Policy Analysis

Cato Institute Policy Analysis No. 289: The National Sales Tax: Who Bears the Burden?

December 8, 1997

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Executive Summary

A leading criticism of a national sales tax replacement for the income tax is that low-income households would be harmed by the regressivity of the tax. This study uses data from the Bureau of Labor Statistics' Consumer Expenditure Survey (CES) to measure the lifetime incidence of a shift from the current income tax to a national sales tax.

The incidence of the tax burden under this reform depends in important ways on the measure of household well-being. If annual income is used to rank households, the tax reform looks very regressive. If lifetime income is used to rank households, the tax reform continues to look regressive, though much less so than when the annual income approach is used. If a universal rebate tied to poverty thresholds is coupled with the national sales tax, as is the case in the Schaefer-Tauzin bill (H.R. 2001), the sales tax is about as progressive as the current income tax. Alternatively, if a payroll tax rebate is provided to low-income families, the new system is only slightly less progressive than the current income tax system.

There are two essential messages of this paper. First, how we rank people--by annual or lifetime income--makes a big difference when we measure the progressivity of a national sales tax. Second, a national sales tax replacement for the income tax is not inherently regressive; it is relatively easy to construct a sales tax that protects the poor from paying any tax and is roughly as progressive as the current income tax. The universal rebate option is a good example of how one could adopt a non-regressive national sales tax.

Introduction

Dissatisfaction with the current income tax continues to generate interest in broad-based tax reform. In particular, there is considerable interest in moving from our current income tax to a consumption tax. In the 104th Congress there were approximately a dozen proposals for substantive tax reform, falling into three broad categories: flat tax, consumer income tax, and retail sales tax. [1]

A major concern with any of the consumption tax proposals is that they are perceived to be highly regressive relative to the current income tax. Much of that perception follows from the idea that, because rich people do most of the saving, any move to a consumption tax will release a substantial share of income from taxation. Incidence studies using annual income support that view; distributional tables for a shift from an income to a consumption tax show that the reform would be highly regressive. [2] A major problem with annual incidence studies of consumption taxes, however, is that life-cycle income and savings patterns distort the measured incidence of a consumption tax in a pronouncedly regressive direction.

The goal of this study is to indicate the biases resulting from measuring the incidence of a consumption tax using an annual incidence approach and to show incidence results for a national sales tax using a lifetime income approach that I have used elsewhere. [3] In addition, I consider two of the leading proposals to make the national sales tax more progressive: 1) provide a family rebate equal to the poverty level times the sales tax rate; or 2) provide a $2,000 per worker refund on payroll taxes. If the sales tax includes a universal rebate tied to poverty thresholds, the sales tax looks nearly as progressive as the current income tax measured by the lifetime incidence approach. [4]

How Should We Measure Tax Incidence?

An incidence analysis attempts to answer the question, Who bears the burden of a particular tax? Any attempt to evaluate the "fairness" of a tax (or a change in the tax system) requires knowing whose disposable income is changed and by how much in response to the tax. Economists often refer to taxes as "regressive" or "progressive," but the confusion over the terms' meanings requires careful definitions. The definitions that most economists use rely on the average tax rate, that is, the ratio of tax liabilities to income. [5] A tax is regressive if the average tax rate falls with an increase in income, proportional if the average tax rate is constant, and progressive if the average tax rate rises with income. Simply put, low-income people pay a higher fraction of their income in taxes than wealthier people if the tax is regressive and a lower fraction if the tax is progressive.

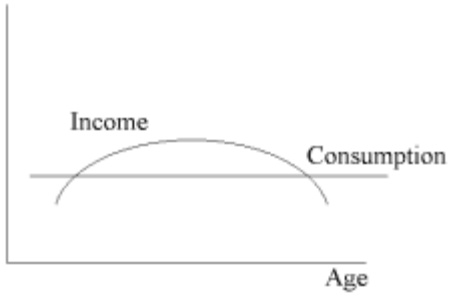
Early tax incidence studies used economic models to inform judgments about relevant incidence results from tax changes. In effect, economists used existing research results to generate plausible assumptions about the incidence of specific taxes. The late Joseph Pechman of the Brookings Institution is a classic example of that type of economist. [6] Using a one-year time frame for analysis, Pechman assumes that consumption taxes are passed forward and borne by consumers in proportion to their expenditures, finding that consumption taxes are quite regressive. [7] A recent study by Brookings Institution economists Gale, Houser, and Scholz confirms this view. [8] In an analysis of a shift from the current income tax to a flat tax, they find that the lowest-income group would see their average tax rate increase by 2.2 percentage points (81 percent increase) while the highest-income group would see their average tax rate decrease by 7.1 percentage points (17 percent decrease). [9] Similarly, economists from MIT and the National Bureau of Economic Research find that there would be a substantial shift in the tax burden to the poor occasioned by changing from the income tax to a retail sales tax. [10]

An alternative approach uses estimates of lifetime income as a measure of the taxpayer's economic well-being. Economists, taking into account both Milton Friedman's permanent income hypothesis and life-cycle considerations, have long recognized that annual income may not be a very good measure of an individual's potential to consume. [11] For purposes of measuring tax incidence, individuals should be grouped by income according to the present discounted value of earnings plus any gifts received.

The lifetime income theory makes the difficulties with the annual incidence approach readily apparent. People tend to earn the highest incomes in their lives around middle age and the lowest incomes in their youth and old age. Consequently, in a cross-section annual analysis, lower-income groups are likely to include some young and elderly people (and some people with volatile incomes) who are not poor in a lifetime sense. Similarly, higher-annual-income groups are likely to contain some people at the peak of their age-earnings profile for whom peak earnings are a poor measure of annual ability to consume.

To see why a lifetime approach makes a difference, imagine a world with identical people who have identical skills and identical earning patterns over their lifetimes. Figure 1 illustrates the lifetime income and consumption paths of a typical person in this imaginary society. Income, initially low and rising to a peak in the middle years, falls as this worker gradually cuts back on work and enjoys more retirement leisure. Consumption, however, is constant over the lifetime. In early years individuals borrow against future income to finance consumption that exceeds income. Savings occurs in the middle years, first to repay borrowing from the early years and then to finance consumption in the retirement years. In this stylized example, I assume that all savings are consumed so that at death there are no assets remaining.

Figure 1. Annual Income versus Annual Consumption over Lifetime of a Typical Worker



Next, assume that there is one person of each age in this identical society. Figure 1 now has an additional interpretation. In addition to indicating consumption and income patterns over an individual's lifetime, it also shows income and consumption patterns for our society of individuals at any given point. Now consider an annual incidence analysis of a national sales tax. Since consumption is constant across all individuals, tax payments will also be constant. But since income varies over a lifetime, the average tax rate (taxes as a fraction of annual income) will fall as income rises, and the tax will look very regressive. But this is clearly wrong. Individuals are exactly the same in this hypothetical society and over their lifetimes will earn exactly the same amount of income and pay exactly the same amount of taxes. A lifetime incidence analysis will correctly conclude that this tax is proportional.

Measuring Lifetime Income

Lifetime income is more difficult to measure than annual income. National Bureau of Economic Research economist James Poterba has proposed using consumption as a proxy for lifetime income, arguing that since household consumption tends to fluctuate less from year to year than income, total annual consumption is likely to be a better measure of household well-being than total annual income. [12] Using data on total expenditures from the CES, Poterba finds that excise taxes on alcohol, tobacco, and gasoline are much less regressive than they appear when viewed in an annual income framework. Following this approach, I find that the system of state and local taxes is less regressive when consumption is used as a proxy for lifetime income. [13] Feenberg, Mitrusi, and Poterba also use the consumption proxy for lifetime income in a detailed analysis of a shift from the current income tax system to a national sales tax. [14] This comprehensive work considers personal income tax, corporate income tax, and estate tax. Using consumption as a proxy for lifetime income, the authors find that the regressivity of the shift measured using annual income is substantially reduced and that the shift can in fact be made progressive through straightforward measures (e.g., lump sum grants or making certain categories of spending exempt from the tax base).

The advantage of the approach taken by these economists is its simplicity: distributional tables can be constructed using data readily available in a single year. The disadvantage, however, is that current consumption may not in fact be a very good proxy for lifetime income. In previous work I have shown that distributional tables for consumption taxes using current consumption as a proxy for lifetime income underestimate the regressivity of a consumption tax. [15] This is because the current consumption approach assumes that consumption is roughly constant over the lifetime. But consumption exhibits the same kind of "hump" that income does over the lifetime, although not as pronounced. The same kinds of errors that occur when we rank people by annual income persist to an extent when we rank them by consumption. Thus, we should view the Feenberg, Mitrusi, and Poterba results as upper bounds on the progressivity of a consumption tax. Further, since these are upper bounds, we cannot conclude from their analysis that the substitution of a retail sales tax for an income tax will be progressive.

One approach to resolving the problem of relying on annual consumption as a proxy for lifetime consumption is to use an explicit computable general equilibrium life-cycle model to investigate the incidence of tax reforms. Studies by Fullerton at the University of Texas and Rogers, an economist at the Congressional Budget Office, are perhaps the best research in this area. [16] In their model, they calculate tax incidence estimates based on age-income profiles and lifetime income measurements. [17] They find that both corporate and individual income taxes appear to be less progressive in a life-cycle framework than under a snapshot analysis, while sales and excise taxes appear to be less regressive. Despite these changes, the overall incidence of the U.S. tax system seems to be about the same as estimated under an annual income framework. [18]

Fullerton and Rogers present the most careful analysis of lifetime tax incidence to date. Their most recent paper considers the impact of a proportional value added tax (VAT) (with and without various progressive features). [19] A VAT is a consumption tax that is levied at each stage of production of goods and services. A proportional VAT reform is more regressive than the current system with after-tax losses of 4.3 percent for the lowest-lifetime-income group and after-tax gains of 10 percent for the highest-lifetime-income group. [20] That is, the lowest-income-group pays 4.3 percent more taxes and the higher-income-group pays 10 percent less taxes. A $10,000 household consumption exemption generates progressivity at the lower end of the income distribution (roughly from the first through the sixth income decile), but the tax continues to be regressive in the higher deciles. [21]

Note that there are different "lifetime" experiments that one can analyze. As Poterba points out, one can look at lifetime tax burdens and/or lifetime income. [22] Fullerton and Rogers look at the lifetime tax burden relative to lifetime income whereas Poterba and Metcalf examine annual tax burdens relative to lifetime income. [23] The latter approach addresses the question of the burden of a particular year's taxes when households are classified by a measure of economic well-being that is less prone to measurement error than annual income.

The annual tax/lifetime income approach is taken in this paper. [24] (See Appendix A for how I measure lifetime income.) In the next section, I measure the incidence of a shift from an income tax to a national sales tax.

The National Sales Tax Base and Rate

I consider a shift from an income tax to a national sales tax using data from the 1994 CES.

Before turning to the data, I consider what tax rate is required if the United States shifted from the current income tax to a broad-based retail sales tax. According to the U.S. National Income and Product Accounts, income taxes in 1994 amounted to $688.5 billion, with about 80 percent of the revenue coming from the personal income tax (see Table 1). Personal consumption expenditures in that year amounted to $4,698.7 billion, but not all of personal consumption should be included in the tax base. First, I must subtract indirect taxes from personal consumption. I also assume that the consumption value of owner-occupied housing and the imputed value of financial services, nonprofit activities, and food produced and consumed on farms would not be taxed. [25] The figure for owner-occupied housing is net of spending on new housing and improvements. In other words, I adjust the housing number to include the cost of a new house while excluding the imputed consumption value of the housing services that result from purchasing the house. [26] Next, I include net foreign spending in the United States in the sales tax base. [27]

Table 1 indicates that the adjusted tax base would be $3.8 trillion and a tax rate of 18.2 percent would be required to raise as much money as the personal and corporate income tax did in 1994. If non-profit activities and imputed financial services are included in the tax base, the rate can be lowered to 16.5 percent. In the analysis below, I include nonprofit activities in the tax base to the extent that they show up as a component of spending by households. I do not, however, include imputed financial services in the base.

While I use micro data from the CES to distribute the income and sales taxes, there are three adjustments I must make to the data before I can analyze the tax reform. First, the CES reports out-of-pocket medical expenditures and ignores spending on a consumer's behalf by health maintenance organizations and insurance companies. I therefore replace health spending reporting with data from the National Medical Expenditure Survey to attribute medical spending to individual households. Second, I make adjustments to the CES income and consumption categories to match aggregate numbers in the National Income and Product Accounts. Third, I attribute corporate tax payments to individual households using a methodology developed by Martin Feldstein of Harvard University and the National Bureau of Economic Research. [28] I provide details on these adjustments in Appendix B.

Table 1. Aggregate Consumption and Taxation, 1994
(Billions of Dollars)

Current Income Tax

Personal Income Tax	544.5
Corporate Income Tax	144.0
Total Income Tax	**688.5**
Retail Sales Tax Base	
Personal Consumption Expenditures	4,698.7
Adjustments to Personal Consumption Expenditures:	
Indirect Taxes	(266.9)
Owner Occupied Housing	(280.2)
Farm Food	(0.5)
Net Foreign Spending	19.8
Consumption Tax Base (including non-profits and financial services)	**4,170.9**
Retail Sales Tax Rate (including non-profits and financial services)	**16.5%**
Imputed Financial Services	(146.0)
Non-Profit Activities	(236.6)
Consumption Tax Base (excluding non-profits and financial services)	**3,788.3**
Retail Sales Tax Rate (excluding non-profits and financial services)	**18.2%**

Before turning to distributional tables for a shift from income taxation to a retail sales tax, I consider the importance of the lifetime income correction. Table 2 presents a cross-tabulation of lifetime income quintiles by annual income quintiles. The table entries are proportions of households in a given annual income quintile that fall into each lifetime income quintile. Thus, the entry in the top left corner of the table is the fraction of households in the lowest annual income quintile with lifetime income in the lowest quintile. This table shows that there is considerable variation among the quintiles based on annual and lifetime income. For example, nearly 30 percent of the households in the lowest quintile for annual income have lifetime income in the third or higher lifetime quintiles. More striking is the fact that 15 percent of the households in the highest lifetime income quintile are in the lowest 40 percent of the income distribution in a given year. The correlation between annual and lifetime income quintiles in the sample is .45.

Table 2. Cross-Tabulation of Annual and Lifetime Income

	Lifetime Income Quintiles				
Annual Income Quintiles	1	2	3	4	5
1	50.1	21.2	17.0	5.9	5.9
2	21.4	27.2	22.5	18.7	10.3
3	13.0	24.5	20.6	23.1	18.8
4	9.1	18.9	19.8	27.1	25.2
5	6.3	8.6	19.4	25.9	39.9

* The table can be interpreted as follows: First quintile represents poorest 20 percent of American households. Fifth quintile represents richest 20 percent of households. Example: 50.1 percent of households in the lowest annual income quintile are also in the lowest lifetime income quintile.

On the basis of Table 2, we should expect a considerable difference between distributional results based on annual income rankings and lifetime income rankings.

Tax Incidence of a National Sales Tax with No Rebate

My first analysis considers a shift from the current income tax to a broad-based sales tax. Table 3 shows the distribution of this shift using an annual income incidence approach. In the first column, households are ranked by annual income. The second column shows the change in tax liability caused by shifting from an income to a retail sales tax, while the third column shows the change in average tax rate (change in tax as a percentage of annual income). Based on the annual income approach, the tax reform is very regressive compared with the current system. Tax liabilities increase for the bottom 70 percent of the income distribution and decrease for the top 30 percent. The changes are quite substantial with the lowest income decile seeing their average tax rate increase by 64 percent. [29] Meanwhile the top decile's average tax rate falls by 7 percent. Another way to measure the regressivity of the tax reform based on annual income is to note that the Suits Index falls from 0.202 (income tax) to -0.217 (retail sales tax) as a result of the reform. [30]

Table 5. Poverty Thresholds for 1994

Family Size	Poverty Threshold
unrelated individual under age 65	$7,710
unrelated individual 65 and over	$7,107
2 persons, householder under age 65	$9,977
2 persons, householder 65 and over	$8,964
3 persons	$11,817
4 persons	$15,141
5 persons	$17,896
6 persons	$20,223
7 persons	$22,956
8 persons	$25,474
9 persons or more	$30,285

Source: *Annual Statistical Supplement: Social Security Bulletin*, 1995.

Table 6. Distribution of a Broad-Based Retail Sales Tax with Universal Rebates: Lifetime Basis

Decile*	Change in Tax Liability (Dollars per average household)	Percentage Change in Average Tax Rate
1	$442	2.2%
2	426	1.5
3	-260	-0.9
4	110	0.2
5	419	0.8
6	29	0.04
7	1	0.1

8	-1,272	-2.0
9	-164	-0.3
10	267	0.1
* First decile represents poorest 10 percent of American households. Tenth decile represents richest 10 percent of households		

Much of the regressivity of the tax reform is eliminated when examining a lifetime income analysis. Table 4 presents the results. The variation in changes in tax liabilities across lifetime income deciles falls markedly relative to the annual income analysis. The reform is still more regressive than the current income tax, with the lowest 70 percent of the income distribution facing tax increases while the top 30 percent enjoy tax decreases. The differences are not nearly as large, however, as when measured using annual income to rank households. Moreover, the change in average tax rates is much smaller, with the lowest lifetime income decile facing an increase in its average tax rate of 5.7 percentage points while the top decile's average tax rate falls by 2 percentage points. Ranking households by lifetime income, the Suits Index now falls from 0.068 to -0.010 with this tax reform. In both the annual and the lifetime analyses, part of the increase in the tax liability at the bottom of the income scale results from the elimination of the earned income tax credit under a national sales tax.

A Sales Tax with a Family Rebate

Next I explore different ways to add progressivity to a national sales tax. One approach is to provide a family rebate, which I model on the earlier Cato Institute study by economists David Burton and Dan Mastromarco. [31]

They have proposed providing universal rebates to households equal to the poverty level to build progressivity into the tax system. This is also the rebate mechanism proposed in H.R. 2001, the leading Congressional sales tax proposal, sponsored by Reps. Dan Schaefer (R-Colo.) and Billy Tauzin (R-La.). In this section, I consider the impact of this proposal on the tax distribution of the retail sales tax. Poverty thresholds for 1994 ranged from $7,107 for an elderly single individual to $30,285 for a family of nine (see Table 5). The rebate would equal the tax rate times the poverty threshold for a given family size. [32] In effect, the rebate removes from the tax base an amount equal to the sum of poverty thresholds for each family in the United States added up over all families, referred to as the aggregate rebate base. Based on extrapolations from the CES data set for 1994, the aggregate rebate base would equal $1.15 trillion. Assuming that nonprofits and imputed financial services are included in the tax base, the static revenue-neutral tax rate would rise from 16.5 percent to 22.8 percent. [33]

When I examine the change with a universal rebate based on poverty thresholds using the annual incidence method, the results indicate that the plan is still much more regressive than the current system. The average family in the lowest income decile would see its tax liability rise by 41 percent, while the wealthiest households would see their tax liability fall by almost 6 percent.

Table 3. Distribution of a Broad-Based Retail Sales Tax: Annual Basis

Decile*	Change in Tax Liability (Dollars per average household)	Percentage Change in Average Tax Rate
1	$2,516	64.3%
2	2,867	24.4
3	3,044	17.4
4	2,837	11.5
5	2,386	7.3
6	870	2.3

7	1,820	3.9
8	-374	-0.6
9	-688	-0.9
10	-15,202	-7.0
* First decile represents poorest 10 percent of American households. Tenth decile represents richest 10 percent of households		

Table 4. Distribution of a Broad-Based Retail Sales Tax: Lifetime Basis

Decile*	Change in Tax Liability (Dollars per average household)	Percentage Change in Average Tax Rate
1	$1,110	5.7%
2	1,088	4.0
3	345	1.0
4	391	1.0
5	572	1.2
6	183	0.4
7	168	0.4
8	-1,269	-2.0
9	-872	-1.3
10	-1,701	-2.0
* First decile represents poorest 10 percent of American households. Tenth decile represents richest 10 percent of households		

The story changes dramatically when I rank people by lifetime income (see Table 6). Now there is no clear pattern to the change in average tax rates. The change, a remarkably close fit to the current income tax distribution, ranges from a decrease of 2 percent (decile 8) to an increase of 2.2 percent (decile 1). Ranking households by lifetime income, the Suits Index for the sales tax with rebate (0.054) is nearly the same as for the current income tax (0.068).

Comparing Table 4 with Table 6, it is easy to see that rebates based on the poverty threshold can offset any remaining regressive aspects of a national sales tax when ranking households by a measure of lifetime income. These results indicate that it is quite possible to structure a consumption tax that is broadly progressive. [34]

Rebating the Payroll Tax

A universal rebate may be viewed as too expansive a program; tax relief should be more narrowly targeted to lower-income workers. In this section, I consider a broad-based retail sales tax coupled with a refund of the employer and employee contributions for payroll taxes up to $2,000 per worker. I first estimate the rebate for which each earner in the sample is eligible. For example, a household with two workers who pay $1,800 and $600 in employee payroll taxes would be eligible for a rebate of $3,200. The worker who paid $1,800 in payroll tax also has $1,800 in employer contributions, for a total of $3,600 in payroll taxes. That worker would be eligible for a rebate of $2,000. Similarly, the worker with $600 in employee contributions would have an additional $600 of employer contributions. The entire $1,200 of payroll taxes would be rebated.

Table 7. Distribution of a Broad-Based Retail Sales Tax with $2,000 per Worker Payroll Tax Rebate: Lifetime Basis		
Decile*	Change in Tax Liability (Dollars per average household)	Percentage Change in Average Tax Rate
1	$1,319	6.8%
2	956	3.5
3	-42	-0.2
4	169	0.4
5	375	0.7
6	-21	-0.1
7	-121	-0.2
8	-1,653	-2.7
9	-679	-1.0
10	-302	-0.5
* First decile represents poorest 10 percent of American households. Tenth decile represents richest 10 percent of households		

Table 7 provides results for the lifetime analysis. Again, the lifetime incidence approach mitigates but does not eliminate the regressivity of the tax. Average tax rates within lifetime income deciles do not fall monotonically, but the top half of the lifetime income distribution benefits from the reform, while the lower half (except for the third decile) faces higher taxes. Now the Suits Index equals 0.016 (compared with 0.068 for the income tax), indicating a slight--though by no means large--regressive shift in distribution due to the tax reform.

Conclusion

The results in Tables 3 and 4 indicate that a shift from the current income tax to a broad-based retail sales tax would be a regressive shift, whether measured on an annual or a lifetime income basis. The analysis using annual income, however, dramatically overstates the regressivity of the shift. Various efforts to add progressivity to the tax system can mitigate regressivity. In particular, a national sales tax with a universal rebate based on poverty thresholds looks nearly as progressive as the current income tax system when households are ranked by lifetime income.

What is the practical importance of these results, given the common objection that people are not--strictly speaking--operating according to a lifetime budget constraint? Liquidity constraints, for example, might be one objection to the lifetime income approach. But the convention of using annual income analysis may be equally flawed. The annual income approach ignores any savings and asset accumulation that allows consumption to depend on income at other points in time. Thus, one might reasonably think of incidence analyses as falling along a continuum with a strict annual income approach at one end and a strict lifetime income approach at the other. Truth lies somewhere in between, and while the regressivity of a shift from the income tax to a broad-based retail sales tax may be greater when measured using a lifetime income approach, it is surely less than when measured with an annual income approach.

The results in this paper suggest that when evaluating the merits of major tax reform (in particular, a shift from income taxation to a national sales tax), policymakers should not focus unduly on distributional considerations. Rather,

Congress would be better advised to focus on the efficiency gains and the broad economic benefits of moving to a consumption tax system.

There are important distributional considerations that I have not considered in this analysis. Transitional gains and losses will be substantial in any tax reform and in particular a reform that shifts from income to consumption taxation. A shift without any transitional rules from income taxation to a national sales tax will (among other things) induce a transfer from the current elderly to the current young. [35] It is also worth noting that this study does not take into consideration the broad economic gains that might be expected from converting to a consumption-based tax system. Low-income Americans may very well realize gains in after-tax income from the tax shift if the economy improves and wages rise. [36]

Appendix A--The Lifetime Income Model

In this appendix, I sketch out the model with which I estimate lifetime income. This approach is based on 1994 research by Caspersen and Metcalf. Lifetime income (W) can be computed either as the present discounted value of the stream of inheritances and gifts received (I_t) plus earned income and transfers (E_t) or as the present discounted value of consumption (C_t) and bequests made (B_t):

$$W = \sum \frac{I_t + E_t}{(1 + p)^t} = \sum \frac{C_t + B_t}{(1 + p)^t}$$

where p is the individual's after tax rate of return. I will construct a measure of lifetime income from the sources side. That is, I will estimate the stream of earned income and inheritances for households and compute the present discounted value of this stream.

I use the income profiles constructed by Caspersen and Metcalf to compute lifetime income in the CES for this study. The income measures from those income profiles are updated to 1994 dollars using the Consumer Price Index (CPI). Lifetime income is defined here as the present discounted value of earned income, transfers, and gifts received by a given family over the adult life of the household head and depends only on the demographic variables associated with each family. This measure assumes that the individual's discount rate remains constant at 4 percent over time and that a household exists as an income-generating entity from the time the head is 21 until the time the head is 80. Workers are continually employed until age 65 at which point they retire. For each family, lifetime income is computed as

$$W_i = \sum_{t-1}^{n} \frac{\hat{Y}_{it}}{(1 + p)^t}$$

where $Y\hat{}_{it}$ is the fitted value of earned income plus transfers and inheritances received for household i in year t from the regression in Caspersen and Metcalf. [37] Additional adjustments to the lifetime income measure are detailed below. I annualize the lifetime income measure by computing the 60-year annual constant annuity that can be obtained in a fair market for this amount of wealth at a 4 percent real rate of interest.

I make two adjustments to the income profiles described above. The first is an attempt to generate an income distribution that more accurately reflects measured income distributions. The second attempts to recover the fixed effect from the Panel Study on Income Dynamics (PSID) regression that is lost in the process of fitting the PSID regression to CES data.

In forecasting income in the CES, I would like to eliminate the randomness in the income measure that is a result of annual temporary income fluctuations while maintaining the stochastic elements of income that affect variance and skew in a persistent way. [38] I make an adjustment to my measure of lifetime income as characterized in equation (2) to account for the loss of skew by allowing for shocks to income that are persistent over time. I assume an AR(1) process for a random shock to log income with first-order autocorrelation of .85 and variance of the innovation of .05.

[39] This will add skew to the distribution of lifetime income.

My measure of lifetime income comes from a regression in the PSID that measures a fixed effect. To preserve the fixed effect in the CES, I incorporate a proxy for the individual effect from the CES based on an auxiliary regression. I add to the annualized measure a fraction of the residual from an instrumental variables regression in the CES of current consumption on age, age squared, and education dummies. This residual incorporates additional information about lifetime income contained in current consumption after controlling for age and educational characteristics. The fraction is set so that the variance of the residual equals the variance of the fixed effect from a fixed-effects regression in the PSID.

This procedure can be viewed as a variation on a method for identifying time-invariant effects in a fixed-effects regression proposed by Hausman and Taylor. [40] They point out that the estimated individual effect is a combination of a true individual effect and the effect of time-invariant variables on the dependent variable. [41] In certain circumstances, it is possible to identify the parameters of the time-invariant variables. To disentangle the two effects, they suggest regressing estimated fixed effects on the time-invariant variables. Recognizing that the fixed effect may be correlated with some of the time-invariant variables, they note the need for instruments for the exogenous time-invariant variables.

Table A1. Consumption Regression in CES

Variable	Coefficient Estimate
Education Dummies	
Some College	0.547 (0.570)
College Graduate	1.633 (0.470)
Post Graduate Education	0.567 (0.433)
Age	0.049 (0.008)
Age Squared (x1000)	-0.475 (0.073)
Intercept	8.583 (0.240)
Number of Observations	1529
Standard Error	0.701

Current consumption is used as a proxy for the estimated individual effect. I proceed by assuming that education is correlated with the true fixed effect and an instrument for the education dummy variable with race, sex, region, and smoker dummy variables. The last variable is a dummy variable for the presence of expenditures in the CES on tobacco products. Table A1 reports results from the IV regression on log-current consumption. Consumption increases with education through college graduation and is hump shaped with respect to income. The regression provides a reasonably good fit and the coefficients are generally significant at the 95 percent level.

Appendix B--Adjustments to Consumer Expenditure Survey Data

Attributing Health Care Spending to Individuals

While the bulk of spending on health care on behalf of households is done by insurance companies and health care organizations, the CES records only out-of-pocket spending by households. Moreover, this spending can often be negative if the household has received a refund from an insurance company for medical spending in the current survey

period. Therefore, I exclude the out-of-pocket spending recorded in the CES and replace it with a prediction of spending on behalf of a household using data from the National Medical Expenditure Survey, a nationally representative sample that followed spending by approximately 20,000 families in 1987. Total medical spending for a household is the sum of employer-provided and individual health insurance, out-of-pocket spending, and spending reimbursed by government insurance (Medicare and Medicaid). The 1987 data are inflated to 1994 values using the National Income Product Accounts (NIPA) aggregates for the two years. I regressed total medical spending on income indicator variables: [42] an indicator variable for the presence of elderly family members, an indicator variable for the presence of children under 18, and family size. The coefficients are precisely estimated with the expected signs. I then forecast income in the CES using the estimated coefficients and replaced the medical-related spending in the CES with this forecasted value.

Imputing Corporate Tax Liabilities to Individuals

I follow the methodology set out by Feldstein [43] to impute corporate tax liabilities to individuals. The approach computes two numbers: (1) the ratio of corporate taxes to total capital income (O) and (2) the ratio of pretax corporate profits to dividends (μ). Under the assumption that corporate income taxes are borne by all capital income, O represents the average tax rate on capital income. Taxes on corporate income are taxes on distributed and nondistributed profits. This method assumes that corporate profits associated with an individual are proportional to dividends received. Thus, μ gives the mark-up to associate corporate profits with households.

Capital income (K) is the sum of corporate profits (C), net interest received by households (O), and rental income (R). Once I compute K and its components along with the corporate tax liability (T) and personal dividends (D), I can compute O and μ:

$O = T/K$

$\mu = C/D$

Pretax corporate profits are the sum of NIPA corporate profits, plus the decrease in the value of corporate debt resulting from inflation, plus real interest earned by pension funds.

NIPA corporate profits (excluding Federal Reserve Bank profits) equaled $506 billion in 1994. Credit market instrument liabilities of the corporate sector equaled $2,627.4 billion (flow of funds). The inflation rate for 1994 based on the CPI was 2.6 percent. Thus, corporate profits should be increased by (.026)($2,627.4) to equal $68.3 billion.

Interest income received by pension funds equaled $57.6 billion. To convert to real interest income, I use nominal interest rates weighted by holdings of pension funds and convert using the inflation rate (π). The holdings are shown in Table B-1. This implies a nominal interest rate (p) of 6.8 percent. The real rate (r) is given by $(1+p)/(1+\pi)-1$, which in this case equals 4.1 percent. The adjuster to convert nominal interest into real interest is the ratio of real to nominal interest: 4.1/6.8 = .602. Thus, real pension interest income is (.602)(57.6 billion) = $34.7 billion. Corporate profits are the sum of reported corporate profits ($506.0 billion), the decrease in corporate debt due to inflation ($68.3 billion), and real pension interest income ($34.7 billion) for a total of $609 billion.

Table B-1
Interest Rates on Pension Fund Holdings

Holding	Amount	Percentage	Interest Rate	Source
Time Deposits, etc.	116.9	15.7	3.0%	FRB source; Assumed based on various rates
Money Funds	31.2	4.2	4.9%	6 month Commercial Paper
Govt Bonds	362.5	48.7	7.1%	10 year G bonds
Corp Bonds	233.4	31.4	8.6%	Baa Bonds

Interest received by households from NIPA is $661.6 billion. This is converted to real interest by the same method as pension interest income. The interest rate weights are based on holdings of households in flow of funds, as shown in Table B-2. This gives a nominal interest rate of 4.4 percent and a real interest rate of 1.8 percent. Thus, real personal interest income is (1.8/4.4)(661.6 billion) = $263.8 billion.

Personal interest expenses (excluding mortgage interest) is $117.2 billion. The nominal interest rate is based on the data in Table B-3. This gives a nominal interest rate of 13.0 percent, a real rate of 10.1 percent, and an adjustment factor of .780. Thus, real interest expenses are (.780)(117.2 billion) = $91.4 billion. Net real interest income is the difference between real interest income ($263.8 billion) and real interest expenses ($91.4), or $172.4 billion.

Table B-2
Interest Rates on Financial Holdings of Households

Holding	Amount	Percentage	Interest Rate	Source
Time Deposits, etc.	2994.8	64.8	3.0%	FRB source; Assumed based on various rates
Money Funds	352.2	7.6	4.9%	6 month Commercial Paper
Govt Bonds	925.8	20.0	7.1%	10 year G bonds
Corp Bonds	346.3	7.5	8.6%	Baa Bonds

Table B-3
Interest Rates on Household Debt

Holding	Amount	Percentage	Interest Rate	Source
Consumer Credit	990.2	59.2	15.7%	Credit Card Rates in FRB
Misc. Debt	681.9	40.8	9.2%	Prime Rate + 2%

Finally, rental income in the NIPA tables is $116.6 billion. Capital income (K) is the sum of corporate income ($609.0 billion), net real interest income ($172.4 billion), and rental income ($116.6 billion), for a total of $898 billion.

Corporate tax liabilities come from the NIPA tables and equaled $144 billion in 1994. Personal dividends (D) are the NIPA dividends paid to persons ($211.0 billion) less dividends attributable to pension funds ($26.3 billion), or $184.7 billion.

The average tax rate on corporate income (O) is the ratio of corporate tax collections to capital income and equals 144/898 or .160. The ratio of pretax corporate profits to dividends (μ) equals 609.0/184.7 or 3.30. Finally, pretax corporate profits per dollar of dividends distributed equals $O\mu$ = .528. Finally, I use the adjusters for underreporting that Feldstein uses for dividends (.71) and interest income (.82). Thus, my formula for attributing corporate tax liability is

Corporate Tax Liability = .528*Div/.71 + .160*Int/.82 + .160*Rent.

Notes

I am grateful to John Sabelhaus for allowing me to use his family level extracts constructed from the CES and to Andrew Mitrusi for helpful discussions and advice.

Notes

[1]. A flat tax means different things to different people. Here, I mean what J. Meade, The Structure and Reform of Direct Taxation: The Report of a Committee Chaired by Professor J.E. Meade (London: George Allen and Unwin,

1978), has called an R-based tax, which is a tax on real transactions that ignores financial flows. Thus, interest payments are not deductible by borrower nor included as income by lender, nor is capital income taxed at the personal level. The Hall-Rabushka Flat Tax and a national Value Added Tax are both examples of a flat rate tax by this definition. The difference is that a VAT on sales tax taxes consumption, whereas the flat tax taxes income.

[2]. See, for example, W. Gale, S. Houser, and J.K. Scholz, "Distributional Effects of Fundamental Tax Reform," in Economic Effects of Fundamental Tax Reform, eds. H. Aaron and W. Gale (Washington: Brookings Institution, 1996).

[3]. E. Caspersen and G. Metcalf, "Is a Value Added Tax Regressive? Annual versus Lifetime Incidence Measures," National Tax Journal 47 (1994): 731-46.

[4]. A second approach to reducing the regressivity of a sales tax is to rebate some portion of the payroll tax (both employer and employee contribution). This approach, while in the spirit of the family allowances contained in the Hall-Rabushka flat tax, does not reduce the regressivity as much as the universal rebate mechanism. Readers who are interested in the distributional impact of the payroll tax rebate can obtain the results by writing to the author.

[5]. In this analysis, I assume that the new tax raises product prices rather than affects wages or capital income.

[6]. J.A. Pechman, Who Bears the Tax Burden? (Washington: Brookings Institution, 1985).

[7]. Variants on the annual approach abound. Musgrave, Case, and Leonard (1974) arrive at similar conclusions. Ballard, Scholz, and Shoven (1987) use a computable general equilibrium model to evaluate the introduction of a VAT in the U.S. economy. They find the VAT to be regressive when introduced as a partial substitute for the individual income tax. See R. Musgrave, K. Case, and H. Leonard, "The Distribution of Fiscal Burdens and Benefits," Public Finance Quarterly 2 (1974): 259-311; and C.L. Ballard, J.K. Scholz and J.B. Shoven, "The Value Added Tax: A General Equilibrium Look at Its Efficiency and Incidence," in The Effects of Taxation on Capital Accumulation, ed. Martin Feldstein (National Bureau of Economic Research, Cambridge, Mass.: 1987) 445-74.

[8]. Gale, Houser, and Scholz, 1996.

[9]. Ibid., Table 8-2, p. 290.

[10]. D. Feenberg, A. Mitrusi and J. Poterba, "Distributional Effects of Adopting a National Retail Sales Tax," Tax Policy and the Economy 10 (1996).

[11]. M. Friedman, A Theory of Consumption Function (Princeton, N.J.: Princeton University Press, 1957).

[12]. J.M. Poterba, "Lifetime Incidence and the Distributional Burden of Excise Taxes," American Economic Review 79, no. 2 (1989): 325-30; and J.M. Poterba, "Is the Gasoline Tax Regressive?" Tax Policy and the Economy 5 (1991): 145-64.

[13]. G. Metcalf, "The Lifetime Incidence of State and Local Taxes: Measuring Changes During the 1980s," in Tax Progressivity and Income Inequality, ed. J. Slemrod (New York: Cambridge University Press, 1993).

[14]. Feenberg, Mitrusi, and Poterba, 1996.

[15]. Caspersen and Metcalf, 1994.

[16]. D. Fullerton and D. Rogers, "Lifetime versus Annual Perspectives on Tax Incidence," National Tax Journal 44 (1991) 277-87; and D. Fullerton and D.L. Rogers, Who Bears the Income Tax Burden? (Washington: Brookings Institution, 1993).

[17]. Fullerton and Rogers first estimate age-wage profiles. Using data on individuals from the Panel Study of Income Dynamics, they regress the wage rate on time, the age of each individual, the age squared, the age cubed, and various demographic variables. The results of this regression describe how a person's earnings potential changes over time as a

consequence of age and the other factors. Once these profiles are determined, each person in the data set can be assigned a measure of his or her respective lifetime income. This is calculated by summing up the discounted values of the areas under the estimated age-wage profiles for each person.

[18]. Andrew B. Lyon, and R.M. Schwab, "Consumption Taxes in a Life-Cycle Framework: Are Sin Taxes Regressive?" Review of Economics and Statistics (77) 1991: 389-406. Lyon and Schwab use a similar approach to estimate the incidence of excise taxes on alcohol and tobacco. They discern little difference between the annual and lifetime approach for cigarettes but find alcohol taxes to be substantially less regressive in the life-cycle analysis.

[19]. D. Fullerton and D.L. Rogers, "Lifetime Effects of Fundamental Tax Reform," in Economic Effects of Fundamental Tax Reform, ed. H. Aaron and W. Gale (Washington: Brookings Institution, 1996).

[20]. Ibid., Table 9-4, p. 334.

[21]. None of these models consider in any detail the dynamics of growth and capital accumulation following a tax reform. The incidence results do not therefore explicitly take into account the impact of tax reform on economic growth.

[22]. J.M. Poterba, "Who Bears the Lifetime Tax Burden? A Book Review," National Tax Journal 44, no. 4 (1993): 539-42.

[23]. Fullerton and Rogers (1996), Poterba (1989 and 1991), and Metcalf (1993).

[24]. Strictly speaking, one cannot compare the results from a lifetime tax/lifetime income analysis (e.g., Fullerton and Rogers [1996]) to an annual tax/lifetime income analysis such as this one. While the approach used by Fullerton and Rogers is appealing on many grounds, it is computationally intensive and does not provide all the information that policymakers care about. Looking at steady-state lifetime tax burdens is important, but the distribution of annual tax liabilities is also of great interest in a world in which tax laws change with some frequency and policymakers face the electorate every few years.

[25]. This is a slightly different tax base and thus a slightly different tax rate than is derived in David Burton and Dan Mastromarco, "Emancipating America from the Income Tax: How a National Sales Tax Would Work," Cato Institute Policy Analysis no. 272, April 15, 1997.

[26]. This is an example of the tax prepayment approach to durables. Rather than try to tax the consumption of housing over its lifetime, we tax the purchase of the house itself under the assumption that the price of a house reflects the present discounted value of the stream of consumption services that the owner will receive over its lifetime.

[27]. G. Hufbauer, Fundamental Tax Reform and Border Tax Adjustments (Washington: Institute for International Economics, 1996). Taxing imports and rebating the tax on exports would be legal under the General Agreement on Tariffs and Trade.

[28]. Martin Feldstein, "Imputing Corporate Tax Liabilities to Individual Taxpayers," National Tax Journal 41 (1988): 37-60.

[29]. The size of the tax shift for this lowest income decile indicates one of the problems of the annual income approach: the tendency to magnify average tax rates as income is likely to be poorly measured and low relative to consumption. It is for this reason that Pechman (1985) dropped the bottom half of the lowest income decile from his analysis. The median change in tax rate for this decile is 32.9 percent. Except for the lowest decile, median and mean tax rates are fairly similar.

[30]. The Suits Index, a tax-based analogue to the Gini Coefficient, ranges from -1 to 1 with negative values indicating a regressive tax and positive values a progressive tax. Since I attribute the corporate income tax to households in this study, the Suits Index for the income tax that I report is not comparable with estimates of the Suits Index reported elsewhere for the personal income tax.

[31]. Burton and Mastromarco.

[32]. Burton and Mastromarco (1997) propose grossing up the rebate so that disposable income after the rebate is brought up to the poverty threshold. Structuring the rebate that way would not change the distributional impact of the tax reform in any substantive way.

[33]. These tax rates are much higher than those estimated in the Burton-Mastromarco study (1997) because of different assumptions about the treatment of government spending under a national retail sales tax.

[34]. Issues of fairness in the transition may still exist.

[35]. See Laurence Kotlikoff, "The Economic Impact of Replacing Federal Income Taxes with a Sales Tax," Cato Institute Policy Analysis, no. 193, April 15, 1993.

[36]. Ibid.

[37]. I use the regression with imputed fixed effects in Caspersen and Metcalf (1994).

[38]. L. Lillard, "Inequality: Earnings vs. Human Wealth," American Economic Review 67 (1977): 42-53. There is considerable evidence of skew in the distribution of income. Large positive skew indicates outliers with large income. If consumption is less skewed than income, income skew will drive down average tax burdens in the top decile.

[39]. There is substantial evidence of large uncertainty in earned income (Abowd and Card [1979]) as well as high persistence in shocks to earnings (Parsons [1978]). My parameter choices follow those of Engen and Gale (1993). See J. Abowd and D. Card, "On the Covariance Structure of Earnings and Hours Changes," Econometrica 57 (1989): 411-46; D. Parsons, "The Autocorreleation of Earnings, Human Wealth Inequality, and Income Contingent Loans," Quarterly Journal of Economics 92 (1978): 551-69; and E. Engen and W. Gale, "IRAs and Saving in a Stochastic Life-Cycle Model," mimeo (Washington: Brookings Institution, 1993).

[40]. J. Hausman and W. Taylor, "Panel Data and Unobservable Individual Effects," Econometrica 49 (1981): 1377-98.

[41]. Another way to think of the estimated individual effect is as the combination of unobservable individual characteristics (e.g., taste and ability) and observable characteristics (e.g., education).

[42]. The income classes were $5,000 to $10,000; $10,000 to $15,000; $15,000 to $20,000; $20,000 to $30,000; $30,000 to $40,000; $40,000 to $50,000; $50,000 to $75,000; and above $75,000.

[43]. M. Feldstein, "Imputing Corporate Tax Liabilities to Individual Taxpayers," National Tax Journal 41 (1988): 37-60.