Measuring the Incidence of a National Retail Sales Tax

by

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Executive Summary

I use data from the Consumer Expenditure Survey (CES) to measure the lifetime incidence of a shift from the current income tax to a National Retail Sales Tax. I show that the distribution of the tax 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. When lifetime income is used to rank households, the tax reform continues to look regressive though much less regressive than when the annual income approach is used.

I also consider various ways to add progressivity to the new tax system. If a universal rebate tied to poverty thresholds is coupled with the national sales tax, the system looks nearly as progressive as the current income tax system when households are ranked by lifetime income. The universal rebate in effect exempts from the sales tax spending by individuals and families up to the poverty threshold. Using the poverty threshold to construct the rebate has the advantage that larger families have more of their consumption exempt from the sales tax than do smaller families. I also consider a rebate of the employer and employee portions of the payroll tax. Because the rebate is targeted towards workers, it is not as effective at mitigating the regressivity of the sales tax as is the universal rebate.

There are two essential messages of this paper. First, whether we rank people by annual or lifetime income makes a big difference when measuring the progressivity of a national sales tax. Second, it is relatively easy to construct a sales tax that is nearly as progressive as the current income tax. The universal rebate option is a good example of how one could proceed.

I. 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 roughly a dozen proposals for substantive tax reform. The proposals fall into 3 broad categories: a Flat Tax, a Consumed Income Tax, and a Retail Sales Tax[1]. A major concern with any of the broad based consumption tax proposals is that they are perceived to be highly regressive relative to the current income tax. Much of this perception follows from the idea that rich people do most of the saving and that therefore any move to a consumption tax will release a substantial share of income from taxation. Incidence studies using annual income support this view; distributional tables for a shift from an income to a consumption tax show the reform to be highly regressive (see, for example, Gale, Houser, and Scholz (1996)). A major problem with annual incidence studies of consumption taxes is that lifecycle income and savings patterns distort the measured incidence of a consumption tax in a pronounced regressive direction.

The goal of this paper 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 retail sales tax (RST) using a lifetime income approach that I have used elsewhere (Caspersen and Metcalf (1994)). In addition, I consider possible variants on a broad based national sales tax to increase progressivity. One approach is to provide a family rebate equal to the poverty level times

[1] A flat tax means different things to different people. Here, I mean what Meade (1978) has called an R-based tax. It is a tax on real transactions and 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 tax by this definition.

the sales tax rate. A second approach is to rebate some portion of the payroll tax (both employer and employee contribution). This second approach is in the spirit of the family allowances contained in the Hall-Rabushka Flat Tax. What I find is that with a lifetime incidence approach a national sales tax is not nearly as regressive as it appears using an annual incidence approach. Moreover, additional progressivity can be built into the tax system. In fact, with 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.

In the next section, I describe the annual and lifetime incidence approaches and why they might differ in their conclusions. I also survey results from previous analyses of broad based consumption taxes. I then describe the methodology used in this study. Section IV presents the results of my analysis and section V concludes.

II. How Does An Economist Measure 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". There is often some confusion as to the meaning of these terms and so it is worth defining them carefully. The definition that most economists use relies on the average tax rate - the ratio of tax liabilities to income.[2] A tax is said to be regressive if the average tax rate falls with income. It is proportional if the average tax

[2] More precisely, the numerator is the change in real disposable income resulting from the change in the tax law. If a new tax is imposed, the change in disposable income might occur because prices have gone up so that a given income purchases fewer goods and services or it might occur because wages have fallen. In this analysis, I assume that the new tax raises product prices rather than affecting wages or capital income.

rate is constant and it is progressive if the average tax rate rises with income. Low income people pay a higher (lower) fraction of their income in taxes if the tax is regressive (progressive).

Early tax incidence studies used the results of partial or general equilibrium models to inform judgments about relevant incidence results. In effect, these studies used existing research results to generate plausible assumptions about the incidence of specific taxes. Pechman (1985) represents the classic example of this type of research. The time frame for analysis is one year, and Pechman assumes that consumption taxes are passed forward and borne by consumers in proportion to their expenditures. Taking this approach, Pechman finds that consumption taxes are quite regressive.[3] A recent study by Gale, Houser, and Scholz (1996) confirms this view. 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% increase) while the highest income group would see their average tax rate decrease by 7.1 percentage points (17% decrease).[4] Similarly, Feenberg, Mitrusi, and Poterba (1996) find that there would be a substantial shift in tax burden to the poor in shifting from the income tax to a retail sales tax.

An alternative approach utilizes estimates of lifetime income as a measure of the taxpaying unit's economic well-being. Invoking Friedman's (1957) permanent income hypothesis as well as life-cycle considerations, economists have long recognized that annual income may not be a very good measure of an individual's potential to consume. With perfect capital markets, individuals

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[3] Variants on the annual approach abound. Musgrave, Case, and Leonard (1974) arrive at similar conclusions. Ballard, Scholz, and Shoven (1987) use a CGE model to estimate the incidence associated with 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.

[4] Table 8-2, page 290 of Gale, Houser, and Scholz (1996).

should be grouped according to the present discounted value of earnings plus gifts received. This theory makes the difficulties with the annual incidence approach readily apparent. People tend to earn the highest incomes in their life 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 (as well as some people with volatile incomes who have obtained a low realization) 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.

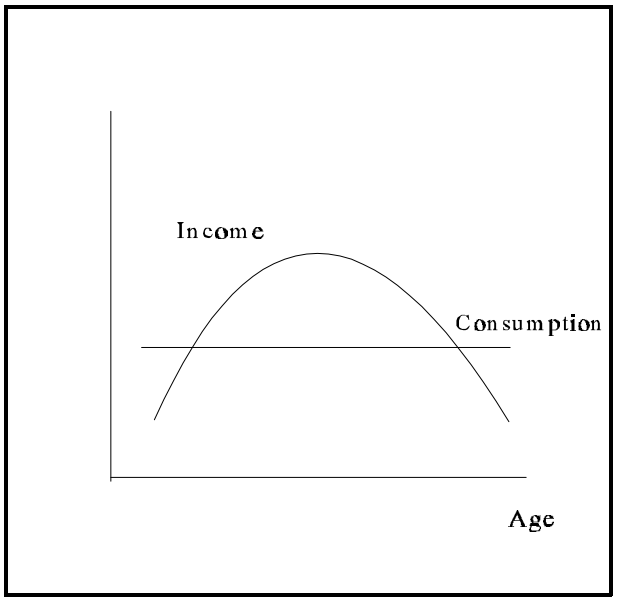

Figure 1. Lifetime Income and Consumption Profiles

To see why a lifetime approach makes a difference, imagine a world with identical people with identical skills and an identical pattern of earnings over their lifetime. Figure 1 illustrates the lifetime income and consumption paths of a typical person in this imaginary society. Income is initially low and rises to a peak in the middle years. It than falls as this worker gradually cuts back on work and enjoys more retirement leisure. Consumption 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'll assume that all savings are consumed so that at death there are no assets remaining.

Next assume that there is one person of each age in this society. Otherwise people are identical. Figure 1 now has an additional interpretation. In addition to it indicating consumption and income patterns over an individual's lifetime, it also shows income and consumption patterns for our society of individuals at any one point in time. 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 (based on where people are on their lifetime income schedule), the average tax rate (taxes as a fraction of annual income) will fall as income rises. 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.

Relative to annual income, lifetime income is more difficult to measure. Poterba (1989, 1991) has proposed using consumption as a proxy for lifetime income, arguing that since household consumption tends to be smoother than income, total annual consumption is likely to be a better measure of household well-being than total annual income. Using data on total expenditures from the Consumer Expenditure Survey, Poterba finds that excise taxes on alcohol, tobacco, and gasoline are much less regressive than they appear when viewed in an annual income framework. Metcalf (1993a) has used a similar approach to analyze state and local tax systems. Like Poterba's findings for excise taxes, he finds that the system of state and local taxes is less regressive when consumption is used to proxy for lifetime income. Feenberg, Mitrusi, and

Poterba (1996) 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. This study is a much more comprehensive study than many of the previous studies in that it considers the personal income tax, the corporate income tax and the estate tax. It merges data from a number of data sources to construct a comprehensive dataset on consumption and income. Using consumption as a proxy for lifetime income, they find that the regressivity of the shift measured using annual income is substantially reduced and that the shift can in fact be progressive with sufficient efforts to add progressivity to the system (lump sum grants or exempting certain categories of spending from the tax base).

The advantage of the approach taken by Feenberg, Mitrusi, and Poterba (hereafter FMP) is its simplicity. Distributional tables can be constructed using data readily available in a single year. The disadvantage is that current consumption may not be a very good proxy for lifetime income. In previous work I have shown (Caspersen and Metcalf (1994)) that distributional tables for consumption taxes using current consumption as a proxy for lifetime income underestimate the regressivity of a consumption tax. This is because the current consumption approach assumes that consumption is roughly constant over the lifetime. However, consumption exhibits the same kind of "hump" that income does over the lifetime (though not as pronounced). The same kinds of errors that occur when ranking people by annual income persist to an extent when people are ranked by consumption. Thus we should view the FMP results as upper bounds on the progressivity of a shift from income to consumption taxation. Since these are upper bounds, we cannot conclude from their analysis that the retail sales tax shift with the progressive elements they model (e.g. lump sum rebates) is actually a progressive shift.

One approach to resolving this problem is to use an explicit computable general equilibrium lifecycle model to investigate the incidence of tax reforms. The work by Fullerton and Rogers (1991 and 1993) is perhaps the best work in this area. The authors 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.[5] 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.

Once individuals are categorized by the present value of lifetime wage potential, Fullerton and Rogers then proceed to re-estimate profiles for each group and to calculate tax incidence estimates based on the age-income profiles and the lifetime income measurements. They find that both the corporate and individual income taxes appear to be less progressive in a life-cycle framework, while sales and excise taxes appear to be less regressive. It is also noted that, despite these changes, the overall incidence of the U.S. tax system seems to be about the same as it has been estimated under an annual income framework.[6]

Fullerton and Rogers present the most careful analysis of lifetime tax incidence to date.

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[5] The wage rate is used here as a measure of annual endowment so that leisure and the utility associated with it can be incorporated into the model.

[6] Lyon and Schwab (1991) use a similar approach to estimate the incidence of excise taxes on alcohol and tobacco. They find little difference between the annual and lifetime approach for cigarettes but find alcohol taxes to be substantially less regressive in the life-cycle analysis.

Their most recent paper (1996) considers the steady-state intragenerational incidence of a shift from the current income tax to a proportional VAT (with and without various progressive features). A proportional VAT reform continues to be regressive with welfare losses of 4.3% for the lowest lifetime income group and welfare gains of 10% for the highest lifetime income group (Table 9-4, page 334). A $10,000 household consumption exemption generates progressivity at the lower end of the income distribution (roughly through the 6th decile) but the tax continues to be regressive in the higher deciles[7].

Note that there are different "lifetime" experiments that one can analyze. As Poterba (1993) points out, one can look at lifetime tax burdens and/or lifetime income. Fullerton and Rogers (1996) look at the lifetime tax burden relative to lifetime income whereas Poterba (1989, 1991) and Metcalf (1993a, 1993b) look at annual tax burdens relative to lifetime income. 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. Strictly speaking, one cannot compare the results from a lifetime tax/lifetime income analysis (e.g. Fullerton and Rogers) 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 policy makers care about. Looking at steady state lifetime tax burdens is important but the distribution of annual tax

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

liabilities is also of great interest in a world in which tax laws change with some frequency and policy makers face the electorate every few years. The approach I use in this paper uses readily accessible information from annual data similar (and in some cases identical) to data used by FMP to distribute the tax reform but uses a measure of lifetime income constructed from lifetime earnings profiles. Appendix A discusses 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.

III. Analysis of Tax Reform Using 1994 Data

I consider a shift from an income tax to a national sales tax using data from the 1994 Consumer Expenditure Survey. 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 roughly 80% of the revenue coming from the personal income tax (see Table 1 below). Personal consumption expenditures in that year amounted to $4698.7 billion. 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, the imputed value of financial services, non-profit activities, and food produced and consumed on farms would not be taxed. 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.[8] Next, I include net foreign spending in the United States in the sales tax base[9]. The first column of Table 1 indicates that the adjusted tax base would be $3.8 trillion and a tax rate of 18.2% 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%. In the analysis I do below, I include non-profit activities in the tax base to the extent that they show up as a component of spending by households. However, I do not include imputed financial services in the base.

[8] 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.

[9] Taxing imports and rebating the tax on exports would be GATT legal (see Hufbauer (1996).

Table 1. Aggregate Consumption and Taxation		
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	4,698.7
Adjustments to Personal Consumption Expenditures:		
Indirect Taxes	(266.9)	(266.9)
Owner Occupied Housing	(280.2)	(280.2)
Imputed Financial Services	(146.0)	0.0
Non-Profit Activities	(236.6)	0.0
Farm Food	(0.5)	(0.5)
Net Foreign Spending	19.8	19.8
Consumption Tax Base	**3,788.3**	**4,170.9**
Retail Sales Tax Rate	**18.2%**	**16.5%**

I use micro data from the Consumer Expenditure Survey to distribute the income and sales taxes. There are 3 adjustments I must make to the CES 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 HMOs and insurance companies. I use data from the National Medical Expenditure

Survey (NMES) to attribute medical spending to individual households to replace the health spending reported in the CES. 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 Feldstein (1988). I provide details on these adjustments in Appendix B.

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

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

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% of

the households in the lowest quintile for annual income have lifetime income in the 3rd or higher lifetime quintile. More striking is the fact that 15% of the households in the highest annual income quintile are in the lowest 40% of the distribution of lifetime income. The correlation between annual and lifetime income quintiles in the sample is .45. Based on Table 2, I should expect considerable difference between distributional results based on annual income rankings and lifetime income rankings.

Section IVA - Broad Based Retail Sales Tax

My first analysis considers a shift from the current income tax to a broad based retail sales tax. The tax base is quite comprehensive. Housing services are not taxed per se but are taxed at the time of purchase of the house. The same approach is used for other durable goods. Medical services are included in the tax base as are other services. Table 3 shows the distribution of a shift from the income tax to a broad based income tax using an annual income incidence approach. Households are ranked by annual income. The second column shows the change in tax liability in 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. Tax liabilities increase for the bottom 70% of the income distribution and decrease for the top 30%. The changes are quite substantial with the lowest income decile seeing their average tax rate increase by 64 percentage points.[10] Meanwhile the

[10] The size of the tax shift for this lowest income decile indicates one of the problems of the annual income approach. It tends to magnify average tax rates as income is likely to be poorly measured and also 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%. Except for the lowest decile, median and mean tax rates are fairly similar.

top decile's average tax rate falls by 7%. 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.[11]

Table 3. Distribution of a Broad Based Retail Sales Tax: Annual Basis		
Decile	Change in Tax Liability	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

Much of the regressivity of the tax reform is eliminated when I shift to 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 regressive - the lowest 70% of the income distribution face tax increases while the top 30% enjoy tax

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

decreases. However the differences are not nearly as large 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 average increase in their 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.

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

Decile	Change in Tax Liability	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

Next I explore different ways to add progressivity to a national sales tax. One approach is to provide a family rebate. I model the rebate on the proposal of Burton and Mastromarco (1996). A second approach is to rebate payroll tax payments up to some maximum amount. A work related rebate makes the retail sales tax mimic in important ways the operation of the Hall-Rabushka Flat Tax which excludes from the wage tax some amount of earned income up to a

maximum amount based on family size. The size of the payroll tax rebate that I consider is related to the amount of earnings (up to a ceiling) and the number of workers making payroll tax contributions. Thus a dual working couple might receive a rebate of $4,000 while a similar couple in which one spouse does not work might receive a rebate of $2,000.[12]

IVB. A Family Rebate

Burton and Mastromarco (1996) have proposed providing universal rebates to households equal to the poverty level to build progressivity into the tax system. In this section, I consider the impact of this proposal on the distribution of the retail sales tax. Poverty thresholds for 1994 ranged from $7,107 for an elderly unrelated individual to $30,285 for a family of size 9 (see Table 5 below). The rebate would equal the tax rate times the poverty threshold for a given family size[13]. In effect, the rebate removes from the tax base an amount equal to the sum of poverty thresholds for each family unit in the United States added up over all family units. Call this amount the aggregate rebate base. Based on extrapolations from the Consumer Expenditure Survey data set for 1994, the aggregate rebate base would equal $1.15 trillion. Assuming that non-profits and imputed financial services are included in the tax base, the revenue neutral tax rate would rise from 16.5% to 22.8%.

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[12] This example rebates payroll taxes up to a maximum of $2,000 per worker. I rebate both the employer and the employee's payroll tax contribution. For example, a worker making $1,500 in contributions out of his paycheck would be eligible for the full $2,000 rebate since the total contribution on her behalf is assumed to be $3,000.

[13] Burton and Mastromarco 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.

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 presents annual incidence results for a broad based national sales tax with a universal rebate based on poverty thresholds.

Table 6. Distribution of a Broad Based Retail Sales Tax with Universal Rebates: Annual Basis		
Decile	Change in Tax Liability	Change in Average Tax Rate
1	1,767	40.9
2	2,245	19.1
3	2,522	14.2
4	2,345	9.6
5	2,027	6.6
6	636	1.5
7	2,079	4.4
8	-256	-0.3
9	-47	-0.1
10	-13,308	-5.8

Compared to Table 3, the tax is modestly less regressive. However it continues to look very regressive. The Suits Index for the sales tax with rebate is -0.155 indicating considerable regressivity (relative to the income tax system it replaces for which the Suits Index equals 0.202). The story changes dramatically when I rank people by lifetime income (see Table 7 below). Now there is no clear pattern to the change in average tax rates. The change 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).

Table 7. Distribution of a Broad Based Retail Sales Tax with Universal Rebates: Lifetime Basis		
Decile	Change in Tax Liability	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

If you compare Table 4 to Table 7, 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 not impossible to structure a consumption tax that is broadly progressive[14].

IVC. Rebating the Payroll Tax

A universal rebate may be viewed as too expansive a program and that 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

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

to $2,000 per worker. I first estimate for each earner in the sample the rebate that he or she is eligible for. For example a household with two workers that pay $1800 and $600 in employee payroll taxes would be eligible for a rebate of $3200. The worker that paid $1800 in payroll tax also has attributed $1800 in employer contributions on her account for a total of $3600 in payroll taxes. She would be eligible for a rebate of $2000. Similarly, the worker with $600 in employee contributions would have attributed an additional $600 of employer contributions. The entire $1200 of payroll taxes would be rebated. Results are shown for annual income incidence measures in Table 8. The reform continues to look quite regressive with average tax rates within deciles falling on average and the top 30% of the income distribution benefitting from the reform at the expense of the lowest 70% of the distribution. The Suits Index is -0.222, not substantially different than the index for the broad based sales tax.

Table 8. Distribution of a Broad Based Retail Sales Tax with $2,000 per worker Payroll Tax Rebate: Annual Basis		
Decile	Change in Tax Liability	Change in Average Tax Rate
1	3,252	81.9
2	3,368	28.8
3	3,266	18.8
4	2,775	11.2
5	2,155	7.5
6	227	0.2
7	1,532	3.3
8	-957	-1.5
9	-1,152	-1.5
10	-14,450	-6.6

Table 9 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 (save the third decile) faces higher taxes. Now the Suits Index equals 0.016 (compared to 0.068 for the income tax) indicating a slight though by no means large regressive shift in distribution due to the tax reform.

Table 9. Distribution of a Broad Based Retail Sales Tax with $2,000 per worker Payroll Tax Rebate: Lifetime Basis		
Decile	Change in Tax Liability	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

V. 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. However, the analysis using annual income dramatically overstates the regressivity of the shift. Various efforts to add progressivity to the tax system can mitigate against 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 a measure of lifetime income. I also considered an approach that rebates payroll tax contributions and found that it does not reduce regressivity substantially, probably due to the fact that many

poor people do not earn incomes sufficient to pay substantial payroll taxes that can then be rebated. However, this proposal might be attractive when viewed in a larger context. First, the payroll rebate has the advantage of targeting aid to the working poor and can be viewed as a replacement for the Earned Income Tax Credit. Second, non-working poor continue to be eligible for welfare benefits and the payroll tax credit can be viewed as an auxiliary subsidy for those poor not eligible for welfare.

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, would render the lifetime income approach objectionable. While it may be reasonable to criticize the lifetime incidence approach as making heroic assumptions about people's ability to make consumption decisions at any point in time based on their lifetime pattern of income, it is equally reasonable to criticize the annual income approach for ignoring any savings and asset accumulation that allows consumption to depend on income at other points in time. Thus, one might reasonable think of incidence analyses as falling along a continuum with a strict annual income approach at one end of the continuum and a strict lifetime income approach at the other end. 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 more regressive than when measured using a lifetime income approach, it is surely less regressive 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) that one should not focus unduly on the distributional considerations discussed in this paper. Rather, one might better focus on the efficiency gains possible under realistic implementations of a national sales tax, along with

administrative considerations and transitional issues.

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 induce a transfer from the current elderly to the current young.[15] How one deals with the transition is an important topic but beyond the scope of this paper.

[15] See the analysis by L. Kotlikoff summarized in a Cato Institute Policy Analysis (1993).

Appendix A - Measuring Lifetime Income

In this appendix, I sketch out the model with which I estimate lifetime income. This approach is based on Caspersen and Metcalf (1994). 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):

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

where ρ 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 in Caspersen and Metcalf (1994) to compute lifetime income in the CES for this study. The income measures from the Caspersen and Metcalf income profiles are updated to 1994 dollars using the 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:

$$W_i = \sum_{t=1}^{n} \frac{\hat{Y}_{it}}{(1+\rho)^t} \qquad (2)$$

where $\hat{Y}_{it}$ 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.[16] Additional adjustments to the lifetime income measure are detailed below. I annualize my 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.[17]

I make two adjustments to the income profiles described above. The first adjustment is an attempt to generate an income distribution that more accurately reflects measured income distributions. The second adjustment attempts to recover the fixed effect from the 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 randomness in the income measure that is due to annual temporary income fluctuations while maintaining the stochastic elements of income that affect variance and skew in a persistent way.[18] 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

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[16] I use the regression with imputed fixed effects in Caspersen and Metcalf.

[17] The annual equivalent (Y) is given by the formula $Y = \left[\frac{1}{\rho} - \frac{1}{\rho(1+\rho)^t}\right]$, when ρ is the interest rate and T the length of contract.

[18] There is considerable evidence of skew in the distribution of income (e.g. Lillard (1977)). 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.

random shock to log income with first-order auto-correlation of .85 and variance of the innovation of .05.[19] This will add skew to the distribution of lifetime income.

My measure of lifetime income comes from a regression in the PSID which 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 (1981). Hausman and Taylor 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.[20] 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, Hausman and Taylor note the need for instruments for the exogenous time-invariant variables.

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[19] There is substantial evidence of large uncertainty in earned income (e.g. Abowd and Card (1979)) as well as high persistence in shocks to earnings (e.g. Parsons (1978)). My parameter choices follow those of Engen and Gale (1993)).

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

In my case, current consumption itself is used as a proxy for the estimated individual effect. I proceed by assuming that education is correlated with the true fixed effect and instrument for the education dummies 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.

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

Appendix B - Adjustments to Consumer Expenditure Survey Data

I. Attributing Health Care Spending to Individuals

While the bulk of spending on health care is done on behalf of households by insurance companies and health care organizations, the CES only records 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 (NMES), a nationally representative sample that followed spending by roughly 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 NIPA aggregates for the two years. I regressed total medical spending on income indicator variables[21], an indicator variable for the presence of elderly family members, an indicator for the presence of children under the age of 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.

II. Imputing Corporate Tax Liabilities to Individuals

I follow the methodology set out in Feldstein (1988) to impute corporate tax liabilities to individuals. The approach compute two numbers: 1) the ratio of corporate taxes to total capital

[21] The income classes were 5000 to 10000, 10000 to 15000, 15000 to 20000, 20000 to 30000, 30000 to 40000, 40000 to 50000, 50000 to 75000 and above 75000.

income (θ) and 2) the ratio of pretax corporate profits to dividends (μ). Under the assumption that corporate income taxes are borne by all capital income, θ represents the average tax rate on capital income. Taxes on corporate income are taxes on distributed and non-distributed 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 (I), 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 θ and μ:

$$\theta = T/K$$

$$\mu = C/D$$

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 $506.0 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%. Thus corporate profits should be increased by (.026)($2,627.4) = $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:

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 mo. Commercial Paper
Govt Bonds	362.5	48.7	7.1%	10 yr G bonds
Corp Bonds	233.4	31.4	8.6%	Baa Bonds

This implies a nominal interest rate (ρ) of 6.8%. The real rate (r) is given by $(1+\rho)/(1+\pi)-1$ which in this case equals 4.1%. 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) = $34.7 billion. Corporate profits are the sum of reported corporate profits (506.0), the decrease in corporate debt due to inflation (68.3), and real pension interest income (34.7) for a total of $609.0 billion.

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:

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 mo. Commercial Paper
Govt Bonds	925.8	20.0	7.1%	10 yr G bonds
Corp Bonds	346.3	7.5	8.6%	Baa Bonds

This gives a nominal interest rate of 4.4% and a real interest rate of 1.8%. Thus real personal interest income is (1.8/4.4)(661.6) = $263.8 billion.

Personal interest expenses (excluding mortgage interest) is $117.2 billion. The nominal interest rate is based on:

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%

This gives a nominal interest rate of 13.0%, a real rate of 10.1% and an adjustment factor of .780. Thus real interest expenses are (.780)(117.2) = $91.4 billion. Net real interest income is the difference of real interest income (263.8) and real interest expenses (91.4) or $172.4 billion. Finally, rental income in the NIPA tables is 116.6 billion. Capital income (K) is the sum or corporate income (609.0), net real interest income (172.4) and rental income (116.6) for a total of $898.0 billion.

Corporate tax liabilities come from the NIPA tables and equal $144.0 billion in 1994.

Personal Dividends (D) are the NIPA dividends paid to persons (211.0) less dividends attributable to pension funds (26.3) or $184.7 billion.

The average tax rate on corporate income (θ) is the ratio of corporate tax collections to capital income and equals 144.0/898.0 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 $\theta\mu$ = .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

$$\text{Corporate Tax Liability} = .528*\text{Div}/.71 + .160*\text{Int}/.82 + .160*\text{Rent}.$$

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