The Regressivity of Sin Taxes
The Lifetime Tax Burden of Taxes on Alcohol and Cigarettes

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NOVEMBER 1997
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Dr. Andrew B. Lyon is an Associate Professor of Economics and Dr. Robert M. Schwab is a Professor of Economics at the University of Maryland. This paper is based largely on a study by the authors, “Consumption Taxes in a Life-Cycle Framework: Are Sin Taxes Regressive?,” which appeared in *The Review of Economic and Statistics* in August 1995.
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Abstract

Distributional analysis plays an important role in the design of tax legislation. Typically distributional analysis compares annual taxes paid to annual income by annual income group. There are several shortcomings with distributional analysis based on annual taxes and annual income. In this paper, we compare annual distributional analysis to distributional analysis based on a five-year period and the lifetime for taxes on alcohol and cigarettes.

Annual measures of the incidence of taxation of consumption goods may differ from lifetime measures for several reasons. First, annual measures of income reflect temporary fluctuations that should have smaller effects on consumption than permanent changes in income. Second, annual measures of income differ from lifetime measures due to age-related differences in earnings. Third, consumption patterns of certain goods may reflect differing patterns across age groups. As a result, the ratio of taxes paid to income earned in any given year for an individual may be quite different than the ratio of cumulative taxes paid to cumulative income over an extended period for that person.

Surprisingly, the results of the study indicate that there is relatively little difference in the assessment of the regressivity of taxes on alcohol and cigarettes. Both annual and lifetime measures of tax incidence find these taxes to be regressive.
I. Introduction

Distributional analysis plays one of the most important roles in the design of tax legislation. Tables showing changes in tax burden by income group are routinely provided by the U.S. Department of Treasury and the Congressional Joint Committee on Taxation for any major tax proposal. Legislation is frequently altered to achieve a more desired distributional outcome as reflected in these official distributional analyses.

The measurement of tax burden raises a number of issues. A classic example of the difficulty of measuring tax burden is an excise tax so high that it discourages any consumption of the taxed good. A simple measure of tax burden that only looks at taxes actually paid would erroneously conclude that the tax in this example imposes no burden, since no taxes are collected. Alternatively, an estimate of tax burden based on purchases that would have occurred had there been no excise tax overstates the tax burden. This is because the consumer can reduce the burden of the tax by substituting other, less preferred, goods for the taxed one.

Economists have long understood the problems of measuring tax burden. Unfortunately, the theoretical measures proposed by economists depend on concepts that may be unmeasurable in practice. For example, to an economist the proper measure of the burden of a given tax is the amount that one would be willing to pay in order to be exempted from the tax. But of course, such a measure cannot be directly observed. As a result, despite the errors involved, practical measurement of tax burden has largely been based on taxes actually collected.

The most common way in which distributional analysis is conducted is to classify individuals into income groups based on their annual income. A shortcoming to this method is that if income is variable over time, a single year's income for an individual may be a poor measure by which to represent the individual's permanent well-being. Further, given variability in annual incomes, individuals are unlikely to base their behavioral decisions solely on their current income.

Recently, there has been substantial interest in expanding upon the traditional measures of tax burden. It has been suggested by many economists that lifetime measures of taxes paid and lifetime income provide, if not a better basis for measuring distributional burdens, an additional dimension by which to measure distributional burdens. For example, Fullerton and Rogers (1993) undertake a lifetime analysis of all U.S. taxes. Other studies that examine excise taxes or consumption taxes over the lifetime include Caspersen and Metcalf (1994), Chernick and Reschovsky (1997), and Poterba (1989, 1991). Lifetime distributional analysis can offer a fuller perspective than distributional burdens relying on annual income and annual taxes. Unfortunately measures of lifetime distribution of tax burden are not as easily constructed because lifetime income and taxes must be estimated.

This paper examines how one might actually measure tax incidence over the life-cycle, using, as an example, two taxes that are commonly believed to be regressive: taxes on alcohol and cigarettes. Studies using annual measures of income and consumption of these items typically find that lower income individuals spend a larger share of their income on these goods than do higher income individuals. An ad valorem tax on alcohol or cigarette expenditure would then be regressive using annual measures of consumption and income, imposing a greater burden on the poor than on the rich. A lifetime measure also might find that
the distribution of taxes on alcohol and cigarettes is regressive if individuals in lower lifetime income categories spend a greater percentage of their lifetime income on alcohol and cigarettes than do individuals in higher lifetime income categories. Yet other hypotheses suggest that these taxes might not be regressive over the life-cycle. For instance, if young adults spend a larger share of their income on alcohol and cigarettes and also generally earn less than older adults, a tax on these goods would be shown to be regressive with respect to annual income yet the tax might be found proportional to lifetime income.

A life-cycle analysis of the distribution of alcohol and cigarette taxes is of interest for two reasons. First, taxes on alcohol and cigarettes are significant. In 1996, federal excise taxes on these goods exceeded $13 billion. Knowing the distributional effects of taxes on these goods is important. Second, distributional effects over the lifetime may add an important dimension to our understanding of the way in which these and other taxes are borne across income groups. This study provides a methodology that might be used to examine the lifetime distributional effects of a wide range of other taxes.

The next section, Section II, describes the drawbacks to annual measures of tax incidence relative to measures over longer periods, including the lifetime measure of tax incidence. Section III provides a traditional annual analysis of the burden of alcohol and cigarette taxes. Section IV presents results of tax incidence measured over a five-year period. In our analysis, the five-year period allows us to examine whether there are any important differences between controlling for short-term fluctuations in income and controlling for longer run changes in income over individuals' lifetimes. Section V presents the empirical results of the life-cycle analysis. Both annual and life-cycle distributional measures of alcohol and cigarette taxes show these taxes to be quite regressive. The results of the life-cycle analysis therefore serve for these taxes to reinforce the distributional findings of the traditional annual incidence studies for these taxes. A concluding section considers whether, in general, life-cycle analysis contributes to our understanding of the distributional burden of taxes.

II. Assessing Tax Incidence: Moving from Annual to Lifetime Measures of Tax Burden

A practical measure of tax burden examines the taxes actually paid by people. This measure, however, is only an approximation of the true burden of a tax. At times, this measure of burden can be quite misleading. As described in the introduction, a very high tax on a good could raise no revenue if it discouraged all purchases of the good. But such a tax clearly has a burden. By forcing consumers to substitute less preferred goods for the heavily taxed one, consumers are made worse off. Lowering a tax on such a good could easily increase tax collections and at the same time make consumers better off.

Even if one uses taxes actually paid as an approximation of tax burden, one must do more to determine whether a tax is distributionally fair. Matters of fairness are inherently subjective. There are ways, however, in which the distributional effect of a tax can be usefully summarized.

Annual Measures of Tax Incidence

The most common way in which distributional analysis is conducted is to classify individuals into income groups based on their annual income. Next one typically compares the tax paid by each
income group over the year to the annual income of that group. If it is found that tax paid as a percent of income is constant across income groups, then the tax is defined to be a proportional tax (see Table 1). If the tax paid as a percent of income increases as income rises, then the tax is defined to be a progressive tax (see Table 2). Finally, if the tax paid as a percent of income decreases as income rises, then the tax is defined to be a regressive tax (see Table 3).

Problems in the Use of Annual Measures of Taxation and Income

Annual distributional analysis implicitly assumes that current taxes paid and current income are sufficient for understanding the distributional effects of a tax. Of course, households rarely have the exact same income from year to year. Labor income may change due to promotions, sickness, leaves of absence, unemployment, or entirely new lines of work. Family income may change as a spouse enters or leaves the labor force. In addition to annual variability in earnings there are also predictable trends in labor income as an individual gains experience in the work force.

A shortcoming to the annual distributional analysis is that if income is variable over time, a single year’s income for an individual may be a poor measure by which to represent the individual’s permanent ability to consume. Further, because of the variability in annual incomes, individuals are unlikely to base their behavioral decisions solely on their current income. As a result, especially for taxes on consumption, the ratio of taxes paid to income earned in any given year for an individual may be quite different than the ratio of cumulative taxes paid to cumulative income earned over an extended period for that person.

Fullerton and Rogers (1993) find that variation between annual income and lifetime income is considerable for most individuals. They find that only 21.1% of individuals are in the same annual and lifetime income decile and only 46.1% are in annual and lifetime categories within plus-or-minus-one decile of each other.  

Lifetime Measures of Taxation and Income

A logical solution to the variability of annual income is to consider measures of tax burden over longer periods, ranging from several consecutive years to the lifetime of the individual.

Lifetime distributional analysis has its roots in several distinguished papers by two Nobel-prize winning economists, Milton Friedman and Franco Modigliani. Milton Friedman’s (1957) permanent income hypothesis was based on the empirical observation that individuals subject to fluctuations in their income typically had much smaller changes in their consumption than in their income. Specifically, a large percentage decline in income was associated with a smaller percentage decline in consumption. Similarly, people experiencing increases in income increased their consumption by a smaller percentage. Friedman’s empirical finding was supported by a solid theoretical foundation. To the extent that annual variability in income was “noise,” i.e., variation that was not representative of future changes in income, individuals could largely ignore these fluctuations and base their consumption decisions on the predictable, permanent component of income. As a result, consumption across years would be less variable than observed income.

While Friedman’s permanent income hypothesis viewed this consumption smoothing as occurring over relatively
Table 1

Hypothetical Proportional Tax Based on Annual Income

<table>
<thead>
<tr>
<th>Annual Income Range</th>
<th>Average Annual Income</th>
<th>Average Annual Tax Paid</th>
<th>Avg. Tax as a Percent of Average Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-20,000</td>
<td>$10,000</td>
<td>$1,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$20,000-$40,000</td>
<td>$30,000</td>
<td>$3,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$40,000-$80,000</td>
<td>$60,000</td>
<td>$6,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$80,000-$120,000</td>
<td>$100,000</td>
<td>$10,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$120,000-$200,000</td>
<td>$150,000</td>
<td>$15,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$200,000+</td>
<td>$250,000</td>
<td>$25,000</td>
<td>10.0</td>
</tr>
</tbody>
</table>

All data are hypothetical in this table.

Table 2

Hypothetical Progressive Tax Based on Annual Income

<table>
<thead>
<tr>
<th>Annual Income Range</th>
<th>Average Annual Income</th>
<th>Average Annual Tax Paid</th>
<th>Avg. Tax as a Percent of Average Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-20,000</td>
<td>$10,000</td>
<td>$500</td>
<td>5.0</td>
</tr>
<tr>
<td>$20,000-$40,000</td>
<td>$30,000</td>
<td>$2,000</td>
<td>6.7</td>
</tr>
<tr>
<td>$40,000-$80,000</td>
<td>$60,000</td>
<td>$6,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$80,000-$120,000</td>
<td>$100,000</td>
<td>$12,000</td>
<td>12.0</td>
</tr>
<tr>
<td>$120,000-$200,000</td>
<td>$150,000</td>
<td>$20,000</td>
<td>13.3</td>
</tr>
<tr>
<td>$200,000+</td>
<td>$250,000</td>
<td>$37,500</td>
<td>15.0</td>
</tr>
</tbody>
</table>

All data are hypothetical in this table.

Table 3

Hypothetical Regressive Tax Based on Annual Income

<table>
<thead>
<tr>
<th>Annual Income Range</th>
<th>Average Annual Income</th>
<th>Average Annual Tax Paid</th>
<th>Avg. Tax as a Percent of Average Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-20,000</td>
<td>$10,000</td>
<td>$1,500</td>
<td>15.0</td>
</tr>
<tr>
<td>$20,000-$40,000</td>
<td>$30,000</td>
<td>$3,300</td>
<td>11.0</td>
</tr>
<tr>
<td>$40,000-$80,000</td>
<td>$60,000</td>
<td>$6,000</td>
<td>10.0</td>
</tr>
<tr>
<td>$80,000-$120,000</td>
<td>$100,000</td>
<td>$9,000</td>
<td>9.0</td>
</tr>
<tr>
<td>$120,000-$200,000</td>
<td>$150,000</td>
<td>$10,500</td>
<td>7.0</td>
</tr>
<tr>
<td>$200,000+</td>
<td>$250,000</td>
<td>$15,000</td>
<td>6.0</td>
</tr>
</tbody>
</table>

All data are hypothetical in this table.
short planning horizons of several years, Franco Modigliani and Richard Brumberg (1954) and Albert Ando and Modigliani (1963) extended the theoretical planning horizon of an individual to the entire lifetime. Under Modigliani's life-cycle hypothesis, if individuals had a perfect ability to borrow and save, consumption smoothing would not just occur across adjacent years, but over an individual's entire adult life. In the absence of any uncertainty, individuals with low current incomes but high lifetime incomes would base their current consumption decisions on their lifetime income.

One might object that few individuals have the ability to plan their affairs with perfect foresight. And even if a young adult had the foresight that he or she would earn a fortune later in life, a bank may not share in this optimistic assessment, and the person might find consumption limited by a lack of collateral. The life-cycle hypothesis is indeed an extreme abstraction of the planning that people might contemplate. But individuals do undertake a great deal of life-cycle financial planning. Education is frequently undertaken as an investment with distant payoffs. IRAs, 401(k)'s, and other employer-provided retirement plans are used by young workers to plan for a distant retirement. While individuals save in these tax-favored accounts they may simultaneously incur debt for other consumption needs. The purchase of a home is accompanied by a mortgage for a significant fraction of its cost, to be paid off in as long as 30 years. Credit card debt, equity lines of credit, car loans, and student loans allow households to smooth the cost of major purchases over time. Those in retirement typically draw down accumulated savings to finance their consumption needs. With the ability to borrow or save, consumption need not be the same as income at any point in time.

Chernick and Reschovsky (1997) suggest that annual measures of tax burden overstate the burden of taxes on those with low annual income given the ability to borrow or dissave, yet at the same time they argue that lifetime measures of tax burden underestimate the practical difficulties of smoothing consumption given the borrowing constraints faced by many with low income. In their analysis, they suggest an intermediate period (in their specific example, 11 years) be used for assessing tax burden.

In the analysis that follows, three alternative durations will be used to assess and compare the incidence of taxes on alcohol and cigarettes: an annual measure; a five-year measure; and a lifetime measure. The comparison of tax incidence across these different durations for these goods allows one to compare the relative effects of relatively short-run transitory income changes to the longer, life-cycle income changes on the measures of tax burden.

### III. Annual Incidence of Alcohol and Cigarette Taxes

In order to compare the annual and life-cycle incidence of a tax it is important to have a single data set that allows one to compute both distributional measures. For this purpose, the Panel Survey of Income Dynamics (PSID) is a unique data source. The PSID is a continuous survey of the income of nearly 5,000 families since 1968. The survey provides limited information on consumption. Between 1968 and 1972, the survey did collect data on alcohol and cigarette expenditures by family. In this section we examine the annual incidence of a tax on the consumption of alcohol and cigarettes.
Our consumption data only provide us information on the total household expenditure on alcoholic beverages and cigarettes, not the units of these items consumed. It is worth noting that actual taxes on alcoholic beverages and cigarettes are not proportional to the expenditure on these items. State and federal taxes on alcohol vary among beer, wine, and spirits. For example, federal taxes on spirits and wine are based on separate functions of alcohol content. Within a category of alcoholic beverage, an inexpensive brand and a costly brand incur the same federal tax if they have the same concentration of alcohol. Federal taxes on cigarettes are a unit tax rather than a tax on expenditure. By modeling the taxes on these goods as if they are proportional to expenditure, the regressivity of these taxes may be understated. This is true, for instance, if lower income individuals purchase less expensive brands and, in the case of alcohol, more heavily taxed varieties of alcoholic beverages. This abstraction, however, should not have a material effect on the comparison of the annual distributional analysis with the life-cycle analysis.

**Annual Measures of Tax Regressivity**

We first use the PSID data to compute annual measures of tax incidence. These serve as our basis for comparison against the life-cycle estimates that we present later. As found in other studies, the PSID data show that lower income groups spend a larger share of their income on alcohol and cigarettes than do higher income groups. Table 4 compares annual consumption of alcohol and cigarettes with annual income by income group. In this table, we have presented the average of our results for each of the five years between 1968 and 1972. Families in the poorest 20 percent of the income distribution are found to spend 1.41% of their income on alcoholic beverages in contrast to families in the highest 20% of the income distribution who spend an average

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Cumulative Distribution (Percent)</th>
<th>Consumption as a Percent of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Income</td>
<td>Alcohol</td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>7.6</td>
<td>13.5</td>
</tr>
<tr>
<td>2</td>
<td>21.4</td>
<td>29.9</td>
</tr>
<tr>
<td>3</td>
<td>39.7</td>
<td>50.3</td>
</tr>
<tr>
<td>4</td>
<td>63.2</td>
<td>71.5</td>
</tr>
<tr>
<td>5 (highest)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suits Index</td>
<td>-0.135</td>
<td>-0.245</td>
</tr>
</tbody>
</table>
of 0.61% of their income on alcoholic beverages. For cigarettes, the lowest income group spends an average of 2.40% of income on cigarettes while the highest income group spends 0.60% of their income on cigarettes.

For each good, the pattern of consumption across income groups indicates that an ad valorem tax on either good would be regressive using the annual data. Lower income groups spend a larger proportion of their annual income on each good than do higher income groups. Although the consumption data is from the 1968-1972 period, the expenditure patterns are similar to analyses based on more recent data.10

In our comparisons with the lifetime measures of tax incidence it is useful to have a measure of the degree of regressivity of each tax. For this purpose we employ the Suits index. The Suits index is computed by comparing income and consumption of each good over the income groups. The Suits index ranges between -1 and +1. A Suits index of -1 is the maximum degree of regressivity (the taxed good is entirely consumed by the lowest income group); a Suits index of +1 corresponds to the maximum degree of progressivity (the taxed good is consumed entirely by the highest income group). A Suits index of 0 corresponds to a proportional tax. (The appendix provides more detail on the construction of the Suits index.)

Using the data for each of the five income groups, we find the Suits index for an ad valorem tax on alcohol to be -0.135 and for an ad valorem tax on cigarettes to be -0.245. The Suits index indicates that both taxes are regressive in an annual context, with the tax on cigarettes more regressive than the tax on alcohol.

**IV. Five-year Measures of Tax Incidence**

Although the ultimate objective of this paper is to compare annual measures of tax incidence with life-cycle measures, the data from the PSID also allow us to present a measure of tax incidence over a period of intermediate length. Here we will present measures of tax incidence for a single five-year period. Tax incidence over this period of intermediate length is useful for several reasons. First, the argument in favor of using longer measures to assess tax incidence is that over short time periods consumption may be relatively invariant to temporary fluctuations in income. Over a five-year period, however, temporary fluctuations in income might be expected to roughly average out. The five-year measure of tax incidence than might be viewed as accounting for transitory changes in income, but not longer life-cycle changes in income or consumption. Second, policymakers may be reluctant to accept the idea that individuals are fully capable of making long-term planning decisions over their entire lives, but from a practical perspective accept the idea that individuals are capable of basing consumption decisions on income over a period greater than one year. The five-year time horizon thus provides a measure of tax incidence that is meaningful to consider when individuals have a limited ability to plan over time periods greater than one year.

Table 5 compares five-year consumption of alcohol and cigarettes with five-year income by income group. Consistent with the hypothesis that individuals do not alter their behavior in response to temporary fluctuations in income as much as they respond to permanent differences in income, families in the poorest 20 percent of the income distribution over the five-
year period are found to spend a smaller share of their income on alcohol and cigarettes than found in the annual examination of expenditure. Similarly, families in the highest income group are found to spend a larger share of their five-year income on alcohol and cigarettes than seen in the annual measure. Ad valorem taxes on alcohol and cigarettes, however, continue to be regressive. The Suits indices show that these taxes continue to be regressive, although slightly less regressive than observed in the annual context. The Suits index is -0.105 for an ad valorem tax on alcohol and -0.228 for an ad valorem tax on cigarettes. In this case, it appears that accounting for transitory fluctuations in income has only a small effect on the regressivity of these taxes found in annual studies.

V. Lifetime Incidence of Alcohol and Cigarette Taxes

The ideal data set for the lifetime analysis of tax incidence would have complete earnings histories and consumption histories for each family. Unfortunately, at the time we undertook this study, the maximum number of years of earnings for any family in the PSID was 20 years, and consumption data on cigarettes and tobacco were only collected for the five-year period between 1968 and 1972. As a result, we use the data within the PSID to estimate a complete lifetime history of income and consumption for each family.

Current income of each family is estimated for all years corresponding to years between age 20 and age 89 for the head of household. Income is estimated for over 1,000 households using age, education, marital status, and geographic

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Cumulative Distribution (Percent)</th>
<th>Consumption as a Percent of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Income Alcohol Cigarette Alcohol Cigarette</td>
<td></td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>8.6 13.2 17.3 1.22 2.07</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>22.7 29.8 38.6 0.93 1.54</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>41.0 51.1 58.7 0.92 1.12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>64.4 69.4 78.4 0.62 0.86</td>
<td></td>
</tr>
<tr>
<td>5 (highest)</td>
<td>100.0 100.0 100.0 0.68 0.62</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>0.79 1.02</td>
</tr>
</tbody>
</table>

Suits Index -0.105 -0.228
variables as explanatory variables. The panel data providing 20 years of actual income data for each family allow us to estimate for each family an individual fixed effect reflecting that family’s permanent ability to earn an above average or below average income given the family’s other observable characteristics. These individual fixed effects make an important contribution to explaining income differences across the population. Estimates that ignore these fixed effects can lead to a misclassification of families by lifetime income group and may overstate the actual regressivity of an ad valorem tax on consumption.

Several alternative methods were used to estimate the lifetime consumption of alcohol and cigarettes for each family. The basic methodology is to first estimate the probability that a family consumes any of the good (for both alcohol and cigarettes, slightly less than half of the families do not consume any of the good); second, contingent on a family consuming any of the good, the quantity of the good consumed is estimated. Variables used in this estimation process are current income, lifetime income, age, education, marital status, race, geographic variables, and religion.

Table 6 shows the resulting estimates of alcohol and cigarette expenditures for families grouped by lifetime income. The distributional effects of these taxes over the lifetime can differ from the annual analysis or five-year analysis for two reasons. First, as compared with either Table 4 or Table 5, lifetime income is shown to be distributed more equally than is either annual income or five-year income. The lowest lifetime income quintile has 9.9% of lifetime income in contrast to the lowest annual income quintile’s 7.6% share of annual income. The highest lifetime income quintile has 33.3% of lifetime income compared to the highest annual income quintile’s share of 36.8% of

### Table 6

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Cumulative Distribution (Percent)</th>
<th>Consumption as a Percent of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alcohol</td>
<td>Cigarette</td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>9.9</td>
<td>12.4</td>
</tr>
<tr>
<td>2</td>
<td>24.9</td>
<td>29.0</td>
</tr>
<tr>
<td>3</td>
<td>43.8</td>
<td>48.9</td>
</tr>
<tr>
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<td>66.9</td>
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<td>5 (highest)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suits Index</td>
<td>-0.067</td>
<td>-0.233</td>
</tr>
</tbody>
</table>
annual income. Second, the share of consumption of each good by each quintile differs over the lifetime relative to the annual or five-year periods.

The lifetime consumption of alcohol is less concentrated among the lowest income quintile than seen in the annual data. The combined effect of the more equal distribution of lifetime income and the less concentrated consumption of alcohol by the lifetime poor make the lifetime incidence of the ad valorem tax on alcohol less regressive than indicated in the annual incidence measure. The Suits index over the lifetime is -0.067, relative to the annual Suits index of -0.135 and the five-year Suits index of -0.105. Even in the lifetime context, however, the alcohol tax remains firmly regressive. The share of lifetime income spent on alcohol among the poorest lifetime income quintile is 40% greater than among the richest lifetime income quintile.

Estimated lifetime consumption of cigarettes, in contrast to alcohol, is found to be slightly more concentrated among the poorest lifetime income quintile than found in the annual data. The Suits index over the lifetime is -0.233, virtually identical to the Suits indices calculated from the annual and five-year consumption data shown in Tables 4 and 5. The unchanged Suits index is the result of two offsetting factors. Income is distributed more equally over the lifetime, however, cigarette consumption is more concentrated among the lifetime poor. In contrast to what might have been expected, we find cigarette taxes to be equally regressive over the lifetime as found in the annual data.

VI. Conclusions

Our research points to some interesting results. The standard view that transitory shocks to income and lifetime consumption smoothing lead to an overestimate of the regressivity of taxes on consumption goods is shown to be incorrect. In our analysis, we find little reduction in the regressivity of taxes on cigarettes when controlling for transitory changes in income as demonstrated by the nearly identical Suits index shown in the annual and five-year analysis. Our lifetime simulations find that incorporation of the full life-cycle does not alter the regressivity of taxes on cigarettes relative to the annual analysis either.

In the case of alcohol, we find that controlling for both transitory effects and life-cycle effect reduces the regressivity of taxes on alcohol relative to annual measures. As described earlier, however, the alcohol tax remains firmly regressive, with the lifetime poor spending a 40% larger share of their income on alcohol than the lifetime rich.

These results suggest it is difficult to generalize how transitory income and life-cycle factors affect the regressivity of various taxes. In general, a more equal distribution of income over the lifetime works to reduce the regressivity of taxes on consumption, and similarly to reduce the progressivity of taxes on income. As shown, however, the consumption of some goods may be more concentrated among the lifetime poor than found in annual studies. For these goods, a tax can be as regressive over the lifetime as found in traditional annual studies.
Appendix: The Suits Index as a Measure of Regressivity

Average tax rates across income groups can be used to classify a tax as regressive, proportional, or progressive. In some cases, however, one would like to have a measure of the degree of regressivity or progressivity. For this purpose, the Suits index is often used as a summary measure of the regressivity or progressivity of a tax.

The following example illustrates the construction of the Suits index. Consider a good on which the poor spend a larger percentage of their income than the rich. A tax on such a good would be regressive, since the average tax rate by income group would decrease as income rose. Figure 1 plots the cumulative consumption of this good against the cumulative income of families, where families are ranked by order of increasing income. For example, Figure 1 shows that 20% of the good is consumed by families with only 4% of cumulative income; 40% of the good is consumed by families with 16% of cumulative income; 60% of the good is consumed by families with 36% of cumulative income; and 80% of the good is consumed by families with 64% of cumulative income. The families accounting for the final 20% of consumption of the good account for the remaining 36% of cumulative income in this hypothetical example. The resulting curve lies below the diagonal line representing the line of proportionality — i.e., the line representing a good which is consumed in proportion to income by all families. This is the case for all goods for which the poor spend a larger share of their income than the rich.

The area between the curve representing the consumption of the taxed good and the line of proportionality gives a measure of the degree of regressivity. The Suits index is defined as twice the area between the curve and the line of proportionality, where areas above the line of proportionality enter with positive weight and areas below the line of proportionality enter with negative weight. The Suits index is bound between -1 and 1, with regressive taxes represented by negative values and progressive taxes represented by positive values. For the extreme case of a good consumed only by the lowest income family, the Suits index is -1. For the extreme case of a good consumed only by the highest income family, the Suits index is 1. A good consumed in proportion to income for all families coincides with the line of proportionality and corresponds to a Suits index of 0.
Figure 1
Regressive Excise Tax on Consumption Good
Endnotes


3 An ad valorem tax is based on the value of the good. Federal alcohol and cigarette taxes are unit taxes, based on the quantity consumed, rather than value. This distinction is discussed in more detail in Section III.


5 An intermediate period longer than one year but less than the lifetime has been suggested by Chernick and Reschovsky (1997) as a useful way for correcting for the shortcomings of annual analysis without requiring one accept the assumption that individuals base their consumption decisions on their full lifetime income.

6 This measure of tax burden also ignores how factor incomes (wages and capital income) can be affected by a tax even if the tax is levied on the consumer. An often mentioned criticism of a luxury tax on boats was that the burden was borne by workers building boats, not by boat buyers. The tax was repealed in 1993 largely on the basis of this argument.

7 This problem of using taxes collected as a measure of tax burden has often created difficulty in determining the change in tax burden when capital gains tax rates are changed. Some argue that a reduction in capital gains tax rates can increase tax collections, at least in the short-run. In this instance, a measure of tax burden based on taxes actually paid leads to the unorthodox conclusion that the tax burden increases when capital gains tax rates are reduced. Differences in the treatment of capital gains taxes in measures of tax burden are one reason that Congressional and Administration estimates of tax burden have differed in recent tax legislation.


9 The families in the PSID are representative of the U.S. population with the exception of a special low-income subset designed to oversample low-income families. This subset is omitted from our analysis.

10 See, for example, Congressional Budget Office (1990, p. 28). The CBO analysis shows that the share of income devoted to alcohol and cigarette consumption is greatest for the poorest annual income quintile and decreases across quintiles as income rises.


12 For the hypothetical good considered in Figure 1, the Suits index is -0.33.
References


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