



**TAX POLICY CENTER**  
URBAN INSTITUTE & BROOKINGS INSTITUTION

## THE DISTRIBUTIONAL BURDEN OF FEDERAL EXCISE TAXES

Joseph Rosenberg

September 2, 2015

### ABSTRACT

The federal tax system imposes a number of excise taxes on goods and services such as gasoline, alcohol, tobacco, air travel, and health care. In fiscal year 2014, the federal government raised \$93.4 billion or 0.5 percent of GDP from excise taxes, accounting for about 3 percent of total federal revenue. This report provides a brief summary of federal excise taxes and presents the methodology the Tax Policy Center uses to estimate the incidence of excise taxes in our distributional tables.

*Joseph Rosenberg is a senior research associate at the Urban-Brookings Tax Policy Center. The author would like to thank James Nunns, Surachai Khitatrakun, Donald Marron, and Eric Toder for helpful comments and discussions. This work was funded by the Peter G. Peterson Foundation (Grant #14007).*

*The findings and conclusions contained within are those of the author and do not necessarily reflect positions or policies of the Tax Policy Center or its funders.*

## INTRODUCTION

Excise taxes are narrowly-based consumption taxes, assessed on certain goods, services, or activities. They can be assessed either on a per-unit basis (e.g., the gasoline tax is levied per gallon) or as a percentage of value (e.g., the federal excise tax on air travel is based on the dollar cost of the ticket). Generally excise taxes are collected at the pre-retail level, such as from producers or wholesalers, and are embedded in the price paid by final consumers.

Excise taxes may be used for a number of purposes. Certain excise taxes are used to fund related government expenditures. For example, excise taxes on gasoline and diesel fuel are directed to the Highway Trust Fund, which is used to fund federal expenditures on highways construction and maintenance, mass transit, and other transportation related projects. Other excise taxes—such as taxes on tobacco and alcohol—are imposed on goods or services considered harmful or that produce negative externalities. These so-called Pigovian or corrective taxes are intended (at least in part) to discourage the taxed behavior. Other purposes might include distributional objectives (e.g., luxury taxes) or simply to raise additional revenue. Of course, an excise tax may satisfy multiple objectives. For example, the Affordable Care Act (ACA) imposed a range of excise taxes in order to influence the structure of the health insurance market and health care delivery system, target groups that were perceived to experience windfall gains from the legislation (e.g., health insurers and medical equipment producers), discourage certain behaviors (e.g., indoor sun tanning), and generally offset the cost of the provisions that expanded health insurance coverage.

Beginning in 2015, the Tax Policy Center (TPC) now includes federal excise taxes in its distributional estimates. We include all federal excise taxes, the largest of which are those assessed on motor fuels, alcohol, tobacco, air transportation, certain health insurance providers and prescription drug manufacturers, and, effective in 2018, certain high-cost employer-sponsored health insurance plans (the so-called “Cadillac tax”). We also include the penalties on individuals without essential health insurance coverage (the “individual mandate”) and employers that fail to meet minimum essential coverage (the “employer mandate”) associated with the ACA.

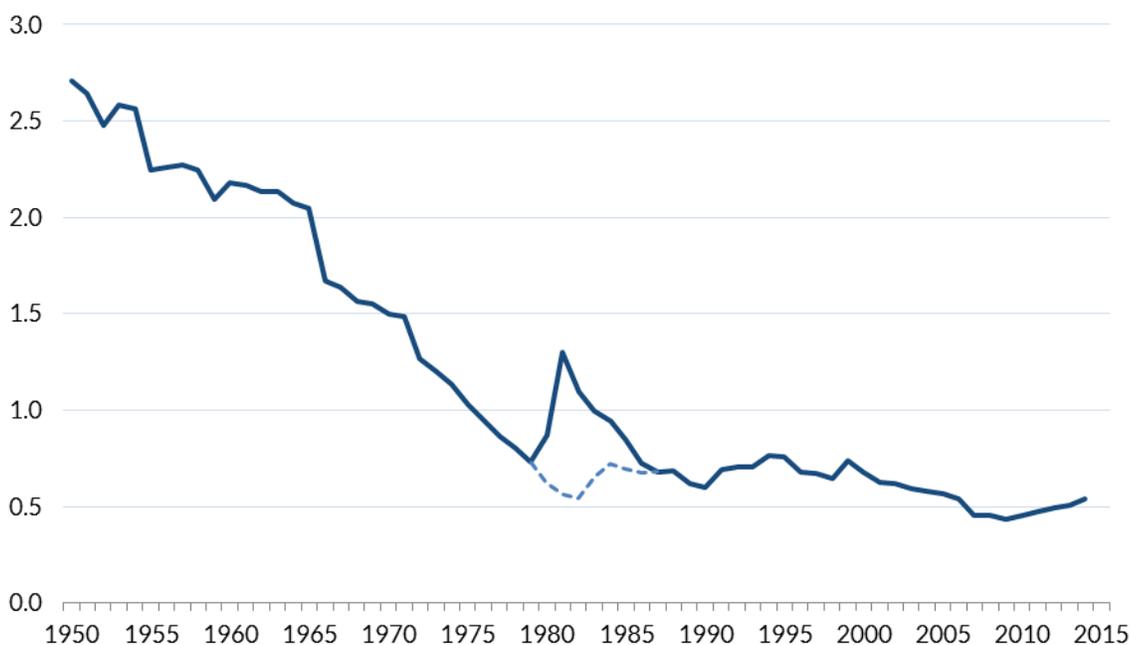
This paper first provides a brief overview of excise taxes in the U.S. federal tax system. It then presents the methodology TPC uses to impute consumption amounts to the microsimulation model that produces distributional estimates of the tax system. Finally, it presents the assumptions we make regarding the incidence of excise taxes and the baseline distribution of all excise taxes and major sub-categories.

Overall, excise taxes are regressive, so somewhat reduce the overall progressivity of the federal tax system. In 2014, average effective excise tax rates decline by income group, from 1.0 percent of pre-tax income in the bottom income quintile, to 0.8 percent in the middle quintile, and 0.4 percent in the top 1 percent of tax units.

## OVERVIEW OF FEDERAL EXCISE TAXES

Federal excise taxes totaled \$93.4 billion in fiscal year 2014, accounting for 3.1 percent of total federal tax receipts.<sup>1</sup> Up until 1941—before the creation of the modern income-based tax system when federal revenues amounted to less than 10 percent of GDP—excise taxes were the largest source of revenue for the federal government. Excise tax revenue as a percentage of GDP fell from 2.7 percent of GDP in 1950 to 0.7 percent of GDP by 1979 (Figure 1). Revenues temporarily increased as a result of the crude oil windfall profit tax imposed in 1980, but excluding that tax, excises held fairly steady (the dashed line in Figure 1) at about 0.7 percent of GDP through the 1990s. Excise tax revenues as a percent of GDP gradually declined again throughout the 2000s to roughly 0.5 percent in recent years.

**Figure 1. Federal Excise Tax Revenue as a Percentage of GDP, 1950-2014**



**Source:** Office of Management and Budget, Historical Tables 2.3 and 2.4.

**Note:** The dashed line excludes receipts from the Crude Oil Windfall Profit Act of 1980.

<sup>1</sup> Throughout this paper, we focus exclusively on federal excise taxes. Many state and local governments impose additional excise taxes, which are not considered here. For much more detail on the specifics of federal excise taxes, see Joint Committee on Taxation (2015).

Excise tax revenues are either transferred to the general fund or to designated trust funds to be expended on specific purposes. General fund excise taxes account for roughly 40 percent of total excise receipts, with the remaining 60 percent going to various trust funds.

General fund excise taxes are imposed on a wide array of goods and services, the most prominent of which are alcohol, tobacco, and health insurance. Other general fund excise taxes include taxes on local telephone service, vehicles with low mileage ratings, ozone-depleting chemicals, indoor tanning services, medical devices, and other regulatory excise taxes.

Other excise taxes are dedicated to trust funds to finance transportation, environmental, or health-related spending. Excise taxes that finance transportation trust funds, such as the Highway Trust Fund and the Airport and Airway Trust Fund, are levied on gasoline, diesel and other transportation fuels, heavy vehicles, tires, and air and sea transportation of persons and cargo. The environmental-related trust funds are financed by excise taxes on fuels, crude oil, and fishing equipment. Health-related trust funds, such as the Black Lung Disability Trust Fund and the Vaccine Injury Compensation Trust Fund, receive revenue from taxes on coal, vaccines, and other items. The Highway Trust Fund and the Airport and Airway Trust Fund account for almost 90 percent of trust fund related excise tax receipts.

Five categories of excise taxes—highway, tobacco, air travel, health, and alcohol—accounted for 94 percent of total excise tax receipts in fiscal year 2014 (Figure 2). We briefly discuss each category below.

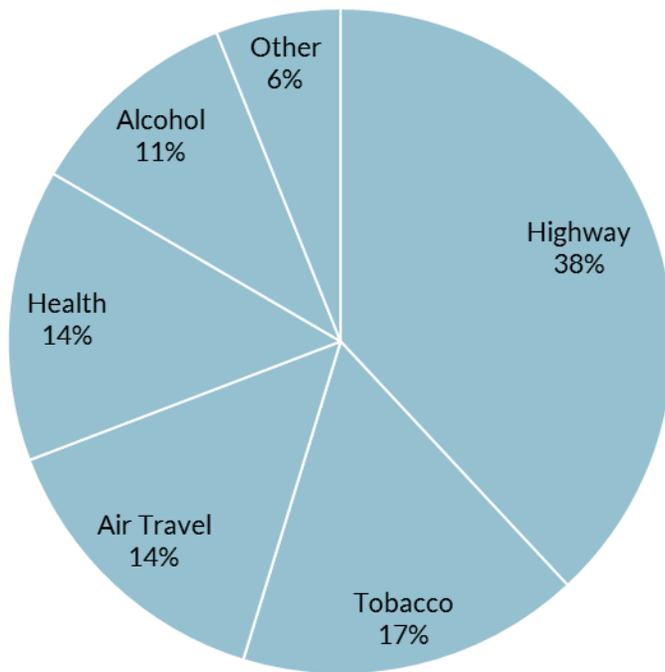
### ***Highway Trust Fund Excise Taxes***

Excise taxes that fund the Highway Trust Fund are imposed on fuels, tractors, heavy trucks, and tires. Gasoline and diesel taxes, which are 18.4 and 24.4 cents per gallon, respectively, make up nearly 90 percent of total Highway Trust Fund revenue.<sup>2</sup> In addition, most other types of motor fuels are also subjected to excise taxes, although “partially exempt” fuels produced from natural gas are taxed at much lower rates. Prior to 2015, certain fuels—including ethanol and other alcohol fuels, biodiesel, and alternative fuels—were entitled to receive tax credits. Those credits are currently expired. In addition to motor fuels, tractors and heavy trucks are subject to a tax that is equal to 12 percent of the retail price. Tires for heavy vehicles are taxed on each 10 pounds of their maximum load capacity that exceed 3,500 pounds. There is also a use tax on the weight of a vehicle in excess of 55,000 pounds.

---

<sup>2</sup> The tax rates include the 0.1 percent tax that is earmarked the Leaking Underground Storage Tank (“LUST”) Trust Fund. In addition to the federal gasoline tax, many states impose an additional excise tax on gasoline. See Auxier (2014) for a discussion of state gasoline taxes.

**Figure 2. Composition of Federal Excise Tax Revenue, FY2014**



Source: Office of Management and Budget, Historical Table 2.4.

According to the OMB, highway related excise taxes totaled \$35.5 billion in revenues in fiscal year 2014, which amounts to 38 percent of all excise tax revenues. Gasoline taxes accounted for more than 60 percent of this revenue, diesel taxes brought in 25 percent, and the remaining 15 percent came from taxes on other fuels, trucks and trailers, and tires.

### ***Tobacco Excise Taxes***

Revenue from tobacco taxes totaled \$15.6 billion in fiscal year 2014, accounting for roughly 17 percent of all excise tax revenue. Federal excise taxes are imposed on tobacco products, which include cigars, cigarettes, snuff, chewing tobacco, pipe tobacco, and roll-your-own tobacco. The tax is calculated per thousand cigars or cigarettes, or per pound of tobacco, depending on the product. Cigarette papers and tubes are also subject to tax. Tobacco taxes are collected when the products leave bonded premises for domestic distribution. Exported products are not subject to the excise tax. In addition, manufacturers and export warehouse proprietors pay an occupational tax of \$1,000 per year per premise (\$500 if their gross receipts are less than \$500,000). Unlike other excises taxes, which are collected by the Internal Revenue Service (IRS), alcohol and tobacco excise taxes are collected by the Alcohol and Tobacco Tax and Trade Bureau (TTB) of the U.S. Treasury Department.<sup>3</sup>

<sup>3</sup> The TTB also collects excise taxes imposed on firearms and ammunition.

## ***Airport and Airway Trust Fund Excise Taxes***

Domestic air travel is subject to a 7.5 percent tax based on the cost of the ticketed fare plus \$4.00 for each flight segment (a flight segment consists of one takeoff and one landing). A 6.25 percent tax is charged on domestic cargo transportation. International arrivals and departures are taxed at \$17.70 per person; there is no tax on international cargo transportation. Both the domestic and international segment fees are adjusted annually based on the percent change in the consumer price index (CPI). Aviation fuels are also subject to taxes: aviation-grade kerosene for non-commercial aviation is taxed at 21.9 cents per gallon, whereas for commercial purposes, the rate is 4.4 cents per gallon. Tax on aviation gasoline is 19.4 cents per gallon.

Revenues from excise taxes dedicated to the Airport and Airway Trust Fund totaled \$13.5 billion in fiscal year 2014, accounting for 14 percent of all excise tax receipts. According to Congressional Budget Office (CBO) data, more than 90 percent of aviation excise taxes came from taxing passenger air fare, with the remaining coming from taxes on air cargo and aviation fuels.

## ***Alcohol Excise Taxes***

Excise taxes on alcohol were \$9.8 billion in fiscal year 2014, accounting for 11 percent of total excise receipts. Tax rates apply differently to distilled spirits, wine, and beer. Distilled spirits are taxed at \$13.50 per proof gallon; tax rates on wines vary based on type and alcohol content, ranging from 22.6 cents per gallon for hard cider to \$3.40 per gallon for sparkling wines. Beer is typically taxed at \$18 per barrel, although for brewers who produce less than 2 million barrels, a reduced rate of \$7 per barrel applies to the first 60,000 barrels. Excise taxes are imposed on domestic or imported products upon leaving bonded warehouses. Alcohol products can be exported or delivered for non-beverage uses without incurring excise tax.

## ***Health Related Excise Taxes Enacted as Part of the Affordable Care Act***

The Affordable Care Act legislation passed in 2010 contained a number of health related excise taxes. Currently, the largest of these taxes is an annual fee on health insurance providers. This fee represents a fixed aggregate amount of tax for each calendar year (\$8 billion for 2014), which is divided up and imposed on insurance providers according to their market share.<sup>4</sup> Beginning in 2015, an annual fee also applies to manufacturers and importers of branded prescription drugs.<sup>5</sup> Beginning in 2018, a 40 percent excise tax will apply to certain high-cost employer sponsored

---

<sup>4</sup> The annual amounts apply to calendar years and are set at \$8 billion for 2014, \$11.3 billion for 2015 and 2016, \$13.9 billion for 2017, and \$14.3 billion for 2018. After 2018, the annual amount is indexed to the growth in health insurance premiums.

<sup>5</sup> The annual fee is equal to \$3 billion for calendar years 2015 and 2016, \$4 billion for 2017, \$4.1 billion for 2018, and \$2.8 billion for 2019 and all subsequent years.

health insurance plans (i.e., the “Cadillac tax”).<sup>6</sup> Other health care related excise taxes include a 2.3 percent tax on medical devices and a 10 percent tax on indoor tanning services. In addition, the ACA imposes excise taxes on individuals without essential health insurance coverage (i.e., the “individual mandate”) and on large employers not offering health care coverage (i.e., the “employer mandate”).<sup>7</sup>

All together, ACA related excise taxes totaled \$13.3 billion in fiscal year 2014, 14 percent of total excise receipts. This group of excise taxes is scheduled to increase significantly over the budget window and will account for more than 22 percent of all federal excise tax revenue by 2025.

### ***Other Excise Taxes***

The excise taxes discussed above accounted for roughly 94 percent of excise tax receipts in fiscal year 2014. The remaining revenue came from the telephone excise tax, several trust-fund related excises (e.g., Black Lung Disability, Inland Waterway, Oil Spill, Aquatic Resources), and miscellaneous regulatory excise taxes (the largest of which includes a tax on the net investment income of domestic private foundations and a tax on certain insurance policies issued by foreign insurers).

## **ESTIMATING CONSUMPTION PATTERNS FOR DISTRIBUTIONAL ANALYSIS**

TPC’s microsimulation model produces revenue and distributional estimates of the U.S. federal tax system.<sup>8</sup> The model is based on a public-use file produced by the Statistics of Income (SOI) Division of the IRS, which contains detailed information from a large random sample of federal individual income tax returns. Since tax return data do not contain any information about consumption patterns, we use data from the Consumer Expenditure Survey (CEX) to assign consumption variables to tax units in the TPC model. Below, we summarize the methodology used to impute consumption onto the TPC model and present the resulting patterns of consumption.<sup>9</sup> More detail about this methodology is provided in the appendix.

---

<sup>6</sup> The “Cadillac tax” is imposed on health coverage that exceeds certain thresholds, equal to \$10,200 for single coverage and \$27,500 for family coverage in 2018. The threshold amounts are indexed to growth in the consumer price index (CPI-U + 1 percentage point in 2019, and CPI-U in subsequent years).

<sup>7</sup> Both the individual and employer mandates appear in the Internal Revenue Code as excise taxes (sections 5000A and 4980H respectively), although statutorily the individual mandate is referred to as a “penalty” and the employer mandate as an “assessable payment.” These penalties are not classified as excise taxes for budget purposes, but rather as miscellaneous receipts.

<sup>8</sup> A description of the TPC tax model and general distributional methodology is available at <http://www.taxpolicycenter.org/taxtopics/Model-Related-Resources-and-FAQs.cfm>.

<sup>9</sup> The methodology described here was originally developed in 2009 by Laura Wheaton, senior fellow at the Urban Institute. This section draws heavily from that work.

## Methodology

### Consumer Expenditure Survey

The primary data source on consumption patterns comes from the CEX's quarterly interview surveys. Consumers are interviewed in five consecutive quarters—with the first interview used to collect some basic information and the second through fifth used to collect expenditure and income data. Although four quarters of expenditure data are collected, the survey is not designed to produce annual spending estimates at the level of the individual consumer unit. Instead, the Bureau of Labor Statistics (BLS) calculates annual spending estimates by adding up the total spending in each quarter. To create a data file with annual expenditures for each consumer unit, analysts must link consumer units across quarters and develop techniques to reweight the data to correct for sample attrition. Reweighting is important, as sample attrition is a much greater problem for certain consumer units (such as young renters) than for others (such as older homeowners).

To provide sufficient sample size for the match and high-income imputations, we pool CEX data for 2010 to 2013 (the tax model is based on calendar year 2011 data). In order to best capture annual consumption patterns, we restrict our sample to only include consumer units with a full year (i.e., all four quarters) of expenditure data. We then reweight each cohort of consumer units by subgroups defined by age, race/ethnicity, home ownership, urban/rural status, and region so that the total number of consumer units for each type matches the total weighted number of all consumer units from the final quarter in which the cohort is interviewed. Our final analytical file contains ten cohorts of consumer units—those reporting a full year of expenditures with years ending in the fourth quarter of 2010 through the first quarter of 2013. The resulting dataset has 12,255 observations. Because the dataset contains ten cohorts, we divide the adjusted weights by 10 when tabulating results and for use in the statistical match, resulting in a total weighted count of 123.1 million consumer units.

We aggregate CEX expenditure categories into 16 general categories: (1) food consumed at home, (2) food consumed away from home, (3) alcohol, (4) tobacco, (5) clothing and footwear, (6) furniture and other household goods, (7) other durable and nondurable goods, (8) motor vehicles and transportation, (9) air transportation, (10) gasoline (including diesel), (11) tenant occupied rent, (12) owner occupied rent, (13) utilities, (14) health (including health insurance), (15) education, and (16) other services. These 16 categories account for roughly 90 percent of total personal consumption expenditures (PCE) as measured in the national income and product accounts (NIPA).<sup>10</sup> Categories of PCE not accounted for include final consumption expenditures of nonprofit institutions serving households (NPISHs) and financial and professional services

---

<sup>10</sup> The CEX does not fully capture consumption as measured in the comparable national income account categories, due to both measurement error and conceptual differences between the CEX and PCE (see e.g., Bee, Meyer, Sullivan, 2012). A comparison between the CEX donor file and NIPA aggregates is shown in appendix table A1.

(including financial services, non-health and non-auto insurance products, legal and accounting services, and funeral and burial services) that are not well captured in the CEX data.

### Statistical Match

In order to impute the CEX data to tax units in the tax model database in a way that preserves variation in consumption patterns across observable characteristics, we perform a statistical match. A “donor file” is constructed from the CEX data and consumer units are placed within “cells” defined by income, home ownership status, and elderly/non-elderly status of the primary member. Income is defined as cash income plus food stamps, contributions received from others (including alimony and child support), and other net cash inflows. For each tax unit, we find the set of records within the appropriate cell that is most similar to the tax unit according to the variables used for the match, and use a weighted random draw to assign one of the donor records to the tax unit. Once the donor record has been selected, we assign the tax unit to have the same types of expenditures as indicated in the CEX donor record. For very low income tax units—those with incomes under \$10,000—we assign the actual dollar values from the CEX. For tax units with incomes above \$10,000, we calculate the ratio of each consumption variable to CEX income and multiply the resulting ratios by the income of the tax unit.

Due to small sample sizes for high-income consumer units and top-coding of income on the CEX, we replace dollar values obtained from the statistical match for tax units with incomes above \$200,000 with an imputed value based on regressions of (log) consumption to income ratios on (log) income (see appendix for more detail on these regression-based imputations).

### **Results**

The final step is to adjust the resulting values of the match and high-income imputations in order to better correspond to 2011 NIPA targets (see appendix for more detail). The distribution of pre-tax expanded cash income and imputed consumption by income percentile are shown below in Table 1. While the distribution of pre-tax income is fairly concentrated among higher income households, the distribution of consumption is much less so. The bottom quintile earns 4.3 percent of income, but it accounts for 12 percent of total consumption. On average, tax units in the bottom income quintile spend nearly twice their annual income. The middle income quintile consumes, on average, 92 percent of its pre-tax income—accounting for 14 percent of pre-tax income and 19 percent of consumption. Consumption to income ratios fall sharply among higher income groups—consumption represents just 40 percent of income within the top quintile and 13 percent within the top 1 percent of tax units.<sup>11</sup>

---

<sup>11</sup> Widely varying consumption-to-income ratios are a well-known issue with the CEX. Our distributional methodology (see below) mitigates problems arising from poor measurement in the survey data by relying on the composition, rather than levels of consumption.

**Table 1. Pre-Tax Expanded Cash Income and Consumption by Income Group, 2014**

Income percentile	Share of Tax Units	Share of Pre-Tax Income	Share of Consumption	Consumption to income ratio
	(Percent)	(Percent)	(Percent)	
Lowest quintile	27.6	4.3	12.0	1.90
Second quintile	21.6	8.5	14.8	1.18
Middle quintile	19.5	14.0	19.0	0.92
Fourth quintile	16.6	20.7	22.8	0.75
Top quintile	13.9	52.7	30.9	0.40
<b>All</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>0.68</b>
<b>Addendum</b>				
80-90	7.2	14.3	13.1	0.62
90-95	3.5	10.0	7.8	0.53
95-99	2.6	12.4	7.0	0.38
Top 1 percent	0.7	16.0	3.1	0.13
Top 0.1 percent	0.1	7.3	0.6	0.06

Source: Tax Policy Center Microsimulation Model (version 0515-v1).

## DISTRIBUTIONAL METHODOLOGY

Excise taxes, like other indirect taxes, create a wedge between the price paid by the final consumer and what is received by the seller. Conceptually, the tax can either raise the total price (inclusive of the excise tax) paid by consumers or reduce the amount available to compensate for factors of production. The burden from such a tax can be separated into two pieces: (1) the reduction in real income, which is equal to the magnitude of the gross revenue generated by the excise tax, and (2) the increase in the price of the taxed good or service relative to the prices of other items of consumption, which depends on the relative mix of consumption by income group and is equal to zero across all tax units. Note that the decline in real income is the same regardless of whether nominal incomes fall (holding the price level constant) or whether prices rise (holding nominal incomes constant).<sup>12</sup>

<sup>12</sup> Estimating conventions usually hold the overall price level and the nominal level of aggregate production/income constant across policy scenarios. TPC follows this convention in its distributional analyses, in which we hold nominal pre-tax incomes constant across policy changes.

However, that still leaves open the issue of the *timing* of the tax burden—that is, whether the burden should be assigned when income is earned or when it is consumed.<sup>13</sup> Conventional distributional analysis—such as that done by CBO—follows the latter approach and distributes excise taxes in proportion to current (imputed) levels of consumption. Alternative methodologies—such as that used by the U.S. Treasury Department’s Office of Tax Analysis (OTA) as described in Cronin (1999)—assign the burden based on current income. Under the income-based approach, one can think of excise taxes as a reduction in the purchasing power at the point income is earned. Of course, if all households fully consumed their income in each year, the two methods would yield identical results.

The income-based approach (with relative price adjustments) has two main advantages over the standard distributional methodology that distributes consumption taxes in proportion to current *levels* of consumption. The first is conceptual. Distributional analyses typically rank (classify) households by their current annual income, which is a proxy for economic well being and/or ability to pay. This works well for income-based taxes, since the timing of tax liability is aligned with the classifier. However, consumption tax liability aligns with the timing of consumption, not the timing of income, resulting in a mismatch of the statutory tax burden and the classifier. The second advantage is empirical. As demonstrated above, estimates of consumption based on survey data such as the CEX are tenuous at best and consumption-to-income ratios vary widely across income groups. The income-based distribution methodology uses only CEX data on the *composition* of expenditures across individuals, rather than estimated levels, and relies more on the higher quality income data observed on tax returns. Toder, Nunns, and Rosenberg (2011) develop such a methodology for distributing broad-based consumption taxes like a value-added tax.

### ***Incidence Assumptions***

For the purpose of distributing excise tax burden, we follow the methodology of Toder, Nunns, and Rosenberg (2011). That is, we assume excise taxes lower real incomes in proportion to each tax unit’s share of burdened income sources. Income sources that are assumed to bear burden include labor compensation (wages, fringe benefits including employer paid health insurance, income from tax-deferred retirement accounts, and employer payroll taxes), the portion of capital income that exceeds the normal rate of return, and wage-indexed cash transfer payments. In addition, we assume that excise taxes paid or passed through to the retail level change the relative prices consumers face (i.e., raise the price of taxed goods and services relative to the

---

<sup>13</sup> See Burman, Gravelle, Rohaly (2005) for illustration of how the different approaches can significantly affect estimates across economically equivalent tax systems.

prices of all other items of consumption).<sup>14</sup> We assign this part of the burden to tax units based on our consumption imputations from the CEX.<sup>15</sup>

The exception to this methodology is that we estimate three of the health insurance related excise taxes—the individual mandate, the employer mandate, and the tax on high-cost employer plans—using the TPC model’s health module. The health module includes imputations of health insurance status (e.g., type of insurance plan and number of people covered) and the level and composition of employer-sponsored insurance premiums. We assume the burden of these taxes is borne by the individual and/or employee, while holding total employer compensation constant. For example, although the “Cadillac tax” is levied on insurance companies, the burden will translate into higher premiums that are passed on to workers in the form of reduced wages. In many cases, employers will avoid the tax altogether by adopting less expensive plans. In fact, the Joint Committee on Taxation (JCT) and CBO estimate that just one-quarter of the net revenue raised by the “Cadillac tax” will be collected as excise taxes from insurers.<sup>16</sup>

Importantly, for the purpose of characterizing the baseline distribution of excise taxes, the indirect effects of excises on the level and composition of factor incomes (and consequently on income and payroll tax receipts) are already captured in the baseline economic forecast. Therefore, the excise tax burden shown in baseline distribution tables is only the gross excise tax collected. Distributional analyses of changes in excises, however, include the change in income and payroll taxes, so-called “direct tax offsets,” associated with the resulting changes in factor incomes. Note that because the offsets for an excise tax are negative, they increase the regressivity of the change. Therefore, the baseline distributions of excise taxes described in the next section appear less regressive than would increases in these excises that raised the same amount of (net) revenue.

### ***Baseline Distribution of Federal Excise Taxes***

Table 2 shows the current law distribution of federal excise taxes using several commonly used measures of tax burden. The total amount of tax burden (gross excise tax collected) for calendar year 2014 is equal to \$95.7 billion. The first column shows the average dollar amount paid by income group. Overall, tax units pay an average of \$566 in federal excise taxes in 2014. The average rises by income group from \$121 in the bottom quintile to \$1,786 in the top income quintile. The second column shows the share of excise taxes paid by income percentile. The lowest income quintile accounts for 5.9 percent of the total excise tax burden, the middle quintile

---

<sup>14</sup> We assume that 100 percent of alcohol and tobacco excises, 75 percent of gasoline excises, and 50 percent of aviation and health excises are paid at the retail level. The remaining excise tax revenue is assumed to be paid by businesses and passed through to the prices of all consumption items, and therefore to have no effect on relative prices.

<sup>15</sup> The relative price effects are based on the expenditure shares of the relevant consumption category (see appendix Table A5). For per-unit excise taxes, that might distort the burden slightly if the tax is not proportional to total expenditures (e.g., higher income individual consume more expensive tobacco and alcohol products).

<sup>16</sup> For more discussion of the “Cadillac tax” and distributional estimates of repealing it, see Mermin and Toder (2015).

another 16.4 percent, while the top quintile pays nearly 44 percent of the total. For comparison, while the top 1 percent pays 9.3 percent of excise taxes, that same income group bears nearly 43 percent of the individual income tax burden (and 5.4 percent of the payroll tax burden).<sup>17</sup>

The third column of Table 2 shows the average excise tax burden as a percentage of average pre-tax expanded cash income. The average tax rate declines as income rises, from 1.0 percent in the bottom quintile, to 0.8 in the third and fourth quintiles, 0.7 between the 80<sup>th</sup> and 95<sup>th</sup> percentiles, and 0.4 percent of income in the top 1 percent. The final column shows excise tax burden as a percentage of total federal burden (including individual and corporate income taxes, payroll taxes, the estate tax, and excise taxes). Excise taxes are nearly one-third of the total burden of the bottom quintile and 11.6 percent in the second income quintile. Those figures are the result of the fact that refundable tax credits create negative average effective individual income tax rates in those quintiles.<sup>18</sup>

**Table 2. Baseline Distribution of Federal Excise Taxes, 2014**

Income percentile	Excise Tax Burden			
	Average amount (dollars)	Share of total (percent)	Average tax rate (percent)	Percent of total federal burden (percent)
Lowest quintile	121	5.9	1.0	33.2
Second quintile	282	10.8	0.9	11.6
Middle quintile	475	16.4	0.8	6.3
Fourth quintile	770	22.6	0.8	4.5
Top quintile	1,786	43.9	0.6	2.3
<b>All</b>	<b>566</b>	<b>100.0</b>	<b>0.7</b>	<b>3.6</b>
<b>Addendum</b>				
80-90	1,126	14.3	0.7	3.6
90-95	1,518	9.4	0.7	3.1
95-99	2,395	10.9	0.6	2.5
Top 1 percent	8,047	9.3	0.4	1.2
Top 0.1 percent	29,254	3.5	0.3	1.0

Source: Tax Policy Center Microsimulation Model (version 0515-v1).

<sup>17</sup> For a comparison of shares of taxes by type of tax, see <http://taxpolicycenter.org/numbers/displayatab.cfm?Docid=4232>.

<sup>18</sup> See <http://taxpolicycenter.org/numbers/displayatab.cfm?Docid=4222>.

The distributional burden varies somewhat across the categories of excise taxes (Table 3). The most noticeable is the tobacco excise tax, for which the share of tax paid is nearly constant across income quintiles. The bottom quintile pays 18.2 percent of tobacco taxes (compared to 5.9 percent of all excises), while the top quintile pays just 26.2 percent (compared to 43.9 percent of all excises). The remaining categories vary only modestly. Excise taxes on air travel are tilted the most toward higher income households, with 53 percent of the tax paid by households in the top income quintile.

**Table 3. Distribution of Federal Excise Taxes by Category, 2014**

Income percentile	Share of Total Excise Tax Burden by Category					
	Highway	Tobacco	Air travel	Health	Alcohol	Other
Lowest quintile	3.5	18.2	3.7	3.6	3.9	3.7
Second quintile	10.2	18.4	6.9	10.1	8.6	9.5
Middle quintile	16.9	17.3	14.0	16.5	16.9	15.2
Fourth quintile	23.5	19.4	22.0	23.5	23.3	23.0
Top quintile	45.6	26.2	53.0	45.8	47.1	47.6
<b>All</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Addendum</b>						
80-90	15.0	8.9	16.5	14.7	15.6	15.5
90-95	9.5	4.6	12.4	9.9	10.8	10.7
95-99	11.4	5.9	13.7	11.6	11.6	11.1
Top 1 percent	9.8	6.9	10.4	9.7	9.0	9.2
Top 0.1 percent	3.6	3.1	3.7	3.4	3.4	3.9
<i>Memo: aggregate revenue (\$ billion)</i>	<i>\$37.6</i>	<i>\$15.0</i>	<i>\$13.6</i>	<i>\$14.6</i>	<i>\$10.0</i>	<i>\$4.9</i>

Source: Tax Policy Center Microsimulation Model (version 0515-v1).

## CONCLUSION

Although excise taxes are a small part of the overall federal tax system, the fact that they are imposed on narrowly defined behaviors and activities implies they have important efficiency and distributional consequences. Furthermore, as evidenced by the recently enacted health care reform legislation, excise taxes might be an important component of incremental tax reforms going forward. In addition, the conceptual and empirical issues faced in modeling excise taxes are useful for considering a range of consumption based taxes including carbon and value-added taxes.

TPC now includes federal excise taxes in its distributional analyses and finds that they are an important component of the federal tax burden, particularly at the bottom end of the income distribution. This fact arises because both the share of income burdened by excises and the share of consumption spending on taxed goods and services is higher, on average, for lower income households.

## REFERENCES

- Auxier, Richard C., 2014. "Reforming State Gas Taxes: How States Are (and Are Not) Addressing an Eroding Tax Base." Urban-Brookings Tax Policy Center, Washington DC.
- Bee, Adam, Bruce D. Meyer, and James X. Sullivan, 2015. "The Validity of Consumption Data: Are the Consumer Expenditure Interview and Diary Surveys Informative?" In Carroll, Christopher, Thomas Crossley, and John Sabelhaus (eds.), *Improving the Measurement of Consumer Expenditures*, 204-240. University of Chicago Press, Chicago, IL.
- Burman, Leonard E., Jane G. Gravelle, and Jeffrey Rohaly, 2005. "Towards a More Consistent Distributional Analysis." Urban-Brookings Tax Policy Center, Washington DC.
- Cronion, Julie-Anne, 1999. "U.S. Treasury Distributional Analysis Methodology." OTA Paper 85, U.S. Department of Treasury, Washington DC.
- Garner, Thesia I., George Janini, William Passero, Laura Paszkiewicz, and Mark Vendemia, 2006. "The CE and the PCE: A Comparison." *Monthly Labor Review*, September 2006. Bureau of Labor Statistics, Washington DC.
- Joint Committee on Taxation, 2015. "Present Law and Background Information on Federal Excise Taxes." JCX-99-15. Joint Committee on Taxation, Washington DC.
- Mermin, Gordon, and Eric Toder, 2015. "Distributional Impact of Repealing the Excise Tax on High-Cost Health Plans." Urban-Brookings Tax Policy Center, Washington DC.
- Poterba, James M., 1989. "Lifetime Incidence and the Distributional Burden of Excise Taxes." *American Economic Review: Papers and Proceedings* 79 (2), 325-330.
- Sabelhaus, John, 1993. "What is the Distributional Burden of Taxing Consumption?" *National Tax Journal* 46 (3), 331-344.
- Toder, Eric, James Nunns, and Joseph Rosenberg, 2011. "Methodology for Distributing a VAT." Urban-Brookings Tax Policy Center, Washington DC.

## APPENDIX: TPC CONSUMPTION IMPUTATIONS

This appendix provides additional detail on the methodology used to assign consumption amounts to tax units in the TPC model database.

### *Consumer Expenditure Survey (CEX)*

The BLS uses two data sources when producing estimates of consumer spending—the quarterly interviews used here, as well as a separate Diary Survey that is intended to capture everyday purchases such as groceries and laundry detergent. There is much overlap between the surveys. When producing published estimates, the BLS draws from the source that appears to do the best job at capturing a particular expenditure (Garner, Janini, Passero, Paskiewicz, and Vendernia, 2006). The two surveys are entirely separate and are not linkable at the micro-level; therefore we use the more comprehensive quarterly interviews as the source of data for this analysis.

The CEX collects information at the level of the “consumer unit.” A consumer unit consists of all persons within the household who are related by blood, marriage, adoption or other legal arrangements. Unrelated persons are combined into the same consumer unit if they use their incomes to make joint expenditure decisions. A consumer unit may contain one or more tax units. Expenditures are not reported below the consumer unit level, and so we do not attempt to break the consumer units down to the tax unit level. (When assigning expenditures to tax return units in the TPC data, we do not assign expenditures to dependent filers. Spending by dependents is assumed to be represented in the spending of the tax unit head).

The CEX data used for this analysis are drawn from the quarterly CEX FMLY, ITAB, and MTAB files. The FMLY file contains basic demographic and some summary level data for the consumer unit. The ITAB file contains monthly income data and the MTAB data contains monthly expenditure data. The CEX is designed to represent spending in each quarter. Consumer units are interviewed in five consecutive quarters—with the first interview used to collect some basic information about the unit and the second through fifth used to collect expenditure and income data. Although four quarters of expenditure data are collected, the survey is not designed to produce annual spending estimates at the level of the individual consumer unit. Instead, the BLS calculates annual spending estimates by adding up the total spending in each quarter. To create a data file with annual expenditures for each consumer unit, analysts must link consumer units across quarters and develop techniques to reweight the data to correct for sample attrition. Reweighting is important, as sample attrition is a much greater problem for certain consumer units (such as young renters) than for others (such as older homeowners).

To preserve confidentiality in the public use data, income reported on the CEX is subject to topcoding. Reported values that exceed a certain threshold are replaced with a value that reflects the mean for top-coded units. Most consumption variables are not subject to topcoding.

Exceptions include spending related to rent, medical services and equipment, and the purchase of homes and boats.

The CEX does not capture a large part of PCE, due both to conceptual difference and reporting problems (Sabelhaus, 1993 and Garner et al., 2006). While our CEX donor file accounts for close to 83 percent of non-health PCE overall (Table A1), the implied totals from the CEX vary considerably by category. In particular, the CEX accounts for less than 30 percent of PCE for health, other durable and nondurable goods, and alcohol.

**Table A1. Comparison of Consumption Categories, 2014**

Category	2011 NIPA (\$billion)	CEX "Donor" File	
		Amount (\$billions)	Percentage of NIPA
1. Food consumed at home	675.9	740.0	109.5
2. Food consumed away	451.1	330.0	73.2
3. Alcohol	178.4	51.0	28.6
4. Tobacco	106.3	50.0	47.0
5. Clothing and footwear	320.6	140.0	43.7
6. Furniture and other household goods	358.7	122.2	34.1
7. Other durable and nondurable goods	717.9	174.0	24.2
8. Motor vehicles and transportation	658.5	719.0	109.2
9. Air transportation	42.7	51.0	119.4
10. Gasoline	299.9	376.0	125.4
11. Tenant occupied rent	372.6	451.0	121.0
12. Owner occupied rent	1,214.5	1,529.0	125.9
13. Utilities	325.5	378.0	116.1
14. Health	2,216.3	488.0	22.0
15. Education	235.5	172.0	73.0
16. Other services	870.9	624.0	71.7
<b>Total</b>	<b>9,045.3</b>	<b>6,395.0</b>	<b>70.7</b>
<b>Total (excluding health)</b>	<b>7,154.5</b>	<b>5,907.0</b>	<b>82.6</b>

Sources: Bureau of Labor Statistics, Consumer Expenditure Survey, Interview Survey (various years); Bureau of Economic Analysis, National Income and Product Account Table 2.4.5U; and author's calculations.

## Statistical Match to TPC Tax Model

In performing the statistical match, some donor records are placed in more than one cell. We use \$200,000 as the arbitrary “cut-off” to define high-income tax units in the TPC database, because CEX units with income above this level are much more likely to have top-coded income than units with lower income. Tax units with incomes less than or equal to \$200,000 are matched to CEX records in the appropriate homeowner/non-homeowner and elderly/non-elderly category. Home-owner tax units with incomes exceeding \$200,000 are matched to homeowner CEX records for units with incomes above \$200,000. Due to the small CEX sample size for non-homeowners with incomes above \$200,000, we allow high-income non-homeowner tax units to be matched with CEX records for units above \$100,000. Because we impute consumption values to high-income units, the CEX donor record is used only to determine the types of expenditures for high-income units.

If more than one donor record is located that corresponds to the tax unit’s characteristics, the weights of the donor records are summed. Each donor record’s weight is divided by the sum to show that record’s percent of the total. Cumulative probabilities are assigned. A uniform random number is drawn and the tax unit is assigned the first donor record for which the cumulative probability equals or exceeds the random number.

When performing the match, the tolerance (allowed difference of donor record income and tax unit income) is initially set as follows:

**Table A2. Tolerance for Statistical Match by Income**

Income of Tax Unit	Range of Donor Income
Negative	Less than \$210,000
\$0 – \$20,000	+/- \$1,000
\$20,000 – \$60,000	+/- \$2,000
\$60,000 – \$100,000	+/- \$5,000
\$100,000 – \$200,000	+/- \$10,000
Greater than \$200,000	Greater than \$100,000 (non-homeowner) Greater than \$200,000 (homeowner)

We do not impose an income restriction for tax units with negative income, other than to require that the income of the donor record be at least \$210,000. There are far fewer CEX donor records with negative income than tax units with negative income. Presumably, the CEX does not pick up most of the income losses that are reflected in the tax data, and so we make the simplifying assumption that tax units with negative incomes have consumption patterns that are distributed similarly to those of consumer units with incomes up to \$210,000.

To preserve confidentiality, region of residence is masked in both the TPC data and the CEX for certain units. We allow tax units with missing region to be matched with donor records from any region, and donor records with missing region to be matched to tax units from any region.

If the initial attempt at the match finds no donor records that match the tax unit on family size, region, married/non-married status, and income subject to the tolerances described above and within the appropriate cell, then the match criteria are relaxed in the following order until one or more matches is obtained:

- 1) The regional constraint is dropped.
- 2) The match is extended to allow a difference of 1 person in family size.
- 3) The match is extended to allow a difference of 2 persons in family size.
- 4) The marital status constraint is dropped.
- 5) The allowed family size difference is incrementally extended up to 15 and then the family size restriction is dropped.
- 6) The allowed income tolerance is incrementally increased by a factor of 1.1, 1.2, 1.3, and so on until it is multiplied by 5.

### ***High-Income Imputations***

The high-income imputations are based on regressions of (log) consumption to income ratios on (log) income. First, we calculate the 10<sup>th</sup>, 20<sup>th</sup>, 30<sup>th</sup>, 40<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup>, 99<sup>th</sup>, and 100<sup>th</sup> income percentiles for all CEX units with positive income. We then drop the observations with incomes above \$210,000 (to remove those that are likely top-coded). For each consumption category, we run the following OLS regression:

$$\ln\left(\frac{C}{Y}\right)_i = \alpha + \beta \ln(V_i) + \varepsilon_i \quad [1]$$

where  $C/Y$  is the ratio of total consumption to total income for each income percentile group, and  $V$  is average income for each income percentile group. If the statistical match assigns a consumption item to a tax unit with income greater than \$200,000, we replace that amount with the predicated value computed using the coefficients estimated in equation [1].

### ***Adjusting CEX Imputations to Hit NIPA Aggregates***

The resulting values of the match and high-income imputations are adjusted in order to better correspond to aggregate targets derived from NIPA. We do not allow the adjustments to increase a tax unit's total consumption to income ratio above the 95th percentile value implied by the CEX data.<sup>19</sup> The results of the match and (unadjusted and adjusted) averages are shown in Table A3.

---

<sup>19</sup> We allow consumption to income ratios higher than the 95th percentile value that result from the match or high-income imputation (to reflect the fact that CEX data show consumption to income ratios that high), but we do not adjust these ratios in order to try to hit NIPA targets.

**Table A3. Consumption Imputations**

Category	CEX “Donor File”		TPC Model		
	Percent with expenditure	Average amount	Percent with expenditure	Average amount (unadjusted)	Average amount (adjusted)
Food consumed at home	99.8	6,023	99.7	4,920	3,932
Food consumed away	93.0	2,879	88.4	2,235	2,956
Alcohol	56.4	732	50.3	623	2,053
Tobacco	26.6	1,517	29.2	1,383	2,080
Clothing and footwear	91.1	1,244	87.5	878	2,103
Furniture and other household goods	78.6	1,260	72.5	931	2,854
Other durable and nondurable goods	87.8	1,608	82.0	1,229	5,075
Motor vehicles and transportation	94.9	6,151	90.2	4,667	4,212
Air transportation	28.5	1,455	22.3	1,108	1,106
Gasoline	93.3	3,273	86.8	2,678	1,999
Tenant occupied rent	34.7	10,543	51.4	8,507	4,180
Owner occupied rent	65.3	19,008	46.4	17,223	15,147
Utilities	96.2	3,191	91.2	2,616	2,049
Health	89.9	4,404	83.1	3,591	9,474
Education	31.9	4,368	24.9	3,709	5,466
Other services	99.8	5,082	99.3	3,688	4,947

Source: Tax Policy Center Microsimulation Model (version 0515-v1).

The distribution and expenditure shares of select consumption categories used for distributing excise taxes are shown in Tables A4 and A5, respectively.

**Table A4. Distribution of Select Consumption Categories by Income Percentile, 2014**

Income percentile	Share of Total				
	Highway	Tobacco	Air travel	Health	Alcohol
Lowest quintile	10.5	25.3	10.0	6.6	11.2
Second quintile	15.6	23.5	9.6	13.5	13.9
Middle quintile	19.9	20.0	15.2	21.9	19.6
Fourth quintile	23.4	19.2	21.1	27.1	23.0
Top quintile	30.0	11.4	43.4	30.4	31.9
<b>All</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Addendum</b>					
80-90	12.7	6.8	15.5	14.6	13.4
90-95	7.0	2.4	12.3	7.8	8.5
95-99	7.1	1.7	11.5	6.2	7.4
Top 1 percent	3.2	0.5	4.1	1.8	2.6
Top 0.1 percent	0.6	0.1	0.6	0.2	0.4

Source: Tax Policy Center Microsimulation Model (version 0515-v1).

**Table A5. Expenditure Shares of Select Consumption Categories by Income Percentile, 2014**

Income percentile	Percent of Total Consumption in Income Group					
	Highway	Tobacco	Air travel	Health	Alcohol	All other
Lowest quintile	3.6	2.4	0.4	8.6	2.0	83.0
Second quintile	4.3	1.8	0.3	14.2	1.9	77.5
Middle quintile	4.3	1.2	0.4	18.0	2.1	74.0
Fourth quintile	4.2	0.9	0.5	18.6	2.1	73.8
Top quintile	3.9	0.4	0.7	15.4	2.1	77.4
<b>All</b>	<b>4.1</b>	<b>1.1</b>	<b>0.5</b>	<b>15.6</b>	<b>2.1</b>	<b>76.6</b>
<b>Addendum</b>						
80-90	4.0	0.6	0.6	17.4	2.1	75.4
90-95	3.7	0.4	0.8	15.7	2.3	77.2
95-99	4.1	0.3	0.8	13.9	2.2	78.6
Top 1 percent	4.2	0.2	0.7	9.0	1.7	84.3
Top 0.1 percent	3.9	0.1	0.5	6.2	1.3	88.1

Source: Tax Policy Center Microsimulation Model (version 0515-v1).



The Tax Policy Center is a joint venture of the  
Urban Institute and Brookings Institution.



BROOKINGS

For more information, visit [taxpolicycenter.org](http://taxpolicycenter.org)  
or email [info@taxpolicycenter.org](mailto:info@taxpolicycenter.org)