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IS A VALUE ADDED TAX PROGRESSIVE? ANNUAL VERSUS LIFETIME INCIDENCE MEASURES

Erik Caspersen

Gilbert Metcalf

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ABSTRACT

We measure the lifetime incidence of a value added tax (VAT) using income data from the Panel Study of Income Dynamics (PSID) and consumption data from the Consumer Expenditure Survey (CEX). When annual income is used as a measure of economic well-being, a VAT looks quite regressive. However, the results change significantly when the analysis is done using lifetime income. Using two different measures of lifetime income, we find that a VAT in the United States would be proportional to slightly progressive over the lifetime.

Erik Caspersen
Department of Economics
Princeton University
Princeton, NJ 08544
and London School of Economics

Gilbert Metcalf
Department of Economics
Fisher Hall
Princeton University
Princeton, NJ 08544-1021
and NBER

1. Introduction

Currently, more than 50 nations employ a Value Added Tax (VAT). Unlike 20 of the 25 members of the Organization for Economic Cooperation and Development, the United States does not employ some form of this tax.[1] The lack of a VAT in the United States is striking, given its significant revenue-raising potential. According to the Congressional Budget Office (1993), a broad-based VAT imposed at a 5% rate beginning in 1995 could raise close to $70 billion in its first year. A VAT that excluded food, housing, and medical care could raise $36 billion. That the United States has never adopted a VAT is not for lack of supporters. In 1985 Senator Roth proposed a VAT-type tax in the belief that it would promote saving. Four years later, a VAT was proposed to reduce the budget deficit. In early 1992, Democratic presidential candidate Edmund G. Brown, Jr., campaigning during the primaries proposed a VAT as a major part of his plan to revamp the U.S. tax code. Even foreign countries have urged the United States to adopt a VAT. In late 1992, the Organization of Economic Cooperation and Development urged the United States to increase the federal gasoline tax by 25 cents per gallon and institute a 5 percent national sales tax.[2] The OECD has been joined by the authors of a recent Twentieth Century Fund report (Ferleger and Mandle (1992))

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[1] Congressional Budget Office (1992).

[2] New York Times, Dec. 6, 1992. For a discussion of the various ways a VAT can be implemented and of the various types of adjustments that can be applied to a flat, general VAT, see CBO (1992).

who propose reducing the personal income tax burden on low and middle income families while raising the burden slightly on upper income families and imposing a VAT.

Why has a value added tax never been adopted in the United States?[3] A major reason is that many liberals have resisted a VAT because of the perceived incidence of the tax. A value added tax ultimately is a tax on goods and services and thus is a tax on consumption. Conventional economic wisdom holds that consumption taxes are passed forward to the consumer (viz. Pechman (1985)). The claim has been made that poor people spend greater percentages of their income on consumption than rich people and thus would pay a greater percentage of their income on the VAT tax. In other words, the VAT would be regressive.[4]

The primary purpose of this paper is to investigate whether a VAT in the United States would really be regressive, and if so what alterations could be made to mitigate its regressivity. The major innovation of this paper is to measure the lifetime incidence of a VAT. With this approach we consider the average tax burden as a fraction of the lifetime income of a household. This is in contrast to annual incidence analyses which measure the well-being

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[3] The resistance is so widespread that when lawmakers consider a VAT, they refuse to label it as such. For example, Reps. Richard Schulze and Frank Guarini introduced a Uniform Business Tax in August of 1991. While essentially a subtraction style VAT, nowhere in the proposal are the words Value Added Tax used.

[4] Conservatives are also suspicious of a VAT arguing that it is a "hidden" tax and will act as a money machine for the federal government, driving revenues up (and hence expenditures). We do not deal with this argument in our paper. For evidence on this point, see Stockfish (1985).

of a household by annual income. We will look at two measures of lifetime income: one measure generated from the Panel Study of Income Dynamics (PSID) and a second from the Consumer Expenditure Survey (CEX).

In brief, we find that over the life cycle, a VAT need not be regressive and in fact can be moderately progressive. When food, housing, and health expenditures are zero rated, the tax looks distinctly progressive. However the results are to some degree sensitive to how lifetime income is defined. But, under both measures of lifetime income the tax is decisively less regressive when a life-cycle framework is used than when an annual framework is used.

We begin in Section 2 with a review of the relevant literature and a consideration of some of the theoretical issues involved in such an analysis. Section 3 proceeds with the specification and estimation of a life-cycle incidence model. In Section 4 we discuss the model's findings and conclude.

2. Incidence Theory and the Value Added Tax

In this section, we discuss the various approaches used to estimate the incidence of consumption taxes such as a VAT. We then describe at a general level the approach we will use. One approach uses the results of general equlibrium models to inform judgments about relevant elasticities. In effect, this approach uses existing empirical work 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. In a similar vein, Messere and Norregard (1989) estimate VAT incidence using a partial equilibrium approach. The VAT burdens were fairly regressive over the income deciles; that is average tax burdens fall as income rises. Messere and Norregard conclude that value added taxation is somewhat regressive.[5]

An alternative approach is to construct computable general equilibrium (CGE) models which allow for relative prices to adjust. Shifting of the tax occurs as a function of underlying utility and production functions. Using a CGE model, Ballard, Scholz, and Shoven (1987) estimate the incidence associated with the introduction of a VAT in the U.S. economy. A VAT is assumed to be a partial substitute for the individual income tax. The basic result of this analysis is that the implementation of a VAT, without alterations such as zero-rating or exemptions, produces welfare losses for lower income cohorts and welfare gains for higher ones. The tax continues to be regressive.

A third 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

[5] Variants on the annual approach abound. Musgrave, Case, and Leonard (1974) arrive at similar conclusions. Brashares et al. (1988) analyze a VAT using an annual income measure which adds pension income less pension accruals. They too find the VAT to be substantially regressive.

considerations, economists have recognized that annual income may not be a very good measure of an individual's potential to consume. With perfect capital markets, individuals 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.

Over the past couple of years several economists have examined the incidence of various taxes using life-cycle models. Fullerton and Rogers (1991 and forthcoming) estimate lifetime income in a large scale multigeneration CGE framework. The authors first estimate age-income 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.[6] The results of this regression describe how a person's earnings potential changes over time as a

[6] 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.

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-income profiles for each person.

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[7].

Fullerton and Rogers present the most careful analysis of lifetime tax incidence to date. Two comments should be made when comparing their results on sales and excise taxes to our results on a VAT. First, as the authors note, sales and excise taxes are not equivalent to a uniform consumption tax. The tax rates facing consumers (on a tax exclusive basis) in their study range from 0 (housing) to 79% (tobacco). Much of the regressivity of sales and excise taxes is due to the fact that necessities tend to be taxed at higher rates than luxury goods. Second, Fullerton and Rogers'

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[7] 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.

use of a Stone-Geary utility function with no minimum required purchase of leisure contributes to the regressivity of the tax.[8] With no minimum required consumption purchases assumed, (variant F in their sensitivity analysis) the authors find that sales and excise taxes now look effectively proportional.

As an alternative to Fullerton and Roger's approach, 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 (1992) 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 more progressive when consumption is used to proxy for lifetime income.

Why do consumption taxes look more progressive under a lifetime tax incidence analysis? Consider two equations for the uses of income in a simple framework in which there are no

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[8] Leisure is untaxed by a VAT. The leisure to income ratio increases from zero and approaches the leisure share parameter from below as income increases. By contrast, the consumption to income ratio will be positive at low levels of income. With one (taxable) consumption good, the ratio would equal 1 until the minimum required consumption was achieved at which point the ratio would decline toward consumption's share parameter.

bequests:

$$Y = C + S \tag{1}$$

$$W = \sum_t \frac{C_t}{(1+\rho)^t} \tag{2}$$

In equation (1) annual income (Y) is allocated between consumption (C) and saving (S). The average tax rate of a consumption tax is given by

$$\frac{\tau C}{Y} = \tau\left(1 - \frac{S}{Y}\right) \tag{3}$$

where τ is the tax rate. Assuming a consumption tax is passed forward to consumers, it is regressive (in an annual context) to the extent that the savings ratio increases with income.

Now consider a consumption tax in a lifetime tax incidence framework. Equation (2) states that lifetime income is simply the present discounted value of consumption over the individual's life. If the tax were applied to all consumption, the tax liability would equal τC in any year and the present discounted value of the lifetime tax payments (discounted at rate ρ) would equal

$$\sum \frac{\tau C_t}{(1+\rho)^t} = \tau W \tag{4}$$

The average tax rate (lifetime tax/W) would simply equal the statutory rate τ. The tax is proportional.

Real life is more complicated. First, bequests are typically not subject to consumption taxation. Hence, to the extent that

bequests rise with income, we will overstate the progressivity of a consumption tax. Menchik and David (1982) find that the ratio of expected bequests to lifetime earnings is U-shaped with the trough at the 80^{th} percentile. This suggests that ignoring bequests will only overstate the progressivity of a consumption tax for the top of the income distribution and that in fact over the rest of the distribution, we might be underestimating the progressivity of the tax by ignoring bequests.

Second, in addition to excluding bequests from the tax base, consumption taxes tend to tax at lower (or zero) rates items such as food, housing, and medical care. To the extent that these excluded items are necessities, a consumption tax will tend to move toward progressivity

Like recent researchers in this area, we propose to engage in a lifetime incidence analysis. We take two approaches to the measurement of lifetime income. First, we use current consumption as a proxy for lifetime income. This allows us to work entirely within the CEX. Second, we provide an alternative measure in which we merge income information from the PSID with expenditure information from the CEX. The next section details our construction of these two measures.

3. Specification and Estimation

In this section, we sketch out the model with which we estimate lifetime income. We then discuss an alternative method to proxy lifetime income. As noted in the last section, we take two

approaches to measuring lifetime income: a consumption based approach and an income based approach. 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 (including transfers) (E_t) or as the present discounted value of consumption (C_t) and bequests made (B_t):

$$W = \sum \frac{I_t + E_t}{(1+\rho)^t} = \sum \frac{C_t + B_t}{(1+\rho)^t} \qquad (5)$$

where ρ is the individual's discount rate. Following Poterba (1989) and Metcalf (1992), to the extent that current consumption exhibits less annual variation than does income, it should provide a better estimate of lifetime income than will annual income.[9] We can then estimate the distribution of lifetime income using a single cross section of data on household consumption. This is the first approach we present in the next section.

Alternatively, we can directly estimate W if we have observations across the lifetime on earned income and bequests received for a given household. In the subsequent subsection, we use data from the PSID to estimate lifetime income which we then merge with consumption data from the CEX.

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[9] It will also allow us to identify more accurately the appropriate lifetime income decile for the young who are borrowing against future income and the elderly who are spending down accumulated assets.

3. a. A Consumption Proxy for Lifetime Income

We begin by constructing a measure of current consumption as a proxy for lifetime income using data from the Consumer Expenditure Survey.[10] This approach operates from the assumption that consumption is relatively smooth over the life cycle. Current consumption is defined as total expenditures less new vehicle purchases and housing costs for homeowners plus the imputed rental values for housing (for homeowners) and automobiles. In addition, we net out contributions to pensions and life insurance.[11] The CEX reports an imputed rental value for owner occupied housing which can be used for the current consumption value of housing. For automobiles, we adopt the approach of Cutler and Katz (1991) and impute the value of new car purchases as a function of demographic characteristics for the subset of CEX households who make a vehicle purchase. Table 1 reports estimates from this regression. For the 1988 CEX, there were 408 households with expenditures on vehicles. We model vehicle expenditures as quadratic in other expenditures; spending rises and peaks at a level of other expenditures of $137,500. Controlling for other expenditures, vehicle expenditures fall with income and family size and rise in households with female

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[10] The CES is a cross-sectional study that has been conducted annually since 1980. The data set is made up of two parts, a quarterly interview and a two week diary, which provide detailed expenditure information for over 5000 families. We use data from the quarterly interviews as they include some important expenditures (e.g. automobiles and other durables) that are not covered by the diaries.

[11] This measure only approximates current consumption as it ignores all other durable purchases.

or non-white heads[12]. While not significant, vehicle expenditures go down with age. We then multiply the predicted vehicle value for each household (based on the regression estimates and household characteristics) by the number of vehicles owned, and we assume the vehicle is consumed evenly over an eight-year period.

The average level of current consumption in the data set is $15,268. This contrasts with an average family income of $20,273. Table 2 provides a tabulation of household incomes versus expenditures by deciles. There exist considerable differences in decile placement according to whether consumption or income is used to rank households. Four percent of the households in the lowest income decile have consumption above the median. Over 7 percent in the second income decile have consumption above the median. On average, nearly one-third of the households are in a consumption decile at least two deciles away from their income decile.

Figure 1 graphs the distribution of annual family income while figure 2 graphs the distribution of current consumption.[13] Annual income is more highly skewed than current consumption and more dispersed (also see table 4). These findings are consistent with evidence presented in Lillard (1977) that lifetime income exhibits less skew and variance than does earnings and evidence in Eden and Pakes (1981) that consumption is less variable than earnings.

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[12] In addition, there are education dummy variables in the regression. While not reported, they indicate that spending appears to fall with educational level.

[13] A density smoother based on Silverman (19860 is used to construct these graphs. Silverman's automatic bandwidth selection procedure is used along with a gaussian kernel.

3. b. An Income Based Measure of Lifetime Income

As an alternative to the consumption based measure of lifetime income, we next estimate the relationship between age and earned income in a longitudinal data set and then use this information to generate lifetime income estimates in a cross-sectional data set. There are two steps to the procedure. First, we use the PSID to estimate age-income profiles for households. Coefficient estimates from these regressions are then applied to households in the CEX to generate estimates of lifetime income for these households. For the two-step procedure, we begin by regressing the log of annual earned income plus transfers and gifts received on age, age squared, and various demographic variables[14].

Regression results are reported in table 3. Income initially rises with age and then falls in later years. Later cohorts have lower income (1% per year) holding other variables constant. Residents of urban areas have higher incomes with a particularly higher level in the west. At age 30, college graduates earn roughly $5,500 more income than household heads with a high school diploma. At age 40, the differential widens with college graduates earning over $12,000 more than high school graduates (in 1980 dollars). Non-white and female headed households earn less than white male household heads. The regression fits reasonable well with an R^2 of .34.

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[14] It should be noted that these variables have to exist in the cross-sectional data set in which the final incidence estimates are to be performed.

We next use these regression results to estimate lifetime income in the 1988 Consumer Expenditure Survey.[15] Lifetime income is defined here as the present discounted value of earned income, transfers, and gifts generated by a given family over the adult life of the household head and depends only on the demographic variables associated with each family. Our measure assumes that the individual's discount remains constant at 4% 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:

$$W_i = \sum_{t=1}^{n} \frac{\hat{Y}_{it}}{(1+\rho)^t} \qquad (6)$$

where $\hat{Y}_{it}$ is the fitted value of earned income plus inheritances received for household i in year t from the regression in table 3.

In forecasting income in the CEX we 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. We make two adjustments to our measure of lifetime income as characterized in equation (6) to account for the loss of these two stochastic elements that should be incorporated in the distribution of lifetime income. First, we allow for shocks to income that are

[15] All monetary figures in the PSID and CES are converted into 1982 dollars.

persistant over time. We assume an AR(1) process for a random shock to log income with first order auto-correction of .85 and variance of the innovation of .05.[16] This will add skew to the distribution of lifetime income.

The second adjustment has to do with individual effects that affect the variance of the distribution of lifetime income. Unlike Lyon and Schwab (1991), we have not assumed the presence of individual effects which are correlated with explanatory variables. The major rationale for correlated individual effects is that they proxy for ability which is presumed to be correlated with education levels (among other things). Omitting some measure of ability raises the possibility of ability bias affecting our forecast of lifetime income. One can control for individual effects by differencing the data or using a fixed effects regression strategy. Unfortunately either of these methods means that the identification of the parameters is driven entirely by variation across time for individuals in the sample. None of the variation across individuals is used. In addition to the loss of considerable information, coefficients of time invariant variables (e.g. level of education) are not identified. Sacrificing this information is worthwhile if there is reason to believe that ability bias is significant. Based on the results of Angrist and Krueger (1991), we believe that the bias resulting from omitting controls for

[16] 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)). Our parameter choices match those of Engen and Gale (1993)).

ability is inconsequential. In a study in which they estimate the effect of schooling on earnings, they find no evidence of significant bias in conventional wage regressions.[17].

While the presence of individual effects may not bias our coefficient estimates, ignoring this component of the error structure will affect household placement within the distribution of lifetime income. Given that the CEX is a single cross section, we are unable to estimate fixed effects for the households in this sample. As an alternative to computing fixed effects, we incorporate information about the individual effect from the household's level of current consumption in our measure of annualized lifetime income. We add to our measure of annualized lifetime income a fraction of the residual from a regression in the CEX of current consumption on age, age squared and education dummies. This residual incorporates additional information about lifetime income contained in current consumption after adjusting 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.

Table 4 gives summary statistics on annual income, current consumption and an annualized measure of lifetime income. This measure is defined as the 60-year annual constant annuity that can be obtained in a fair market for this amount of wealth at a 4% real

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[17] See also Griliches (1977) and Ashenfelter and Krueger (1992).

rate of interest.[18] Figure 3 graphs the distribution of this measure. Mean lifetime income (annualized) is comparable with annual income and somewhat higher than current consumption. The variation in the lifetime measure is substantially lower than variation in annual income. This is consistent with the permanent income hypothesis which stresses the importance of transitory shocks to income. It is also consistent with the role that rising wage profiles (with age) play in contributing to the variation in annual earnings (and income) distributions (see Lillard (1977) for a further discussion on this point). At the same time, the positive skew in lifetime income has been reduced substantially though not eliminated. The positive skew is also reduced for current consumption relative to annual income. The change in skew for consumption and annualized lifetime income suggests the importance of transitory shocks to income in creating a highly skewed distribution of income. Like the tabulation of current consumption and annual income, a tabulation of annual income and annualized lifetime income shows considerable differences in household rankings. The fraction of households in the lowest annual income decile with lifetime income above the median is 16%. Almost 23% of the households in the second annual income decile have lifetime income above the median.

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[18] The annual equivalent (Y_n) is given by the formula $Y_n = \left[\frac{1}{r} - \frac{1}{r(1+r)^T}\right]^{-1} W$, when r is the interest rate and T the length of contract.

4. Distributional Impact of a VAT

We now turn to measuring the distributional impact of a 5% value added tax. Before turning to the results, we briefly discuss some of the basic assumptions behind the analysis. We begin by noting that we are conducting an absolute incidence analysis. That is to say, a VAT is introduced without the removal or alteration of any existing forms of taxation. Furthermore, we assume that government expenditures would not change in size or composition with the introduction of a VAT.[19] Second, we assume that the VAT is passed forward to consumers. Consequently the amount of tax burden falling on a consumer unit is the statutory rate multiplied by the dollar amount of consumption. This assumption accords with previous work measuring the incidence of consumption taxes (e.g. Pechman (1985), Musgrave, Case, and Leonard (1974)). It can be justified by assuming that the supply of consumption goods is perfectly elastic, as would be the case with perfectly competitive markets and constant returns to scale in production. The additional virtue of this assumption is that we can easily compare our findings about the incidence of a VAT with findings of previous researchers who have looked at consumption taxes. Third, we take as the unit of observation the household, arguing that major consumption decisions are typically made at the household level.

[19] We ignore the distributional effects of changes in the deficit.

We compute average tax rates for each individual by totaling their expenditures in the CEX on taxable commodities and multiplying this amount by .05. We then divide the tax liability by the relevant measure of income. Table 5 shows the median tax rate for each decile under three different measures of income for a VAT applied to all expenditures. In addition, we report the Suits Index. 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.[20] The Suits Index in the annual income case is -.113. If annual income is used as a measure of economic well-being, the VAT is clearly regressive. The median tax rate for the lowest decile is 6.56% and falls to 3.15% for the top decile. If we use current consumption as a proxy for lifetime income, the story changes significantly. The tax now looks essentially proportional and the Suits Index is .020. If an annualized measure of lifetime income is used, the tax becomes less regressive than when annual income measures well being. The Suits Index for lifetime income is -.030 and median tax rates vary between 3.32% and 5.02%.

If a VAT were introduced in the United States, there would likely be zero ratings for various consumption commodities. In table 6, we present distributional tables for a VAT which exempts food, housing, and health expenditures at all stages of production.

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[20] The Suits Index is constructed from an Income Concentration Curve (ICC), a graph of the cumulative taxes paid against cumulative income. The Suits Index is 1 minus the ratio of the area under the ICC to the area under the 45 degree line.

The VAT now raises considerably less revenue and average tax rates fall correspondingly. The VAT also looks considerably less regressive even when annual income is used to measure economic well-being. The Suits Index in this case is now -.056, down from -.113. Using the consumption based measure of well-being, the VAT looks decidedly progressive with median tax burdens rising from 1.12% to 2.74% between the bottom and top decile. The Suits Index is now .073. Using the annualized measures of lifetime income, the tax looks essentially proportional with the average tax rate ranging from 1.39 to 1.78%. The Suits Index is now .002.

The results presented in tables 5 and 6 accord with intuition derived from an examination of the lifetime budget constraint. A broad based tax is essentially a tax on lifetime income. Hence a flat rate VAT is proportional. As goods with low income elasticities are excluded from the tax base, the tax becomes increasingly progressive. These results suggest that concerns over the potential regressivity of a value added tax are misplaced.[21]

5. Conclusion

In this paper we have shown that a value added tax in the U.S. would be at most slightly regressive (and possibly progressive) over the life cycle despite appearing regressive when viewed in a

[21] This is not to say that a VAT with zero rated items is the best way to achieve a progressive consumption tax. The same degree of progressivity could likely be achieved with less administrative cost and fewer distortions through the use of a progressive consumed income tax (e.g. the personal cash-flow tax as described in Bradford (1986)).

traditional, annual income-based framework. These incidence results were generated in two different ways. The first approach used current consumption as a proxy for lifetime income. The second method estimated lifetime income through a two-stage process. The first stage was the estimation of the relationship between annual income and age using longitudinal data to construct a measure of lifetime income, and the second involved using this information to analyze consumption patterns with a cross-sectional data set. The use of two data sets was necessary due to the lack of appropriate expenditure data in the panel data set used in the first stage.

The findings of this paper are potentially of large practical importance. As a result of annual income-based tax incidence analyses, expenditure-based taxes such as a VAT are generally viewed as fairly regressive. Consequently, some legislators have been unwilling to consider implementing a VAT. Our analysis shows, however, that a VAT would be at the least proportional over the life cycle and possibly progressive. Furthermore, adjustments such as zero-rating would be effective at making a VAT more progressive. With regressivity less of a legitimate concern, the political feasibility of a VAT might be enhanced.

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Table 1

Expenditures on Vehicles

Variable	Coefficient Estimate
Age	-2.83 (10.59)
Expenditures on other goods	.44 (.02)
Expenditures squared (x 1000)	-.0016 (.0023)
Income	-.07 (.01)
Family size	-397.29 (98.36)
Female	482.66 (335.45)
Non-white	947.22 (609.98)
Intercept	-1131.99 (2252.85)
N	408
R^2	.557

Regression also includes dummy variables for level of education received. Observations are from 1988 CES for households which purchased vehicles. Standard errors are reported in parentheses.

Table 2. Tabulation of Consumption versus Income from 1988 CES

Income Deciles	Consumption Deciles 1	2	3	4	5	6	7	8	9	10	
1	**56.67**	22.00	9.33	4.67	3.33	0.67	0.00	2.00	0.67	0.67	3384
2	29.80	**31.79**	19.87	8.61	2.65	3.31	1.99	1.99	0.00	0.00	5923
3	4.64	27.15	**22.52**	19.21	10.60	8.61	4.64	1.99	0.66	0.00	8775
4	5.33	9.33	20.67	**17.33**	26.67	9.33	3.33	4.67	1.33	2.00	11822
5	1.99	5.96	12.58	17.88	**17.22**	19.87	11.26	3.97	8.61	0.66	14953
6	0.00	2.65	6.62	15.89	17.88	**17.88**	17.88	10.60	7.95	2.65	18502
7	0.00	0.00	4.00	8.00	10.67	22.00	**21.33**	14.00	14.67	5.33	22525
8	0.00	0.66	3.31	4.64	6.62	9.93	24.50	**25.83**	15.89	8.61	27476
9	0.66	0.66	0.00	2.65	3.97	7.95	9.93	21.85	**29.14**	23.18	35059
10	0.66	0.00	1.32	0.66	0.66	0.66	4.64	13.25	21.19	**56.95**	54162
	4362	6870	8744	10602	12523	14486	17028	19815	23606	34653	

Source: authors' calculations from the 1988 Consumer Expenditure Survey. Cell entries are the probability of being in a consumption decile conditional on being in a given income decile. Consumption is net of expenditures on automobiles and housing and inclusive of rental equivalents for those durables. Pension and life insurance contributions are also excluded. Averages for consumption and income within each decile are presented in column and row margins respectively. There are 1507 observations in the data set.

Table 3. Earnings Regression

Variable	Coefficient Estimates
Age	.067 (.003)
Age Squared	-.00075 (.00003)
Trend	-.010 (.0004)
Female Head of Household	-.529 (.015)
Non-white Head of Household	-.210 (.015)
Northeast - Urban	.152 (.022)
Midwest - Urban	.085 (.018)
South - Urban	.135 (.020)
West - Urban	.102 (.022)
Education:	
Some High School	-.125 (.069)
High School Graduate	.085 (.066)
Some College	-.020 (.075)
College Graduate	-.237 (.090)
Post Graduate	-.449 (.139)
Unemployed	-.510 (.006)
Age of Spouse	-.002 (.0003)

Table 3 (continued)

Variable	Coefficient Estimates
Age * Northeast	.002 (.0005)
Age * Midwest	.0007 (.0004)
Age * South	.0024 (.0004)
Age * West	.0028 (.0005)
Education * Age	
Some High School	.0116 .0029
High School Graduate	.0089 (.0027)
Some College	.0182 (.0032)
College Graduate	.0324 (.0040)
Post Graduate	.0443 (.0059)
Education * Age Squared	
Some High School	-.0002 (.00003)
High School Graduate	-.0001 (.00003)
Some College	-.0002 (.00003)
College Graduate	-.0003 (.00004)
Post Graduate	-.0004 (.00006)
Age * Non-White	.0008 (.0003)

Table 3 (continued)

Variable	Coefficient Estimates
Elderly	-3.169 (.129)
Age * Elderly	.052 (.002)
Intercept	8.376 (.065)
N	134,217
Adj R^2	.337

Dependent Variable is the log of earned income plus transfers and gifts received. Standard errors are reported in parentheses.

Table 4 Income Measures

	Annual Income	Current Consumption	Annualized Lifetime Income
Mean	20,273	15,268	20,219
Median	16,620	13,398	19,614
Standard Deviation	16,230	9,348	9,630
25^{th} Percentile	8,884	8,670	12,442
75^{th} Percentile	27,323	19,733	26,476
Skew	3.55	2.24	.49

Statistics are for the 1507 observations in the CES data set for 1988. See text for details.

Table 5 Distribution of a VAT on Total Expenditures

Decile	Annual Income	Current Consumption	Lifetime Income
1	6.56	5.01	5.02
2	5.11	4.96	4.11
3	5.03	4.92	3.92
4	4.46	5.24	4.17
5	4.57	5.09	3.32
6	4.09	5.25	3.69
7	4.03	5.32	3.40
8	3.58	5.27	3.53
9	3.38	5.21	3.71
10	3.15	5.45	3.69
Suits Index	-.113	.020	-.030

Table 6. Distribution of a VAT:
Food, Housing, Health Cost Zero Rate

Decile	Annual Income	Current Consumption	Lifetime Income
1	1.26	1.12	1.43
2	1.43	1.73	1.59
3	1.70	1.66	1.40
4	1.68	1.99	1.76
5	1.87	2.01	1.48
6	1.76	2.39	1.61
7	1.80	2.42	1.39
8	1.72	2.46	1.58
9	1.54	2.46	1.62
10	1.58	2.74	1.78
Suits Index	-.056	.073	.002

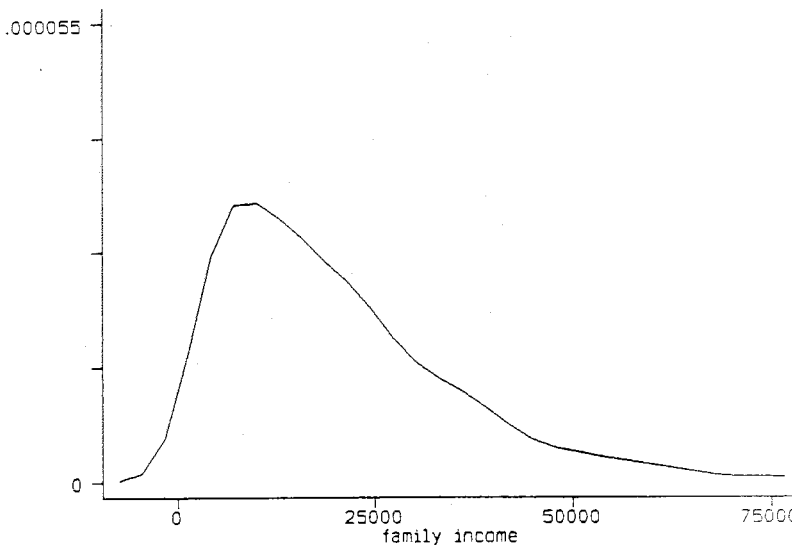

Figure 1. Annual Income

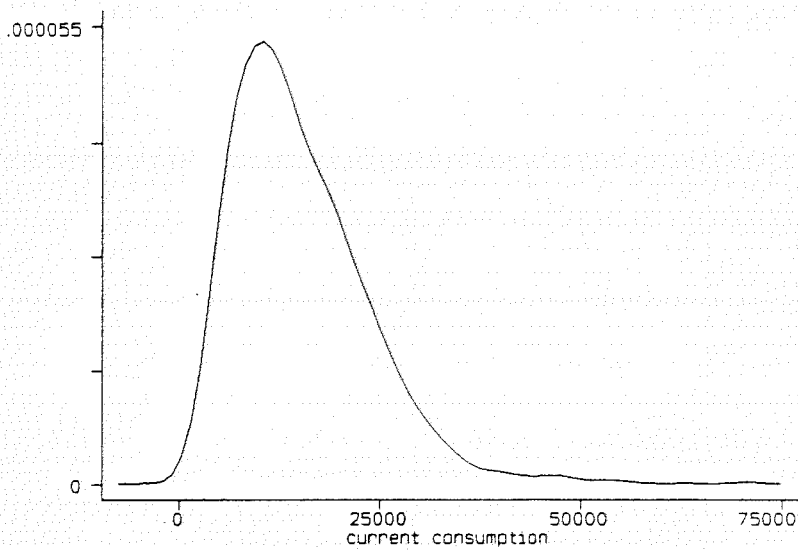

Figure 2. Current Consumption

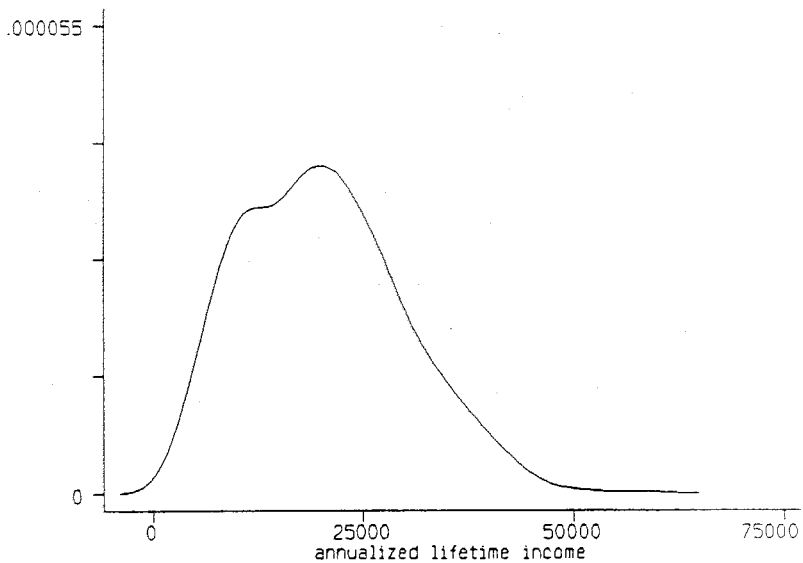

Figure 3. Annualized Lifetime Income