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Julie-Anne Cronin

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Julie-Anne Cronin*
U.S. Department of the Treasury

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This paper provides a detailed description of Treasury's distribution methodology. In some ways our methodology is unchanged from the 1999 version of this paper but there have been updates to our methodology to reflect more recent research and the greater availability of micro data. The Office of Tax Analysis has improved its modeling of health, retirement, and business decisions. Our income measure now includes the insurance value of both employer and government provided health insurance. Our ranking measure adjusts ability to pay according to family size. Our micro-simulation model is based on a sample of 338,000 individual income tax returns, more than double the size of our sample in 1999.

* Julie-Anne.Cronin@treasury.gov

Introduction

The Treasury Department's Office of Tax Analysis (OTA) prepares various analyses to inform the development of the Administration's tax policy and assess major Congressional tax proposals. In addition to analyzing the merits and deficiencies of current and proposed tax laws in terms of efficiency, simplicity and administrability, OTA is responsible for estimating Federal receipts, estimating revenue changes for actual and proposed tax legislation, and estimating the distribution of tax burdens for current law and for enacted and proposed legislation. OTA's distributional analyses show the current distribution of pre-tax and after-tax income across families and how proposed changes in tax law would affect the distribution of after-tax income. They provide policy makers with guidance on the fairness of proposed changes in tax law.

Distributional analysis must decide how to sort individuals into units that share resources, how to measure ability to pay, how to measure tax burden and on whom that tax burden falls. There is not universal agreement among economists on these theoretical issues involved in distributional analysis. Theoretical differences, combined with differences in practical implementation of theory, including data and measurement issues, may lead to somewhat different rankings of ability to pay and measures of fairness.

Because distributional analysis frequently plays a significant role in the deliberation over tax proposals, it is important that the methodology for producing them be well-developed and well-understood. This paper provides an updated description of Treasury's Distribution Model (DM) and offers some insight into why Treasury's distributional results sometimes differ from those of other government organizations, such as those produced by the Joint Committee on Taxation (JCT) and the Congressional Budget Office (CBO), and policy groups such as the Urban-Brookings Tax Policy Center (TPC).¹ While the primary purpose of this paper is to inform the users of Treasury's distributional analyses, we also hope to further the discussion of distributional issues and elicit suggestions for further improvements to Treasury's methodology.

Distributional analysis has several components. The component choices affect the quantitative results of the analysis and, in some instances, the qualitative results as well. The major components of distributional analysis are the taxes included, the covered population, the unit of analysis, the time period of analysis the income measure, the equivalency measure, and the incidence assumptions. Section 1 provides an overview of Treasury's component choices. Detailed descriptions of the income measure, equivalency measure, and incidence assumptions are given in Sections 2, 3, and 4. Section 5 discusses the mechanics of creating Treasury's distribution model including the data, imputations and calculators used in our model. Section 6 presents and discusses a standard Treasury distribution table for an illustrative proposal.

¹ For JCT methodology see JCT (1993), Kleinbard (2008), and JCT (2013). For CBO methodology, see the Appendix of CBO (2016). For TPC methodology see TPC (2015).

1. Overview of Treasury’s Distribution Methodology

Taxes Included: All federal taxes are included in Treasury analyses: individual and corporate income taxes, payroll taxes (Social Security tax, Medicare tax, and unemployment tax), excises and customs duties, and estate and gift taxes. Treasury analyses do not include state or local taxes. At 2021 income levels and law,² the individual income tax represents the largest share of the total federal tax burden (49 percent), followed by payroll taxes (38 percent), the corporate income tax (9 percent), excises and customs duties (4 percent), and estate and gift taxes (1 percent).

All individual taxes, including refundable credits, are included as taxes in Treasury distribution tables. Refundable tax credits may reduce tax liabilities below zero. Treasury includes refundable tax credits as part of the tax system (as negative taxes) even to the extent that they are scored as outlays (exceed liabilities). The premium tax credit (PTC), both the advanced portion as well as the reconciliation portion are included in Treasury analyses.³

Covered Population: The target population is those individuals who are part of a tax filing unit that would have an obligation to file a U.S. individual income tax return if the unit met the individual income tax filing thresholds. We estimate this population by including all residents of the United States and any non-residents who file U.S. individual income tax returns. Of note, under this definition, Treasury includes undocumented and institutionalized residents of the United States as part of the covered population as well as residents who are part of a tax filing unit that does not actually file an income tax return (non-filers).⁴

Of the 183 million filing units represented in Treasury’s 2021 Distribution Model (DM), 32 million (18 percent) do not file individual income tax returns. Many of these families pay payroll, excise and corporate income taxes.

Unit of Analysis: The tax family is the unit of analysis. Treasury’s family includes the taxpayer, his or her spouse if filing a joint return, and dependents (if any).⁵ All families are included, whether or not any member of the family files an individual income tax return. Dependents are attached to their larger family unit. Single (non-dependent) individuals are considered one-person families. The economic incomes of all members of a family are added together to compute the family's cash income. Treasury estimates that there are 183 million tax families in 2021.

² Treasury produces baseline distribution tables as part of the forward-looking Budget exercise using Administration forecasts of economic and demographic variables. As a result, the 2021 numbers were forecast in 2020 and are, therefore, pre-pandemic.

³ In contrast, the TPC does not include the PTC as either a tax credit or a source of untaxed income in its standard analyses. TPC treats the PTC the same as Medicaid which is an outlay program which it also does not include in income. Treasury includes the insurance value of Medicaid in their income measure and the PTC as a tax credit.

⁴ In general, a tax filing unit is not required to file a tax return if its income falls below a certain threshold (\$12,550 in 2021 for a single filer under age 65). Some low-income taxpayers may opt to file a return in order to claim certain refundable credits (credits that exceed tax liability) or receive a refund of withheld taxes. Elderly, low-income families and single individuals without children are more likely to be part of the nonfiling population.

⁵ Dependent college students living away from home are treated as family members by Treasury.

In contrast, some analyses, such as those conducted by CBO, use households as the economic unit. Households usually consist of one family but may include multiple families. The incidence of multi-family households is more common for low-income households and rare for high-income households. As a result, all else equal, distributions based on households are more likely to show more equal distributions of income than distributions based on families.

Time Period of Analysis: Treasury creates tables showing the distribution of the tax burden in two time periods – the short run and the long run. Both are single year snapshots of tax burdens, as opposed to lifetime measures of tax burdens. They are based on annual measures of income levels and demographic characteristics present in the first year of the 10-year Budget period (also referred to as the “current” year), assuming the current tax law for that year. Short-run tables measure tax burdens in the first year of the Budget period. Long-run tables measure tax burdens under “fully phased-in law,” which is generally the law as it will apply in real (inflation indexed) terms at the end of the Budget period. While many tax provisions are constant over time, current and proposed changes in tax law often include provisions whose effects vary over time: some are explicitly temporary, some are not indexed for inflation, and others are delayed or phased in. Using fully phased-in law provides a measure of tax burdens under the law as it will operate at the end of the Budget planning horizon, which should most fully reflect the long-run, permanent, distributional consequences of legislation.⁶

Income Measure: Treasury uses an annual measure of pre-tax, post-transfer cash income. Cash Income consists of wages and salaries (excluding employee and employer contributions to employer-sponsored retirement accounts and individual retirement arrangements), net income from a business or farm, taxable and tax-exempt interest, dividends, rental income, realized capital gains (including nontaxable housing gains and unrealized capital gains at death), cash and near-cash transfers from the government, retirement benefits (when distributed), and employer-provided health insurance and other employer benefits. Employer contributions for payroll taxes and the federal corporate income tax are added to place cash income on a pre-tax basis. Because it is a relatively broad measure of income, Cash Income more effectively captures a family’s relative economic well-being than a measure that, for example, excludes some components of income such as nontaxable transfer income or employer-sponsored health benefits.

A more detailed description of Treasury’s Cash Income measure is provided in Section 2.

Equivalency Measure: For the purpose of ranking families by ability to pay, Treasury adjusts Cash Income for family size. Larger families are assumed to require more resources to achieve the same level of welfare as smaller families. Without an adjustment for size, large families and single-person families with the same level of Cash Income would be ranked the same and the lowest income deciles would be predominantly singles. Treasury only uses the equivalency measure for the purpose of ranking families, not for calculating tax burdens or summary statistics.

A more detailed description of Treasury’s equivalency measure is provided in Section 3.

⁶ Fully-phased in law as a concept is less meaningful if there is a general understanding that certain pieces of legislation are not expected to sunset (are expected to be extended).

Incidence Assumptions: The individual income tax is assumed to be borne by payers. Payroll taxes (employer and employee shares) are assumed to be borne by labor (wages and self-employment income). The share of the corporate income tax that represents a tax on supernormal returns is assumed to be borne by shareholders. The share of the corporate income tax that represents collections from a cash flow tax is assumed to have no burden in the long run, and the remainder of the corporate income tax, the share imposed on the normal return to investing, is assumed to be borne equally by labor and positive normal capital income. Excise taxes are assumed to be borne by labor and capital income. In addition, excise taxes are assumed to raise the price of taxed goods relative to other goods, thereby increasing tax burdens for consumers of taxed goods and lowering tax burdens for consumers of untaxed goods. The estate and gift taxes are assumed to be borne by decedents.

A more detailed description of the Treasury's incidence assumptions is provided in Section 4.

2. Cash Income

Central to the measurement of the distribution of tax burdens is the measurement of a family's relative ability-to-pay. An income measure, along with a family equivalency measure discussed below, allows Treasury to rank families from the least well-off to the most well-off, and to use this ranking to group families into deciles of ability-to-pay. Treasury uses a cash income concept. JCT, CBO and TPC use similarly broad income concepts in their distribution tables.⁷

Cash Income consists of wages and salaries (net of employer and employee contribution to retirement accounts), employer contributions for health insurance, life insurance, child care, and education expenses, other net income from a business or farm, taxable and tax-exempt interest, dividends, rental income, realized capital gains (including all realized housing gains and unrealized capital gains at death), cash transfers from the government (including food stamps and the insurance value of Medicare and Medicaid), and retirement distributions. Employer contributions for payroll taxes and the federal corporate income tax burden are added to place Cash Income on a pre-tax basis. Cash Income is shown on a family basis.

Cash Income can be described by comparison to adjusted gross income (AGI) reported on an income tax return, which is a narrower but well documented income concept used in the determination of taxable income. Cash Income's relationship to AGI gives us an understanding of what might be missing when we distribute tax burdens by a narrow, tax-dependent concept which is computationally less demanding but incomplete when determining a family's ability to pay.

Cash Income can also be described by income source: labor, capital, or transfer income (detail below). The sources of cash income gives us a better understanding of the types of income that accrue to families with differing abilities to pay. The income source is often a determining factor in the distribution of tax burden incidence as explained in Section 4 on tax incidence.

⁷ See Kleinbard (2008), CBO (2016) and TPC (2015).

Cash Income as Derived from AGI

At projected 2021 income levels,⁸ Cash Income is \$18.3 trillion compared to AGI of \$13.9 trillion. The major differences between Cash Income and AGI can be categorized into three types: (i) income items excluded from the definition of gross income under the tax code but included in Cash Income; (ii) adjustments for costs of earning income and income earned in previous years; and (iii) the addition of the corporate income tax burden.

Income excluded from AGI. Cash Income includes a number of items which clearly represent income to the recipient but are not included in AGI. With respect to labor earnings, these items include: the foreign earned income exclusion, the self-employed health deduction, the basis of nontaxable IRA and pensions distributions, and employer-provided fringe benefits (including employer contributions for health insurance, life insurance, child care, and education benefits, military allowances, the health insurance component of worker's compensation, and the employer share of payroll taxes). With respect to capital income, these items include: excludable realized housing gains and unrealized capital gains at death,⁹ nontaxable IRA and pension distributions (excluding basis), and tax-exempt interest. With respect to transfer income, these items include: nontaxable Social Security benefits, the insurance value of Medicare and Medicaid, Supplemental Security Income (SSI), Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP) benefits, Low Income Housing Energy Assistance (LIHEA), wage replacement under workers compensation, and veterans' benefits.

Other adjustments. We make certain other adjustments to AGI to arrive at cash income. Cash Income excludes all costs of earning income, such as the above-the-line deduction for educator expenses. However, above-the-line deductions that are not costs of earning income in the current year, such as the student loan interest deduction and the tuition and fees deduction, are added back to income. Cash Income also excludes state and local tax refunds since the refunds reflect repayments of deductions from income earned in a previous year (and those itemized deductions are not subtracted in the computation of cash income).

Corporate income tax burden. The corporate income tax burden is added to Cash Income to place it on a pre-tax basis. Because we assume that laborers and capital owners bear the burden of the corporate income tax, we add to labor and capital income the burden of those taxes remitted by other entities on their behalf. In other words, our assumptions about corporate tax incidence

⁸Projected income is income based on the Administration's economic assumptions. The figures and tables in this document are for 2021 but were produced pre-pandemic. As a result, the income levels and tax burdens in all tables should be considered illustrative of what would have occurred for 2021 if the pandemic had not disrupted the economy. In general, distributional analysis is a planning tool for evaluating policies on a forward-looking basis. As such, distributional analyses are estimates of income levels and tax burdens in the first year of the budget period which is usually the year following the year in which they are produced.

⁹Death is a realization event in the Treasury distribution model. Under the current tax code, only capital gains that are realized are subject to tax; accrued but unrealized capital gains are not taxed and upon death ownership is transferred to heirs with a step-up in basis. As a result, capital gains accrued but not realized by the decedent are never taxed even though they are income to the decedent. Treasury's distribution model aims to include all income (all sources of ability to pay) whether taxed or not. Because Treasury's model is realization based, we have elected to include accrued but unrealized gains during the decedent's lifetime in the year of the decedent's death. Alternately, in a Haig-Simons framework (Haig 1921), accrued but unrealized gains would be included on an annual basis.

imply that pre-tax labor and capital income would be higher by the amount of the tax if the tax did not exist.

The relationship between Cash Income and AGI at 2021 income levels, as described above, is shown in Table 1. The largest additions to AGI are for employer fringe benefits, part of labor income, and transfer income such as excluded social security benefits. These types of income accrue to families with particular characteristics, such as those employed in jobs that provide fringe benefits and the elderly. These additions are necessary to fully capture the ability to pay for these families and to appropriately calculate their tax burdens relative to their income.

Table 1: AGI and Cash Income in 2021

	(\$B)
AGI	\$ 13,864
plus	
Income not included in AGI	
labor income	\$ 2,102
capital income	\$ 675
transfer income	\$ 1,375
Other Adjustments	\$ 6
Corporate income tax	\$ 300
Equals Cash Income	\$ 18,323

Cash Income by Source

Cash Income can also be described by source: labor income, capital income, transfer income and the corporate income tax. Table 2 shows Cash Income by source. A version of this table is available for each model year on Treasury’s Office of Tax Analysis webpages.¹⁰ There are two distributions shown in Table 2. The first bank shows the distribution for each source of income across deciles. In this bank, we see that Cash Income is skewed toward the highest income families; 45 percent of Cash Income accrues to the top decile of the income distribution and 9 percent to the top 0.1 percent of the income distribution. The second bank shows the distribution of each type of income within a decile. In the second bank, we see that labor income is the major source of income in general comprising 71 percent of all Cash Income. The composition of labor, capital and transfer income in Treasury’s model is described below.

¹⁰ <https://home.treasury.gov/policy-issues/tax-policy/office-of-tax-analysis>

Table 2: Distributions of Income by Source Across and Within Deciles (2021 Pre-pandemic Income Levels)

Adjusted Family Cash Income Decile ¹	Family Cash Income	Transfer Income	Labor Income	Positive Capital Income			Negative Capital Income	Corporate Income Tax
				Total Positive Capital Income	Normal Capital Income	Supernormal Capital Income		
<i>--- Percent Distribution of Income Across Deciles ---</i>								
0 to 10 ¹	0.7	3.2	0.6	0.1	0.1	0.2	2.4	0.2
10 to 20	2.1	7.2	1.8	0.2	0.2	0.3	3.0	0.5
20 to 30	2.9	8.2	2.8	0.4	0.4	0.5	4.5	0.7
30 to 40	3.8	10.1	3.8	0.7	0.6	0.7	5.1	1.1
40 to 50	4.9	10.8	5.2	1.2	1.2	1.1	6.0	1.7
50 to 60	6.5	10.8	7.1	2.1	2.3	1.8	6.1	2.8
60 to 70	8.5	11.6	9.4	3.3	3.8	2.7	6.3	4.2
70 to 80	11.1	11.9	12.5	5.0	5.8	4.0	6.5	6.1
80 to 90	15.3	13.2	17.4	8.2	9.4	6.8	7.5	9.4
90 to 100	44.5	12.6	39.2	78.8	76.4	81.8	21.5	73.1
Total ¹	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
90 to 95	11.0	6.0	12.3	8.2	9.2	6.9	4.7	8.5
95 to 99	15.0	5.2	15.3	18.6	20.8	16.0	7.2	16.6
99 to 99.9	9.7	1.3	7.7	21.1	19.9	22.7	6.0	18.9
Top .1	8.8	0.2	3.9	30.8	26.5	36.2	3.6	29.0
<i>--- Percent Distribution of Income Source Within Decile ---</i>								
0 to 10 ¹	100.0	45.3	55.5	3.3	1.4	1.9	-4.6	0.4
10 to 20	100.0	35.6	64.0	2.0	0.9	1.1	-2.0	0.4
20 to 30	100.0	29.1	70.1	2.6	1.3	1.3	-2.1	0.4
30 to 40	100.0	27.3	70.9	3.2	1.7	1.5	-1.8	0.5
40 to 50	100.0	22.3	74.4	4.3	2.5	1.8	-1.6	0.6
50 to 60	100.0	17.0	77.8	5.8	3.6	2.2	-1.3	0.7
60 to 70	100.0	14.0	79.2	7.1	4.5	2.6	-1.0	0.8
70 to 80	100.0	10.9	80.7	8.2	5.3	2.9	-0.8	0.9
80 to 90	100.0	8.8	81.1	9.8	6.2	3.6	-0.7	1.0
90 to 100	100.0	2.9	62.8	32.3	17.5	14.8	-0.6	2.7
Total ¹	100.0	10.2	71.3	18.3	10.2	8.1	-1.3	1.6
90 to 95	100.0	5.5	80.1	13.7	8.6	5.1	-0.6	1.3
95 to 99	100.0	3.5	72.7	22.7	14.1	8.6	-0.6	1.8
99 to 99.9	100.0	1.4	56.6	39.6	20.8	18.8	-0.8	3.2
Top .1	100.0	0.2	31.3	63.7	30.6	33.1	-0.5	5.4

¹Families with negative incomes are excluded from the lowest income decile but included in the total line. Families with negative income have a significant share of negative capital income.

Labor Income

Labor income includes wages, earnings from self-employment (including pass-through business income that is subject to payroll taxes), employer-provided fringe benefits, the labor share of retirement distributions (basis), and employer contributions for payroll taxes.

Wages and earnings from self-employment are measured on a pre-tax basis but exclude deductible employee contributions for retirement (e.g., 401(k) contributions). Treasury's income measure includes retirement income when distributed but not in the years of contributions and accrual.¹¹ Employer-provided fringe benefits are an important source of income and tax savings for certain families. Tax-free fringe benefits include employer sponsored health insurance, life insurance, education benefits, childcare benefits, transportation and parking benefits, military subsistence allowances, tax-free combat pay, and worker's compensation.¹²

Retirement distributions derive from a number of sources and the treatment in Treasury's model as either labor or capital income depends on the source. Distributions from defined benefit plans and distributions attributable to employer contributions to defined contribution plans (including accruals on such contributions) are treated as deferred labor income in Treasury's model. Distributions from defined contribution plans attributable to employee contributions are split between labor and capital income. The portion of the distribution that represents the initial employee contribution (basis) is treated as deferred labor income and the portion of the distribution that represents accruals on the initial employee contribution is treated as capital income. This allocation of employee contributions to labor income is comparable to the treatment of employee contributions to a taxable account. If a taxpayer used wages to contribute to a taxable account, then the contribution would be labor income and accruals on the account would be capital income when realized.

Both taxable and tax-free retirement distributions are included in income. However, retirement distributions that are rolled over from one tax-preferred account to another tax-preferred account are excluded from income since Cash Income only includes realized income.

Treasury assumes that the incidence of the payroll tax, both the employer and the employee share is on the employee. Under this assumption, observed wages are lower than they would be without a payroll tax. If employers were not subject to payroll taxes, then wages would be higher for each worker by exactly the amount of the tax paid by the employer on behalf of the

¹¹Some distribution tables from other tax policy organizations include retirement contributions, accruals, and distributions in income in distributional analysis (see Rosenberg (2013)). In earlier versions of our model (see Cronin 1999), Treasury also followed this tradition of double counting retirement income. The argument for doing so is that retirement contributions, accruals, and distributions all represent an ability to pay taxes at different stages of life. One counter argument is that retirement savings should not be treated differently than other forms of savings. Other savings vehicles include the purchase of stocks. Stocks are generally purchased with after-tax income. In Treasury's methodology (as is the case with TPC, CBO and JCT), capital gains are only included in income when realized. Accrued capital gains are not included in income in the year of accrual, and basis is not included in income in the year of realization.

¹²Workers compensation benefits are split between medical benefits which are converted to an insurance value that is attributed to all covered workers and wage replacement which is attributed to the worker receiving the benefit.

employee. Treasury therefore adds the employer share of payroll taxes to the employee's wage income to arrive at a pre-tax value of wages.

As shown in Table 2, labor income is the largest source of income for all families in all deciles. Only the top 0.1 has less than 50 percent of their income from labor. For the top 0.1 percent, 64 of their income comes from capital.

Capital Income

Capital income includes taxable and tax-exempt interest, dividends, realized capital gains, income or loss from rents, royalties, the capital share of pass-through business income and losses,¹³ and the capital share of retirement distributions. Realized capital gains includes realized gains on the sale of a house, including the portion that is excluded from taxable income. Further, death is a realization event in Treasury's model. The accrued gains on unrealized assets of a decedent are included in capital income as realized gains of the decedent in the year of death. (Mortality probabilities vary by age, gender and income and are imputed to the tax data from administrative data on deaths from the Social Security Administration.)

Capital income is further split between normal and supernormal returns. As discussed in Section 4.2, this refinement is needed to distribute the corporate income tax. Normal capital income includes all interest income (taxable and tax-exempt), 40 percent of dividends, 40 percent of realized capital gains, 40 percent of the capital share of pass-through business income and 75 percent of the capital share of retirement distributions.¹⁴

As shown in Table 2, capital income is the most skewed income distribution. The top decile receives 79 percent of all positive capital income. Even within the top decile the distribution of capital income is skewed to the very highest income. The top 1 percent receives over half of all positive capital income and the top 0.1 percent over 30 percent of all positive capital income.

Transfer Income

Transfer income is a broad category of income including both taxable and nontaxable sources as well as both means-tested benefits and those available without regard to income. Transfer income includes: Social Security benefits, the insurance value of Medicare and Medicaid, welfare benefits from SNAP, TANF, LIHEAP, WIC and SSI, unemployment compensation, alimony, debt forgiveness, and cost sharing reductions. Section 5, which describes the mechanics of developing the distribution model, also provides a brief overview of the methods OTA uses to impute transfers not available in the tax data.

Social security benefits are the largest component of transfer income (60 percent of total transfers). The next largest component of transfer income (18 percent of total transfers) is the

¹³ Treasury assigns pass through income to labor if it is subject to payroll taxes, otherwise it is considered capital income.

¹⁴ The percentage of corporate capital income attributable to normal returns was estimated in Cronin et. al. (2013). Treasury assumes that the percentage of pass-through business capital income attributable to normal returns is also 40 percent.

insurance value of Medicare. Notably neither social security benefits nor Medicare are means tested, both being dependent on factors other than current income. As a result, the distribution of transfer income while flatter than the distribution of labor and capital income is still slightly skewed to the higher end of the income distribution. As shown in Table 2, 60 percent of total transfer income is received by the top half of the income distribution. Yet, transfer income is very large as a share of total income for the lower deciles. Transfer income is 45 percent of total cash income for the lowest income decile.

Including the Corporate Income Tax in Cash Income

The corporate income tax is included in Cash Income to arrive at an estimate of pre-tax income. The corporate income tax is remitted by corporations but, as discussed in Section 4, the burden of the corporate income tax is assumed to be passed through to workers and owners of capital income. As a result, wages and returns to capital would be higher in the absence of the corporate income tax. Treasury therefore includes the corporate income tax in the income of the individual to whom the burden is assigned.

3. Equivalency Measure

For the purpose of ranking families by ability to pay, Treasury adjusts cash income for family size. Larger families are assumed to require more resources to achieve the same level of welfare as smaller families. Without an adjustment for size, large families and single-person families with the same level of cash income would be ranked the same. Prior to 2013, Treasury did not adjust for family size when ranking families into deciles.

Not adjusting for size is equivalent to assuming that families benefit from perfect returns to scale; the addition of a family member without additional income does not affect a family's well-being.

An alternate (extreme) assumption would be to rank units on a per capita basis by dividing family income by family size. This is equivalent to assuming that there are no returns to scale from living within a family unit; that is, two people living together require twice the income of one person living alone in order to have the same level of well-being.

Treasury's current methodology assumes that families of different sizes require different levels of resources to attain the same level of well-being. We assume that families benefit from returns to scale; a family of two can live more cheaply than two single-person families. But we also assume that returns to scale are not perfect; a family of two cannot live as cheaply as a single-person family. To put this assumption into practice, Treasury divides family income by the square root of family size when ranking families in distribution tables (see Cronin, Lin and DeFilippes (2012) for a full discussion). This adjustment reflects the returns to scale found in poverty thresholds and is the same adjustment used by several policy groups (CBO and the Organization of Economic Cooperation and Development (OECD)).¹⁵ Under this equivalency

¹⁵ TPC uses the square root of family size to adjust family rank in some of their supplemental analyses. TPC's standard distribution tables and JCT distribution tables do not adjust for family size.

adjustment the rank of a family of four with \$50,000 of income is equivalent to that of a family of one with \$25,000 of income.

Ranking families (or households) without an equivalence scale has implications for policy analysis. Many tax provisions are adjusted for family size, because the tax law recognizes that larger families have higher consumption needs (a lower ability to pay) than smaller families with the same income. For example, a number of dependent-related tax benefits, including child tax credits and the earned income tax credit, vary with family size. Tax brackets are wider for joint and head of household filers than for single filers. Likewise, standard deductions are larger for joint filers.

Without an adjustment for family size, single-person families (no children) would make-up the large majority of the lowest income quintile, 71 percent at 2013 income levels¹⁶ and very few families with children would be considered very poor, only about a quarter of all families in the first quintile. With a family size adjustment, families are reranked according to size adjusted income. Families with more members move lower in the income distribution and families with fewer members move higher in the income distribution. Thus, with a family size adjustment, the number of families in the first quintile that are singles falls to 58 percent and the number with children rises to about a third. This is especially important for distributing tax provisions intended to benefit poor families with children. Without the size adjustment, these provisions would appear less targeted to low-income families.¹⁷

4. Estimating Burden and Incidence Assumptions

4.1 Estimating Burden

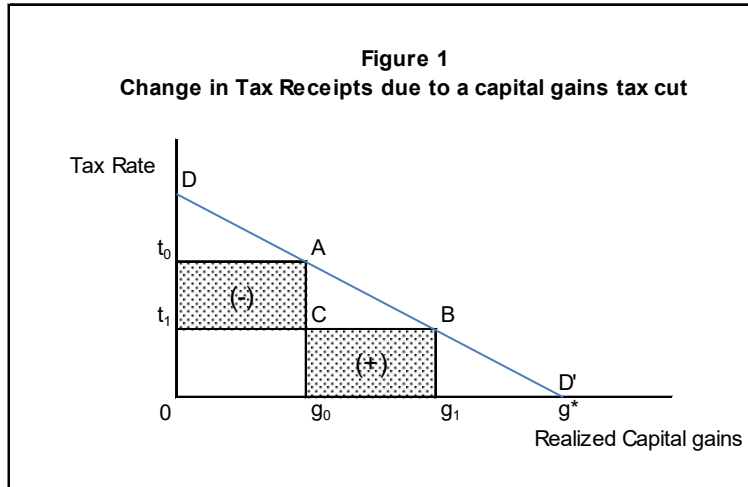
Incidence assumptions include not only assumptions about who bears the burden of a particular tax, but also how much burden or benefit is conferred. For a proposed change in tax law, Treasury distributional analyses reflect the fact that the resulting change in tax burden for a given year is not necessarily equivalent to the expected change in tax liability for that year. This difference in Treasury's distribution and revenue estimating methodologies is fully consistent with the different purposes served by revenue estimates and distributional analyses. Revenue estimates are measures of the change in government receipts due to a tax proposal. Distribution estimates are measures of the change in burden due to a tax proposal.

Consider the change in tax receipts due to a capital gains tax cut as illustrated in Figure 1. The figure shows the "demand" (DD') for realized capital gains. If the tax rate is t_0 , then the amount of gains realized is g_0 . As the tax rate on realized gains falls, the amount of capital gains realized increases, until at a tax rate of zero, an amount of capital gains equal to g^* is realized. If the capital gains tax rate is reduced from t_0 to t_1 , government receipts are reduced by lower tax payments on the current-law level of capital gains realizations but increased by the taxes paid on

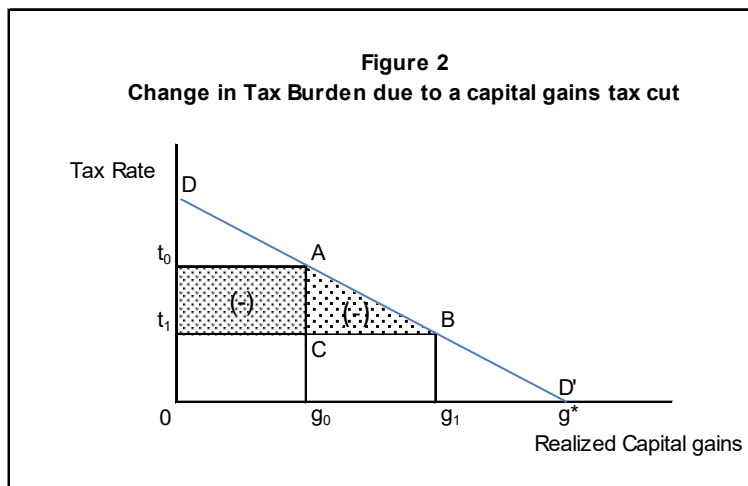
¹⁶ See Cronin, Lin and DeFilippes (2012).

¹⁷ Adjusting for family size is also important when trying to assess horizontal equity, where families with the same ability to pay have equal tax burdens. As shown in Cronin, Lin and DeFilippes (2012) the variance in average tax rates for the middle quintiles falls dramatically when income rankings are adjusted for family size.

additional realizations induced by the tax cut. The reduction in government receipts on current realizations is illustrated in Figure 1 by the shaded rectangle t_1t_0AC , and the increase in government receipts due to increased realizations by the shaded rectangle g_0CBg_1 . The estimated net effect of these two changes in government receipts equals Treasury's revenue estimate for a capital gains tax cut.



In contrast, Treasury's distribution estimates are intended to measure the change in tax burden due to a tax proposal. The burden, or benefit, of a tax proposal may not be properly measured by the change in tax payments; such is the case with a capital gains tax cut. In Figure 2, the total tax burden of a capital gains tax at rate t_0 is represented by the area $0t_0Ag^*$. The burden has two sources: the tax liability, represented by rectangle $0t_0Ag_0$ and a dead weight loss, represented by triangle g_0Ag^* . If the capital gains tax rate is reduced from t_0 to t_1 , both the amount of tax due on current-law realizations and the amount of dead weight loss is reduced. The total reduction in tax burden is equal to the shaded region t_1t_0AB .



Clearly, however, the tax collected on induced realizations (g_0CBg_1), although part of the revenue estimate because it represents a change in government receipts, does not represent a

change in tax burden. Under both rates (t_0 and t_1) area g_0CBg_1 is part of the tax burden. At rate t_0 , it is part of the dead weight loss, and at rate t_1 it is part of taxes collected.

Accounting for changes in dead weight loss

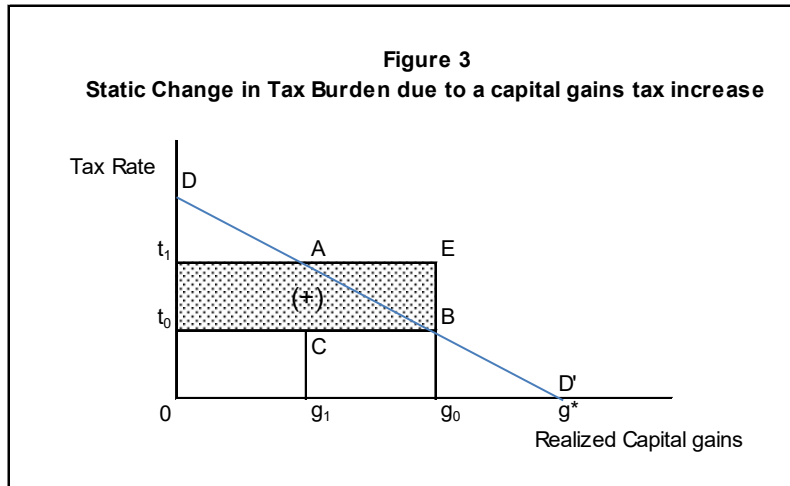
In general, Treasury's distribution estimates assume static income and measures tax burden assuming no change in total income, including realized capital gains. Using a static estimate, however, misses an important piece of the change in tax burden; the change in deadweight loss.¹⁸ If Treasury were to assume realizations were fixed, we would underestimate the decrease in tax burden due to a capital gains tax cut and overestimate the increase in tax burden due to a capital gains tax increase.

Figure 2 shows how Treasury would estimate the burden for a reduction in the capital gains tax rate under a static income assumption. Assuming realizations are fixed, Treasury would only include the reduction in tax liability on current-law realizations (t_1t_0AC). We would not include the additional reduction in dead-weight loss (CAB).¹⁹ Thus, Treasury would *underestimate* the amount of tax relief arising from a reduction in the capital gains tax rate.

In contrast, a static realization assumption would *overestimate* the amount of tax burden arising from an increase in the capital gains tax rate. Figure 3 shows the effects of a capital gains tax increase. In the figure, under current law, the capital gains tax rate is t_0 and the level of realizations is g_0 . If the capital gains tax rate were increased from t_0 to t_1 the level of realizations falls to g_1 . The change in tax burden is represented by the area t_0t_1AB . It is the difference between the smaller tax burden under tax t_0 ($0t_0Bg^*$) and the larger tax burden under tax t_1 ($0t_1Ag^*$). The increase in tax burden is composed of two parts. The increase in tax on the lower level of realizations (t_0t_1AC) and the increase in deadweight loss (CAB). Under the static income assumption, Treasury would *overestimate* the change in tax burden by calculating the tax increase on the original (static) level of realizations (t_0t_1EB). This overestimates the tax burden by an amount equal to AEB . Some taxpayers would have been willing to realize gains at tax rates higher than t_0 but not as high as t_1 . For these taxpayers the deadweight loss should be estimated by the marginal tax rate that they were willing to pay, not t_1 .

¹⁸The discussion that follows uses capital gains as an example, but this discussion can be generalized to other situations, such as change in tax rates on labor.

¹⁹As a separate but related issue, the baseline burden of capital gains is not complete. The existence of a tax on capital gains produces a lock-in effect which has an associated burden (described above as dead weight loss and, for tax rate t_0 , illustrated by triangle g_0Ag^* in Figure 1). Treasury does not include the burden of this lock-in effect in the baseline.



Estimating changes in deadweight loss

In Figures 2 and 3, the absolute value of the change in deadweight loss is the same; it is triangle ABC (ABC is equal to AEB). If we use a static income assumption, we fail to include it as part of the decrease in tax burden from a capital gains tax cut and we double count it as part of the tax burden from a tax capital tax increase (rectangle AEBC is twice the size of triangle ABC). One solution is to estimate ABC directly. This amount should be added to the reduction in burden from a static capital gains tax rate cut and subtracted from the increase in burden from a static capital gains tax rate increase. Treasury has adopted a variant of this methodology for significant changes in capital gains tax rates. To estimate the change in deadweight loss at the tax return level, we multiply the change in realizations for the tax return by $\frac{1}{2} (t_1 - t_0)$. This methodology is only an approximation. In reality the demand for realizations may not be linearly related to the tax rate.

Static cash income, not static taxable income

But for the exception described above, distribution tables generally assume static or unchanged income; they do not however assume static taxable income. For both revenue estimating and distributional purposes, Treasury assumes that taxpayers seek to optimize their income composition in order to minimize their tax liability. For example, if a new tax exemption for an employer fringe benefit were proposed, Treasury's distributional analysis would assume that some taxable wages would be shifted into tax-free fringe benefits, keeping total compensation fixed but lowering tax burden. In such a case taxable income would fall but total cash income would be unchanged.

4.2 Incidence Assumptions

Treasury assumes the individual income tax is borne by payers and payroll taxes (employer and employee shares) are borne by labor (wages and self-employment income included in the payroll tax base). Treasury assumes the share of the corporate income tax that represents a burden on supernormal capital income is borne by shareholders and the share of the corporate income tax

that represents a burden on normal capital income is borne equally by labor and normal capital income. Excise taxes are assumed to be borne by labor and capital income. In addition, excise taxes are assumed to raise the price of taxed goods relative to other goods, thereby increasing tax burdens for consumers of taxed goods and lowering tax burdens for consumers of untaxed goods. Treasury assumes estate and gift taxes are borne by decedents. More detailed descriptions of the incidence assumptions for each tax are given below.

Individual Income Tax Incidence

The distribution of individual income taxes to families by adjusted family cash income decile is based on tabulations from the Individual Tax Model (ITM described in the next section). For many, but not all provisions, the change in tax liabilities is equivalent to the change in burden used for Treasury distributional analysis. Provisions for which this is not the case include capital gains (discussed above), tax preferred savings vehicles, and voluntary speedups of tax payments, such as those induced by rolling over a front-loaded individual retirement account (IRA) into a Roth or back-loaded IRA.²⁰

Tax-preferred savings vehicles. For proposed changes, Treasury measures the tax benefit from participation in IRAs and similar tax-preferred savings vehicles as the present value of the tax savings from one year's contributions.²¹ In general, a dollar of savings generates a stream of current and expected future tax liabilities on current and expected future income. If the savings vehicle is tax-preferred, then earnings in the account grow tax-free and the stream of tax liabilities is lower than the liabilities generated from savings made to a taxable vehicle. Treasury measures this tax benefit as the present discounted value of the total reduction in tax liabilities over the individual's lifetime that results from saving the amount in a tax-preferred savings vehicle.²² It is assumed the contribution is kept in the account until it must be distributed, or for retirement accounts, is kept until age 65 and then distributed in equal amounts over the taxpayer's expected remaining lifetime. Thus, Treasury's measure represents the present value of the additional consumption the taxpayer can undertake as a result of the tax preference for one year's contributions.

As an illustration, consider the case of a \$1 pre-tax contribution made to a back-loaded versus a front-loaded IRA, as shown in Table 3. In the table, r is the rate of return and the discount rate, t is the marginal income tax rate (assumed to be constant over the entire period), the contribution is made in year 0, and the distribution is in year n . The table shows that the lifetime tax benefit of a \$1 pre-tax contribution to a back-loaded IRA is the same as a \$1 pre-tax contribution to a front-

²⁰A front-loaded or traditional IRA allows for a deduction from taxable income in the year of contribution but is taxable in the year of distribution. A back-loaded or Roth IRA does not allow for a deduction in the year of contribution but the distributions are excluded from taxable income.

²¹In the baseline, Treasury measures the burden of existing tax-preferred savings vehicles on a cash-flow basis, not on the present value of the tax savings for current year contributions. The present value approach is used only for estimating the tax benefits for proposed law changes.

²²This difference does not consider amounts in the tax-preferred account that would otherwise have received tax-preferred treatment. For example, if IRAs were expanded, the additional contributions to IRAs might otherwise have been invested in tax-exempt bonds or other tax-preferred forms.

loaded IRA. In both cases, the participating taxpayer receives tax-free earnings over the entire period and pays a present discounted value of tax equal to t .

Table 3: Cumulative Value and Annual Tax liability on a \$1 Pre-tax Contribution to Alternative Savings Vehicles¹

Savings Vehicle		Year 0	Year 1	Year 2	Year n ²
Taxable	Cumulative Value	$1-t$	$(1-t)(1+r(1-t))$	$(1-t)(1+r(1-t))^2$	$(1-t)(1+r(1-t))^n$
	Annual tax liability	t	$(1-t)rt$	$(1-t)(1+r(1-t))rt$	$(1-t)(1+r(1-t))^{n-1}rt$
Front-loaded IRA	Cumulative Value	1	$(1+r)$	$(1+r)^2$	$(1-t)(1+r)^n$
	Annual tax liability	0	0	0	$t(1+r)^n$
Back-loaded IRA	Cumulative Value	$1-t$	$(1-t)(1+r)$	$(1-t)(1+r)^2$	$(1-t)(1+r)^n$
	Annual tax liability	t	0	0	0

¹In the table, r is the rate of return and the discount rate, t is the marginal income tax rate, the contribution is made in year 0, and the distribution is in year n .

²For IRAs, assumes withdrawal is made in year n with no penalty. For the taxable account and front-loaded IRAs, the cumulative value is net of taxes paid.

Note, however, that the timing of tax payments is not the same for the two savings vehicles. A \$1 contribution made to a back-loaded IRA is taxed in the year the contribution is made (year 0) whereas for a front-loaded IRA the same amount of tax, plus the earnings on the tax, is not collected until distribution in year n . As a result, measuring tax benefits by the change in tax liabilities in the year of contribution would erroneously measure one account (front-loaded IRAs) as conferring a greater tax benefit.

Voluntary speedups of tax payments. Treasury does not include voluntary tax payments induced by changes in tax law in its measure of tax burden. If a taxpayer voluntarily initiates a taxable event because of a change in tax law, the taxpayer must be at least as well off taking the action and paying tax as would have been the case if no action had been taken. One example of voluntary payments not representing burdens is the Taxpayer Relief Act of 1997 rollover provision for Roth IRAs. The provision allowed taxpayers with front-loaded IRAs to roll them into back-loaded Roth IRAs.

Because contributions to back-loaded IRAs are not deductible, a taxpayer switching to a back-loaded IRA must pay tax on the amount rolled over in the year of the rollover.²³ Note, however, that if the taxpayer's marginal income tax rate were the same in the current year as in the expected year of distribution, and if his or her discount rate were equal to the rate of return on the IRA, then the discounted present value of the tax liability on the front-loaded IRA would be equivalent to the current year tax liability owed due to the rollover. Therefore, if a taxpayer *chooses* to rollover from a front-loaded into a back-loaded IRA, the tax liability incurred from the rollover must be lower than (or at most equal to) the present discounted value of the tax liability the taxpayer would have owed if he or she had maintained the front-loaded IRA. This would occur if the taxpayer expected to be in a higher marginal tax bracket in later years, or if he or she had a discount rate that was lower than the rate of return.

²³ TRA97 allowed taxpayers who made such rollovers by December 31, 1998 to spread the income tax payments on the rollover over four years.

Corporate Income Tax Incidence

In 2008, Treasury revised its incidence assumption for the corporate income tax.²⁴ Prior to 2008, Treasury assumed the corporate income tax was borne by all (positive) capital income.²⁵ Currently, Treasury assumes the share of the corporate income tax that represents a burden on supernormal returns is borne by supernormal capital income as held by shareholders and the share of the corporate income tax that represents a burden on the normal return, is borne equally by labor and normal capital income. Treasury estimates that 63 percent of the corporate income tax burden is borne by supernormal corporate capital and the remaining 37 percent is borne equally by labor and normal capital income.

Cronin, Lin, Power and Cooper (2013) discuss in detail Treasury's revised methodology for distributing the corporate income tax. The change in distribution methodology was motivated by the desire to incorporate some of the more recent findings in the literature and to give Treasury the ability to more accurately capture the distributional effects of moving from income to consumption taxation.

Under a consumption tax, the normal return on an investment bears no burden while the supernormal return is still subject to tax. Treasury's methodology separates the supernormal from the normal return, so that the difference between a consumption tax and the income tax can be shown. Further, while tax may be collected on the normal return under a consumption tax, there is no tax burden on the normal return over the life of the investment. The present value of the tax savings arising from expensing allowed in year one is offset by the tax collected on the normal returns to the investment over its lifetime. Under the new methodology, Treasury differentiates between corporate tax liabilities and corporate tax burden. The part of the corporate tax that represents a cash flow tax, and not a burden, is not distributed.

Table 4 compares the distribution of the corporate income tax under the current and prior methodology. Both methodologies lead to a progressive distribution of the corporate income tax. The current methodology is only slightly less progressive than the methodology prior to 2008. Under the current methodology 73 percent of the burden falls on the top decile of families whereas the previous methodology would have estimated that 79 percent of the burden fell on the top decile. The current methodology allocates a portion of the tax to labor income which is not as highly concentrated as capital income (see Table 2), but it allocates a large portion of the burden to supernormal corporate capital income which is more highly concentrated than normal capital income. The net result of apportioning the burden to labor income, normal capital income and supernormal capital income is a baseline distribution that is not much different than the prior methodology.

²⁴ CBO (2016), JCT (2013) and TPC (Nunns (2012)) have also revised their corporate income tax incidence assumptions to allocate a portion of the incidence to labor. TPC also differentiates between the treatment of normal and supernormal returns.

²⁵ Treasury had maintained this assumption since 1990, although some earlier Treasury studies (including Nelson, 1987) took a shorter run view and distributed the corporate income tax to corporate shareholders.

However, the new methodology allows us to differentiate among proposals that only effect supernormal returns or only effect normal returns. For example, while a change in the corporate tax rate affects both the normal and supernormal return and would be distributed in proportion to the baseline distribution, a change in depreciation only affects the normal return. Allowing full expensing for all investments (a consumption tax) would remove the taxation of the normal return, leaving only supernormal returns taxed.

Table 4: Distribution of Corporate Income Tax

Adjusted Family Cash Income Decile	Current Methodology	Methodology Prior to 2008 (100% on positive capital income)
0 to 10 ¹	0.2	0.1
10 to 20	0.5	0.2
20 to 30	0.7	0.4
30 to 40	1.1	0.7
40 to 50	1.7	1.2
50 to 60	2.8	2.1
60 to 70	4.2	3.3
70 to 80	6.1	5.0
80 to 90	9.4	8.2
90 to 100	73.1	78.8
Total ¹	100.0	100.0
90 to 95	8.5	8.2
95 to 99	16.6	18.6
99 to 99.9	18.9	21.1
Top .1	29.0	30.8

¹Families with negative incomes are excluded from the lowest income decile but included in the total line.

Payroll Tax Incidence

Payroll taxes are broadly assessed on wages and self-employment income. Because of nearly universal coverage and because aggregate labor supply is very inelastic, Treasury assumes that labor bears the entire burden of the payroll tax, both the employee and the employer shares.²⁶

The payroll tax has three components. The hospital insurance (HI) component applies to all wages and self-employment income with an additional tax on high levels of wage income (over \$250,000 for joint filers). The old-age, survivors, and disability insurance (OASDI) component is capped at a relatively high level of wage income (\$142,800 in 2021), and the unemployment insurance (UI) component is capped at a relatively low level of wage income (\$7,000). Only the federal component of UI is distributed in Treasury tables.²⁷

²⁶ This incidence assumption is followed by JCT, CBO, and TPC.

²⁷ Unemployment Insurance is funded under the Federal Unemployment Tax Act (FUTA) by a 6 percent federal tax on the first \$7,000 of wages. The tax is paid by the employer and not withheld on wages paid to the employee.

Excises and Customs Duties Incidence

In general, excise taxes (and other consumption taxes such as value added taxes and carbon taxes) create a wedge between the prices received by producers and the prices paid by consumers. The tax might be passed forward, only increasing the prices paid by consumers, or it might be passed backward, only decreasing the prices received by producers. Or, it might be passed partly forward and partly backward, both increasing the prices paid by consumers and reducing the prices received by producers. How much of the tax is passed forward versus backward depends primarily on demand and supply price elasticities (how responsive producers and consumers are to changes in price).

If the tax is passed forward, the prices paid by consumers are the original prices plus the tax. This would result in a general price rise which is inconsistent with revenue estimating assumptions. In contrast, if the tax is passed backward, the prices paid by consumers are unchanged and the producer receives the original price less the tax. To pay the tax, producers lower wages and capital returns. Thus, under either method the purchasing power of consumers falls (either because of higher prices or lower wages and capital income). Treasury assumes that the tax is passed back, decreasing the prices received by producers but leaving the prices paid by consumers unchanged. This assumption makes the distributional model consistent with Treasury's revenue estimation procedures, which assume that the general price level is unchanged.

Given this approach, there are three components to Treasury's excise tax distribution estimates. First, the tax is passed back to factor incomes. Second, because factor incomes fall, we assume that the taxes associated with those factor incomes (individual income, payroll, and corporate income taxes) also fall. Lastly, although the general price level does not change, relative prices do change. Goods subject to excise taxes become more expensive relative to goods that are not subject to excise taxes. Each component is discussed below.

Component 1: Factor income effect

Under the assumption that excise taxes lower the price producers receive, factors of production receive lower returns. Although the tax initially hits producers of the taxed good, under the assumption of mobile labor and capital, the returns to all labor and supernormal capital would fall. As a result, labor and supernormal capital returns bear the burden of the excise tax.²⁸ In the distribution model, a family's share of the factor income tax is proportional to their share of total labor and supernormal capital income. Labor income, which primarily includes wages, earnings from self-employment and certain work-related fringe benefits, is estimated to be about \$13.1

Employers generally receive a 5.4 percent credit against FUTA taxes for payment of state unemployment taxes which effectively reduces the Federal rate to 0.6 percent. Treasury includes 0.6 percent of the first \$7,000 of wages paid by the employer as a Federal tax burden on the employee (and as pre-tax income to the employee).

²⁸ As discussed in Cronin et al. (2013) the normal return to capital is exempt from consumption taxes. Under a consumption tax, such as a value added tax, new investments are expensed (allowed a full deduction). On a present value basis, this is equivalent to exempting the normal return from tax. Only returns in excess of the normal return, referred to here as the supernormal return, are taxed. In this context, the supernormal return includes all returns in excess of the normal return. Supernormal returns could be the result of successful risk taking or rents. For consistency, Treasury applies the same methodology to all forms of a consumption tax (including excises and a carbon tax).

trillion at 2021 levels. Supernormal capital income, which includes a share of dividends, realized gains, and capital income from noncorporate businesses, is estimated to be about \$1.5 trillion at 2021 levels. Families ranked in the top ten percent of the income distribution receive about 39 percent of all labor income and 82 percent of all supernormal capital income (see Table 2). The factor income effect of an excise tax is progressive; the factor income tax burden as a share of income rises with income.

Component 2: Tax offset

Because an excise tax reduces factor incomes, it reduces the taxes that are paid by factor incomes, namely individual income, corporate income, and payroll taxes. The reduction in income and payroll taxes offsets part of the revenue raised by the excise tax. OTA uses a standard total offset of 25 percent of the excise tax revenue. In the distribution model, half of the offset is for individual income tax liabilities, 15 percent for corporate income tax liabilities and the remaining 35 percent for payroll tax liabilities. A family's share of each tax offset is in proportion to their positive tax burdens under each tax. Families ranked in the top ten percent of the income distribution bear 74 percent of the burden of the positive individual income tax, 73 percent of the corporate income tax burden and 33 percent of the payroll tax burden. On net the tax offset component is regressive (reduces progressive taxes).

Component 3: Relative price effects

Under the third component, taxed goods are assumed to become more expensive relative to all other consumption goods. This occurs even though the general price level is unchanged. To achieve this relative price effect, we first estimate the increase in price that would occur if the tax were passed forward into increases in prices of the taxed good. Next, to keep the price level unchanged, we impose a general price decrease for all other goods. We are left with higher prices for the taxed good and lower prices for all other goods. Whether or not this component is regressive depends on the relative consumption of the taxed good for low- and high-income families. For example, because tobacco is a relatively high share of consumption for low-income families compared to high-income families, this component is regressive for the tobacco excise.

For purchases made by businesses and customs duties, we assume there are no relative price effects. Excises generally apply to all purchases, including those made directly by families in their role as consumers as well as those made by businesses that use the taxed good or service to produce other goods and services. Certain taxed goods and services, such as gasoline and air transportation, are used extensively as intermediate inputs by businesses to produce a wide range of goods. Treasury assumes that the incidence of excises on purchases by businesses is the same as that of a broad-based consumption tax.²⁹

The share of consumption attributable to purchases by businesses varies by excise. Purchases by businesses are assumed to be 55 percent of the dollar value of airline services, 50 percent of

²⁹Price effects would occur for consumption taxes that exclude certain goods, such as food, or have varying rates depending on the good. A carbon tax, for example, would fall more heavily on carbon intensive goods and many value added taxes exclude basic necessities.

phone services, 25 percent of gasoline purchases, 20 percent of alcohol consumption, and 0 percent of tobacco consumption.

As an illustration of our excise tax methodology and the importance of price effects, Table 5 shows distributions for the two hypothetical increases in excise taxes, an additional \$10 billion excise tax on air transportation compared to an additional \$10 billion tax on tobacco. Table 5 includes the total excise tax increase and separately the three components of the tax increase. The first two components, the factor income effect and the tax offset are the same for each excise. The last component, the price effect is different. Both price effects net to zero. The airline excise price effect is a \$4.5 billion increase in the price of airline services purchased made by consumers net of a \$4.5 billion decrease in all other goods (the other \$5.5 billion is assumed to be purchases for intermediate goods which has no price effect). On net, because airline services are consumed disproportionately by higher-income families, this amounts to a subsidy for goods purchased by lower income families and a net tax for purchases by higher income families. In contrast, the tobacco excise price effect is very regressive. All tobacco purchases are assumed to be purchases by consumers. The price effect is a \$10 billion tax on tobacco products net of a \$10 billion subsidy on all other products. Although the net effect is zero (as seen in the total line), low-income families spend a disproportionate share of their budget on tobacco and the price effect increases their burden relative to high income families.

Table 5: Comparing the Distributons of Airline and Tobacco Excise Taxes

Adjusted Family Cash Income Decile ¹	Total Tax Change (Factor Income Effect+Tax Offset+Net Price Effect)				Factor Income Effect	Tax Offset	Net Price Effect	
	Airline Excise		Tobacco Excise				Airline	Tobacco
	\$B	%	\$B	%			\$B	\$B
0 to 10 ¹	0.0	-0.2	1.4	18.4	0.0	0.0	-0.1	1.3
10 to 20	0.0	0.3	1.1	14.5	0.2	0.0	-0.1	1.0
20 to 30	0.1	1.0	0.9	12.6	0.2	0.0	-0.1	0.7
30 to 40	0.1	1.8	0.8	10.8	0.3	0.0	-0.1	0.5
40 to 50	0.2	3.0	0.7	9.3	0.4	-0.1	-0.1	0.3
50 to 60	0.4	4.9	0.7	8.8	0.6	-0.1	-0.1	0.2
60 to 70	0.5	6.9	0.6	7.8	0.8	-0.1	-0.1	-0.1
70 to 80	0.8	10.4	0.5	6.3	1.1	-0.2	-0.1	-0.4
80 to 90	1.2	16.3	0.5	6.3	1.6	-0.4	0.0	-0.7
90 to 100	4.1	55.3	0.3	4.6	4.7	-1.5	0.9	-2.9
Total ¹	7.5	100.0	7.5	100.0	10.0	-2.5	0.0	0.0
90 to 95	1.0	12.9	0.2	2.9	1.1	-0.3	0.1	-0.6
95 to 99	1.5	19.7	0.1	1.9	1.6	-0.4	0.3	-1.0
99 to 99.9	0.9	12.4	0.0	0.4	1.0	-0.4	0.2	-0.7
Top .1	0.8	10.3	0.0	-0.6	0.9	-0.4	0.2	-0.6

¹Families with negative incomes are excluded from the lowest income decile but included in the total line.

Estate and Gift Tax Incidence

Estate and gift taxes are assumed to be borne by decedents. We measure the burden by applying the estate tax calculator to our imputed wealth and probabilities of death. To the extent that the family income of decedents and heirs are comparable, assuming estate and gift taxes are borne by decedents as opposed to heirs will not greatly affect their distribution by income. This assumption is also consistent with Treasury's treatment of other taxes on capital, which are assumed to be borne by the current owners of capital income.

4.3 Baseline Distribution of Taxes

Table 6 shows the resulting distribution of total federal taxes and each federal tax separately. A version of this table is available for each model year on Treasury's Office of Tax Analysis webpages.³⁰ Table 6 has three banks. The first bank shows the distribution of the levels of each tax, the second bank shows the distribution of shares for each tax and the last bank shows the average rates, defined as tax divided by cash income. Total federal taxes are fairly progressive, ranging from negative average rates for the bottom deciles to 31.6 percent for the top 0.1 percent. The average total federal tax rate (all taxes divided by all cash income) is 19.1. The highest decile pays 60 percent of the total tax burden relative to its 45 percent share of total cash income. The lowest two income deciles, on net, receive refundable credits but combined they have less than a 3 percent share of total cash income.

Two other general observations before considering the distributions of each tax. One, Treasury distribution tables have an equal number of families in each decile, not an equal number of people. Even with the adjustments for family size, the lowest income deciles have relatively fewer people. This will affect the resulting distribution of benefits that are dependent on family size. Second, the largest taxes (in terms of revenue) are the individual income tax and the payroll tax. Corporate income taxes are relatively small. As a result, changes to the distribution of corporate income tax have relatively small impacts on the distribution of total federal taxes.

The distribution of the individual income tax. The individual income tax is very progressive. The average rates for the bottom 4 deciles of the income distribution are negative, meaning on net families in the bottom 40 percent of the income distribution are receiving individual income tax credits in excess of their individual income tax liability. Many of these families pay payroll and excise taxes and therefore have a positive Federal tax liability.³¹ Current law includes several refundable tax credits (the premium tax credit, the earned income tax credit, the child tax credit and the American opportunity tax credit). The average rate for the lowest income decile is -10.8. The average rate for the top decile is 16.9 percent and for the top 0.1 percent, it is 23.0 percent. Of note, the second lowest income decile, not the lowest income decile, has the largest refundable credits. There are more families with children in the second decile.

³⁰ <https://home.treasury.gov/policy-issues/tax-policy/office-of-tax-analysis>.

³¹ For greater detail on who pays Federal tax, see Distribution Table 2016 006, "Number and Share of Families Paying Individual Income and Payroll Taxes under 2016 Current Law." (<https://www.treasury.gov/resource-center/tax-policy/tax-analysis/Documents/Number-and-Share-of-Families-Paying-Taxes-Current-Law-2016.pdf>)

The distribution of the corporate income tax. The distribution of the corporate income tax burden is also progressive. Because labor bears a small fraction (18.5 percent) of the burden of the corporate income tax and some low-income families receive capital income (certain retirement distributions for example), the lower deciles do bear some of the burden of the corporate income tax. However, because capital income bears the larger burden of the corporate income tax, high-income families bear a large share of the burden. The bottom 50 percent of the income distribution bears 4 percent of the burden of the corporate income tax and the top decile of families bears 73 percent of the burden of the corporate income tax. The top 0.1 percent of families alone bears 29 percent of the corporate income tax. The average rate for the lowest income decile is 0.4 percent. The average rate for the top decile is 2.7 percent and for the top 0.1 percent it is to 5.4 percent.

The distribution of the payroll tax. Although the statutory rate for all but very low and very high income wage earners is flat (15.3 percent combined employer and employee rate on wages in excess of \$7,000 but below \$142,800 in 2021), the payroll tax is mildly progressive (not proportional or regressive as is generally assumed) through the first nine cash income deciles. As was shown in Table 2, labor income as a share of total income generally rises through the first nine income deciles; a flat rate applied to a component of income whose share of income grows as income increases produces a progressive distribution.

The average payroll tax rate rises from 7.2 percent in the first decile to 8.9 percent in the ninth decile. The payroll tax becomes regressive, falls as a share of income, after the ninth decile for two reasons. First, the OASDI wage cap lowers the statutory payroll tax rate for wage earners over the cap and second, the share of labor income as a percent of total income falls in the top decile as the share of capital income increases. The Affordable Care Act (ACA) of 2010 introduced an additional Medicare tax for high wage families (an additional tax of 0.9 percent for families with wages over \$200,000 (\$250,000 for joint filers)) but average payroll tax rates still fall dramatically at the top of the income distribution. The average rate for payroll taxes falls to 8.7 percent for the 90 to 95th percent, 6.5 percent for the 95th to 99th percent, 3.3 percent for the 99th to 99.9 percent and 1.2 percent for the top 0.1 percent.

The distribution of excise taxes. Federal excises are fairly flat, between 0.6 percent and 0.8 percent of income for all income deciles except the lowest income decile. The lowest decile has a significant excise tax burden, 1.7 percent of cash income, due to the excise tax on cigarettes and other tobacco products

The distribution of estate and gift taxes. The estate and gift tax is highly progressive, but it is small compared to other taxes. Over 93 percent of the estate and gift tax burden falls on the top 0.1 percent. Five percent of the estate tax burden is not shown in the tables other than the total because it accrues to decedents with negative income. Families with negative income are not shown in the detail but are included in the total. We separate these families from the lowest decile because they have large capital losses and are otherwise not similar to low-income families.

Table 6: Distribution of Income and Federal Taxes under 2021 Pre-Pandemic Income Levels and Law

Adjusted Family Cash Income	Number of Families	Number of Individuals	Family Cash Income	Total Federal Taxes	Individual Income Taxes	Corporate Income Taxes	Payroll Taxes	Excises and Customs Duties	Estate and Gift Taxes ¹
<i>--- Millions of Families and Billions of Dollars ---</i>									
0 to 10 ¹	17.7	26.4	131.6	-2.1	-14.2	0.5	9.4	2.2	0.0
10 to 20	18.3	36.9	376.3	-16.8	-52.7	1.4	31.5	3.0	0.0
20 to 30	18.3	34.0	524.4	16.3	-36.4	2.2	46.8	3.8	0.0
30 to 40	18.3	32.2	692.4	49.6	-17.9	3.3	59.6	4.6	0.0
40 to 50	18.3	32.0	905.7	91.9	4.1	5.2	76.7	5.9	0.0
50 to 60	18.3	32.8	1,191.6	147.7	30.5	8.4	100.9	7.9	0.0
60 to 70	18.3	34.4	1,552.8	220.7	66.6	12.5	131.2	10.4	0.0
70 to 80	18.3	35.5	2,029.6	337.9	127.9	18.3	177.9	13.8	0.0
80 to 90	18.3	37.0	2,804.1	540.4	242.1	28.2	250.7	19.3	0.0
90 to 100	18.3	38.9	8,162.2	2,105.8	1,375.5	219.2	432.2	57.9	21.1
Total ¹	183.0	340.9	18,322.7	3,495.0	1,725.6	299.8	1,318.4	129.0	22.3
90 to 95	9.2	19.0	2,008.3	440.0	225.2	25.6	175.1	14.1	0.0
95 to 99	7.3	15.8	2,751.1	651.2	403.7	49.8	178.2	19.5	0.0
99 to 99.9	1.6	3.7	1,784.5	502.7	373.6	56.8	59.2	12.8	0.2
Top .1	0.2	0.4	1,618.3	511.9	373.0	87.1	19.6	11.4	20.8
<i>--- Percent Distribution ---</i>									
0 to 10 ¹	9.7	7.7	0.7	-0.1	-0.8	0.2	0.7	1.7	0.0
10 to 20	10.0	10.8	2.1	-0.5	-3.1	0.5	2.4	2.4	0.0
20 to 30	10.0	10.0	2.9	0.5	-2.1	0.7	3.5	2.9	0.0
30 to 40	10.0	9.5	3.8	1.4	-1.0	1.1	4.5	3.5	0.0
40 to 50	10.0	9.4	4.9	2.6	0.2	1.7	5.8	4.6	0.0
50 to 60	10.0	9.6	6.5	4.2	1.8	2.8	7.7	6.2	0.0
60 to 70	10.0	10.1	8.5	6.3	3.9	4.2	10.0	8.0	0.0
70 to 80	10.0	10.4	11.1	9.7	7.4	6.1	13.5	10.7	0.0
80 to 90	10.0	10.8	15.3	15.5	14.0	9.4	19.0	15.0	0.0
90 to 100	10.0	11.4	44.5	60.3	79.7	73.1	32.8	44.9	94.6
Total ¹	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
90 to 95	5.0	5.6	11.0	12.6	13.0	8.5	13.3	11.0	0.0
95 to 99	4.0	4.6	15.0	18.6	23.4	16.6	13.5	15.1	0.1
99 to 99.9	0.9	1.1	9.7	14.4	21.7	18.9	4.5	9.9	1.0
Top .1	0.1	0.1	8.8	14.6	21.6	29.0	1.5	8.9	93.6
<i>--- Average Rates ---</i>									
0 to 10 ¹				-1.6	-10.8	0.4	7.2	1.7	0.0
10 to 20				-4.5	-14.0	0.4	8.4	0.8	0.0
20 to 30				3.1	-6.9	0.4	8.9	0.7	0.0
30 to 40				7.2	-2.6	0.5	8.6	0.7	0.0
40 to 50				10.2	0.5	0.6	8.5	0.6	0.0
50 to 60				12.4	2.6	0.7	8.5	0.7	0.0
60 to 70				14.2	4.3	0.8	8.5	0.7	0.0
70 to 80				16.6	6.3	0.9	8.8	0.7	0.0
80 to 90				19.3	8.6	1.0	8.9	0.7	0.0
90 to 100				25.8	16.9	2.7	5.3	0.7	0.3
Total ¹				19.1	9.4	1.6	7.2	0.7	0.1
90 to 95				21.9	11.2	1.3	8.7	0.7	0.0
95 to 99				23.7	14.7	1.8	6.5	0.7	0.0
99 to 99.9				28.2	20.9	3.2	3.3	0.7	0.0
Top .1				31.6	23.0	5.4	1.2	0.7	1.3

¹Families with negative incomes are excluded from the lowest income decile but included in the total line. Families with negative income incur over 1 percent of estate and gift tax burden.

5. The Mechanics of Measuring Income and Tax Burden

Treasury's Individual Tax Model (ITM) is the foundation of Treasury's Distribution Model (DM). The ITM is Treasury's basic tool for estimating the revenue effects of individual income tax changes. The DM starts with all the imputations and calculations on the ITM and adds imputations necessary to estimate cash income and other federal taxes at the return level to create the DM.

5.1 The Individual Tax Model (ITM)

The base ITM file is the Statistics of Income (SOI) annual stratified random sample of individual income tax returns. The current version of the ITM is based on the SOI sample from tax year 2016. Over 338,000 unweighted, nondependent returns are included in the 2016 SOI sample. These returns represent 150 million returns that were filed in 2017. The SOI Division of the IRS collects entries from each sampled return's form 1040EZ, 1040A, or 1040 including attached schedules and supporting forms. The Office of Tax Analysis (OTA) then creates a set of imputations based on the SOI tax data. For example, to simulate the response to a proposal that changes the treatment of itemized deductions, non-itemizers must have the option to itemize. Because non-itemizers do not report itemized deduction expenses, OTA imputes itemized deduction expenses to non-itemizers. Other SOI-based ITM imputations include wage and self-employment earnings attributable to each spouse for two-earner joint returns; employee pension plan participation; classification of partnership and S corporation income by business sector; and social security income for tax returns with AGIs below the tax inclusion threshold. Such imputations are based on information returns (forms W-2 and SSA-1099) matched to the tax returns.

The base tax file is augmented by files containing other demographic and economic data. These additions include an exact match for age using date of birth from social security records, and imputations for non-filers, retirement savings decisions, health insurance coverage and premiums, and wealth. Each imputation is discussed briefly below.

ITM Imputations

Non-Filer imputation. The base SOI file only represents families that filed an individual income tax return. Some tax proposals may cause non-filing families to file so all potential tax returns must be represented on the ITM for revenue estimating purposes. Further, Treasury distributional analyses measures the total federal tax burden for all U.S. residents (plus U.S. citizens living abroad who should file tax returns) whether or not they actually file an individual income tax return. Most families that do not file federal individual income tax returns will still bear a burden from other federal taxes, such as payroll or excise taxes.

To impute non-filers, the base SOI sample is augmented with a sample of information returns (such as Form SSA-1099s) using the same sampling criteria used for the stratified random sample of tax returns.³² OTA weights these returns so that along with filers, the total estimated

³²In more detail, the tax sample has two components: a random sample based on social security number (SSN) ending digits and an oversample of high-income returns and returns with certain low-probability characteristics, such as

population matches our covered population as approximated by the Social Security Area Population. OTA uses Census targets to group non-filers into tax return units and assign certain demographic characteristics, such as filing status and the number and age of children.

Retirement savings decisions. The ITM also models contributions to, withdrawals from and balances and accumulated benefits in tax preferred retirements savings account for each individual. The model includes tax data on deductible employee contributions to tax-preferred retirement savings accounts such as traditional 401(k) plans, on withdrawals from defined contribution plans and on pension payments from defined benefit plans. The model imputes estimates for nondeductible employee contributions to tax-preferred retirement savings accounts, such as Roth IRAs and Roth 401(k)s, for employer contributions to defined benefit plans, for balances in defined contribution accounts and for accumulated benefits in defined benefit plans. These imputations are based on Administrative data, tax data (Forms W-2 and 5500) and the Survey of Consumer Finances (SCF).

Health Insurance Coverage and Premiums. Beginning with tax year 2015, all insurers (including self-insured employers, private insurers, and government entities) are required to report, using the Form 1095 series, to the enrollee and the IRS information about the enrollee's health insurance offers and coverage. There are three forms in the 1095 series: Form 1095-A "A Health Insurance Marketplace Statement," Form 1095-B "Health Coverage," and Form 1095-C "Employer-Provided Health Insurance Offer and Coverage." Individuals may receive more than one form in this series. Treasury uses the information on these forms to assign the type of insurance coverage to each individual on the ITM. The coverage types are marketplace, uninsured (no indication of coverage on the 1095 series), employer-sponsored coverage, non-group private coverage outside marketplace (off-exchange), Medicare or other public coverage.

Marketplace premiums are imputed using information from Forms 1095-A and 8962 (Premium Tax Credit). Employer sponsored insurance premiums are imputed using months of coverage from Forms 1095-B/C for employer sponsored insurance and Form W-2. Large employers are required to report the total premium for policies provided to employees each year on Form W-2.

More detail on the distribution of coverage by type can be found on Treasury's website: <https://home.treasury.gov/policy-issues/tax-policy/office-of-tax-analysis>.

Wealth imputation and estate tax calculator

The ITM includes a wealth module for each tax return that imputes values of assets (namely, stocks, bonds, real estate assets, business assets, retirement assets, and other nonfinancial and financial assets), liabilities (namely, mortgage debt and other debt), and unrealized capital gains (at death), and the holding periods associated with these assets and liabilities. The imputation uses tax data (Forms 1040 and 706) and the Survey of Consumer Finances (SCF). The model

negative income or a high number of capital gains transactions. Oversampled strata receive lower weights. The highest-income returns have a weight of one (all are included in the sample). Treasury uses the same sample design to choose non-filers from information returns for individuals who do not file an income tax return. If an individual with one of the random SSN ending digits receives a Form W2 or 1099 but does not file an income tax return, then they are included in the sample.

imputes unrealized capital gains using the SCF and estimates for holding periods using the SOI 2007 Sales of Capital Assets study.

To calculate estate tax liability, mortality probabilities are estimated for each return. Mortality probabilities vary by age, gender and income and are imputed to the tax data from administrative data on deaths from the Social Security Administration. Estate tax liability, conditional on the probability of death, is estimated using estate calculators applied to our imputed wealth.

Extrapolation and Tax Calculators

In addition to its detailed data base, the ITM consists of an extensive set of computer programs which are used to simulate individual income tax liabilities and payroll tax liabilities, and changes in these liabilities, for every year of the budget window. The Office of Management and Budget (OMB) provides Treasury with an economic forecast of income levels, employment, price levels, and interest rates which are then used to extrapolate the base-year ITM over the ten-year budget window, and thus ensure that Treasury's model is consistent with OMB's forecast of national income, employment, and inflation. The ITM is updated twice a year for January budget assumptions and for mid-session review assumptions. In contrast, the DM only uses the extrapolated population and income levels present in the first year of the budget period. In general, the DM is updated only once a year, based on January budget assumptions.

5.2 The Distribution Model (DM)

The DM starts with the ITM data, imputations, calculators, and extrapolation for the first year of the budget period. It then adds nontaxable sources of income and consumption to create the components necessary to estimate Cash Income and simulate each federal tax. The DM uses the ITM calculators to simulate individual income, payroll, and estate tax changes. The distribution of the corporate income tax is simulated using the DM's capital and labor income distributions. The distribution of excise taxes is simulated using the DM's capital, labor and consumption distributions. Brief descriptions of the major DM imputations are given below.

Estimating Nontaxable Sources of Income

Nontaxable sources of income include nontaxable social security income, the insurance value of Medicare and Medicaid, means-tested transfer income, employer-provided fringe benefits, and realized housing gains.

Social security income. Social security income was the largest source of both taxable and nontaxable transfer income on the DM. Of the \$1,121 billion in total social security income included in cash income for 2021, \$666 billion (59 percent) is excluded from taxable income. Nontaxable social security income is added to the ITM and the DM using an exact match with social security information returns.

Insurance value of Medicare and Medicaid. Generally speaking, Medicaid is public health insurance for low-income individuals (including the elderly) and Medicare is public health insurance for the elderly. Families with either Medicaid or Medicare are identified on the ITM as

having public health insurance. For simplicity, the DM assumes all elderly individuals identified as having public health insurance are in Medicare and all nonelderly individuals identified as having public health insurance are in Medicaid.³³

In general, the total value of insurance is equal to the benefits it delivers. Treasury starts with this assumption. We also assume that both Medicare and Medicaid are community rated; that is, the insurance value does not vary by pre-existing health conditions, actual benefits received or the relative health of an individual. We distribute the total cost of Medicare across all Medicare recipients equally to arrive at an initial Medicare insurance value, but we cap this value at one third of family income. We assume that low-income families are unlikely to value health insurance over subsistence levels of other consumption needs, such as food and housing, and the cap is a rough implementation of this assumption.

Medicaid coverage includes coverage for low-income elderly, low-income disabled, low-income children and low-income, non-elderly adults. Treasury only models Medicaid expenditures for low-income, nonelderly adults. The elderly are covered in our model by Medicare. We are considering adding coverage for children to our methodology in the future, but our current model does not include Medicaid coverage for children. We also do not include Medicaid coverage for disability in our model. All individuals run a small risk of becoming disabled and if disabled, the very high medical expenditures and inability to earn income could reduce their circumstance such that they become eligible for Medicaid. Therefore, an imputed insurance value for Medicaid's disability coverage would be spread across all individuals and would have little effect on any family's relative position in the distribution of income.

We spread the insurance value of all Medicaid expenditures for low-income, non-elderly adults across all nonelderly adults currently enrolled in public insurance as well as all adults who are currently uninsured who are eligible for Medicaid and who would be expected to enroll in Medicaid if they incurred medical expenses. At 2021 levels, this value is \$4,328 per eligible adult. As with our imputed insurance value for Medicare, we cap this value at one third of family income in recognition that the value to the recipient cannot exceed the value of other basic needs.

Means-tested transfers include SSI, TANF, SNAP, WIC, LIHEAP, as well as certain veteran's benefits. For each transfer program, the DM uses Current Population Survey (CPS) data and a logistic regression to estimate the probability that a family in the tax data would receive a particular transfer (e.g., SNAP). The total number of recipients is then targeted to the counts projected by each program. The level of benefits is assigned by matching tax families to CPS families with similar characteristics who are receiving the benefit.

Employer-provided fringe benefits. As discussed above, employer sponsored health insurance coverage (including flexible spending accounts (FSAs) and dental and vision coverage) is modeled on the ITM. In addition, the DM uses Form W2s and administrative data to impute the

³³ Roughly 9 percent of Medicaid recipients are elderly, but in our model we will place them in Medicare not Medicaid. Average Medicaid expenditures for elderly Medicaid recipients are higher than average Medicare expenditures so this has the potential to affect our imputation. In practice, however, the assignment of the low-income elderly to Medicare or Medicaid will not matter. The insurance value of both imputations is capped at one-third of the recipient's family income, and the cap is likely to be binding for the low-income elderly who would have been eligible for Medicaid.

insurance value of nontaxable employer sponsored life insurance, education benefits, and transit and parking benefits to families with employers who offer these benefits.

Realized housing gains. On the ITM, about 74 million returns are estimated to have owner occupied housing in 2016. On the DM, the value of each home is estimated using the property tax deduction (imputed for nonitemizers) and zip code-level property tax rates. The estimated level of accrued but unrealized gains on each home is estimated using the Survey of Consumer Finances (SCF) and age of primary taxpayer. Home sales are estimated using probabilities that vary by age, income and home value using targets from the American Housing Survey (AHS).

Estimating Consumption

In order to assess the burden of relative price changes caused by excises and certain other consumption taxes (e.g. a carbon tax or value added tax), the DM also includes an imputation of each family's consumption of goods and services. The only source of detailed expenditure information is the Consumer Expenditure Surveys (CE). Unfortunately, it has documented problems with regard to underreporting of income and the accuracy of its expenditure rates (expenditures relative to income), particularly for low and high-income households.³⁴ Further the CE only collects information on out-of-pocket expenditures, not all consumption. Some public and employer-provided consumption and private transfers are not included in the CE.

In order to build a more consistent and inclusive relationship between consumption and income, Treasury derives a family's total consumption using tax data and the Survey of Consumer Finances (SCF). The CE is still used to apportion a family's total expenditures across particular categories of goods and services. But these expenditures are then adjusted to account for consumption that is not out-of-pocket.

Derived aggregate consumption is equal to cash income minus federal, state and local individual income taxes, corporate income taxes³⁵, payroll taxes and savings out of cash income. Treasury uses the deductions for state and local income taxes (including the imputations for non-itemizers) as an estimate of state and local income taxes. Savings rates by age, marital status, and income are estimated using multiple years of the SCF.

We impose a de minimis consumption amount for each family equal to half of the poverty level for a family of its size. We assume that families cannot exist without this level of consumption and that unmeasured transfers or debt finance, either public or private, are providing for the de minimis consumption levels. This adjustment increases consumption overall by less than 1 percent but increases consumption for the bottom income decile by 43 percent.

We compute the share of a family's annual expenditures on each good or service, by using 6 years of the CE data from 2012 to 2017 and doing an unconstrained statistical match. The statistical match is based on dividing the CE and tax data into 320 similar cells based on marital

³⁴ See the Sabelhaus et. al. (2012) and Myer, Mok and Sullivan (2009).

³⁵ Corporate income taxes are added to cash income to put it on a pre-tax basis; observed labor and capital income is lower than it would be absent the corporate income tax. For determining consumption, we subtract the corporate income tax since the pre-tax income it represents is not available to be used on consumption.

status, 4 age groups (oldest filer), whether or not the family had children and 20 percentiles of consumption. Each cell was required to include at least 10 donor records. We collapsed cells with insufficient donors to near neighbors so that in the end we used 297 cells to match the tax data to the CE.

Once we have the match, we apply the share of total expenditures for each good and service of the 83 expenditure categories on the CE to the DM’s estimate of out-of-pocket expenditures. We then add categories of consumption imputed to Treasury’s distribution model that are not out-of-pocket expenditures represented on the CE. For example, we add employer-paid health insurance premiums and the insurance value of Medicare and Medicaid to Treasury’s measure of health consumption. Likewise, we add employer-paid childcare, employer-paid life insurance, employer-paid transportation benefits, and employer-paid education benefits to their respective categories of consumption.

Table 7 shows the distribution of income and consumption at 2021 levels. Recall that the difference between consumption and cash income in Treasury’s model includes both taxes and savings or dissavings out of cash income. In total, consumption is 70 percent of income. High income families have a disproportionate share of both income and consumption, but as expected, income is more skewed than consumption. Families in the top 10 percent of the income distribution accrue 45 percent of total cash income but account for only 37 percent of total consumption. Further, the ratio of consumption to income is above one for the bottom two income deciles but is .6 for the top income decile.

Table 7: Distribution of Consumption

Adjusted Family Cash Income Decile	Cash Income	Consumption	Ratio Consumption to Cash Income
	(%)	(%)	
0 to 10	0.7	1.5	1.5
10 to 20	2.1	3.1	1.1
20 to 30	2.9	3.9	1.0
30 to 40	3.8	4.8	0.9
40 to 50	4.9	6.0	0.9
50 to 60	6.5	7.6	0.8
60 to 70	8.5	9.5	0.8
70 to 80	11.1	11.6	0.8
80 to 90	15.3	15.0	0.7
90 to 100	44.5	37.0	0.6
Total	100.0	100.0	0.7
90 to 95	11.0	10.2	0.7
95 to 99	15.0	13.3	0.6
99 to 99.9	9.7	7.3	0.5
Top .1	8.8	6.2	0.5

6. Distributing Tax Proposals

Table 8 is a standard distribution table for a change in tax law. It shows the distribution of a \$100 per person refundable credit, assuming universal eligibility and take-up. (Table 8 is illustrative,

not intended to represent any actual proposal, and only presented to enable a discussion of the components of a standard distribution table.)

Table 8: Standard Distribution Table (\$100 per person refundable credit)¹

Adjusted Family Cash Income Decile	Number of Families (millions)	Distribution of Cash Income (%)	Distribution of Total Federal Taxes		Average Federal Tax Rate		Tax Change				Change in After-Tax Income (%)
			Current Law (%)	Policy (%)	Current Law (%)	Policy (%)	Amount (\$B)	Average (\$)	Percent Distribution (%)	Current Law ² (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0 to 10 ³	17.7	0.7	-0.1	-0.1	-1.6	-3.6	-2.6	-149	7.7	-126.0	2.0
10 to 20	18.3	2.1	-0.5	-0.6	-4.5	-5.5	-3.7	-202	10.8	-21.9	0.9
20 to 30	18.3	2.9	0.5	0.4	3.1	2.5	-3.4	-186	10.0	-20.8	0.7
30 to 40	18.3	3.8	1.4	1.3	7.2	6.7	-3.2	-176	9.5	-6.5	0.5
40 to 50	18.3	4.9	2.6	2.6	10.2	9.8	-3.2	-175	9.4	-3.5	0.4
50 to 60	18.3	6.5	4.2	4.2	12.4	12.1	-3.3	-179	9.6	-2.2	0.3
60 to 70	18.3	8.5	6.3	6.3	14.2	14.0	-3.4	-188	10.1	-1.6	0.3
70 to 80	18.3	11.1	9.7	9.7	16.6	16.5	-3.6	-194	10.4	-1.1	0.2
80 to 90	18.3	15.3	15.5	15.5	19.3	19.1	-3.7	-202	10.8	-0.7	0.2
90 to 100	18.3	44.5	60.3	60.7	25.8	25.8	-3.9	-213	11.4	-0.2	0.1
Total ³	183.0	100.0	100.0	100.0	19.1	18.9	-34.1	-186	100.0	-1.0	0.2
90 to 95	9.2	11.0	12.6	12.7	21.9	21.8	-1.9	-208	5.6	-0.4	0.1
95 to 99	7.3	15.0	18.6	18.8	23.7	23.6	-1.6	-215	4.6	-0.2	0.1
99 to 99.9	1.6	9.7	14.4	14.5	28.2	28.1	-0.4	-223	1.1	-0.1	0.0
Top .1	0.2	8.8	14.6	14.8	31.6	31.6	0.0	-226	0.1	0.0	0.0

¹ This is not an actual proposal and is being used for the sole purpose of explaining the features of a standard distribution table.

² The tax change is as a percent of the absolute value of current law tax liability. As a result, all tax cuts are shown as negative and all tax increases as positive.

³ Families with negative income are not included in the lowest income decile but are included in the total.

Columns 1-3 and 5 are the same in every standard distribution table produced for a particular model year. These columns are the distributions of families, cash income, total federal taxes under current law and average federal tax rates under current law. They orient the reader to the population under consideration, the distribution of pre-tax consumption possibilities (income) and tax burden under current law. Columns 3 and 5 are presented for comparison to proposed law. The same distributions can be found in the baseline tables (Table 6 in this paper).

Columns 4, 6 and 7-10 are measures of the effects of the proposed law. Columns 4 and 6 present the distributions of total federal tax burdens and average tax rates under policy and are distributed next to the distributions of current law for ease of comparison. Columns 7-10 consider the tax change.

Column 7 is the distribution of the tax change. In this column we see that the total proposed tax change is a \$34.1 billion tax cut. In column 8, we see that the average tax cut is \$186 per family and varies from \$149 on average for families in bottom decile to \$213 for families in the top decile, reflecting the difference in the average family size, 1.49 versus 2.13. Families in the top decile are larger on average so they receive a larger tax cut per family. Column 9 is the distribution of the tax cut and similarly shows that the tax cut is fairly even across families with slightly more going to the top of the distribution because of their slightly larger size.

Column 9 compares the size of the tax cut to each decile's current tax burden. For a tax cut the change is presented as a negative and for tax increases it is presented as a positive. It is the proposed tax change divided by the absolute value of the current law tax burden. For families with net refunds the tax burden may be negative; some families receive more in refundable tax credits than they pay in total federal taxes. Presenting all tax cuts (including increases in the level of refundable credits) as a negative simplifies interpretation of this column. Table 8, column 9, shows that the proposal reduces tax burdens by 1 percent overall but by 126 percent for the lowest income decile and by 0.2 percent for the highest income decile. An extra \$100 credit per person increases refundable credits for the low income by a fair amount but does not affect the tax burden of the highest decile by much.

Column 10 shows the change in after-tax income due to a proposal. It is the closest approximation to a change in welfare since it shows, by how much a family's consumption *might* increase or decrease due to the proposal. It is the change in consumption possibilities; "possibilities" because a family may choose to save (or dissave) instead of changing consumption. Table 8, column 10 shows that the proposal increases after-tax income, consumption possibilities, by 0.2 percent overall but by 2 percent for the lowest income families and by 0.1 percent for the highest income families. This is not surprising. An extra \$100 per person has a higher utility impact for families with low after-tax income than for families with high after-tax income.

7. Conclusion

Treasury continually strives to improve its modeling. One area that we would like to focus on, for distributional analysis, is improving our modeling of pass through businesses (partnership and small business corporations). We are considering whether some of the incidence of the individual income tax remitted by these businesses are actually borne by their employees. We would also like to improve our modeling of the choice of business form and how that might affect burden. Finally, we would also like to improve our modeling of the income source for pass through businesses; how much of their income is a return to capital versus a return to labor.

Another area we would like to consider improving is the equivalency measure. Should it vary with income? Does return to scale have the same meaning for families in the poorest decile as those in the top 1 percent. Should we vary equivalency depending on a family's composition, adults versus children or elderly versus non-elderly.

Our distribution model also does not consider the cost of living. A \$100 tax cut has very different implications regarding consumption possibilities in low cost-of-living areas as opposed to a high cost-of-living areas such as San Francisco or New York City.

Finally, our distribution model does not include the burden of state and local taxes. A more complete analysis of how changes in federal tax burden affect changes in after-tax income, consumption possibilities, would include these taxes.

In general, distributional analysis is only one of many tools Treasury uses to evaluate current tax law and tax proposals, and it has limitations. Treasury's distribution tables are single-year snapshots that do not address changes in distribution over time. Lifetime income and incidence may be very different than single-year income and incidence. For example, a family that expects to have children may benefit in the future from a child credit proposed now. A low-income student may be high income later in her lifetime. Further distributional analysis do not address other important aspects of good tax policy such as efficiency. A tax proposal that increases GDP or requires fewer compliance costs may have very different welfare implications than one that does not. Distributional analysis also focuses on vertical equity. Winners and losers tables (counts of taxpayers with tax cuts and tax increases by income decile) and examples can be used to judge horizontal equity or the implications of tax policy on certain vulnerable groups.

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