EQUITY AND DISTRIBUTIONAL ISSUES IN THE DESIGN OF ENVIRONMENTAL TAX REFORM

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Many politically active groups are looking to environmental tax reform (ETR)[2] as they seek to solve environmental and social problems. The use of market mechanisms, rather than the more common "command and control" system of regulation ("thou shalt not . . ."), is becoming increasingly popular because it can be more efficient and offers greater flexibility. But since lower-income households spend a greater percentage of their income on basic necessities, which tend to be more resource intensive than luxury goods, some people who might otherwise support ETR are hesitant because of equity concerns. But ETRs need not purchase environmental quality at disproportionate expense to lower-income groups.

To have a productive discussion about equity concerns, one must first specify the details of the ETR under consideration. The variety of ETRs that could be implemented at the federal, state, or local level is enormous. Energy, water and wastewater, solid and hazardous waste, and land and structures offer interesting and complex opportunities for user fees or environmental taxes. Income, payroll, property, sales, utility, and other existing taxes or government charges (for example, municipal business license fees) could be reduced. This paper shows that well-designed ETRs need not be regressive.

We begin by discussing regressivity. What are the various ways of measuring it? Are some methods better than others, and if so, why? We explain eight ways that one might estimate regressivity, and explain why only two of the eight are useful for the design of practical, politically feasible ETRs. Second, we discuss the three ways that ETRs can be designed to prevent regressive equity and distributional impacts, or in some instances to increase the progressivity of the tax system. We believe that this information will increase the credibility and persuasiveness of ETR advocacy efforts.

HOW IS REGRESSIVITY MEASURED?

A person's financial burden resulting from a price change can be measured in various ways. One can look at the burden from only the price that changes (for example, gasoline), or one can look at the burden from all the price changes that the initial change eventually causes (for example, the increase in the price of food because the price of gasoline rose).[3] Economists call the first burden "direct" and the second burden "indirect." The sum of these is the best measure of the burden of a new tax or some other policy that changes prices, but much of the literature on regressivity considers only the direct burden.

One can also look at the financial burden from a price change before people and businesses change their behavior in response to the price change, or after. Estimating burden taking today's behavior as unchanging is much easier, but it is also unrealistic. After all, if behavior does not change, then the tax reform will not create an environmental benefit. But estimating burden after behavior changes is very difficult, and often involves questionable assumptions. So although it is better in theory, it may be inferior in practice. Both approaches are useful. Burden *without* behavioral change reflects what might happen immediately after the tax reform, before people have a chance to change. It also reflects what might happen to the most unfortunate people and businesses—those for whom changed behavior is very difficult or costly. Estimates of burden *with* behavioral change reflect

what might happen after people and the economy have had some time to find or implement other ways of behaving (for example, for businesses to make investments in energy- or material-efficient technologies).

The income that bears the new tax burden can also be looked at in two ways. The usual way is to look at annual income. Another way, considered realistic by some economists but disputed by others, is to consider the impact as a percentage of estimated lifetime income. The idea here is that an increase in the price of gasoline may be very costly as a percentage of a college student's current annual income, but it might be much less costly as a percentage of that student's lifetime income. Since the lifetime income of two students might vary enormously, the lifetime income approach can be helpful, especially when one is interested in the way different people within a seemingly homogenous group may be affected (for example, all students, or all those who make between $10,000 and $15,000 *this* year). But since new taxes or fees are paid for with today's income, the lifetime approach does not make sense to the man in the street.

In sum, there are eight different ways to calculate the distributional impact of an ETR. First, there are four different ways of assessing the financial burden of the tax:

1. direct impacts without behavioral change.
2. direct impacts with behavioral change.
3. direct and indirect impacts without behavioral change.
4. direct and indirect impacts with behavioral change.

Second, each of the above estimates can be expressed as a percentage of:

1. annual income.
2. lifetime income.

The take-home message for those who are designing ETRs is that the best and most practical estimating methods for the distribution of burden of a specific ETR both use *annual income*, and include *direct and indirect impacts.* Therefore, the two best (out of eight possible) ways to estimate regressivity are the above criteria either (1) with behavioral change or (2) without behavioral change. The following subsections provide additional details and academic citations that should help to make ETR advocacy more credible and persuasive.

Direct and Indirect Burden

There has been quite a bit of academic research on the distributional impact of energy taxes alone (that is, without considering any tax offsets), and from the 1970s to the early 1990s the conventional wisdom has been that such levies are regressive. Studies done by Zupnick (1975, 409–14), Palmer et al. (1976, 545–68), Stucker (1977, 171–86), and Henderson (1988) all seem to confirm that the burdens of gasoline and other energy taxes often fall disproportionately on low-income consumers. But this represents only one piece of a larger picture. These studies have an important limitation: they are "partial equilibrium" studies that measure only the *direct* effects of the taxes in question, failing to account for *indirect* effects.[4]

Casler and Rafiqui (1993, 197–205) highlighted this criticism in their report on fuel tax equity, which states that in much of the previous energy tax research, "[a]ttention focuses on a particular fuel . . . and the effects on other commodities are ignored." Because of this failure to focus on a broad range of effects, they conclude that such partial equilibrium studies are incapable of capturing the true impact of such taxes on tax equity. A more complete analysis would account for indirect effects as well. And it would certainly not claim—as some people have—that a broad-based energy tax, such as a carbon tax, will have a pattern of direct plus indirect burden that is the same as the pattern of direct burden (alone) for a gasoline tax.

More recent *general* equilibrium studies show that when indirect effects are included, the picture of the real impact of energy taxes changes. Prices still increase, of course, but the burden is less concentrated on lower income groups. Incorporating these effects broadens the tax base for the energy levies, which brings the new taxes much closer to being proportional to income than strongly regressive.

Two studies done in the mid-1970s by Herendeen (1974, 18–22) and Hannon (1975, 95–101) first demonstrated this result by finding that there is a far

SIDEBAR: LOOKING AT CASLER AND RAFIQUI'S DATA

The result of including indirect costs can be seen in table 1, in which energy expenditures of the poorest fifth of the income distribution are compared with those of the richest fifth. The second column shows the percent of annual income spent on direct energy costs for the bottom fifth of the population relative to the percent of annual income spent on direct energy by the wealthiest fifth. The third column shows how the numbers change when indirect costs are included.

TABLE 1: HOW DO INDIRECT EFFECTS ALTER THE DISTRIBUTIONAL PICTURE?

Fuel Type	Percentage of Annual Income Spent on Fuel Type—Ratio of Poorest Fifth to Richest Fifth	
	Direct Expenditures Only	Direct Plus Indirect Expenditures
Gasoline	114.5	110.8
Coal	333.2	114.2
Refined Petroleum	127.1	92.2
Electricity	147.5	118.5
Natural Gas	182.7	131.3
Total	135.3	107.7

Note that when the indirect costs are accounted for, the difference between the amount of income spent by the poor relative to the wealthy decreases significantly, thus indicating that direct and indirect energy expenditures are much more proportional than direct expenditures alone (still regressive in most cases, but to a far lesser degree). In particular, note the significant drop in the ratio for coal (a drop of 219 percentage points), and that the well-off actually spend a higher percentage of their income on refined petroleum than do the poor.

more proportional and uniform relationship between energy expenditures and income level when one accounts for both direct and indirect energy consumption. More recently, this result was confirmed by Casler and Rafiqui (1993, 95–101), who found that analyzing direct and indirect effects leads to far less variation across income groups. Although fuel taxes are still mildly regressive after this adjustment, they find that the taxes are much more neutral than regressive (see sidebar), and that "in terms of total distributional effects, total direct and indirect energy consumption is a good candidate for taxation."

This particular finding—that energy use is a good candidate for taxation on distributional grounds—might not apply to other environmental "bads." That is, water or solid waste taxes might unduly burden lower-income groups even after indirect impacts are accounted for. Our point is that things are sometimes not what they appear. Methodologically, any distributional analysis that omits indirect burden could be very misleading.

The Burden of Taxes with or without Estimates of Behavioral Change

The idea behind ETR is that a change in taxes will change behavior in a way that is good for the environment. But as a practical matter it is difficult to estimate how behavior will change. Consequently, many studies assume no change in behavior in order to get a first approximation of who might be burdened by a tax reform. The studies of Bernow et al. (1997), Hoerner (1997), and Metcalf (1998) assume no change in behavior. These studies use input-output models that *cannot* reflect behavioral changes. But this is acceptable—so long as those who are using the results understand that the burden of the ETR has been *estimated*, and that the estimate represents the burden on people and businesses *before* they have a chance to adjust.

Other burden analyses attempt to account for behavioral change. For example, the computable general equilibrium models of Ballard and Medema (1993, 199–216); Jorgenson and Wilcoxen (1993, 7–25); Goulder (1995, 271–297); and Krutilla, Viscusi, and Boyd (1995, 5–22) allow households and businesses to adjust to price changes. But such results are not necessarily more correct than those from input-output models. One has to ask if the structure of the models and inputs to the models (most important, elasticities of demand or of substitution) are realistic representations of how the particular people and businesses modeled in the analysis will respond to the specific tax reform of concern. An economic model can be very realistic for one policy question, but unrealistic for some other policy question. And in some instances, economists differ on what input parameters to use. For example, the elasticity of demand for gasoline may vary by income group. If one average elasticity of demand for gasoline were used for all income groups in the model, the reported distribution of burden by income group would be questionable. So the results of computable general equilibrium models are also *estimates* of the burden of an ETR—estimates that represent the burden on people and businesses *after* they have adjusted.

Annual and Lifetime Incomes

Before moving to consideration of offsetting tax cuts, the concept of "life-cycle" analysis—used often in the tax literature to analyze the distributional effects of consumption taxes—is worth a brief mention. Using life-cycle analysis, consumption or excise taxes are analyzed with respect to estimated lifetime income rather than with respect to annual income.

Annual consumption expenditures tend to be much more stable from year to year than annual income, which suggests that there is some "deeper" idea of income that people use to guide their expenditure decisions. For example, a family with young children that expects its income to increase in future years may spend more than it will earn in a given year, but later in life repay the debts taken on earlier. This is because they expect lifetime income to be higher than today's income times the number of future working years.

The implication for policymakers is that environmental taxes appear to be less regressive under life-cycle analysis than under annual income analysis. Suppose a person will make $50,000 a year after graduation from college, but current annual income is only $10,000. Then the burden on this particular "poor" person will seem very high under an annual measure, but be much less under a lifetime measure. Similarly, suppose a person will make $50,000 a year on average but made $100,000 last year because they worked an enormous amount of overtime. Then the burden on this particular "rich" person will be much lower on an annual income basis than under a lifetime measure. So in *both* cases—annual income that is unusually low or high—the annual measure looks more regressive than the life-cycle measure.

Several recent studies have used life-cycle analysis to examine the equity impact of energy taxes. For example, a study by Christian (1992, 221–81) finds that carbon taxes will appear less regressive under life-cycle measurement than annual income measurement. Some persons might argue that this means that energy taxes are "really" less regressive than they appear based on annual measures. But that is not true. Neither measure is more correct, scientifically. They simply measure burden in different ways.

There are, however, several practical advantages of the annual income approach over the lifetime income approach. First, the lifetime approach usually assumes that people's expectations of their future income are correct. The method calculates what people think they will earn in a lifetime, and compares tax burden against that expected income. If actual income turns out to be higher or lower, the actual tax burden could be much higher or lower as well. Second, any burden of tax changes will be paid from *today's* income, not from lifetime income (unless people borrow to pay their taxes, which is rare). For both practical reasons, legislators and policymakers are wary of the life-cycle approach. Although it is useful at times, comparing tax burden with the actual income people earn today is much more tangible to people than comparing it with an economist's estimate of the lifetime income that people, in theory, expect to earn.

HOW CAN REGRESSIVE IMPACTS BE AVOIDED, OR BLUNTED?

If one wants to boost the use of environmental taxes, how can one design them so that environmental quality is not disproportionately paid for by lower-income persons? There are three ways of designing ETRs to avoid or blunt regressivity—and two of the ways could be used to actually increase the progressivity of the tax system.

Exempting Some Amount from the Tax

Some amount of pollution, resource use, energy use, and so forth can be exempt from tax, with adjustments made to account for household size or location. This approach might not avoid all regressivity, but it is actually progressive if one only compares those who use less than the exempt amount with those who use more. This approach, at least, blunts regressive impacts.

The untaxed price for the exempt amount is sometimes called a "lifeline rate." It is common in the utility industry to charge one rate for each unit of something up to a certain amount (the first "block"), and a higher rate for each unit in the second block, and an even higher rate for more purchases. Block rate pricing has been used extensively with products that are metered to each customer at fixed locations, such as electricity, gas, and water. It might be used creatively with products that are metered at many locations (for example, gasoline), or controlled substances such as pesticides and some fertilizers. Some European ETRs have been designed in this way. Modern technology might make this approach feasible for many more ETRs.

This option is attractive because revenue recycling to reduce existing taxes (discussed below) may fail to reach every household, or may recycle different amounts of revenue to households with the same burden (before revenue recycling). Exempting a specified amount from the environmental tax or fee could cover everyone in the economy, so it avoids the problem of missing important parts of the population with the revenue recycling mechanism. Of course, the exemption might give a break to those who may not need one, and it will reduce revenue yield. But it is a great strategy if regressivity is an important enough concern.

Uniformly Reducing Existing Regressive Taxes

Second, the new environmental taxes can be combined with reductions in existing regressive taxes (for example, the Social Security payroll tax, or state sales taxes). The overall result could be an ETR that is not regressive, or that even increases progressivity.

To test for the plausibility of such a result, Gilbert Metcalf of Tufts University, one of the nation's leading experts on distributional analysis and environmental taxation, conducted a study for Redefining Progress (RP) in which he evaluated the equity impacts of three national tax shift proposals (Metcalf 1998).[5] He found that "a modest tax reform in which environmental taxes equal 10 percent of federal receipts . . . has a negligible impact on the income distribution when the funds are rebated to households through reductions in the payroll and personal income tax." He also found that increased progressivity would not be difficult with an ETR.

TABLE 2: DISTRIBUTIONAL IMPACT OF VARIOUS TAXES IN SELECTED STATES

	Share of Annual Family Income Represented by Each Tax (Percent)						
Family Income Group (Based on Annual Income)	Poorest 20 Percent	Second 20 Percent	Middle 20 Percent	Fourth 20 Percent	Next 15 Percent	Next 4 Percent	Richest 1 Percent
CALIFORNIA (1998)							
Sales and Excise Taxes (Total)	8.1	7.2	5.6	4.5	3.3	2.2	1.3
General Sales (Individuals)	4.3	4.0	3.3	2.7	2.1	1.4	0.8
Gasoline Taxes	0.7	0.6	0.5	0.4	0.2	0.1	0.1
Property Taxes on Families	2.9	2.2	2.1	2.2	2.3	1.8	0.9
MAINE (1995)							
Sales and Excise Taxes (Total)	6.3	4.9	3.9	3.4	2.7	1.7	1.1
General Sales (Individuals)	3.1	2.5	2.0	1.7	1.4	0.9	0.6
Gasoline Taxes	0.8	0.7	0.5	0.5	0.3	0.2	0.1
Property Taxes on Families	4.1	2.8	2.9	2.8	2.7	2.2	1.1
MICHIGAN (1995)							
Sales and Excise Taxes (Total)	7.6	5.7	4.6	3.8	2.9	2.1	1.3
General Sales (Individuals)	2.5	2.0	1.7	1.4	1.1	0.8	0.6
Gasoline Taxes	0.6	0.4	0.3	0.3	0.2	0.1	0.1
Property Taxes on Families	3.0	2.4	2.2	2.1	2.1	1.8	0.7
MINNESOTA (1998)							
Sales and Excise Taxes (Total)	7.0	5.7	4.6	3.8	2.9	1.9	1.2
General Sales (Individuals)	3.0	2.6	2.2	1.9	1.5	1.0	0.7
Gasoline Taxes	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Property Taxes on Families	2.8	2.5	2.5	2.5	2.4	2.0	0.9
OREGON (1995)							
Sales and Excise Taxes (Total)	1.2	0.9	0.7	0.5	0.4	0.2	0.1
General Sales (Individuals)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gasoline Taxes	0.9	0.7	0.5	0.4	0.3	0.2	0.1
Property Taxes on Families	6.5	3.4	3.4	3.6	3.4	2.8	1.1
VERMONT (1995)							
Sales and Excise Taxes (Total)	4.3	3.5	3.1	2.5	1.9	1.2	0.8
General Sales (Individuals)	1.9	1.5	1.4	1.2	0.9	0.6	0.4
Gasoline Taxes	0.6	0.4	0.4	0.3	0.3	0.1	0.1
Property Taxes on Families	5.0	3.0	4.2	3.5	3.5	2.7	1.2

Metcalf's analysis considers only federal-level ETRs, however, and one of his key findings is that designing a progressive ETR is easier if payroll tax reductions are possible. What about tax shifts at the state level, where there is no payroll tax? Can they be done in a way that would be progressive? While a sophisticated analysis is beyond the scope of this short paper, it is instructive to look at the estimated distributional burden of various taxes in a few states.

The percentages in table 2 represent the share of income that each tax represents in each state, by income group. The California and Minnesota data is from 1998 (Ettlinger 1999); the data for the remaining states is from 1995 (Ettlinger et al. 1996). Percentages in table 2 are shares of family income for the groups identified in the column headings; percentages in the column headings are based on annual income in 1998 or 1995, as appropriate.

What does this table tell us? Mainly, it tells us that states have options for ETR that would probably not increase the tax burden on the poor. Each of these states has several options for reducing other regressive taxes, thus yielding a neutral—or progressive—overall tax reform.

For example, property taxes on families in all six states are mildly regressive, although there are some anomalies (for example, the up-and-down impact in Vermont), and in others the property tax is roughly flat except at the very top and bottom (for example, California, Oregon). And in all of the states (except for Oregon, which has no general sales tax), sales taxes are regressive—in many cases, even more regressive than the gas tax. Any of these states could potentially improve progressivity—as well as the environment—if it raised gasoline taxes and used the revenues to reduce the general sales tax.

Another option for states to offset regressivity or even implement progressive ETRs would be to reduce taxes on labor. More than 70 percent of U.S. families now pay more in payroll taxes than in federal income tax, and payroll taxes are regressive because most of them apply only to wage and salary income up to a ceiling of about $70,000. Of course, states do not have a payroll tax—but this does not mean they have no options for offsetting the rising tax burden on labor income.

For example, one way to effectively reduce labor taxes at the state level would be to provide a credit to firms or individuals for a percentage of federal payroll taxes paid. This approach was included in the first legislative effort to pass an ETR in the state of Minnesota, which included a 7.5 percent credit on the employer's payroll tax payments. In RP's recent monograph, *Greening the Golden State: A Tax Reform for California's Future* (Hamond et al. 1999),[6] we proposed a credit that would, in practice, exempt from payroll tax the first portion of wages. The credit would be claimed on income tax returns and would be available to both firms and workers.[7] This idea would not be administratively complex (at least in California) because most workers—even those who owe no state income tax—still file returns. Thus, the mechanism already exists for offering such a credit, which would lead to higher take-home pay for workers right away and potentially more job creation over time. We estimated that a credit based on a wage exemption of $2,000 would cost California about $3.6 billion a year; in states with smaller economies, of course, the revenue loss would be much lower.

Reducing Other Existing Taxes in a Progressive Fashion

Third, revenues from an environmental tax could be used to lower an existing tax nonuniformly. For example, a state could pass a new or higher tax on metered products such as electricity or water, and use the revenues to increase the progressivity of the state income tax. This does not mean higher income taxes on those with higher incomes; it means only that tax relief would be greater on a percentage basis as one goes down the income scale. This allows greater tax relief to middle-income taxpayers than perhaps the second approach. This idea is attractive to some prominent economists. MIT economist Paul Krugman (1997) endorsed the concept in his introduction to *Tax Waste, Not Work*.[8] And in a column in *Fortune* magazine, Harvard professor Gregory Mankiw (1999, 60, 64) endorsed a tax reform that would increase gasoline taxes and reduce income taxes, noting that if Congress were concerned about regressivity, "there is nothing to

stop it from cutting tax rates on lower incomes more than on higher incomes."

Would this idea fly politically? In states where the income tax burden is spread relatively evenly, this idea might have traction. But this approach might not offset the burden of new taxes on those near the bottom of the income distribution because many such persons pay little or no income tax. To address this concern states might adopt refundable income tax credits (that is, you get the money even if you don't owe any tax), but even this mechanism won't reach those who don't file income tax returns.

CONCLUSION

From reviewing much of the early energy tax literature, it is clear that the general view on energy taxes and their equity effects has changed over time. Through the 1970s and '80s, studies that focused on fuel taxes and their direct effects suggested that energy taxes were strongly regressive and should be avoided. This view dominated perceptions of energy tax equity until recently, when the importance of indirect effects became more widely recognized. Today, any study that does not evaluate indirect effects is highly suspect. Advocates should know that the lifetime income approach will usually make an ETR appear less regressive than the annual income approach. The annual approach, therefore, is safer if one is deeply concerned about regressivity. It is also more practical. Last, both studies that do not include behavioral change and those that do are useful. The first represents burden before people and businesses respond; the second represents how burden might be distributed after people and businesses adjust their behavior.

Fortunately, concerns about regressivity can be addressed through the design of ETRs. There are three design approaches that can be used individually, or in some combination. The first is to exempt some amount of consumption of the taxed item (for example, pollution, energy use, water use) from the environmental tax. The second is to use revenues to reduce an existing tax that is as regressive or more regressive than the new environmental tax. The third is to use revenues to reduce an existing tax in a way that increases the progressivity of that tax.

As Metcalf (1998) writes, "distributional concerns about the greater use of environmental taxes can be addressed through a careful menu of tax reductions that are targeted to low-income households. While it is certainly true that environmental reforms could be designed that are quite regressive . . . distributionally neutral (or even mildly progressive) reforms are certainly feasible." In short, ETRs are not inherently regressive. Environmental tax reform advocates can design specific ETRs that appeal to constituencies that care about the environment but are equally or more concerned about income inequality and the increasing gap between rich and poor in the United States.

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NOTES

1. Jeff Hamond is a strategic consultant to Redefining Progress (RP); Hardy Merriman was an intern at RP in the summer of 1999; Gary Wolff is the director of the Incentives Program at RP.

2. We define an environmental tax reform (ETR) as any combination of an environmental tax (or user fee, or "green" fee, depending on the situation) with a reduction in one or more existing taxes or government fees. If the ETR is revenue neutral, we would call it an environmental tax shift. But because revenue neutrality is difficult to achieve in practice, and many states around the country are enjoying budget surpluses, we address ETRs in this paper (noting that ETS is a type of ETR). Revenue neutrality may be a good starting point because it blunts the claim that new taxes or user fees mean larger government. But revenue neutrality is a means to an end, not an end in itself.

3. The prices that change are not always easy to calculate. Many studies assume that the full tax is passed forward to consumers as higher prices for finished products (this is called forward incidence) or passed entirely back onto workers as lower wages and investors as lower rates of return (backward incidence). In most real cases, some mix of forward and backward incidence will occur. So one should be aware of how the price changes were calculated in any particular study of the burden of a tax reform—and ask if the calculation or assumptions are realistic. If assumptions are used that may not be realistic, the conclusions of the study need to be used very cautiously.

4. A partial equilibrium study looks at the effect of one or a few changes in prices in isolation, without considering the effects such changes will have on prices and demand throughout the economy.

5. The executive summary of Metcalf's paper, "A Distributional Analysis of an Environmental Tax Shift," can be viewed at <http://www.rprogress.org/pubs/wpts2/wpts2_execsum.html>.

6. Read the executive summary of *Greening the Golden State,* or download the full report, at <http://www.rprogress.org/pubs/greengold/greengold_execsum.html>.

7. An exemption at the bottom end provides a greater relative benefit to lower-wage workers than a rate reduction because the dollar amount exempted from tax makes up a higher percentage of their income.

8. Krugman's introduction to *Tax Waste, Not Work* can be viewed at <http://www.rprogress.org/pubs/twnw/twnw_intro.html>.

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