

Income-Tax Progressivity: A Century-old Debate

*Harvey S. Rosen**

Income taxes are accepted as a permanent feature of the fiscal landscape. No one expects them to be repealed and replaced with some other tax. Nevertheless, there appears to be a chronic dissatisfaction with the structure of the income tax, manifested in periodic calls for its reform. Following two years of debate, there

was a massive overhaul of the federal income-tax system in 1986.

Has this stilled the desire for change? Not at all. A number of additional changes are already being debated. Some legislators, for example, have suggested that tax rates for high-income taxpayers be increased. In any case, we can expect more modifications of the law within the next few years.

One major source of controversy is disagreement over how progressive the income tax should be—that is, how the tax burden should be allocated among different income groups.

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The problem of how to design a tax system is an old one. Several centuries ago, the French statesman Colbert suggested that “the art of taxation is the art of plucking the goose so as to get the largest possible amount of feathers with the least possible squealing.”¹ Modern economics takes a somewhat less cynical approach, emphasizing how taxes should be levied so as to enhance economic efficiency and promote a “fair” distribution of income.

These modern approaches to the problem of optimal tax progressivity are worth exploring. While the theory of optimal tax progressivity does not provide a definitive solution to the controversies surrounding tax design, it does provide a useful framework for thinking about the problem systematically.

WHAT IS “PROGRESSIVITY”?

Debates over tax progressivity sometimes become confused because people have different things in mind when they use the term. Before proceeding, we should carefully define progressivity and several related concepts.

Suppose you have calculated every person’s income-tax burden and want to characterize the associated distribution of tax burdens. The “bottom line” of such an exercise is often a description of the tax as proportional, progressive, or regressive. The definition of proportional is straightforward; it describes a situation in which the ratio of taxes paid to income is constant regardless of income level. If everyone pays 20 percent of their income to the government, the tax system is proportional.

It is not as easy to define progressive and regressive. A natural way to define these words is in terms of the *average tax rate*, the ratio of taxes paid to income. If the average tax rate increases with income, the system is progres-

sive; if it falls, the tax is regressive. Confusion arises because some people think of progressivity in terms of the *marginal tax rate*—the change in taxes paid with respect to a change in income. According to this view, a tax system is progressive only if people with higher incomes have higher marginal tax rates.

A Hypothetical Tax Law. To see the distinction between the two definitions, consider this simple hypothetical income-tax structure. Each individual computes his or her tax bill by subtracting \$5,000 from income and paying an amount equal to 25 percent of the remainder. (If the difference is negative, the individual gets a subsidy equal to 25 percent of the figure.) Table 1 shows the amount of tax paid, the marginal tax rate, and the average tax rate for several income levels. The average rates increase with income. However, the marginal tax rate is constant at 25 percent because for each additional dollar earned, the individual pays an additional 25 cents, regardless of income level. People could disagree about the progressivity of this tax system and each would be right according to his or her own definition.

TABLE 1
Income and Taxes Under a Hypothetical Income Tax

Income	Tax Liability	Marginal Tax Rate	Average Tax Rate
\$2,000	\$ -750	25%	-38%
\$5,000	\$0.0	25%	0.0%
\$10,000	\$1,250	25%	13%
\$25,000	\$5,000	25%	20%
\$50,000	\$11,250	25%	22.5%
\$100,000	\$23,750	25%	23.8%

¹See George Armitage-Smith, *Principles and Methods of Taxation* (London: John Murray, 1907) p. 36.

It is therefore very important to make the definition clear when using the terms regressive and progressive. Most economists believe that the *average* tax rate is more suitable for characterizing progressivity, and this convention will be used from this point on.

A nice example of the distinction between marginal and average tax rates is provided by the U.S. rate schedule that applied to your 1988 income. As in the hypothetical tax law in Table 1, under U.S. law your taxable income is found by making certain subtractions from total income. (Total income is referred to as adjusted gross income, or AGI.) In the simplest case, a family subtracts a \$5,000 standard deduction and an exemption of \$1,950 per family member. In some cases, a family may find it advantageous to itemize its deductions rather than take the standard deduction. For simplicity, we assume throughout that households do not itemize.² Thus, a family of two would subtract \$8,900 ($5,000 + 2 \times 1,950$) from AGI in order to compute its taxable income.

After taxable income is computed, the tax liability is found by using the information in Table 2. The first column shows the various *total* income categories; the second shows the corresponding *taxable* income categories (found by

subtracting \$8,900); the third column has the marginal tax rate applied to each dollar of taxable income within that bracket; and the fourth column shows the associated average tax rates. To understand how the schedule works, consider a family of two whose AGI is \$50,000. Assuming that the family takes the standard deduction, its taxable income is \$41,100. According to Table 2, the family must pay 15 percent of its first \$29,750 of taxable income (\$4,462.50) and 28 percent of each dollar between \$29,750 and \$41,100 (\$3,178). The family's tax liability is therefore \$7,640.50. The family's *average* tax rate with respect to total income is 15.3 percent ($\$7,640.50/\$50,000$). Its *marginal* tax rate is 28 percent, because for each additional dollar of earnings its tax liability goes up by 28 cents.

By looking only at the marginal rates in Table 2, which drop from 33 percent to 28 percent as income rises, one might be tempted to conclude that people whose total incomes fall in the \$80,800-\$158,150 range bear a heavier

TABLE 2
Tax Liabilities, 1988
(Married Couple with Standard Deduction)

Total Income	Taxable Income	Marginal Tax Rate	Average Tax Rate
\$0 - 38,650	\$0 - 29,750	15%	0% - 11.5%
\$38,650 - 80,800	\$29,750 - 71,900	28%	11.5% - 20.1%
\$80,800 - 158,150	\$71,900 - 149,250	33%	20.1% - 26.4%
\$158,150 -	\$149,250 -	28%	26.4% - *

*Special rules apply to the taxpayer in this bracket: 1) he computes 28 percent of total personal exemptions; 2) he computes 5 percent of taxable income above \$89,560; and 3) he adds the lesser of these two amounts to 28 percent of taxable income. The resulting sum is his tax liability.

²In reality, the likelihood that a family itemizes deductions increases with its income. Hence, the actual pattern of tax payments is likely to be less progressive than suggested by calculations based on this assumption.

tax burden than those with higher incomes and that the tax system is therefore regressive. This conclusion is wrong because it ignores the distinction between average rates and marginal rates. For example, based on the table, the tax liability of a family with total income of \$300,000 is \$82,600, giving it an average tax rate of 27.5 percent. This exceeds the average tax rate in the \$80,800-\$158,150 bracket. Thus, even though the richer family has a lower marginal tax rate, its *average* tax rate is higher.³

EDGEWORTH'S MODEL OF OPTIMAL TAX PROGRESSIVITY

Now that progressivity has been defined, we are ready to think about how progressive a "good" income tax should be. F.Y. Edgeworth examined this question almost a century ago.⁴ Making several assumptions about the goals of the government and about personal behavior, he deduced what the optimal tax system should look like. Let's begin by stating Edgeworth's assumptions.

The *first assumption* offers a standard for judging whether the tax structure is "good." Edgeworth assumed that the satisfaction of every person in society depends only upon his or her level of income. Economists use the slightly archaic term "utility" to describe the amount of satisfaction or pleasure that people obtain from income. Edgeworth assumed that the goal of society is to collect whatever taxes have to be raised in such a way that the sum of

individuals' utilities is as high as possible. Roughly speaking, this corresponds to the goal of obtaining the "greatest good for the greatest number."

The *second assumption* concerns the relationship between the amount of income a person receives and his level of satisfaction. Edgeworth assumed that if two individuals have the same income, then they also have the same level of utility. That is, people are all capable of receiving the same amount of pleasure from the same amount of spending. Edgeworth also assumed that the more income a person has, the higher his level of satisfaction. When income increases, however, utility increases at a decreasing rate. According to this assumption, when your income doubles, you become happier, but not twice as happy. This seems quite sensible. If you give a billionaire another billion dollars, chances are that he will value the second billion a lot less than he did the first.

A numerical illustration of this concept is provided in Table 3. It shows the amount of utility corresponding to various amounts of income for two individuals, Romeo and Juliet. According to the table, when Romeo's income increases from \$1 to \$2, his level of satisfaction

TABLE 3
Income and Utility
in Edgeworth's Model

Income	Romeo's Utility	Juliet's Utility
\$1	500 "utils"	500 "utils"
\$2	800	800
\$3	1,000	1,000
\$4	1,100	1,100
\$5	1,105	1,105
\$6	1,106	1,106

³As noted earlier, these calculations probably overestimate the extent to which tax payments are progressive, because of the assumption that everyone takes the standard deduction. See Joseph A. Pechman, *Federal Tax Policy*, fifth edition (Washington, D.C.: The Brookings Institution, 1987), for some estimates that take itemized deductions into account.

⁴See F.Y. Edgeworth, "The Pure Theory of Taxation" (1897), reprinted in *Readings in the Economics of Taxation*, Richard A. Musgrave and Carl S. Shoup, eds. (Homewood, IL: Richard D. Irwin, 1959) pp. 258-96.

increases by 300 “utils.” When income goes from \$2 to \$3, his satisfaction again increases, but this time by only 200 “utils.” Similarly, for each dollar increase in his income, Romeo’s level of satisfaction continues to increase, but by successively smaller amounts. Note also that for each income level, Juliet has the same amount of satisfaction as Romeo. This reflects the assumption that people are capable of receiving equal pleasure from income.

The *last assumption* is that the total amount of income is fixed. People continue to earn the same amount of income regardless of the tax system.

Edgeworth’s Result. Suppose now that the government has a certain amount of tax revenue it must raise by taxing people’s incomes. Given the three assumptions, how should it proceed? For concreteness let us suppose that: 1) the society is composed of two citizens, Romeo and Juliet; 2) Romeo’s income is \$3 and Juliet’s is \$5; and 3) the government needs to raise \$2 in taxes.

Before any taxes are raised, Romeo’s level of satisfaction is 1,000 (corresponding to an income of \$3) and Juliet’s is 1,105 (corresponding to an income of \$5). Hence, the sum of their utilities is 2,105. Now recall that the government’s goal is to collect the \$2 of tax revenue so as to leave the sum of their levels of satisfaction as large as possible. From whom should the government collect the first dollar? Let’s consider both possibilities:

1. *Government collects the first dollar from Romeo.*
His income falls to \$2 and his utility to 800. Juliet’s level of satisfaction stays at 1,105. The sum of their utilities is 1,905.
2. *Government collects the first dollar from Juliet.*
Her income falls to \$4 and her level of satisfaction to 1,100. His income stays at \$3 and his utility at 1,000. The sum of their levels of satisfaction is 2,100.

The answer is clear—the first dollar should be raised by taxing Juliet, because this leaves the total level of satisfaction higher than if

Romeo were taxed. Intuitively, this makes perfect sense. Because Juliet starts out being richer than Romeo, she places less of a value on her last dollar than he does. Therefore, taking the dollar away from her creates the smallest decline in the *sum* of their utilities.

The government still needs to raise one more dollar. Who should be taxed? At this stage, Romeo’s income is \$3 and Juliet’s is \$4. The same logic as before suggests that, once again, Juliet should pay the dollar—the loss of her fourth dollar causes less harm than would Romeo’s loss of his third dollar. Thus, in the simple society we have set up, the entire tax burden should be paid by Juliet.

This numerical example correctly captures the implications of Edgeworth’s three assumptions for tax policy: taxes should be set in such a way that the after-tax distribution of income is as equal as possible. In particular, income should be taken first from the rich because the amount of pleasure they lose is smaller than that of the poor. If the government requires more revenue even after complete equality has been reached, then the additional tax burden should be distributed evenly.

Edgeworth’s model, then, implies a radically progressive tax structure—incomes are leveled off from the top until complete equality is reached.

CRITIQUE OF EDGEWORTH’S MODEL

The policy implications of this result are breathtaking, so the assumptions behind it require careful scrutiny.

First, the model assumes that the goal of the tax system is to make the sum of the levels of satisfaction as high as possible. Implicit in this notion is the idea that incomes are common property that can be redistributed as the society sees fit. This view has been attacked by some political philosophers, particularly libertarians. They argue that how “society” should redistribute income via the tax system is a meaningless question because “society” per se

has no income to distribute. Only *people* receive income, and the sole possible justification for government redistribution is when the pattern of property holdings is somehow improper. (For example, if the rich obtained their wealth by literally stealing from the poor, then the resulting distribution of property would be deemed “improper.”) In the libertarian view, evaluating a tax system according to what it does to the sum of utilities is not a sensible approach.

Second, the validity of assuming that people with the same level of income receive the same amount of pleasure from that income is fundamentally impossible to determine. It simply cannot be known, because pleasure cannot be measured objectively. One possible defense for this assumption is that it should be treated not as a psychological statement, but as an *ethical* one. Specifically, in designing a redistribution policy, government ought to act *as if* people are the same in this sense, whether they are or not.

Finally, consider the last assumption—that the total amount of income in the society is fixed. The size of the pie does not change as the government redistributes its pieces. Suppose, however, that an individual’s level of satisfaction depends not only on income but on leisure as well. Each person chooses how much leisure to surrender (how much to work) to maximize his own well-being. Taxes will generally change people’s work decisions and diminish total real income. For example, taxing Juliet may make her decide to work less and thereby earn \$3 instead of \$5. The government must then tax both Romeo and Juliet to raise \$2 in revenue. The greater an individual’s marginal tax rate, the greater the impact on incentives and the larger the decrease in income.

Thus, a society whose goal is to make the total level of satisfaction as high as possible faces an inescapable dilemma. On one hand, it prefers a progressive tax system to bring about equality in income. However, the high mar-

ginal tax rates associated with a progressive system reduce the total amount of income available. The optimal tax system must take into account the costs (in terms of lost real income) of achieving more equality.

So even if we are willing to accept that people with the same incomes have the same level of satisfaction, we cannot conclude that the best tax policy is to level off incomes from the top. The optimal policy depends on how the tax system affects people’s behavior.

Do these criticisms of Edgeworth’s assumptions mean that his analysis was silly or worthless? Certainly not. His work made a vital contribution by introducing the idea that the structure of the optimal tax system should be logically *deduced* from a set of underlying assumptions, not merely asserted as a first principle. He presented a rational argument for a progressive tax system and provided a foundation for further thinking about this issue.

MODERN STUDIES

One of the most vexing problems with Edgeworth’s analysis is the assumption that the total amount of income available to society is fixed. Confiscatory tax rates are assumed to have no effect upon the amount of output produced. More realistically, suppose that an individual’s level of happiness depends not only upon income but upon leisure as well. As noted above, the increased equality brought about by a more progressive tax will come only at the cost of a lower level of efficiency. An optimal income-tax system finds the best trade-off between equality and efficiency. In Edgeworth’s model, there is no trade-off, because the cost of obtaining more equality is zero. This explains his prescription for a perfectly egalitarian outcome.

A Linear Income Tax. How much is Edgeworth’s result changed when work incentives are taken into account? Nicholas Stern studied a model similar to Edgeworth’s, but he assumed that individuals make choices between

spending their time earning money and spending their time at leisure.⁵ To simplify the analysis, Stern assumed that a person's tax liability is a fixed percentage (t) of income minus some rebate:

$$\text{Tax} = t \times \text{Income} - \text{Rebate}$$

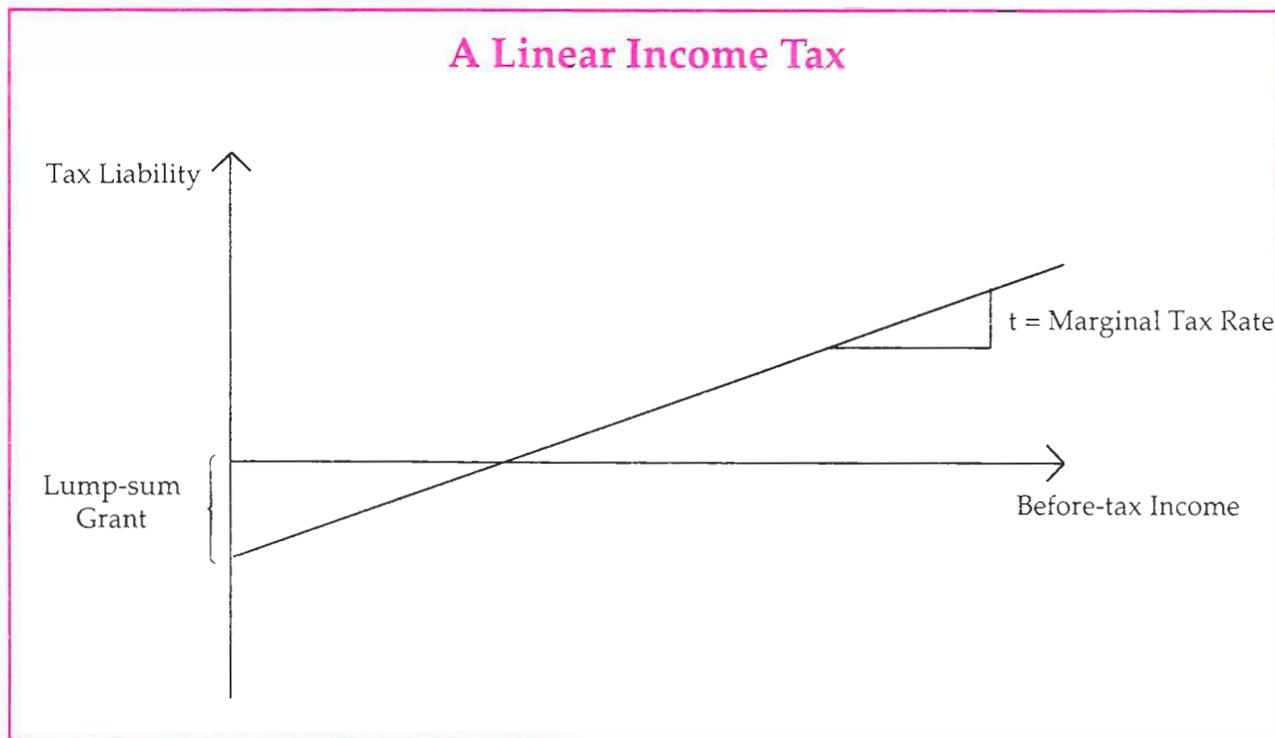
For example, suppose that the rebate is \$3,000 and $t = .25$. Accordingly, a person with income of \$20,000 would have a tax liability of \$2,000 ($-\$3,000 + .25 \times \$20,000$). A person with an income of \$6,000 would have a tax liability of minus \$1,500 ($-\$3,000 + .25 \times \$6,000$). Such a person would receive a \$1,500 grant from the government.

The significance of this formula is best understood by graphing it. In the graph below, income is measured on the horizontal axis and

tax revenues on the vertical. When income is zero, the individual's "tax burden" is negative—he receives a lump-sum grant from the government of \$3,000. When $t \times \text{income}$ equals the rebate (\$3,000), the individual has zero income-tax liability. Note that for each additional dollar of income, the individual must pay \$0.25 to the government. That is, the marginal tax rate is 0.25.

Because the geometric representation of this equation is a straight line, it is referred to as a linear income-tax schedule—or, more popularly, a "flat tax." It is important to remember from our earlier discussion that even though the marginal tax rate for a linear tax schedule is constant, the schedule is progressive in the sense that the higher an individual's income, the higher the proportion of income paid in taxes. Just how progressive depends on the precise level of the rebate and the marginal tax rate (t). A higher marginal tax rate along with a larger rebate, holding total tax revenue constant, entails a more progressive tax system. However, higher marginal tax rates also create

⁵See Nicholas H. Stern, "On the Specification of Models of Optimum Income Taxation," *Journal of Public Economics* 6 (July/August 1976) pp. 123-62.



larger disincentives to work. The optimal-income-tax problem is to find the “best” marginal tax rate—the value that maximizes the sum of utilities subject to the constraint that a given amount of revenue (above the required rebates and grants) be collected.

Stern assumes a modest labor-supply response to taxes—a 10 percent decrease in the after-tax wage rate leads to a 1 percent decrease in hours worked. He finds that a value for t of about 19 percent makes the total level of satisfaction as high as possible. This is considerably less than the value of 100 percent implied by Edgeworth’s analysis. It is, incidentally, also much smaller than the actual marginal tax rates found in many Western countries. (For example, we saw above that marginal tax rates in the United States go as high as 33 percent.) Even quite modest incentive effects appear to have important implications for optimal marginal tax rates.

More generally, Stern showed that the more responsive that labor supply is to the after-tax wage, the lower the optimal marginal tax rate, other things being the same. Intuitively, the “cost” of redistribution is the work disincentives it creates. The more responsive the supply of labor to changes in the after-tax wage, the higher the cost of redistribution, so that less should be done.

This description of Stern’s results may convey a somewhat false sense of precision as to what economists really know about the optimal tax system. After all, as pointed out above, there are many controversial value judgments behind the notion that the goal of taxation should be to maximize the sum of individuals’ satisfaction levels. Moreover, there is substantial uncertainty about the behavioral responses that are crucial to measuring the trade-off between efficiency and equity. No one is quite sure just how responsive labor supply is to changes in the wage rate. Nevertheless, it is extremely informative to have explicit calculations of what the optimal tax rates would be

under alternative sets of assumptions.

A Nonlinear Income Tax. We noted earlier that Stern restricted himself to studying linear income-tax schedules, in which the marginal tax rate is constant. There have also been analyses of general tax schedules that allow marginal tax rates to either increase or decrease with income. One most surprising result is that maximization of social welfare requires the marginal tax rate to be zero at the very top of the income scale.⁶

To see why, suppose that the richest person is Mr. Hughes, who currently has an income of exactly \$1 billion and who faces a positive marginal tax rate on his billion-and-first dollar. Now suppose the marginal tax rate on the billion-and-first dollar is reduced to zero. Knowing that if he earns another dollar he will get to keep it all, Hughes may decide to do so. If he does, it makes him better off. The government is no worse off, because it still collects the same amount of revenue as before. Similarly, no other taxpayer is made worse off. In short, Hughes is better off and no one else’s welfare has decreased. Social welfare, which is the sum of each person’s level of welfare, has therefore increased. Of course, Hughes may choose not to earn the extra dollar. In that case, no harm is done—the status quo is simply maintained.

One must be very cautious in drawing policy implications from this result. The very richest person in society may have an extremely high income even compared to other wealthy people. Hence, zero is probably a poor approximation to the optimal marginal income-tax rate, even for most people in the highest 1 percent of the income distribution. Moreover, note that this result pertains to the *marginal* tax rate facing the richest individual. It says nothing about the *average* tax rate. It is possible to

⁶See Jesus Seade, “On the Shape of Optimal Tax Schedules,” *Journal of Public Economics* 7 (1977) pp. 203-35.

collect very high taxes from an individual on income earned before the last dollar and thus have a high average rate even though the marginal rate is very low.

The contrast between this result and income-tax systems in the real world is striking. Far from having zero marginal tax rates at the highest incomes, actual tax systems tend to tax these incomes at the highest rates. Under the U.S. federal personal income tax, the marginal tax rate at the top of the income scale is now 28 percent; at times it has been 90 percent. It is interesting to note, however, that marginal tax rates under the current law do decline at the very top of the income scale (see Table 2).

State Income Taxes. So far we have been assuming that the income tax is a single tax that is levied at the national level. In fact, 43 states and several cities levy their own income taxes. In 1986, the states collectively raised \$67.5 billion from personal income taxation, about 29.6 percent of their total tax collections. The structures of these taxes vary greatly across states. For example, in North Dakota there are eight brackets; in the top bracket (over \$50,000 of taxable income) the marginal tax rate is 12 percent. In Pennsylvania, there is only one rate: 2.1 percent.

Does optimal tax theory provide insights as to how the state tax systems should be structured? To begin thinking about this problem, note that we have implicitly assumed that the only possible behavioral response to increased taxes is a change in work effort. We have not contemplated another possibility—if taxes become too high, people may leave the country altogether. One does indeed hear stories about people who become “tax exiles” in order to escape income taxes. Nevertheless, for a country like the United States, the assumption that emigration is not affected by the tax code is sensible.

However, the scope for interstate mobility is quite substantial. If the state income tax in New York becomes too high, it is not all that

costly for some people to move to New Jersey or Pennsylvania. In terms of our earlier discussion, when a state income-tax system becomes more progressive, there will tend to be *two* effects that reduce total real income within the state: some citizens will leave the state and those who stay may change their work effort. In effect, redistribution is more costly for a state than for a national government. Hence, the optimal progressivity for a state income tax is likely to be less than for a national tax.

SOME CAVEATS

The optimal tax models described here are very simple, and it is not hard to think of ways in which they could be made more realistic. For example, the models ignore the fact that income taxes affect not only earnings but also nonlabor income, such as interest and dividends. Thus, increases in the tax rate create disincentives to save as well as to work. Such disincentives may lower the amount of investment. Economists have examined optimal tax progressivity in models with savings.⁷ Although these models are more complicated than the ones considered here, the basic thrust is the same—the optimal income tax depends on the trade-off between efficiency and equity.

Another possible drawback with the analysis is that it assumes that each person’s level of satisfaction depends only on his or her *own* level of income and leisure. It might be the case, however, that people are altruistic—their own well-being increases when someone poorer than themselves becomes better off. To the extent that this is the case, over some range of tax rates it may be possible to achieve both more efficiency and more equity by raising taxes on the rich. However, whether such al-

⁷See, for example, Mervyn A. King, “Savings and Taxation,” in *Public Policy and the Tax System*, G.A. Hughes and G.M. Heal, eds. (London: George Allen and Urwin, 1980) pp. 1-35.

truistic feelings are present is hard to determine.

We must also emphasize that optimal tax theory is meant to be *prescriptive*, not *descriptive*. That is, one cannot claim that the theory correctly characterizes existing tax systems. There is no reason to expect the political process to lead to a tax system that is optimal in the sense of maximizing the sum of people's satisfaction levels. Pork-barrel politics and the pleadings of special-interest groups may have a greater impact on tax legislation than the search for the best trade-off between efficiency and equity.

In conclusion, the theory and computation of optimal tax rates continue to be of great interest to economists. However, this line of research cannot be expected to produce a blueprint for "the" optimal tax system. As has been stressed, the answer depends to a large extent upon value judgments, and the tools of economics do not provide definitive answers to ethical questions. However, the literature on optimal taxation makes an important contribution. It permits us to analyze, in a systematic way, the implications of alternative ethical and behavioral assumptions and to discuss tax policy within a coherent framework.