered an import. If gold were treated as a commodity, even these surpluses might have been deficits.) Much of the investment in the early U.S. canals, railroads, and industry was financed by foreigners. International capital flows are not a new phenomenon.

Neither is awareness of the implications of an open economy for the stock of capital, the wages of labor, and the revenues of the state. Adam Smith laid out the case for treating capital with kid gloves in *The Wealth of Nations*.

The proprietor of stock is properly a citizen of the world, and is not necessarily attached to any particular country. He would be apt to abandon the country in which he was exposed to a vexatious inquisition, in order to be assessed to a burdensome tax, and would remove his stock to some other country where he could either carry on his business, or enjoy his fortune more at his ease. By removing his stock he would put an end to all the industry which it had maintained in the country which he left. Stock cultivates land; stock employs labor. A tax which tended to drive away stock from any particular country would so far tend to dry up every source of revenue both to the sovereign and to the society. Not only the profits of stock, but the rent of land and the wages of labour would necessarily be more or less diminished by its removal.¹⁷

In addition to the international flow of capital, one must consider the willingness of savers to increase saving at the expense of consumption, and to alter their investment plans as conditions

¹⁷ Adam Smith, *An Inquiry into the Nature And Causes of the Wealth of Nations*, Chapter II, 1776.

change. Since Michael Boskin's 1978 paper on saving and after-tax returns, people have been a bit more willing to concede some flexibility in saving behavior.¹⁸

Does Atlas Shrug?, edited by Joseph Slemrod, contains a number of interesting studies describing the taxation of the rich and their responses.¹⁹ In Chapter 13, "Entrepreneurs, Income Taxes, and Investment", authors Robert Carroll, Douglas Holtz-Eakin, Mark Rider, and Harvey S. Rosen explored the effect of changes in marginal tax rates on the investment behavior of entrepreneurs. They found that "a five-percentage point rise in marginal tax rates would reduce the proportion of entrepreneurs who make new capital investments by 10.4 percent. Further, such a tax increase would lower mean capital outlays by 9.9 percent." They add, "the magnitudes of the estimated response are quite substantial. Our response to the question posed by the title of this volume is that these particular Atlases do indeed shrug."²⁰

Progressive taxes on human capital may also hurt labor, and a flat rate tax may be best. People with particularly high levels of human capital earn returns well above those available to ordinary labor. They may have special talents, such as athletes and entertainers. They may be people with an unusual ability and willingness to make decisions and manage risk, such as successful entrepreneurs. They may be people who have acquired advanced educations and skills. Such people are among the highest paid people in the country. They earn more, but they also face higher average and marginal tax rates than most workers.

Because labor is not homogeneous, and there are significant differences in the skill mix across the population, the relative amounts of skilled and unskilled labor can make a difference in the wage rates earned by each group. Taxing the earnings of people with significant human capital at higher rates than ordinary labor may prove to be counter-productive to workers, just as excessive taxation of physical capital appears to be. If people with significant human capital withdraw that capital from the market due to high tax rates, the productivity, wages, employment, and incomes of other people who would have worked with them may be lowered. The tax on the personal service income of the highly compensated is then shifted to other workers and factors.²¹

Some studies indicate that high income workers do not seem to reduce work effort in the presence of high tax rates. Several reasons are offered. Upper income individuals may receive

¹⁸ Michael Boskin, "Taxation, Saving, and the Rate of Interest," *Journal of Political Economy*, 86 (Part 2), April 1978, S3-27.

¹⁹ Joel B. Slemrod, ed., *Does Atlas Shrug? The Economic Consequences of Taxing the Rich* (New York: Russell Sage Foundation; and Cambridge, MA: Harvard University Press, 2000).

²⁰ Robert Carroll, Douglas Holtz-Eakin, Mark Rider, and Harvey S. Rosen, "Entrepreneurs, Income Taxes, and Investment," Chapter 13, in *Does Atlas Shrug, op. cit.*, pp. 427 and 442.

²¹ See Franklin Allen, "Optimal Linear Income Taxation with General Equilibrium Effects on Wages," *Journal of Public Economics*, 17, 1982, pp. 135-143.

some of their compensation in the form of "psychic perks" rather than financial rewards. The tax may be avoided by changing the method of compensation. The tax may be shifted to other factors.

Psychic perks might include the power and prestige that are associated with prominent positions in business, sports, or entertainment. These perks are unaffected by high tax rates. Economist Henry Simons, godfather of the progressive income tax, offered this as a justification for not fearing adverse consequences from steeply progressive taxation. Simons dismissed the concern that highly skilled workers or entrepreneurs would cut back on their efforts very much simply because they were taxed, on the grounds that their jobs were interesting — "Our captains of industry are mainly engaged not in making a living but in playing a great game" — and that the status and power attached to these jobs were rewards enough to encourage continued effort.²² This cavalier assumption cannot hold, however, when highly progressive rates reach down to tens of millions of small business owners and professional couples in the middle class.

High tax rates can sometimes be avoided by employing alternative forms of financial compensation that allow the recipients to defer the high tax payments, as with pension plans, or by taking them in a form, such as capital gains or stock options, that is subject to a lower rate of taxation and which also have a deferral feature. There has been a surge in stock options as a form of compensation in recent years, spurred in part by the 1993 Tax Act. That Act raised the top marginal tax rates to 36 percent and 39.6 percent from 31 percent. It also decreed that executive salaries in excess of \$1 million would be non-deductible business expenses, apparently in a misguided effort to discourage inequality across the wage scale and to punish corporate boards perceived as being too generous to top management. To the extent that the marginal product of the affected senior management justified the higher salaries, the meddling of the law reduced economic efficiency and equity, rather than enhancing it. The options explosion, however, altered incentives for senior management, and has been blamed for some recent corporate scandals which, though small in number, have been rather spectacular.

Another reason that the rich may not appear to be stampeding into retirement may be that they are able to shift the tax to other factors. Such people's human capital and talents may be in somewhat inelastic demand. If so, with only a small change in their numbers they may be able to trigger higher compensation to cover their higher taxes. The burden of the tax would shift to other workers and consumers without the appearance of a large reduction in the hours worked of the rich. In a typical production function, a small distinct factor of production would typically have a smaller elasticity of demand than larger or more readily substitutable factors. (See Appendix A.) As highly paid as some CEO's are, their compensation is generally a small percent of a business's total costs, and their knowledge of the business and ability to run it at maximum efficiency may be very hard to replace, at least in the short run. Their administrative or inventive talents, however, may be transferable to other applications, and they may be more mobile, across companies or across borders, than ordinary labor. This would suggest a further ability to shift taxes to other factors.

²² Henry C. Simons, *Personal Income Taxation* (Chicago IL: University of Chicago Press, 1938), p. 20.

Neutrality and economic efficiency versus income redistribution

Neutral tax systems maximize income. The potential damage to ordinary labor from excessive taxation of capital, both physical and human, is significant. It suggests that a saving-consumption neutral tax with a flat rate would serve every type of economic actor better than the current tax system, which includes the graduated comprehensive personal income tax, the corporate income tax, and the estate and gift taxes. The alternatives might include a saving deferred income tax²³, a national retail sales tax, a value added tax (VAT)²⁴, a returns exempt Flat Tax²⁵, or some combination. The more familiar comprehensive or broad-based income tax in use today taxes most income as it is received, including income used for saving, and taxes the returns on saving as soon as they accrue (except for capital gains, which can be deferred until realized). Such taxes fall more heavily on income used for saving than for consumption. The tax bias against saving is made worse by imposing an add-on corporate tax and transfer (estate and gift) taxes.²⁶ Any justification of the comprehensive or broad-based income tax and the additional corporate and death duties must rely on significant non-economic social benefits, because these taxes impose high economic costs, including reduced incomes across the board.

Redistribution lowers total income and can hurt those it is designed to help. Early advocates of redistributionist tax systems acknowledged some of the costs. Professor Henry Simons was one of the most influential early advocates of the broad based income tax. Simons and Professor Robert Haig defended the use of a definition of taxable income that includes both income saved and the subsequent returns on the saving, including capital gains, interest, and dividends (basically, one's income was defined as equal to current consumption plus the increase in one's wealth during the year). This tax base is sometimes described as "the increase in the ability to consume". It results in a tax that is not saving-consumption neutral; that is, it falls more heavily on income used for saving than consumption.²⁷ Since the rich save more than the poor, taxing saving more heavily than consumption is assumed to be "progressive". Simons also favored making the marginal tax rate structure graduated (higher tax rates imposed on incremental taxable income as it exceeds specified levels) to further increase the progressivity of the system. The pure Haig-Simons definition of income did not allow for a corporate tax in addition to the individual

²³ A tax on income less net saving, in which all saving is tax deferred in the manner that current law allows for limited amounts of saving in an ordinary IRA, 401(k), or pension. This type of tax is also called an inflow-outflow tax, a consumed income tax, an individual cash flow tax, or an expenditure tax.

²⁴ Value added tax, including European style credit invoice method VATs, goods and services taxes or GSTs (as in Canada and Australia), or subtraction method VATs (also called business transfer taxes in the United States, such as is proposed in the USA Tax).

²⁵ A returns exempt tax does not allow a deduction for or deferral of current saving, which must be done on an after-tax basis, but it does not subsequently tax the returns on that after-tax saving. It is the method used for Roth IRAs.

²⁶ See footnote 7.

²⁷ See footnote 7.

income tax, however, because that would have been an additional layer of double taxation. The professors would have preferred an integrated tax structure that passed corporate income on to shareholders for taxation as it was earned, but were thwarted by practical impediments. Even for these redistributionists, the degree of double taxation and distortion inherent in an add-on corporate income tax went too far.

Professor Simons was well aware that the twin distortions of the tax base and the rate structure inherent in the income tax could lead to a drop in saving, investment, and national income. Therefore, he knew of the possibility of adverse shifts in the tax burden due to heavy taxation of capital income and progressivity. In his magnum opus, *Personal Income Taxation*, Simons wrote:

The case for drastic progression in taxation must be rested on the case against inequality — on the ethical or aesthetic judgment that the prevailing distribution of wealth and income reveals a degree (and/or kind) of inequality which is distinctly evil or unlovely...

The degree of progression in a tax system may also affect production and the size of the national income available for distribution. In fact, it is reasonable to expect that every gain, through taxation, in better distribution will be accompanied by some loss in production...

[I]f reduction in the degree of inequality is a good, then the optimum degree of progression must involve a distinctly adverse effect upon the size of the national income...

But what are the sources of loss, these costs of improved distribution? There are possible effects (a) upon the supplies of highly productive, or at least handsomely rewarded, personal services, (b) upon the use of available physical resources, (c) upon the efficiency of enterpriser activity, and (d) upon the accumulation and growth of resources through saving. Of these effects, all but the last may be regarded as negligible...²⁸

As mentioned above, Simons dismissed the concern that highly skilled workers or entrepreneurs would make less effort if highly taxed because they found their jobs interesting. Simons took more seriously the possibility that saving and investment would suffer from his policy prescription:

With respect to capital accumulation, however, the consequences are certain to be significantly adverse... [I]t is hardly questionable that increasing progression is

²⁸ Simons, *op. cit.*, pp. 18-20.

inimical to saving and accumulation... That the net effect will be increased consumption ... hardly admits of doubt."²⁹

Simons's remedy was not to do away with progressivity, but to offset its effect on saving by running federal budget surpluses:

The contention here is not that there should be correction of the effects of extreme progression upon saving but that government saving, rather than modification of the progression, is the appropriate method for effecting that correction, if such correction is to be made.³⁰

The assumption that the government virtuously would run large budget surpluses to make up for the anti-growth consequences of a biased and progressive tax system has proven to be utterly naive. Furthermore, a budget surplus cannot make up for the adverse effects that high corporate or individual tax rates and unfriendly capital cost recovery allowances have on the present value of after-tax cash flow from an investment, a calculation that any business school graduate will undertake in deciding on the feasibility of an investment project. Thus, even an offsetting budget surplus would not prevent a reduction in the equilibrium capital stock from a reduction in the marginal return on investment.

Professor Alfred Marshall, who bowed to the general acceptance of progressivity, nonetheless favored a more neutral graduated tax on consumption over a graduated tax on income: "[T]here is a general agreement that a system of taxation should be adjusted, in more or less steep graduation, to people's incomes: or better still to their expenditures. For that part of a man's income, which he saves, contributes again to the Exchequer until it is consumed by expenditure."³¹ As Marshall pointed out, one does not need to adopt a non-neutral income tax to achieve progressivity. Saving-consumption neutral taxes can be made progressive as well. In fact, it is not necessary to have graduated tax rates to achieve progressivity. A tax which exempts some amount of income at the bottom, and imposes a flat marginal tax rate on income above that amount, is progressive, because the average tax rate will rise with income. A graduated consumption-based tax is not as economically efficient as a flat rate consumption-based tax, because it increases the tax penalty at the margin the more productive an individual becomes and the more effort he or she makes. Nonetheless, it is far more efficient than a graduated income tax.

The tax bias against saving that was built into the income tax may have been seen as a way of putting a kinder face on capitalism and defending the free market and private property against the foreign ideologies of fascism, national socialism, and communism that seemed to be sweeping the world in the 1930s. In retrospect, however, we can see that the broad-based income tax retards investment, which reduces wages and employment and keeps people who lack savings and access

²⁹ *Ibid.*, pp. 21-23.

³⁰ *Ibid.*, p. 29.

³¹ Marshall, *op.cit.*, p. 661.

to capital from getting ahead. Taxes on capital formation hurt the poor more than the rich (who can simply exchange the pleasures of current consumption for the future income of similar present value that their saving would have generated).

Implication of dynamic effects of taxes for estimating federal revenues

A better understanding of the economic consequences of taxation would also benefit the Treasury and the Congress as they plan the federal budget and contemplate changes in the tax system. Government revenue estimators generally ignore the effect of tax changes on the over-all level of economic activity, employment, incomes, payroll, profits, dividends, and capital gains. This method is known as "static revenue estimation" or "static scoring". Static scoring leads to mis-estimates of the effect of tax changes on revenues. In particular, the revenue losses from tax reductions that would promote an increase in economic activity are overstated, and the revenue gains from raising taxes in a manner that would retard the economy are overstated. Different tax changes have different effects on the economy. Ignoring these effects denies Congress and the Executive important information in choosing among tax proposals. Inaccurate revenue estimates therefore interfere with budget planning and assessment of proposed tax changes. In particular, they exaggerate the difficulty in achieving fundamental reform of the tax system. By contrast, "dynamic scoring" would take into account the effect of tax changes on total income and its component parts. Dynamic scoring would lead to more accurate revenue forecasting and, one would hope, to tax bills that are more concerned with increasing national and individual income, and less inclined toward redistributing a fixed pie.

V. Burden Tables: an exercise in misdirection

Whenever a change is proposed to the tax system, one of the first questions asked is "What is the distribution of the tax increase or decrease?" That is to say, "If this tax change is enacted, who will pay more, and who will pay less?" or "Who will be helped or hurt by the tax change?" One possible concern is how the "burden" is distributed among people of different incomes, that is, how the tax change affects the progressivity of the tax system.

Burden table assumptions, methods at odds with economic theory, reality

Tax analysts in the research community, the JCT, the Congressional Budget Office (CBO), and the Office of Tax Analysis of the Treasury (OTA) present "burden tables" or textual analysis to answer these questions. The presentation of these estimates has considerable political import. Therefore, it is important to remember that, when tax analysts prepare burden tables or present a description of tax incidence, they must make assumptions and apply conventions to assign the incidence of the tax to various economic actors, be they consumers, workers, savers, etc. Among other things, they must make assumptions about the responsiveness of labor, capital, and consumers to the tax, and what time frame to consider in presenting the burden. Some of these conventions have more to do with convenience than with accuracy, and are, in fact, highly arbitrary and often contrary to economic reality.

Incidence, not burden. These "burden tables" or "distribution tables" show how a tax proposal would alter tax payments of individuals across various income classes or quintiles in a given year, other things held constant. (One such table, prepared jointly by the Urban Institute and the Brookings Institution and available on line, is displayed in Appendix C. Other methods of display are possible, such as listing how many tax filers get tax reductions of various amounts, how the tax cut is distributed among single filers, joint filers, families with children, the elderly, etc.)

Such tables are based on existing levels of each type of pretax income, and the existing distribution of whatever exemptions and deductions are in force at the time of the tax change. They attribute each tax either to consumers or producers, or to labor or capital, with a vague nod to economic theory in what would be a limited partial equilibrium analysis of the shifting of the tax within its own market if it were done consistently. However, they generally assume that taxpayers' aggregate incomes and behavior are not affected by the tax change. Thus, the analysis is cut short of a full exploration of the economic consequences of the tax, and the ultimate burden of the tax is not described. Consequently, these "burden" tables attempt to demonstrate only the initial incidence of the taxes (and should be renamed "incidence tables"). They tell us virtually nothing about the distribution of the burden of the taxes after people adjust their behavior as a result of the levies.

Inconsistent attribution and sloppy theory. Furthermore, the conventions used in tax analysis are often inconsistent from one tax to the next, and fail to do a good job of demonstrating even the initial incidence of the taxes. In standard JCT burden tables, and in Treasury and CBO analytical work, consumption taxes are usually assumed to be "passed forward" to consumers in the form of higher prices. These taxes include:

- Retail sales taxes and value added taxes
- Excise taxes (whether imposed on the manufacturer, the distributor, or at the point of retail sale)

Meanwhile, income taxes and other taxes on factors are assumed to be "passed backwards" to workers and owners of capital in the form of lower take home pay and after-tax incomes from saving and investing. These taxes include:

- The personal income taxes (federal, state, and local)
- The corporate income taxes (federal, state, and local)
- The payroll tax
- The estate and gift taxes (federal and state)
- Property taxes

Customs fees are an exception to this pattern. They are consumption taxes but are assumed (by the Treasury) to be borne by the suppliers of the foreign labor and capital that produced them. (See Table 1, Appendix C, for a more detailed view of the methodology of tax analysis used by the different federal agencies.)

Consumption taxes, such as a retail sales tax, a VAT, or excise taxes, whether imposed on consumers or on manufacturers, are routinely described as being paid by consumers in the form of higher prices, because it is assumed that consumers are less flexible than producers, so that consumer prices increase by an amount equal to the tax, with none of the tax borne by the producers of the taxed goods. It is as if the supply of goods and services were totally elastic, such that production would dwindle to zero if there were any reduction in the price received by the producers, so the consumers must foot the entire bill.

The personal income tax, however, which falls on labor and capital income of individuals, is routinely described as falling entirely on individual income earners in the form of lower after-tax incomes, with none borne by the consumers of their output. The payroll taxes on wages are similarly assumed to be borne entirely by labor. The estate tax is assumed to fall on the decedents, and the gift tax, if triggered before death, on the donors. The distribution of the corporate income tax is so uncertain that it is left out of most burden tables, but is thought to be borne mainly by either shareholders (at least in the short run) or workers (in the long run, as capital adapts). These taxes are described as if workers, savers, and investors offered their labor and capital in totally inelastic supply, undiminished in quantity, when the tax cuts their compensation. It is assumed that they make no demand for an increase in compensation in response to the tax, so they swallow the entire burden of the income and other factor taxes that they pay.

In effect, the analysts pretend that producers can shift consumption taxes onto their customers, but must absorb income taxes placed on their own earnings. Supply is infinitely elastic and infinitely inelastic at the same time. This is an inconsistent approach to tax shifting that is at odds with both economic theory and real world experience.

In addition, neither approach deals with any further adjustments that occur in the real world when taxes are imposed and resources are shifted in response from one use to another. Such adjustments are the province of general equilibrium analysis.

These questionable presentations of initial incidence, unfortunately, can have a profound affect on the prospects for adoption of one or another tax change. Understanding the shortcomings of the existing "burden" tables that are really bad efforts at "incidence" tables would improve the policy debate. The goal is not so much to arrive at a better presentation of "incidence", but to redirect attention from the concept of initial incidence, and to refocus the debate on the actual economic consequences of tax changes, the ultimate burden of taxation, and the ultimate economic benefits of favorable tax reform.

Snapshots in time rather than lifetime impacts. It is very misleading to display the distribution of tax changes as affecting people only in proportion to their current earnings.

A very large share of the income inequality in our economy is due to the fact that more experienced and older workers earn more than their younger counterparts. Most people will experience a gradual increase in their real incomes as they advance in their careers and their work

experience builds, followed by a decline in current earnings upon retirement. Even if everyone had the same lifetime incomes, people currently age 50 would probably display higher incomes than people currently age 20 or currently age 80. It is misleading to characterize these normal age-related or experience-related changes in income over peoples' lives as class-based income inequality. That, however, is exactly what the burden tables do when they lump all ages together.

Similarly, saving behavior and ownership of assets vary with age. A reduction in the tax rate on capital gains does nothing this year for someone who has no capital gains this year, but will help him in the future when he has gains to realize. Suppose Mr. Jones turns 70 this year, and decides to sell his business of fifty years for a \$1 million gain. Mr. Smith is only 69, and will wait to sell his business until next year. The reduction in the capital gains tax from 20 percent to 15 percent saves Mr. Jones \$50,000 this year, and saves Mr. Smith nothing. Should Mr. Smith feel left out? Hardly. He'll get his benefit next year. The burden tables would suggest massive unfairness each year, because one (different) person each year gets a \$50,000 tax break (in the one year of his life in which he has a million dollar gain), and another person the same year gets none.

In this illustration, the capital gains of both Jones and Smith had built up over many years. Should the gain be counted as occurring only in the year it is taken, boosting the realizer into the top quintile? Would it not better be counted for distribution purposes as it is accrued (at an average gain of \$20,000 a year), which would make it clear that each man is solidly middle class? Should it be counted at all, in that the gain is merely the accumulated reinvestment (saving) of income recorded in the Gross Domestic Product (GDP) in the years it was originally earned? That makes it double counting, which is why economists do not count capital gains in national income (and why the capital gains tax is double taxation to begin with).³²

The Treasury has recently constructed and "aged" a panel of taxpayers whose returns it has followed for several years, based on a sample of the taxpaying population.³³ The panel enables the Treasury to examine how a tax change would affect a typical taxpaying population over time, not just in a single year. As an illustration, the authors compared the expanded distributional analysis of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and the

³² In a very fundamental sense, taxation of capital gains is double taxation of the future income of an asset. Assets have value because they provide income over time (by providing services over time for which the asset's owner is paid). In fact, the current market price of an asset is the present value of the expected after-tax future earnings of the asset (the future after-tax returns discounted to the present by an appropriate discount rate). It is the after-tax returns that are relevant because that is the only part of the returns *that the owner can expect to keep*. An asset will rise in value today if there is an increase in what people expect the asset to earn in the future. If the asset does in fact earn the higher expected income in the future, that higher income will be taxed when it is earned. To also tax the rise in the present value of that increased future after-tax income stream (the present-day capital gain) is to tax the future earnings twice.

³³ See Julie-Anne Cronin, Janet Holtzblatt, Gillian Hunter, Janet McCubbin, James R. Nunns, and John Cilke, "Treasury's New Panel Model for Tax Analysis," prepared for the 96th Annual Conference on Taxation "Forecasting Government Fiscal Situations" Session, National Tax Association, Chicago, IL, November 25, 2003, forthcoming in the proceedings of the conference.

Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) over the span of the then-current budget period (2004-2013) to the distribution calculated at a point in time. Looked at over time, the major provisions of the bill benefitted many more taxpayers than was indicated by a one year snapshot.

In the panel study, some taxpayers who lacked dividends income or capital gains in some years of the period had dividends or capital gains in other years, and benefitted from the bills' reductions in the tax rates on dividends and capital gains. Some taxpayers who were in the lowest tax brackets in some years were in higher brackets in others, and benefitted from the reduction in marginal tax rates in the four highest brackets at some time during the period. The authors report that, "For example, in the first year 34.7 percent of taxpayers would benefit from the reduction of tax rates above 15 percent, whereas over ten years 60.7 percent would benefit in at least one year... In the first year, some tax return filers do not benefit from any of the major provisions of EGTRRA because they have no income tax liability under pre-EGTRRA law and do not qualify for the expanded refundability of the child credit. But over time, nearly all taxpayers, 94.4 percent, would benefit."³⁴ Over time, then, the benefits of the bill are far more widely distributed than is indicated by the ordinary one year snapshot of the distribution of the tax reduction.

This research goes far in revealing the flaws inherent in standard distribution tables and the distributional objections to growth-oriented tax changes. Nonetheless, it still leaves out entirely the economic adjustments induced by the tax changes, which may have an even greater role in spreading the benefits of a growth-oriented tax change. For example, the reduction in the tax rates on dividends and capital gains lowers the service price of capital, and will induce more investment, which will lead to higher productivity and higher wages across the board. Consequently, anyone who works will benefit from the higher wages triggered by the bill, even if he or she never has dividends or capital gains. Even people living entirely on Social Security will benefit from the lower cost structure and more plentiful supply of goods and services made possible by the lower tax rates on wages and capital income. These additional benefits can only be found by taking into account the shifting of the tax burden and the changes in people's economic circumstances that are due to the economic adjustments to the tax changes.

Measuring dynamic responses essential to a true burden table

The burden tables normally produced by the Treasury, the Congressional Committees, and outside researchers do not take into account the economic consequences of taxation and the resulting shifts in incomes and tax burdens. These shifts can have very large effects on the pre-tax incomes of workers, savers, and investors at all income levels, which means that they can have a major effect on the level and distribution of tax burdens. Because the burden tables ignore these effects, they do not accurately measure the tax burden, either in the aggregate or as to how it is distributed among different groups within the population.

³⁴ *Ibid.*, p. 8.

A true burden table can only be created by undertaking an assessment of the dynamic effects of the tax on economic behavior. The information needed to produce a true burden table is identical to that which is required for dynamic revenue estimation (discussed earlier). Government revenue estimators are very reluctant to attempt dynamic scoring of the revenue effects of tax changes, claiming that the process is too difficult and controversial. If that is correct, then they need to give up the pretext that the burden tables that they routinely produce are accurate. If one cannot do dynamic scoring of tax changes for budget purposes, one cannot generate accurate burden tables. If burden tables are feasible, then so is dynamic scoring, and it should be adopted forthwith.

VI. Analysis of some specific types of taxes

The corporate income tax

Initial incidence of the corporate income tax. No competent student of taxation believes that corporations pay the corporate income tax. Only people pay taxes. Things and abstractions do not pay taxes. A corporation is, in law, a legal person, but that is, in fact, a legal fiction. Therefore, corporations do not really pay the corporate income tax. Conservative Nobel Prize-winning economist Milton Friedman is well known for espousing that view, but liberal economists share it as well. The liberal Nobel economist Wassily Leontief told the *New York Times* twenty years ago: "Corporate income taxes fall ultimately on people. Economists have tried but have never succeeded in finding out how the weight of these taxes is ultimately distributed among income groups. There can be little doubt that elimination of corporate income taxes would simplify our tax system and limit its abuse."³⁵

Ultimate burden of the corporate income tax. Tax analysts generally assume that the corporate income tax is borne, at least in the first instance, by shareholders. As the Treasury put it, "because corporations are owned by shareholders, corporations have no taxpaying ability independent of their shareholders. Corporations pay taxes out of the incomes of their shareholders."³⁶ However, the analysis does not stop there.

Economists also recognize that corporate taxes, though initially coming out of shareholders' incomes, have further economic repercussions that shift part of the ultimate burden to others. As the Treasury report continues: "Importantly, the burden of the corporate income tax may not fall on shareholders. A corporate tax change could induce responses that would alter other forms of income as well. For example, some of the burden may be shifted to workers through lower wages, to consumers through higher prices, to owners of non-corporate capital through lower rates of return on their investments, or to landowners through lower rents. This shifting might not happen

³⁵ Wassily Leontief, "What It Takes to Preserve Social Equity: Amid Dynamic Free Enterprise," *New York Times*, February 1, 1985, p. A29.

³⁶ Treasury Integration Study, *op. cit.*, p. 146.

quickly, so the short-run incidence could well differ from the long-run incidence."³⁷ (Note the Treasury's interchangeable use of the terms incidence and burden, for both the short run own-market effect and the long run general equilibrium outcome.)

In years past, the Congressional Budget Office has also suggested that the corporate tax falls about half on owners of capital and about half on the work force, arguing that the tax depresses capital formation and therefore depresses productivity and wages, shifting at least some of the burden to labor.

More recently, the Treasury and the CBO have assumed that the corporate tax is borne by owners of all capital (corporate capital and competing non-corporate capital), and none by workers. Most economists believe that the burden of the corporate tax is borne to some extent by shareholders, workers, and consumers (who are often the same people in different roles), but they do not agree on the division of the burden. Because of the uncertainty in the profession, the JCT has stopped assigning it to anyone in the official "burden tables". If the corporate income tax were raised and individual income taxes were cut by equal amounts, the burden tables would show a reduction in the tax on the population with no loss of federal revenue, an ultimate (and quite impossible) free lunch!

Of course, someone pays the corporate income tax, even if the JCT cannot point out who it is. In fact, a modern view of the corporate tax in the context of an open, globally integrated economy holds that the burden of the corporate tax falls primarily on labor, after all adjustments are taken into account.

Varying views of the corporate tax. In 1962, Professor Arnold Harberger produced a seminal article on the incidence of the corporate income tax.³⁸ The article did more than analyze the corporate tax; it showed the importance of going beyond narrow partial equilibrium analysis in looking at the effects of taxation.

The early Harberger work suggested that the corporate tax was borne by the owners of all capital, not just corporate capital. Harberger assumed a *closed economy* with a *fixed total capital stock*. The capital could be allocated either to the corporate or to the non-corporate sectors, which were assumed to produce somewhat different goods and services.³⁹ If a corporate tax were imposed, raising the tax rate above that of the non-corporate sector, capital would migrate to the

³⁷ *Ibid.*

³⁸ Arnold C. Harberger, "The Incidence of the Corporation Income Tax," *Journal of Political Economy*, 70, no. 3, June 1962, pp. 215-240.

³⁹ If the types of business organizations, corporate and non-corporate, were equally effective in all sectors of the economy, then there would be no cross-sector re-allocation due to the tax, and no reduction in the returns to the non-corporate sector. Corporate businesses would merely shift the form of their organization to non-corporate, giving up whatever efficiencies (for example, ease of financing or trading ownership in a large business) that had driven them to the corporate form to begin with. They would bear the burden of the tax.

non-corporate sector. Gross returns would rise in the corporate sector and fall in the non-corporate sector to equalize after-tax yields between the sectors. Thus, a portion of the corporate tax would be shifted to non-corporate capital. There would also be an efficiency (dead weight) loss that would make the burden greater than the amount of the tax itself.

In later work, Professor Harberger changed his assumption that the economy is closed, and concluded that the corporate tax is borne largely by domestic labor, at least in the case of a small open economy that has little impact on the world rate of return.

Putting a tax on the income from corporate capital would simply lead to adjustments whereby less capital would be at work in that country... Where would the capital go? It would go abroad... In realizing that the presence of the tax implies that significantly less capital will be combining with the same amount of total labor (in the small developing country), it should come as no surprise that the equilibrium wage has to be lower. But there is an additional and more critical reason (above and beyond simple capital labor-substitution) why labor's wage must fall: the need to compete with the ROW [rest of the world] in the production of manufactures (corporate tradables). The tax is a wedge that has been inserted into the pre-existing cost structure. The prices of corporate tradable products cannot go up because they are set in the world marketplace; the net-of-tax return to capital cannot go down (except transitorily), because capital will not be content to earn less here (in the small developing country) than abroad. Some element of cost has to be squeezed in order to fit the new tax wedge into a cost structure with a rigid product price at one end and a rigid net-of-tax rate of return to capital on the other. The only soft point in this cost structure is wages. If they do not yield, the country may simply stop producing corporate tradables. Or, if the country continues to produce such goods, then wages must have yielded — by just enough to absorb the extra taxes that have to be paid...⁴⁰

Harberger goes on to point out that the United States is a large country, not a small one, so the exit of U.S. capital would somewhat depress the rate of return to capital in the world, which would somewhat mitigate the capital flight and reduce the share of the tax burden passed on to U.S. labor. Nonetheless, he estimates that U.S. labor would still have to bear seven-eighths of the corporate tax.⁴¹ *Harberger assumes an unchanged world capital stock, i.e., that the world stock of capital does not fall to restore after-tax returns to the levels they enjoyed before the imposition of the U.S. tax. If one instead adds the assumption that the world capital stock is elastic over time with respect to the rate of return, then even this modest offset to the impact of the U.S. corporate tax on U.S. labor would vanish.*

⁴⁰ See Arnold C. Harberger, "The ABCs of Corporation Tax Incidence: Insights into the Open-Economy Case," in *Tax Policy and Economic Growth* (Washington, DC: American Council for Capital Formation, 1995), Chapter 2, pp. 51-73. Cited lines on pp. 51-52.

⁴¹ *Ibid.*, p. 61.

Harberger reiterated his analysis in a recent interview in the *IMF Survey* conducted by Prakesh Loungani.⁴²

Loungani: The effects of some economic policies are better understood thanks to your academic contributions. You did path-breaking work on whether capital or labor bears the burden of the corporate income tax.

Harberger: There are interesting developments to report on that front. In the closed-economy case that I analyzed in the 1960s, the natural result is that capital bears the burden of the tax and can easily bear more than the full burden. But my students and I have now analyzed the open-economy case, which is more applicable to today's global economy. The result in this case is that labor bears the burden and can easily bear more than the full burden.

Loungani: That's quite a flip. Why does it happen?

Harberger: Think of the so-called "tradable goods" sector of an open economy, the sector that produces goods that are traded on a world market. The prices of these goods are determined in the world market. And, with an open economy, the rate of return to capital is largely determined in the world market, because capital can flow from country to country in search of the highest return. Now the government gets in there and tries to impose a corporation income tax on capital. Well, who bears the burden? Capital can move across national boundaries to try to escape the tax. So it's labor, the factor of production that can't easily escape national boundaries, that ends up bearing the burden of the tax.

In this analysis, part of the fixed quantity of U.S. capital relocates abroad, and domestic labor suffers a loss in income and therefore bears the entire corporate tax, plus a dead weight loss. One could go two steps further in refining the analysis, however.

First, one could note the effect of the shift of U.S. capital abroad on foreign labor and world capital returns, while retaining the idea of a fixed total world capital stock. This would put some of the burden of the corporate tax back on U.S. capital. If the United States were a very small economy, the shift in U.S. assets abroad would have little impact on global rates of return, and the Harberger result for the U.S. would follow. Given the size of the U.S. economy, however, there would be some effects abroad. The tax on domestic U.S. corporations would drive some investment offshore, but that investment would have to compete harder for available foreign labor. Initially, the foreign capital-labor ratio would rise, increasing returns to foreign labor, but reducing returns to foreign capital, consisting of the expatriate U.S. capital and the pre-existing foreign capital. The misallocation of the fixed world capital would depress capital returns here and abroad. At least temporarily, all capital, U.S. and foreign, would suffer some loss of income due

⁴² *IMF Survey*, Vol. 32, No. 13, July 14, 2003, International Monetary Fund, Washington, DC.

to the U.S. tax. Nonetheless, U.S. labor would bear most of the burden of the tax, which would exceed the tax revenue due to the added dead weight burden of the economic distortions.

Second, however, one really must relax the (still partial equilibrium) assumption of a fixed quantity of domestic and world capital. Capital formation has been shown to be sensitive to the after-tax return. Over time, there would be a reduction in the quantity of foreign-located capital (whether foreign or U.S. owned) to restore its normal after-tax return, reducing the gains to foreign workers. Foreign returns to capital would not decline significantly. The reduction in the quantity of U.S. capital would restore its original after-tax return as well. Capital would bear very little of the burden of the U.S. corporate income tax. In the long run, one should expect a general equilibrium result that the main losers would be U.S. workers.

Other analysts have a different view of the corporate income tax in an open, or partially open, economy. For example, Jane Gravelle and Kent Smetters construct a model in which the largest part of the corporate tax can be borne by domestic capital in spite of trade and capital flows, in effect restoring the old view of who bears the corporate tax.⁴³ They get this result by assuming imperfect substitution of domestic and foreign capital (people prefer the stocks and bonds of their home country governments and businesses) and imperfect substitution of domestic and foreign goods and services. They also assume a fixed total capital stock to abstract from the issue of the elasticity of saving.

In their four sector model, they get the usual result of a corporate tax shifted mainly to domestic labor when substitution elasticities are very large: capital moves abroad, equalizing the domestic and foreign after-tax rates of return. The capital flight depresses rates of return to foreign capital ("exporting" some of the tax) and raises foreign wages. Wages of domestic labor (the immobile factor) fall. But assuming lower elasticities, which the authors feel are more plausible, less capital shifts abroad (because it is assumed to be somewhat immobile too). People are willing to accept a drop in the after-tax return on capital to own domestic assets, and the tax can open a permanent differential between rates of return at home and abroad. As a result, the bulk of the corporate tax falls on domestic capital, less on domestic labor. Some capital is exported, which shifts some of the tax to foreign capital, with some gains to foreign labor, but less than in the high elasticity case.

There are several areas of concern with the Gravelle-Smetters approach:

- The assumption of a constant world capital stock is unrealistic, just as it is in the Harberger analysis, and simply throws out the bulk of the adjustment process. The quantity of capital has been seen to vary substantially to restore its after-tax rate of return to normal levels over time following a tax change. The lower worldwide return on capital, post-tax, would depress global capital accumulation and shift the tax back to labor.

⁴³ Jane Gravelle and Kent Smetters, "Who Bears the Burden of the Corporate Income Tax in the Open Economy?" Working Paper 8280, National Bureau of Economic Research, Cambridge, MA, May 2001.

- The assumption of a low substitutability of domestic and foreign capital appears to be at odds with observed international flows of financial and physical investment. Even if savers and investors on average display a home country preference, the capital markets act very "open" if even a few large savers are, at the margin, willing to move capital freely across borders. It may be that many people never buy foreign securities, and many companies prefer to invest at home, reducing the average ratio of global to local assets in domestic portfolios. At the margin, however, there are many people, businesses, and institutions that freely arbitrage across borders. Multinational financial and non-financial corporations send funds and direct fixed investment all over the world. Consider that the outflow of U.S. capital has been averaging roughly \$400 billion a year, and foreign investment in the U.S. has been averaging over \$500 billion a year for some years. The sum of the annual cross-border investment flows has been about a trillion dollars, almost as large as total annual investment in the United States.
- In the cases where the corporate tax falls on domestic capital, the Gravelle-Smetters model implies that a tax increase can lower the after-tax rates of return on capital for a very long time and can lead to prolonged differences in the after-tax rates of return on domestic and foreign capital. This is disturbing on two grounds. First, in the modern world, returns on global assets of similar risk and quality do not display wide and permanent differentials. Second, taxation of capital has risen drastically over the last hundred years with the inventions of the corporate and personal national and sub-national income taxes, property taxes, and estate and inheritance taxes, yet there has been no correspondingly large change in the real, risk-adjusted after-tax yields on capital, either financial or physical. It appears that capital, by adjusting its quantity, is able to shift a large part of the taxes aimed at it onto other factors.

Payroll tax

The entire Social Security payroll tax on wages is remitted by employers to the Treasury, but according to statute, it supposedly is paid half by employees and half by employers ("statutory obligation"). Most economists would argue that, legislative language notwithstanding, the initial incidence and the ultimate economic burden of the entire tax is borne by workers. Why? The whole tax comes out of gross labor compensation that could otherwise have gone to labor. Furthermore, the supply of labor has been thought by many to be highly "inelastic". Consequently, the tax is assumed to be "shifted" almost entirely onto the worker, not only in its initial incidence, but in its ultimate burden.

A more modern view of the labor force suggests that the work force, particularly certain subgroups, such as secondary workers in a family and teenagers, do respond to changes in the after-tax wage. A general equilibrium economist would argue that this partial elasticity of the supply of labor would further shift a portion of the ultimate burden of the payroll tax to other economic factors, such as consumers, other types of labor, and any immobile forms of capital such as land, as the labor supply shrinks in response to the tax. Mobile capital, however, would bear little of the burden, as it could move abroad or shrink in quantity to restore its original rate of return.

The unified estate and gift taxes

The federal unified gift and estate tax (the "death tax") is an additional layer of tax on saving. Every cent saved to create an estate has either been taxed, or will be taxed, under some provision of the income tax. Ordinary saving by the decedent was taxed repeatedly when the decedent and the companies she or he may have owned shares in paid individual and corporate income taxes. Saving by the decedent in a tax-deferred retirement plan will be subject to the heirs' income taxes and was subject to the corporate income tax in the case of stock holdings. The death tax is always an extra layer of tax.

Prior to 2001, the estate and gift tax rate topped out at 55% if a parent left money to a child, but could reach almost 80% under the generation skipping tax (GST) if the bequest went to a grandchild or other relative more than one generation removed from the decedent. (The GST rate is equivalent to imposing a 55% tax on the estate as if it had gone to a child, and then imposing another 55% rate on the remaining 45% of the estate as if it had gone from the child to the grandchild. Congress didn't want to miss out on any potential revenue by letting anyone's death go untaxed!)

If a near-to retirement couple were thinking of working an extra year just to add to an estate, the combined income, payroll and estate tax rates could have exceeded 78%, or even 90% with the GST. That produced quite an incentive to retire instead of continuing to work or to reinvest interest or dividends in an estate. The 2001 Tax Act reduces the top estate tax rate to 45% by 2007, and raises the exempt amounts for the estate and gift tax. It will eliminate the estate tax (but not the gift tax) in 2010, but the tax will reappear at the old rates in 2011 unless Congress votes to make the repeal permanent.

Under the conventions used by the Treasury, the unified estate and gift tax is assumed to be born by the decedents (or donors, if they exceed exempt amounts before they die). The assumption about decedents is distinctly odd, as they are beyond feeling any pain. The heirs are the ones who get lower bequests due to the tax, and they are a more reasonable choice for victims. However, there is no readily obtainable data on who the heirs are, so the decedents are selected by default. This is much the same rationale as that offered by the drunk who looks for his lost car keys on the sidewalk under the lamp post, instead of in the parking lot where he dropped them, because under the lamp post is the only place with enough light to search by.

An even odder form of misrepresentation is that this tax is not even called a tax in the National Income and Product Accounts, which instead label it as an innocuous-seeming and voluntary-sounding "asset transfer" from the private sector to the government. It is not a tax, in NIPAnese, because it falls on the principal rather than the income of the assets — a distinction without economic meaning or merit.

There is one way in which the decedents could be said to have borne the estate tax. If they had a rigid goal of how much after-tax bequest they wished to leave their heirs, and trimmed their consumption during their lifetimes to save additional sums or to buy additional life insurance to

cover the added tax cost of leaving an estate, then one could say that they had borne part of the burden of the tax. However, it is a fundamental law of economics that the more expensive you make something, the less people will do of it. The estate and gift taxes seem far more likely to reduce the personal saving and capital accumulation of the potential donors, rather than their personal consumption, and therefore to reduce the inheritances of their heirs.

The heirs do not bear the full cost of the estate and gift taxes, however. These taxes add to the tax on capital formation, and result in a reduced stock of capital. The economic consequences of the reduced capital stock are largely borne by the labor force.

In spite of (or because of) its horrendously high tax rates, the death tax probably doesn't raise any net revenue for the government. Professor B. Douglas Bernheim of Stanford estimates that avoidance of the estate tax by giving assets to children, most of whom are in lower income tax brackets than their parents, costs more in income tax revenue on the earnings of the assets than the estate tax picks up.⁴⁴ Gary and Aldona Robbins of Fiscal Associates estimate that the reduced saving and capital formation lower GDP and wages by so much that the resulting reductions in income and payroll tax collections exceed the estate tax take.⁴⁵ If Bernheim and the Robbinses are each even half right, the tax loses money. Estate repeal would pay for itself, and would encourage wealth and job creation.

VII. Conclusion

Centuries of thought and research have been devoted to the relationship between taxes and economic behavior. Classical pioneers explored the price or incentive effects of taxes on the supply of factors and products over two hundred years ago. Microeconomists refined the concepts a century later. In the middle of the last century, the Keynesian focus on aggregate demand turned taxes into a demand management tool divorced from price or incentive effects, a theoretical detour that the monetarist school and the neo-classical resurgence have largely corrected.

Today, although more sophisticated work than ever before is being done in the tax field, it appears that the original insights of the classical pioneers still hold true. Strenuous efforts to find exceptions to the "law of demand" have largely come a cropper. It is still the best presumption that, if something is made more expensive, people will buy less of it, and if something is made less expensive, people will buy more of it. This law still applies to work, saving, and investment, and to the trade-off between current and future consumption, and between consumption of market goods and leisure. Increase the tax on effort, and less will be supplied. Reduce the tax on effort, and more will be offered. Fewer inputs mean less total output. Factors of production are largely complementary to one another. More of one factor of production boosts

⁴⁴ B. Douglas Bernheim, "Does the Estate Tax Raise Revenue?" in *Tax Policy and the Economy*, vol. 1, ed. Lawrence H. Summers (Cambridge, MA: MIT Press, 1987) pp. 113-138.

⁴⁵ Gary Robbins and Aldona Robbins, "The Case for Burying the Estate Tax," *IPI Policy Report*, No. 150, Institute for Policy Innovation, Lewisville, TX, 1999.

the productivity and income of the other factors. Less of a factor limits the productivity and income of all the other factors.

It is well understood in the economics profession that the current tax system imposes heavier taxes on income used for saving and investment, and on the formation of human capital, than on income used for consumption. Today, most economists would agree that these tax disincentives to save and invest, to work and take risk have consequences. They lead people to under-save and over-consume, and to work less and play more. These modern advances in economic understanding strongly urge us to dispose of the current income tax structure and replace it with a flat rate tax that is neutral in its treatment of saving and consumption.

The tax biases against saving and investment and steeply graduated tax rates were introduced for the purpose of improving "social equity". In decades past, it was assumed that the added layers of tax on income used for capital formation would do relatively little economic damage, would inconvenience only the wealthy, and would provide significant income redistribution. It is becoming apparent, however, that most of the taxes that seem to fall on those who supply physical capital, intellectual capital, or special talents to the production process, may actually be shifted to ordinary workers and lower income retirees in the form of reduced pre-tax and after-tax incomes.

The adverse economic consequences of non-neutral taxation and graduated tax rates , and the resulting adverse impact on "social equity", are not displayed in the so-called "burden tables" used to inform the public policy debate or the votes in Congress. With bad information, the public and the Congress are left with a bad tax system and a sub-optimal economy.

A more rational system of calculating and displaying the real tax burden, one that took full account of how taxes are shifted, would make it easier to explain and adopt a more rational tax system. A more rational tax system, in turn, would maximize the efficiency of the economy as a whole, and would enable every individual to maximize his or her potential lifetime productivity and income.

Stephen J. Entin
President and Executive Director

Appendix A: A Typical Production Function

A standard Cobb-Douglas production function provides a useful illustration of many of the points raised in this paper. Output (Y) is a function of labor inputs (L) and capital inputs (K), with the exponents (a and $1-a$) set equal to the shares of the two factors, which sum to one: $Y = AL^aK^{1-a}$. In the U.S. economy, the share of labor, a , has been about $2/3$ of GDP for many decades, and the share of capital, $1-a$, has been about $1/3$. "A" is a scale term reflecting the technology of the time, often referred to as "total factor productivity".

The marginal product of a factor is the additional output produced by adding one unit of a factor, holding the quantity of the other factor constant. It is what an employer would be willing to pay to obtain the extra unit. The marginal product schedule is the demand schedule for the factor. In equilibrium, the wage is equal to the marginal product of labor, and the return on capital is equal to the marginal product of capital.

The marginal product of labor = $MPL = aAL^{a-1}K^{1-a} = aY/L$. The marginal product of capital = $MPK = (1-a)AL^aK^{-a} = (1-a)Y/K$. The formulas show that as more of either factor is added, its marginal product falls and the marginal product of the other factor rises. A tax on one factor that depresses the quantity offered of that factor reduces the reward to the other factor.

The elasticities of the marginal products as the quantities of the factors change (the percent change in the marginal product of a factor associated with a percent change in the quantity of that factor or the other factor) govern the change in the wage or rate of return as the amount of either factor shifts. The elasticity of the marginal product of labor with respect to the quantity of labor can be shown to be $-(1-a)$, or $-1/3$. It takes a three percent reduction in the quantity of labor to boost the marginal product by one percent (a movement along the labor demand curve). The elasticity of the marginal product of capital with respect to the quantity of capital is $-(a)$, or $-2/3$ (a movement along the demand curve for capital). It takes a 1.5 percent reduction in the quantity of capital to boost the marginal product by one percent. The demand for the larger factor, labor, is more elastic, and its demand curve is less steeply sloped, than the demand for the smaller factor, capital. This assumes that all labor is homogeneous, and all capital is similarly interchangeable.

The elasticity of the marginal product of labor with respect to the quantity of capital is $(1-a)$ or $1/3$. A one percent drop in the capital stock will lower the wage by $1/3$ percent (a shift in the labor demand curve). The elasticity of the marginal product of capital with respect to the quantity of labor is (a) or $2/3$. A 1 percent drop in the capital stock will lower the rate of return by $2/3$ percent (a shift in the demand curve for capital). Less of either factor lowers the productivity and return to a given quantity of the other factor. The change in the return to a factor will affect the quantity offered, according to supply conditions.

If there are more than two factors, the function may be expanded. E.g., $Y = AL^aK^bT^{(1-a-b)}$. Perhaps T stands for land (terre, in French) or the scarce human capital or talent of entrepreneurs, artists, athletes, or highly trained engineers or surgeons, etc. Assume that ordinary labor is not readily substitutable for the labor of these highly paid individuals. Assume the top talent earns

about 10 percent of GDP, with the shares of ordinary labor at 60 percent and of capital at 30 percent. The elasticity of demand for the new, smallest distinct factor will be -0.9; it will take only a 1.1 percent reduction in the quantity of talent to raise the earnings of these individuals by one percent, giving them the least elastic demand of the three factors. If the elasticity of supply of this highly paid factor is about as high, or a bit higher than that of ordinary labor (with higher incomes and wealth, and more control over their businesses and schedules, they may have greater flexibility as to working or not working), the factor would be better able to shift a tax to other factors than would the general labor force.

Appendix B: Labor Supply Elasticity Estimation: Studies in Confusion?

There is a large economic literature on labor supply elasticities, covering two basic decisions, whether to enter the labor force or not, and if so, how many hours to work. Behaviors of single workers of either sex, married couples, and teenagers are explored, using various data sources and methods (e.g. time series and cross sections). The results are quite varied. The topic is a difficult one, and there are many differing approaches, some of which make more theoretical sense than others. There is no space here for a lengthy review of the literature, but a few cautions are in order.

Some writers believe that the empirical evidence points to a labor supply elasticity of zero (labor force participation and hours worked do not respond to changes in the wage) or even a negative value (such that a lower wage would induce people to work longer hours to make up the lost income). In the zero elasticity case, there would be no tax shifting due to labor supply effects. In the negative elasticity case, the higher tax would induce people to work longer, benefitting the people they work with and boosting returns to the owners of capital. That would create reverse tax shifting.

If work effort declined with a rising wage, and rose with a falling wage, one would have a "backward-bending" supply curve of labor. The "income effect" of a higher net wage (due either to a raise or to a reduction in the tax rate) might reduce hours worked because people can afford to "buy" more leisure. At the same time, the "substitution effect" of a higher hourly wage would make work more rewarding and would make taking an hour of leisure more costly, which would normally encourage added work and less leisure. For a zero or negative supply elasticity to occur, the income effect would have to be strong enough to offset the "substitution effect" of a higher hourly compensation rate. This situation would be an exception to the normal "law of demand", which states that people buy less of something if its relative price increases, and more if it falls. (See the discussion of "Giffen goods", below.)

The concept of a backward-bending supply curve of labor is applicable only in certain select situations, not as a general rule for the entire population. Where the literature finds zero or negative labor supply elasticities, it generally has gone astray in one of several ways: 1) Most studies either use gross wages in the labor supply function, ignoring taxes altogether, or use the wrong tax concept (average tax rates instead of marginal tax rates) in computing incentive effects. 2) Many of the labor force studies are conducted with time series data that do not hold technology and other influences constant. 3) Studies that assume income effects from tax changes often ignore the accompanying changes in federal borrowing, transfer payments, and government outlays that tend to cancel out such income effects.

Some studies study the relationship between gross wages and work effort, which begs the question of how taxes affect behavior. Others use after-tax wages, derived either from disposable income or calculated using average tax rates. But in determining the effect of a tax on the incentive to work an extra hour or not, it is the marginal tax rate that is relevant, not the average tax rate. Marginal tax rate series are hard to construct for time series work, and average tax rates

are not a good substitute, because changes in the two types of rates have often been quite different year by year and over time.

A labor supply curve is properly defined as a schedule of hours offered at different wages at a point in time, other things equal. It is difficult to measure how people would respond to a wide range of wages at a moment in time, because researchers can only see the actual wage arrived at in the market, not the hypothetical alternatives. Consequently, some researchers try to infer such responses by looking at changes in hours worked over time as real wages have changed. Over time, however, other things are not equal, because technology, capital, education, and the goods and services one can buy with income are changing over time, and all affect the incentive to work.

If, over time, technological advances or increased capital formation boost productivity, then individuals can produce more goods and services (= output = income) in less time. Everyone really is richer, and people can "buy" more leisure and still have more goods and services simultaneously. People might choose to take more leisure as their hourly wages and incomes rise, as well as enjoy more goods and services (in the jargon, both goods and leisure are "normal goods", the consumption of which rise with income). In the case of a technology advance, it is not right to say that income went up because wages went up. Rather, wages went up because output (= income) went up.

The ability to take more leisure and have more goods and services too as incomes rise over time does not imply a backward-bending supply curve of labor. In particular, such a labor force reaction to a productivity-related jump in real income does not mean that a rise in the after-tax wage due to a reduction in marginal tax rates at a point in time would have a similar dominant "income effect" on the labor-leisure choice. One can see why, in several ways.

From a government finance perspective, if, at a moment in time, tax rates are reduced, and government spending is not cut to match, the government will have to borrow back the tax cut from the population. This leaves the public with no increase in real consumable income even if what we call "disposable income" goes up. Saving would have to rise, whether due to interest rate effects, or to the perfect foresight effect described Robert Barro — that people realize that taxes must rise in the future to pay off the added government debt, with interest, and they save their tax cuts against that rainy day.

Suppose instead that government spending is cut back to match the tax cut. If transfer payments are cut, then the recipients have a negative income effect to match the positive income effect on the taxpayers. If government consumption spending is cut, then the suppliers to the government have a similar loss of income. Put another way, the government-provided product or service can be viewed as income in kind to those who enjoy it, and without it, they would have to buy it for themselves. There is no meaningful sense in which the mere juggling of the federal budget can increase the real output or income of the nation.

Of course, any subset of the population can receive a windfall in the form of a transfer from the rest of society, as by winning the lottery or receiving a tax cut that is financed by someone else. They may decide to retire or work less, and spend their windfall on goods and services produced by others. But their positive income effects are offset by negative income effects for others who must work harder to replace their lost income. Therefore, in a tax and transfer system, income effects wash out, and all that are left are substitution effects. If the government boosts tax rates on Peter to give an income subsidy to Paul, then Peter's income loss is matched by Paul's income gain. Meanwhile, at the higher tax rate structure, both men face higher statutory marginal tax rates on added effort that discourage work. In addition, Paul's subsidy may be means tested; he may lose some of his transfer payment for each additional dollar he earns, an implicit bump to his effective marginal tax rate, which further discourages work.

Looked at in terms of real output and income, note that at a moment in time one is dealing with a fixed technology and level of capital stock. Consequently, workers cannot take more leisure without causing a drop in production. They cannot enjoy higher, or even unchanged, levels of per capita current consumption unless they continue to work to produce the goods and services they want to consume. Put another way, if everyone thought he or she was richer due to a tax rate reduction, and took more leisure, the output of goods and services (= income) would drop, and there would be no additional income out of which to buy the added leisure. (This analysis is strictly true in a closed economy. In an open economy, there is wiggle room until foreigners get tired of lending more, or until they are receiving interest and dividends equal to the added annual borrowing.)

Note that if people did buy more leisure (the good whose relative price had risen) and consume fewer market goods and services (whose relative price had fallen), it would mean that market goods and services collectively resemble a "Giffen" good, a good for which the income effect outweighs the substitution effect. According to Alfred Marshall, Sir Robert Giffen hypothesized that, if the price of a very important element of one's budget fell enough to enable one to buy formerly unaffordable substitutes, purchases of the now-cheaper commodity might actually decrease as its price fell, contrary to the normal Law of Demand. Marshall wrote:

There are, however, some exceptions. For instance, as Sir R. Giffen has pointed out, a rise in the price of bread makes so large a drain on the resources of the poorer labouring families and raises so much the marginal utility of money to them, that they are forced to curtail their consumption of meat and the more expensive farinaceous foods: and bread being still the cheapest food which they can get and will take, they consume more, and not less of it. But such cases are rare; when they are met with, each must be treated on its own merits. (Marshall, *op. cit.*, pages 109-110.)

Indeed, such cases are so rare that speculation about a practical example of a Giffen good is often narrowed down to potatoes in Ireland before the great famine. If the price of potatoes fell just enough to enable a lucky subsistence-level family to buy a chicken, the unlucky chicken might substitute for a few potatoes, and total potato consumption might fall. No surveys of starving peasants were taken at the time, however, and statistics from the period are wanting, so even that

case may not be provable at this late date. What happened to the excess potatoes is not made clear. Perhaps they were exported (unlikely, given their bulk and the lamentable state of transportation at the time), or converted to a higher-value, more easily traded form (although Ireland is not known for its vodka).

Strictly speaking, the case of a Giffen good involves the allocation of a family's cash income among market goods and services, and is one where spending on a particular market good is a high proportion of a family's cash budget. It occurs within the market system, and does not involve the labor-leisure choice. In the goods vs. leisure trade-off described above, the budget in question is that of one's time, which can be used either for leisure or to earn money to buy market goods and services. Nonetheless, the idea that something that has become relatively less expensive (leisure after an increase in tax rates on earned market income) is consumed in lower quantity should at least give people pause. Furthermore, the Giffen example assumes that the family's reaction to the price change does not, in turn, alter the production, availability, and price of the products in question, and the income of that and all other families. That condition is decisively violated when one is considering an economy-wide reduction in the supply of labor, and a corresponding reduction in national output and income.

Appendix C: Burden Tables

Table 1: How Government Analysts Measure and Attribute Tax Incidence

Methodology	Congressional Budget Office	Department of the Treasury	Joint Committee on Taxation
Unit of Analysis ^a	Household	Family	Tax unit
Income Definition	Wages and salaries Self-employment income Rental income Interest and dividends Realized capital gains Cash transfer payments Retirement benefits In-kind benefits ^b Taxes paid by businesses (employer's share of social insurance taxes and corporate income taxes) ^c Employee contributions to 401(k) retirement plans	Wages and salaries Self-employment income Employer-provided fringe benefits Employer's share of social insurance taxes ^c Net interest income Pretax corporate profits Real accruals of nonstock capital gains Pension and benefits from individual retirement accounts Real earnings on retirement and life insurance assets Imputed rent from owner-occupied housing Cash transfer payments	Adjusted gross income Tax-exempt interest Employer's contributions to health and life insurance Employer's share of social insurance taxes ^c Workers' compensation Nontaxable Social Security benefits Medicare (Insurance value) Alternative minimum tax preference items Excluded income of U.S. citizens living abroad
Taxes Included and Assumptions About Their Incidence	Individual income tax, borne by payers Corporate income tax, borne by capital income Social insurance taxes, borne by employees ^c Excise taxes, borne by consumers	Individual income tax, borne by payers Corporate income tax, borne by capital income Social insurance taxes, borne by employees ^c Excise taxes, borne by consumers and by labor and capital income Customs duties, borne by labor and capital income Estate and gift taxes, borne by decedents	Individual income tax, borne by payers Corporate income tax burden not attributed to any individuals Social insurance taxes, borne by employees ^c Excise taxes, borne by consumers
Adjustments to Income	Incomes adjusted by household size for ranking purposes ^d	No adjustments	No adjustments
Presentation of Results	By income quintile and dollar income category	By income quintile and dollar income category	By dollar income category

SOURCE: Congressional Budget Office, *Effective Federal Tax Rates, 1979-1997*, October 2001.

a. Households are people who share a single housing unit, regardless of the relationships among them. Families are people related by blood, marriage, or adoption who live together. Taxpayers filing dependent returns are considered part of the primary taxpaying unit and are not counted separately.

b. Includes Medicare, Medicaid, employer-paid health insurance premiums, food stamps, school lunches and breakfasts, housing assistance, and energy assistance.

c. Social insurance taxes finance Social Security, Medicare, and federal unemployment insurance.

d. Adjusted by dividing by the square root of the household's size.

Sample Distribution Table

This distribution table was prepared by the Tax Policy Center operated jointly by the Urban Institute and the Brookings Institution. It calculates how the 2001 and 2003 tax cuts changed the average tax liabilities, average federal income tax rates, and after-tax incomes of people at various cash-income levels in 2004, assuming unchanged levels of economic activity and pre-tax incomes.

April 8, 2004

Preliminary Results

<http://www.taxpolicycenter.org>

Table T04-0053
Fully Phased-In "Middle-Class Provisions" in EGTRRA and JGTRRA:
Distribution of Individual Income Tax Change by Cash Income Class, 2004¹

Cash Income Class (thousands of 2003 dollars) ²	Tax Units ³			Percent Change in After-Tax Income ⁴	Percent of Total Tax Change	Average Tax Change (\$)	Average Federal Tax Rate ⁵	
	Number (thousands)	Percent of Total	Percent with Income Tax Cut				Pre-EGTRRA	Proposal
Less than 10	20,428	14.2	5.8	0.1	0.1	-4	3.6	3.5
10-20	26,467	18.4	52.5	1.1	4.4	-155	6.6	5.6
20-30	20,379	14.2	78.7	2.0	9.6	-439	12.8	11.1
30-40	15,377	10.7	84.7	1.9	9.3	-566	16.6	15.0
40-50	11,446	8.0	92.9	1.9	8.8	-722	18.7	17.1
50-75	20,054	14.0	97.8	1.9	19.9	-930	20.6	19.1
75-100	11,395	7.9	98.0	2.3	18.6	-1,528	22.7	20.9
100-200	13,281	9.3	95.0	1.7	24.0	-1,690	25.1	23.8
200-500	3,339	2.3	75.0	0.5	4.1	-1,155	27.6	27.2
500-1,000	527	0.4	82.2	0.3	0.8	-1,404	29.7	29.5
More than 1,000	257	0.2	84.2	0.1	0.4	-1,439	33.8	33.8
All	143,509	100.0	70.6	1.5	100.0	-652	22.6	21.4

Source: Urban-Brookings Tax Policy Center Microsimulation Model (version 0304-2).

(1) Calendar year. Baseline is pre-EGTRRA law. Includes the following provisions in the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA): creation of 10-percent bracket for first \$7,000 of taxable income for singles (\$14,000 for married couples filing jointly and \$10,000 for heads of household), indexed for inflation after 2003; \$1,000 child tax credit amount; additional child tax credit with 15-percent refundability rate; allow child credit and EITC regardless of AMT liability; repeal use of modified AGI in calculation of EITC; increase the standard deduction and width of the 15-percent bracket for married couples to twice that for singles; and increase the width of the EITC plateau by \$3,000 for married couples; qualifying long-term capital gains and dividends taxed at 0 / 15 percent rates.

(2) Tax units with negative cash income are excluded from the lowest income class but are included in the totals. For a description of cash income, see <http://www.taxpolicycenter.org/TaxModel/income.cfm>

(3) Includes both filing and non-filing units. Tax units that are dependents of other taxpayers are excluded from the analysis.

(4) After-tax income is cash income less: individual income tax net of refundable credits; corporate income tax; payroll taxes (Social Security and Medicare); and estate tax.

(5) Average federal tax (individual income tax, net of refundable credits; corporate income tax; payroll taxes (Social Security and Medicare); and estate tax) as a percentage of average cash income.