

TO: ZACHARY Q. JACKSON, INDIANA STATE BUDGET DIRECTOR
FROM: JACOB ALDER, TAX ANALYST
DATE: MARCH 2, 2022
RE: MEASURING PROGRESSIVITY OF FEDERAL INCOME AND EXCISE TAXES

This memorandum provides an estimate of the distribution of 2010 tax burden for two federal taxes: individual income and excise. These metrics are relevant to Indiana as the Indiana State Budget Authority (SBA) because they provide insight into the local state implications of tax policy. With the appropriate data, we can determine the progressivity of various taxes in Indiana, too.

To obtain this calculation, I employed Daniel B. Suit's index, first introduced in 1977, to measure the progressivity of each federal tax by income quintile. I have replicated Equations (3) and (4) from Suit's original paper below. The index is "inspired by and related to the Gini ratio" and spans +1 (extreme progressive) to 0 (proportional) to -1 (extreme regressive), representing the proportional share of tax burden among taxpayers.¹

$$S_x = 1 - (L_x/K), \text{ where}$$

$$L_x \approx \sum_{i=1}^N (1/2)[T_x(y_i) + T_x(y_{i-1})](y_i - y_{i-1})$$

The simple measure calculates the area under the curve created by an accumulated percent of tax burden. S_x is Suit's index for a given tax x , calculated by subtracting 1 minus the ratio of the Lorenz Curve approximation, L_x , divided by K , which is the area of a triangle with base and height of 100 for any given tax. The Lorenz approximation is given by the sum of all the individual quintiles, which are indexed from $i = 1 \dots N$ which is the total number of brackets (in this case, five quintiles). The total of a given tax x is represented by T_x and is a function of income y_i and the prior quintile y_{i-1} . The

I obtained data from the Congressional Budget Office (CBO) report "The Distribution of Household Income and Federal Taxes, 2010."² My analysis uses pretax 2010 income to calculate the cumulative household share of tax burden. In Table A.1 in the Appendix I include the raw CBO data as well as the cumulative percentages necessary to calculate Suit's Index. Figure 1 shows a graphical representation of the cumulative household share of tax burdens, modeled after the Lorenz Curve. The graph plots the population quintiles on the horizontal axis and the accumulated tax burden percent on the vertical axis. As income and taxes become respectively more unequal, the Lorenz Curve shows a greater bulge or sag. A tax that is shared evenly by income groups would tightly fit the upward diagonal line.

¹ Suits, D.B., 1977. Measurement of Tax Progressivity. *The American Economic Review* 67, 747–802, at 747.

² Congressional Budget Office, December 2013. <http://www.cbo.gov/sites/default/files/cbofiles/attachments/44604-AverageTaxRates.pdf>

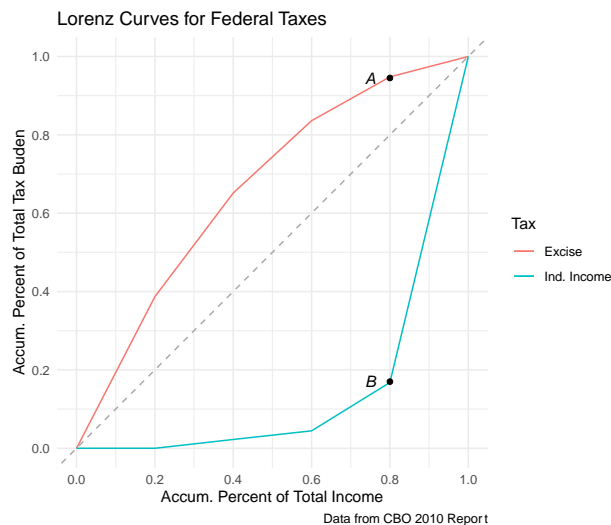


FIGURE 1. LORENZ CURVES FOR FEDERAL EXCISE AND INDIVIDUAL INCOME TAXES

Note: The slight bulge in the red curve, representing the regressivity of the excise tax, is not as great as the sag in the blue curve, which represents the progressivity of the individual income tax. Points A and B correspond with the amount of respective tax shared by the bottom 80 percent of the population: these are 95 and 17 percent, respectively.

A sag in the curve indicates tax progressivity, whereas a bulge indicates regressivity. Point A on the red curve (located at 0.80 on the horizontal axis and approximately 0.95 on the vertical axis) means that the bottom four quintiles of the population shared roughly 95 percent of the total federal excise tax burden. Point B on the blue curve (located at 0.80 on the horizontal axis and approximately 0.17 on the vertical axis) means that the bottom four quintiles of the population shared roughly 17 percent of the individual income tax burden.

From a visual standpoint, the two lines both indicate the tax burden was unequally distributed by income group. Suit's index of the individual income tax is nearly double in absolute value the excise tax, indicating the federal tax on personal income is twice as progressive as the sales (excise) tax is regressive. This corresponds with the calculation of Suit's index for both taxes, respectively. Table 1 provides the calculation of Suit's index for both taxes. Following the practice of the CBO, I reported the index for all five quintiles, divided in even quintiles, as well as subdividing the top quintile into five smaller quintiles. (See the *Note* to Table 1). This differentiation allows for further analysis: the income tax index increases from 0.48 to 0.58, reflecting the substantial share of taxes paid by the top income bracket. Meanwhile, the excise tax index shows a slight increase in regressivity, but within a reasonable change. Neither tax is equally distributed.

TABLE 1. SUIT'S INDEX FOR FEDERAL EXCISE AND INDIVIDUAL INCOME TAXES

	Suit's Index		Interpretation
	Even Quintiles	4 Quintiles + Divided Top	
Excise Tax	(0.262)	(0.290)	Regressive
Individual Income Tax	0.482	0.575	Progressive

Note: Suit's index is a measure of the progressivity (or regressivity) of a tax burden. The values for the excise and individual income tax in the Even Quintiles column are generated treating each quintile's share equally (i.e., 20%, 40%, 60%, 80%, 100%). The Four Quintiles + Divided Top treats the bottom four quintiles the same as in the former column, but further segments the top quintile (i.e., 20%, 40%, 60%, 80%, 81-90%, 91-95%, 96-99%, Top 1%).

APPENDIX

TABLE A.1. CBO DATA USED TO CALCULATE THE SUIT'S INDEX

Income Group	Tax 2010 Income [2010 Dollars]	CBO Reported Share of Total as Percent of Whole			Calculated Cumulative Shares as Percent of Whole*		
		Income	Tax: Ind. Income	Tax: Excise	Income	Tax: Ind. Income	Tax: Excise
Lowest Quintile	24,100	5.1	-6.2	13.4	5.1	-6.2	13.4
Second Quintile	44,200	9.6	-2.9	15.4	14.7	-9.1	28.8
Middle Quintile	65,400	14.2	2.9	18.7	28.9	-6.2	47.5
Fourth Quintile	95,500	20.4	13.3	20.6	49.3	7.1	68.1
Highest Quintile	239,100	51.9	92.9	31.5	101.2	100	99.6
All Quintiles	92,200	100	100	100	201.2	200	199.6

* Values may not total 100 percent due to rounding

Note: These data are reported in the Congressional Budget Office's December 2013 report titled "The Distribution of Household Income and Federal Taxes, 2010." The reported metrics in columns 2 and 3 come from Table 1, "Distribution of Before- and After-Tax Income, by Income Group, 2009 and 2010" and are before-tax dollars. The Tax columns 4 and 5 come from Table 3. "Shares of Federal Taxes, by Income Group, 2009 and 2010." The columns 6, 7, and 8, are calculated as cumulative shares of the total from 3, 4, and 5, respectively.