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Frameworks for Distributional Analyses

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Abstract

Government transfers and federal taxes significantly affect the distribution of resources available to U.S. households. But conclusions about how redistributive the tax and transfer system are depend on the framework used to analyze them, especially the income measure used to rank households.

Distributional analyses have predominantly focused on how taxes affect household well-being. Many of those analyses have used a broad measure of income—one that includes income from market sources as well as government transfers—as the basis for ranking households and measuring average tax rates across the income distribution. Because government transfers are included in the income measure used as the foundation for those distributional frameworks, those frameworks are less suitable for measuring the distributional effects of income received from government transfers. To effectively study how both government transfers and federal taxes jointly affect household well-being across the income spectrum, it is necessary to consider alternative frameworks for comprehensive distributional analyses.

This paper examines alternative frameworks to analyze the combined effects of government transfers and federal taxes on the distribution of household income. The current methodology employed by the Congressional Budget Office in its distributional analyses relies on a broad measure of before-tax income to rank households and as the denominator for the calculation of average tax rates across the income distribution. The strengths and shortcomings of that framework are considered, as are the strengths and weaknesses of frameworks based on market income (which excludes all government transfers) and based on gross income (which excludes means-tested government transfers, but includes social insurance government transfers).

The paper concludes with an examination of the distributional consequences of a hypothetical policy change and shows how conclusions can differ based on the framework the policy change is presented in and whether the policy is enacted as a means-tested transfer or an economically equivalent refundable tax credit.

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Introduction

The relative ranking of households by income level is of great interest to legislators, public policy analysts, the media, and the general public alike. Indeed, growing levels of income inequality has become a widely debated issue in public policy in recent years. Distributional analysis is the primary tool used to examine the dispersion of income and how governmental policies alter the distribution of household resources. But conclusions about how equal or unequal the distribution of income is and how redistributive the tax and transfer system are depend on the framework used to analyze them, especially the income measure public policy analysts use to rank households by in their analyses.

Although federal policies alter the distribution of income and resources through a variety of mechanisms, distributional analyses have historically focused almost exclusively on a single mechanism: taxes. There are several reasons for this narrow focus. Every U.S. household pays federal taxes, either directly or indirectly, and major parts of the tax system, like the progressive structure of the individual income tax, are specifically intended to have distributional effects—that is, to differentially affect certain segments of the population. In addition, the Internal Revenue Service collects high quality income and tax data. Because of the universal nature of taxes, an explicit redistributive function of taxes, and the collection of high quality tax data, taxes have been the primary focus of distributional research.¹

Taxation, however, is not the only mechanism through which the federal government affects the distribution of household resources. Government transfer programs also directly affect the distribution of resources among U.S. households. Although there is a wide range of government transfers, they can generally be categorized into one of two types: social insurance transfers or means-tested transfers. Social insurance programs (such as Social Security, Medicare, and Unemployment Insurance) are defined as transfer programs into which individuals explicitly pay over the course of their lives to cover specific risks. Means-tested transfer programs provide both cash and in-kind benefits to households, families, or individuals based on their need. Means-tested cash transfer programs include AFDC/TANF, and SSI; means-tested programs providing in-kind benefits include programs such as Medicaid, SNAP, and housing assistance.

When contemplating the distributional effects of taxes, most tax policy analysts strive to use as broad a definition of income as possible for ranking households and as the denominator in tax rate calculations. The consensus within the tax profession is that a theoretically optimal measure of annual income for such analyses is Haig-Simons income, which is equal to consumption in a given year plus change in net worth. This measure represents the total amount of economic

¹ Furthermore, the government agencies and public policy think tanks that have been producing distributional analyses are almost all from tax-centric organizations. Some of the more prominent groups that have been producing distributional analyses in the United States include the Office of Tax Analysis at the U.S. Treasury, the Joint Committee on Taxation, the Tax Analysis Division at the Congressional Budget Office, and the Urban-Brookings Tax Policy Center.

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resources a household (or any other unit of analysis) is able to harness in a given time period and serves as a proxy for a measure of economic welfare. This measure is also considered a reasonable proxy for one's ability to pay their tax liabilities and is therefore deemed an appropriate denominator for the calculation of tax rates.² There are, however, numerous analytical and data obstacles to measuring a pure Haig-Simons income. Those obstacles prevent the U.S. government agencies conducting distributional analyses of federal taxes from utilizing this optimal income measure, yet they all use a broad income measure to some degree.

CBO is expanding its distributional analysis from taxes alone to the combined tax and transfer system for several reasons. An analysis of the combined tax and transfer system offers a more complete view of the effect of government on the distribution of resources. Indeed, some have argued that looking at the distribution of taxes alone, without considering the spending financed by those taxes, paints a misleading portrait of the distributional effects of government policy. In many ways taxes and transfers are economically equivalent, and there is no reason that taxes and transfers should be analyzed in a different context. In addition, tax provisions such as the Earned Income Tax Credit and the Child Tax Credit have increasingly taken on characteristics of means-tested transfer programs. And distributional analysis of the Affordable Care Act, which delivers assistance through both the tax and transfers system, requires a broader focus than taxes alone.

Although a broad Haig-Simons income concept may be the most appropriate income measure for analyzing the welfare of households and the ability of those households to pay their tax liabilities, it may not be the most appropriate income measure to use when attempting to broaden the analytical framework beyond taxes to also include the effects of transfers. Under a Haig-Simons definition, transfers received from the government, whether cash or in-kind, increase potential consumption. Consequently such payments are considered part of a person's ability to pay taxes, and are often included in the income base against which tax payments are measured. The transfer system is essentially stacked before the tax system. This ability-to-pay concept is not suitable for analysis of the combined tax and transfer system; instead a pre-transfer income measure of ability to pay is required.

A large portion of the transfer system, however, is in the form of Social Insurance programs (such as Social Security, Medicare, and Unemployment Insurance). In those transfer programs, individuals explicitly pay over the course of their lives to cover specific risks. While those programs may appear highly redistributive in a cross-sectional view, over longer time horizons, they appear much less redistributive. Analyzing those programs in a cross-sectional analysis is not the optimal analytic framework and will overstate how much redistribution occurs through the transfer system.

² A widely accepted principal of "fairness" in taxation is that of vertical equity – the notion that those with greater ability to pay should pay more in taxes than those with less ability to pay.

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CBO’s current distributional analyses rank households by “before-tax income,” which includes market income as well as government transfers, both cash and in-kind, and is meant to proxy a broad, Haig-Simons income measure. As CBO endeavors to broaden the scope of its distributional analyses from one that primarily focuses on taxes to one that includes taxes and transfers, a Haig-Simons income measure may no longer be the most appropriate framework to use.³ That method has proven useful for understanding the implications of tax policy alone, but has limitations in providing insight into transfer policy or the net effects of government intervention on the distribution of household resources. This paper examines how using alternative income measures for ranking households changes conclusions about the relative well-being of households at different points in the income distribution and the distributional impacts of government policies. Specifically, we examine the benefits and drawbacks of two other income measures to serve as the foundation of CBO’s distributional analyses: Market Income and Gross Income, which we define as market income plus social insurance transfers.

Range of Distributional Frameworks in Use Today

Distributional analyses provide important insights into how various segments of the population are faring over time and how government tax and transfer policies affect different segments of the population. As such, distributional analyses are conducted by a wide range of individual researchers, public policy think tanks, and government agencies all around the world and garner broad interest from lawmakers, the media, policy advocates, and the general public alike.

The numerous research groups involved in producing such analyses have generated a wide range of distributional frameworks based on a variety of assumptions. The frameworks used for analyses of income distributions vary widely in large part because of variety of specific questions researchers attempt to answer with their distributional analyses. Furthermore, researchers face practical limitations on the data available to them to construct an optimal measure of income for use in a given distributional analysis. The choices that researchers make in how to classify income sources and what measures to use when ranking households significantly affect the conclusions one can draw from those analyses.

Although the terminology and details vary, the most common frameworks in use today rank households by a measure of annual income defined somewhere along a continuum between “market income” (before any government intervention) and “final income” (after all government intervention, including all transfers and both direct and indirect taxes).⁴ The United Kingdom,

³ Although CBO has recently published a full fiscal incidence report—*The Distribution of Federal Taxes and Spending in 2006*, (November 2014)—the analytic framework discussed in this paper is not intended for a full fiscal incidence analysis. That is, the framework may not be appropriate for allocating to households the distributional effects of government spending on public goods, which would be included in a full fiscal incidence analysis. Instead, this framework is merely a step in that direction.

⁴ In addition to the selection of what income measure to use when ranking households and calculating tax rates in distributional analyses, there are numerous other dimensions along which distributional frameworks differ. Two important dimensions include the unit of analysis used by the distributional framework (tax units, families, or

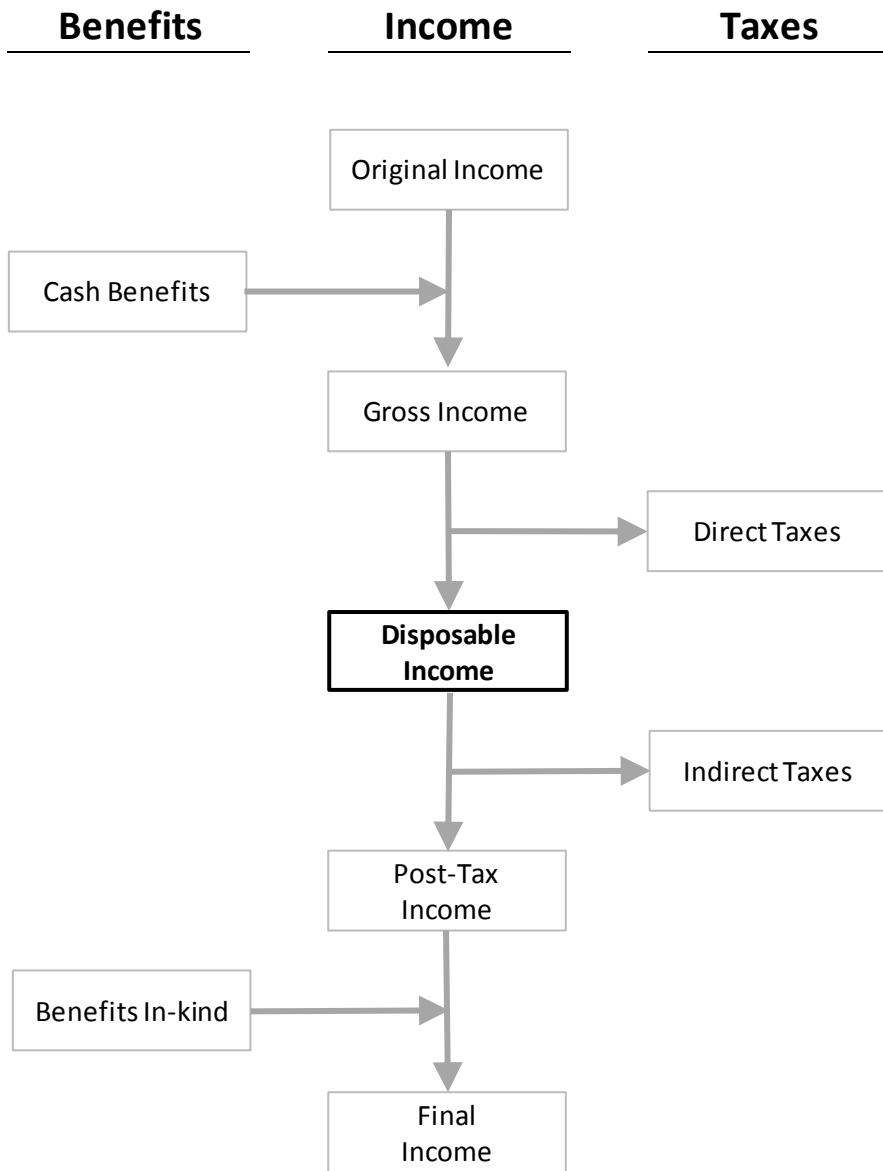
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for example, has a rather detailed framework of the continuum of income with five separate income concepts and four separate categories of government benefits and taxes (see **Figure 1**). In contrast, the current framework used by the Congressional Budget Office is more consolidated with three income concepts and two forms of government intervention, namely: transfers and taxes (see **Figure 2**).

households, for example) and whether and how income is adjusted to account for differences in the size of those units of analysis. (See the **appendix** for more details on those characteristics of distributional frameworks.)

Figure 1.

United Kingdom’s Office of National Statistic’s Framework for How Government Transfers and Taxes Affect Household Resources

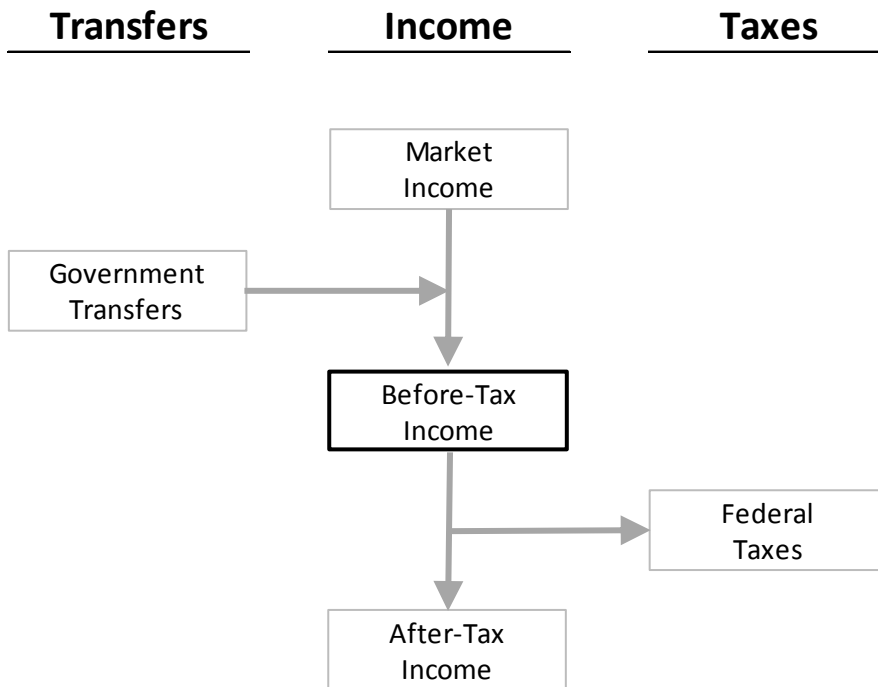


Source: United Kingdom Office for National Statistics. “The Effects of Taxes and Benefits on Household Income, Financial Year Ending 2014”. June 29, 2015.

Notes: In the U.K. framework, households are ranked by equivalized disposable income. As such both cash benefits and direct taxes influence the ranking of households, whereas indirect taxes and benefits in-kind do not.

Figure 2.

Congressional Budget Office’s Framework for How Government Transfers and Taxes Affect Household Resources



Source: Congressional Budget Office.

Notes: In the CBO framework, households are ranked by household size adjusted before-tax income. Households are ranked by gross income, adjusted for household size differences. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Government transfers include Social Insurance transfers (Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits) and means-tested transfers, which consist of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.. Before-tax Income is market income plus government transfers. Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

The range of distributional frameworks in use today can broadly be classified into two groups based on the type of analysis being conducted: Tax analyses and fiscal incidence analyses. Tax analyses, in general, are conducted by U.S. researchers, think tanks, and government agencies and focus primarily on the distributional effects of the U.S. tax system. Fiscal incidence analyses are more comprehensive and attempt to measure the distributional effects of both governmental transfers and taxes. Those analyses have largely been conducted by foreign government agencies. Although fiscal incidence studies are less prevalent in the US, there are several early

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papers in the literature conducting such analyses and a few more recent papers conducting comprehensive U.S. fiscal incidence analyses.

In general, the distributional analyses of taxes utilize frameworks that are based around pre-tax income measures, though the scope of income included in those before-tax income measures vary across the researchers and organizations.

Tax Analyses

There are numerous researchers, public policy think tanks, and government agencies that produce analyses of the distributional effects of federal taxes. Because of the focus on taxes and a desire to analyze the progressivity of the federal tax system, every group conducting this type of analysis bases their distributional framework on some form of before-tax income. There is, however, a range of before-tax income measures used in those analyses. The frameworks in those analyses can generally be divided into those that utilize a narrow definition of before-tax income and those that utilize a broad definition of before-tax income.

Narrow Income Definitions

Most distributional tables reported directly by the IRS rank taxpayers by Adjusted Gross Income (AGI), one of the simplest and least inclusive income measures in distributional analyses. AGI represents a subset of market income reported directly on tax returns, which excludes many forms of income. Most significant among those exclusions are both the health insurance premiums and taxes paid by employers on behalf of workers.⁵ The IRS is a government agency whose primary mandate is the processing of tax returns as part of the revenue collections for the federal government. Although the IRS releases detailed distributional tables showing numerous income sources and tax-related values by income classes, they generally do not strive to produce economic analyses with those data.

The influential analyses done by Piketty and Saez also use a measure of market income available on tax returns, adding back statutory adjustments to AGI but excluding all government transfers, including taxable Social Security benefits. Their choice was based on the ready availability of reliable tax return data over a long historical period, and the ability to decompose income from tax sources into capital and labor components.⁶

Broad Income Definitions

The distributional framework used by Joint Committee on Taxation (JCT) employs a broader measure of market income, which adds back non-taxable income that is excluded from AGI,

⁵ IRS, Statistics of Income—"2013 Individual Income Tax Returns". Internal Revenue Service Washington, D.C. <http://www.irs.gov/pub/irs-soi/13inalcr.pdf>

⁶ Thomas Piketty and Emmanuel Saez, "The Evolution of Top Incomes: A Historical and International Perspective," AEA Papers and Proceedings: Measuring and Interpreting Trends in Economic Inequality 96, no. 2 (May 2006): 200–205, <http://elsa.berkeley.edu/~saez/piketty-saezAEAPP06.pdf>. For updated data, see Emmanuel Saez, "Striking It Richer: The Evolution of Top Incomes in the United States" (working paper, University of California–Berkeley, March 2, 2012), <http://elsa.berkeley.edu/~saez/saez-UStopincomes-2010.pdf>

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such as health insurance premiums and taxes paid on behalf of workers, as well as tax-exempt interest and other items. JCT’s expanded income measure further includes federal government retirement benefits—specifically, untaxed Social Security benefits and the imputed value of Medicare are included.⁷

Both the U.S. Treasury and the Urban-Brookings Tax Policy Center (TPC) use even more expansive income definitions that include market income, federal retirement income (although Treasury excludes Medicare from that category), and also cash and near-cash government transfers (like benefits from the Supplemental Nutrition Assistance Program).

CBO’s current methodology ranks households by “before-tax income.” That income measure is equal to market income plus government transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Government transfers are cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

None of the income measures used in analyses of the distributional effects of taxes are perfect Haig-Simons income measures. There are several important components of a Haig-Simons income measure that is missing in each of them. For example, none of the income measures used in those analyses include the inside build of assets held in pension funds or the accrued value of defined benefit pension plans. Similarly, none of them include the accrued value of any other capital asset, instead, the capital gain—the difference in the value of an asset from when it was acquired to when it is sold—is counted as income in the year in which the sale of the asset takes place. A more pure Haig-Simons treatment of capital gains would allocate some income (or loss) in each year that the asset is held based on how the market value for the asset fluctuates from year-to-year. Finally, imputed income from owner-occupied housing and durable goods is also not included in most distributional analyses.

Other Distributional Frameworks

Within the class of analyses focused on analyzing the distributional effects of taxes, there are several studies that do not rely on a variant of before-tax income as the central measure of their analytical frameworks. Distributional analyses are most often based on measures of annual income. One critique often made of distributional analyses, though, is that an annual measure of income is not a very good proxy for economic well-being. Individuals, families, and households may be subject to income shocks (either positive or negative) that will move them into income categories that are not representative of their “true” economic well-being. Examining individuals, families, and households in annual cross-sections effectively limits distributional

⁷ See Joint Committee on Taxation, *Estimating Changes in the Federal Individual Income Tax: Description of the Individual Income Tax Model*, April 23, 2015, page 26-. And *Overview of the Definition of Income Used by the Staff of the Joint Committee on Taxation in Distributional Analyses*. JCX-15-12. February 28, 2012.

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analyses to capture the amount of income smoothing (in the form of saving and borrowing) that occurs over the life-cycle or in response to income shocks. Some distributional analyses have attempted to address this inherent short-coming in distributional analyses based on annual measures of income.

Hassett and Mathur recently used a consumption-oriented distributional model in order to correct for a significant shortfall in all annual income-based frameworks.⁸ To the extent households smooth their consumption patterns over their lifetimes regardless of temporary fluctuations in income; a consumption based framework may provide a more accurate assessment of household welfare in a given year. Measures of consumption among both high- and low-income households, however, are widely considered unreliable and to the extent that one considers inequality in wealth accumulation an important distributional issue, annual consumption models may also fall short of an ideal framework.

Finally, Fullerton and Rogers have explored a distributional analysis of tax burdens based on lifetime income, rather than annual income.⁹ That sort of model solves several problems present in annual income or consumption models. Most significantly, that under annual models people who are early in their careers, in retirement, or briefly unemployed may be classified as low-income even if their lifetime earnings were (or will be) quite high. However, the authors are careful to note that lifetime models should be used to augment, not replace, annual models: tax policies are constantly evolving and people actually do tend to make current consumption decisions on current income, not expected lifetime income.

Fiscal Incidence Analyses

Fiscal incidence analyses examine the combined distributional effects of taxes and government spending. Those analyses tend to be based on frameworks at either end of the income spectrum. Recent U.S. fiscal incidence studies have used market income as their distributional framework, whereas numerous fiscal incidence studies conducted by foreign governments and other international organizations typically utilize some measure of market incomes net of direct taxes and cash transfers—usually referred to as disposable income—as their distributional frameworks.¹⁰

U.S. Analyses

A sparse and dated body of work exists in which U.S. researchers attempted to expand beyond the narrow focus of the distributional effects of taxes to produce more comprehensive fiscal incidence analyses. That literature, however, grapples primarily with how to allocate the

⁸ Hassett, Kevin. Mathur, Aparna. A New Measure of Consumption Inequality. AEI Economic Studies. June 2012.

⁹ Fullerton and Rogers, *Who Bears the Lifetime Tax Burden?* (Washington, DC.: Brookings Institution, 1993).

¹⁰ The range of taxes and spending programs included in fiscal analyses varies from study to study. On the tax side of the budget, fiscal incidence analyses conducted by foreign governments and other international research organizations generally omit corporate taxes from their distributional analyses. On the spending side, most fiscal incidence analyses limit the scope of analysis to spending on transfer programs, while others try to capture all government expenditures (which includes government spending on public goods).

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economic benefits of governmental spending on public goods to U.S. households.¹¹ More recently, there have been a few reports that have allocated the full effects of the entire federal budget to U.S. households. Chamberlain and Prante (2007) conducted an extremely detailed analysis of how federal, state, and local taxes and spending affect U.S. households.¹² CBO published a report on the distribution of federal taxes and spending in 2006, which allocated nearly the entire federal budget to U.S. households.

In contrast to the fiscal incidence reports published by foreign governments, neither the Chamberlain and Prante study nor the CBO study ranked households by an after-tax income measure. The Chamberlain and Prante study ranks households by cash money income, which includes wages and salaries, self-employment income, and other market-based income as well as government cash transfer payments like Social Security, unemployment benefits, and other means-tested transfers. Their intuition for using this measure is that it is a broadly understood measure for legislators, policy analysts, and lay audiences can easily locate themselves in the study's distributional tables.¹³ When calculating tax rates, Chamberlain and Prante use a much broader definition of income to proxy a household's ability to pay their tax liabilities. They also use that broad income measure as the denominator when calculating government spending rates across the cash income quintiles. [Despite C&P complaining about how CBO (and others) double count income when we include transfers in our before-tax income measure (because we don't subtract that income from other households in the aggregate), they calculate "spending rates" that have those transfers in the denominator. I need to check whether they made any changes to their methodology in the Prante & Hodges 2013 report.]

The comprehensive fiscal incidence study published by the CBO used market income as the ranking measure and the denominator when calculating federal tax and transfer rates.¹⁴ Because ranking households by market income results in a distribution that has elderly households being over-represented in the bottom market income quintile, the CBO report did not include elderly households in their analysis by market income quintiles.

Foreign Analyses

There exists a rich literature on fiscal incidence analyses from foreign governments and among international organizations. The United Kingdom, for example, has been producing detailed analyses of how fiscal policies affect the distribution of resources in their respective countries on

¹¹ See, for example, Gillespie (1965), Aaron and McGuire (1970), and Ruggles and O'Higgins (1981).

¹² Andrew Chamberlain and Gerald Prante, "Who Pays Taxes and Who Receives Government Spending? An Analysis of Federal, State, and Local Tax and Spending Distributions, 1991-2004." Tax Foundation Working Paper No. 1, March 2007. That report was subsequently updated in 2014 to examine tax and spending policies over the period 2000-2012: Gerald Prante and Scott Hodge, "The Distribution of Tax and Spending Policies in the United States." Tax Foundation Special Report No. 211, November 2014.

¹³ Unlike many other distributional analyses, the Chamberlain and Prante study does not make any household-size adjustments to income when ranking households.

¹⁴ Market income was adjusted for differences in household size when ranking households, but was not adjusted for calculation of various rates.

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a regular basis, some for a very long time.¹⁵ Current fiscal incidence analyses in those countries rely on a measure of disposable income for the foundation of their reports. Disposable income is measure of market income plus direct transfers minus direct taxes. Those reports tend to focus on year-over-year changes and long-term changes in the nominal distribution of resources and in measures of income inequality (specifically, how measures of Gini coefficients change over time).

Because direct transfers and taxes are included in the income measure used to rank household, the calculation of tax and transfer rates are not a primary focus of those reports. The U.K. does, however, report measures of taxes as a proportion of gross income (that is, market income plus cash transfers) for each of the disposable income classes.¹⁶

Australia also has a long history of producing fiscal incidence analyses, and has recently been publishing them on a biannual basis. In their most recent analysis, Australia provides distributional rankings by at least five different income measures, but emphasizes those ranked by market income, disposable income and final income.¹⁷

Canada and New Zealand have produced fiscal incidence analyses more sporadically. The most recent fiscal incidence analysis for Canada examines the comprehensive effects of the government tax and transfer system on a measure of family-level “post-government” income.¹⁸ The most recent New Zealand fiscal incidence analysis ranks households by disposable income.¹⁹

The International Monetary Fund (IMF) and the Organization for Economic Co-Operation and Development (OECD) have recently published reports on the income inequality and the effects of governmental policies on income inequality. The primary goal of those reports has been to highlight international comparisons and have focused on measures of disposable income in the analyses.²⁰

¹⁵ An early analysis of the redistributive nature of tax and spending policies in the U.K. was published by Tibor Barna in 1945. The Central Statistical Office (subsequently renamed the Office of National Statistics) in the U.K. has been regularly publishing fiscal incidence studies since the 1960s.

¹⁶ United Kingdom Office for National Statistics. “The Effects of Taxes and Benefits on Household Income, Financial Year Ending 2014”. June 29, 2015.

¹⁷ Australian Bureau of Statistics, Government Benefits, Taxes and Household Income, Publication 6537.0, 2009–10, June 29, 2012

¹⁸ Dyck, Dagmar, “Fiscal Redistribution in Canada, 1994-2000” Department of Finance, Canada Working Paper 2003-2.

¹⁹ Omar Aziz, Matthew Gibbons, Chris Ball and Emma Gorman, “The Effect on Household Income of Government Taxation and Expenditure in 1988, 1998, 2007 and 2010” Policy Quarterly – Volume 8, Issue 1 – February 2012 – Page 29

²⁰ IMF Staff Discussion Note, Causes and Consequences of Income Inequality: A Global Perspective. Era Dabla-Norris, Kalpana Kochhar, Nujin Suphaphiphat, Frantisek Ricka, Evridiki Tsounta, <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf>. June 2015

Before-Tax Income Framework (CBO’s Current Methodology)

The Congressional Budget Office has been producing reports on the distribution of household income and federal taxes for well over a decade.²¹ Although the methodology used in those analyses has undergone several revisions over the years, key features of the current methodology include:

- The income measure used to rank households is before-tax income—a comprehensive income measure that includes market income and government transfers.²²
- The unit of analysis is households; a household consists of people sharing a housing unit, regardless of their relationships.
- When ranking households, income is adjusted for household size by dividing household income by the square root of the number of people in the household.
- Corporate income taxes are assumed to fall on both labor and capital.
- In-kind benefits going to households, such as Medicare and Medicaid, are valued at the average cost to the government.

In the current CBO framework, before-tax income is equal to market income plus government transfers (see **Figure 2**). Market income includes the direct compensation workers receive from their employers, including wage and non-wage compensation, as well as investment income. Non-wage compensation includes fringe benefits like employers contributions for health insurance premiums. It also includes payments made by employers on behalf of their workers for payroll taxes. Government transfers include both cash and in-kind benefits from federal, state, and local governments.²³ Federal taxes include both direct taxes (individual income tax and payroll tax) and indirect taxes (corporate income tax and excise taxes).²⁴

²¹ More details of CBO’s methodology are given in appendix B.

²² Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement and other sources of income. CBO strives to measure income as broadly as possible and thus includes in income some items that people may not usually consider part of income. For example, CBO counts taxes paid by businesses as part of household before-tax income; because those taxes are ultimately borne by households in the form of reduced income, CBO adds them to before-tax income in order to measure more accurately what a household’s ability to consume would have been in the absence of those taxes.

²³ CBO relies on the U.S. Census Bureau’s Current Population Survey Annual Social and Economic Supplement for information on household receipt of income from many government transfer programs. Some programs such as Medicaid and AFDC/TANF are jointly administered by the federal government and state governments; both the federal and state portions are included in CBO’s analyses. One program, State General Assistance benefits, is solely administered by states and also included in CBO’s measure of government transfers.

²⁴ The four sources of taxes included in CBO’s analyses account for more than 90 percent of all federal taxes collected in a given year. Other revenue sources not included in CBO’s distributional analyses include the estate and gift taxes, the state portion of unemployment insurance collections, net investment earnings from the Federal Reserve remitted to the Treasury, and other miscellaneous fees and fines. It is important to note that the CBO framework does not include the distributional effects of state and local taxes to arrive at a true measure of final income available for households to divide between savings or consumption.

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Two aspects of CBO's income definition bear further discussion – capital gains and pensions. Market income includes capital gains income when realized, rather than as it accrues. Similarly for pensions, income is measured when received or withdrawn (in the case of defined-contribution type retirement accounts), rather than as it accrues. Those income sources are treated that way in part because of data limitations. Another rationale for that treatment of capital gains and pension income is that it aligns with how the tax system measures and collects revenues on those income sources. Using the same accounting framework when measuring income and taxes is intuitive, although not optimal. Under a comprehensive Haig-Simons income definition, often operationalized by defining income as equal to consumption plus the change in net worth, changes in the value of capital and pension assets would be counted as annual accruals of income rather than lumpy realizations. Both Haig and Simons recognized the practical difficulties in using accruals as the basis for taxation, however. Haig suggested a “scheme of arbitrary apportionment of the gain over the period of accrual” for purposes of income taxation. Simons suggested that the current treatment of gains upon realizations might be the only administrable way to tax them.²⁵

An accrual treatment of capital gains and pensions would address a common critique of some distributional analysis – their exclusion of corporate retained earnings from household income. Those retained earnings should translate directly into an increase in the corporate stock price, generating an equal amount of accrued household income.

In practice, efforts to measure pensions and gains on an accrual basis are hampered by data constraints. Existing household surveys and administrative data simply do not capture well the increase in personal assets at the household level. The value of benefits promised under defined-benefit plans are particularly difficult to measure as they accrue. While there has been some progress on measuring capital income at the household level as it accrues, based on asset holdings and the assumption that all households receive the same rate of return on a given asset type, those estimates are limited to certain years (Armour, Larrimore and Burkhauser (2013), Smeeding and Thompson (2010)).

In the absence of more comprehensive data, it is impossible to accurately apportion the capital gains realized in a single year over multiple years, and that the practical choice is between counting the gain as income when realized or allotting only part or none of it to current income.²⁶ Omission seems the worse choice, especially because the favorable tax treatment of capital gains

²⁵ Haig, Robert M. (1921). "The Concept of Income—Economic and Legal Aspects". *The Federal Income Tax*. New York: Columbia University Press. Simons, Henry (1938). *Personal Income Taxation: the Definition of Income as a Problem of Fiscal Policy*. Chicago: University of Chicago Press.

²⁶ Extensive examination of tax data on the sales of capital assets indicates that apportioning gains across years on the basis of a single year's realizations would lead to significant error. See Congressional Budget Office, *Perspectives on the Ownership of Capital Assets and the Realization of Capital Gains* (May 1997).

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income has created strong incentives for high income taxpayers to recharacterize ordinary income as capital gains.

The desire to examine the joint distribution of income and taxes also argues for including pension and capital gains income upon realization. The US income tax is assessed on such income when realized; there is some logic to using the same accounting principles for the measurement of income and taxes. Otherwise the misalignment in timing would show, for instance, very high tax rates on pensioners or on taxpayers whose primary income is capital gains. While in theory one could compute the taxes on such income on an accrual basis as well, doing so would require making assumptions about future tax law, household economic circumstances, and the timing of pension receipt and the sale of assets.

Table 1 presents a typical distributional table that would be found in recent CBO reports on the distribution of household income and federal taxes. Prior to 2013, the table would have focused on taxes – including only before-tax income, federal taxes, and after-tax income, while more recent reports have begun to include market income and government transfers in order to provide a more complete presentation of government intervention.

Table 1.

Distribution of Household Income, Government Transfers, and Federal Taxes, 2006 CBO's Current Framework: Before-Tax Income

Dollars	Quintiles					All
	Lowest	Second	Middle	Fourth	Highest	Households
Market Income	14,700	28,800	49,400	79,700	234,100	81,400
+ Government Transfers	7,100	12,300	12,100	10,400	8,900	10,200
= Before-Tax Income	21,800	41,100	61,500	90,000	243,000	91,600
- Federal Taxes	1,300	4,000	8,600	16,100	62,500	18,700
= After-Tax Income	20,600	37,100	52,900	73,900	180,400	72,800
Federal Tax Rate (Percent)	5.7	9.8	14.1	17.9	25.7	20.5

Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income.

Government transfers are cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

Before-tax income is market income plus government transfers.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by before-tax income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

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When households are ranked by before-tax income, the average before-tax income in the highest income quintile (fifth) is approximately 10 times as much as the average before-tax income in the lowest quintile (see **Table 1**). Approximately one-third of before-tax income in the lowest income quintile is government transfers, whereas the comparable proportion in the highest income quintile is only 5 percent.

Within this framework, the overall federal tax system is clearly progressive—as income increases, households pay a larger share of their income in taxes. Households in the second quintile, for example have an average federal tax rate that is approximately twice as large as the rate in the lowest income quintile and households in the highest income quintile have an average federal tax rate that is approximately 5 times as large as the average rate paid by the lowest income quintile.

Strengths of Before-Tax Framework

CBO has historically taken a tax-centric approach in their presentation of the distribution of household income. Before-tax income – including market income and all transfers – provides a useful proxy for a household’s ability to pay the tax liabilities they incurred and is therefore an appropriate denominator for calculating federal tax rates.

Another strength of the before-tax income measure is the inclusion of social insurance payments received largely by those households in retirement. CBO’s distributional analyses focus on a cross-section of income, transfers and taxes in a given year and include households of all ages and at all stages in their careers. Thus, households of people who are early in their careers, in retirement, or briefly unemployed may be classified as low-income even if their lifetime earnings were (or will be) quite high. By including Social Security benefits and Medicare in our income measure, we partially correct for this bias – relatively well-off retired households who rely heavily on those programs will not be classified in the lowest-income group just because they are not active earners.

Shortcomings of Before-Tax Framework

The current framework, however, is tax-centric and doesn’t allow for a rigorous analysis of the full fiscal impact of public policies on household well-being. Although it is easy to see in the current distributional framework that the tax system is progressive, it is less easy to understand from the framework what the progressivity of the transfer system is and what net effect of government transfers and taxes have on households in various segments of the income distribution.

The current CBO presentational framework does not treat the redistributive effects of taxes and transfers equally. Ranking taxpayers by an income measure that includes transfers but not taxes embeds a significant source of government intervention in the analytic framework, reducing the ability to effectively analyze the redistributing effects of government transfers. Any exogenous

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changes in transfer policies, for example, will result in a new ranking of households making it difficult to disentangle the re-ranking effects from the direct policy effects.

As a result of government transfers being included in the income measure used to rank households by and to divide federal taxes by when calculating tax rates, CBO's current presentational framework does not allow for the calculation of a meaningful transfer rate (analogous to a tax rate) and to analyze how those have been changing over time. Because of the inclusion of transfer income in the ranking income measure and the tax-centric approach to presenting its distributional analyses, CBO has historically not calculated federal transfer rates.

Gross Income Framework (Market Income plus Social Insurance)

CBO's current distributional framework limits our ability to make comparisons between taxes and transfers and to illustrate the full scope of government involvement in the allocation of resources. To address those limitations, CBO is exploring using a gross income measure as the foundation for its distributional analyses.

Gross income equals market income plus social insurance transfers. An alternative, though identical, definition of gross income is before-tax income minus means-tested transfers (see **Figure 3**). That measure of income would be used as the income to rank households by and the income to use as the denominator in the calculation of transfer and tax rates.

Social insurance programs (such as Social Security, Medicare, and Unemployment Insurance) are defined as transfer programs into which individuals explicitly pay over the course of their lives to cover specific risks. Social Security provides insurance for three specific types of risks: the risk of poverty in retirement, the risk of disability, and the risk of being unable to support children in the event of a worker's death. Similarly, Medicare provides insurance for health related expenses in retirement and unemployment insurance provides partial replacement of wages in the event of one losing his or her job. Because the risks those programs insure against are relatively evenly distributed across households, the benefits received from those programs also tend to be relatively evenly spread across households.

Means-tested transfer programs provide both cash and in-kind benefits to households, families, or individuals based on their need. Means-tested cash transfer programs include AFDC/TANF, and SSI; means-tested programs providing in-kind benefits include programs such as Medicaid, SNAP, and housing assistance. In order to receive benefits from those programs, households, families, or individuals generally must be below certain income thresholds and benefits often phase-out over a particular income range. Because of the targeted nature of those transfer programs, the benefits are generally progressive, meaning transfers from those programs make

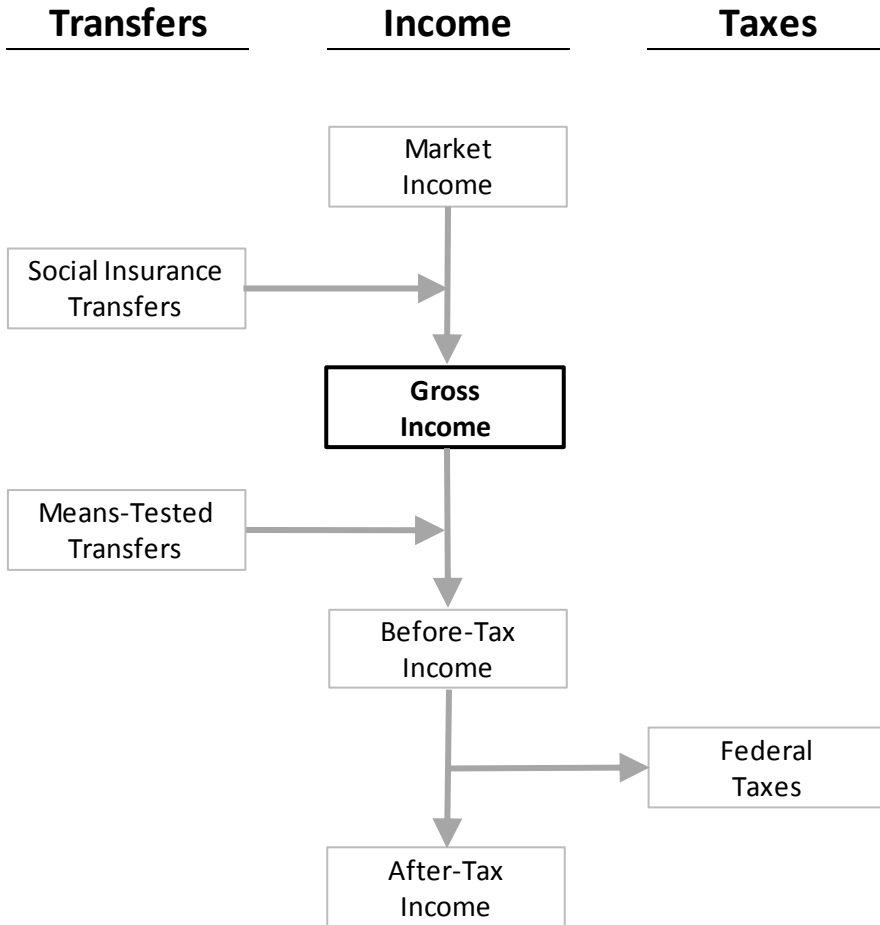
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up a larger share of household resources for low income households than they do for high income households.²⁷

²⁷ Refundable tax credits are another form of means-tested transfer administered through the individual income tax system. Two significant federal policies that provide additional cash assistance to households through the tax system are the Earned Income Tax Credit and the Child Tax Credit. Furthermore, the passage of the 2012 Patient Protection and Affordable Care Act (referred to as the ACA) significantly expands the amount of means-tested transfers provided to households through the tax system. The ACA premium assistance tax credit reduces the price households below certain income thresholds must pay for health insurance purchased on government health insurance exchanges. In addition, the ACA includes cost-sharing subsidies, which provides additional indirect assistance to households in the form of higher quality health insurance plans purchased through the exchanges. Because the ACA cost-sharing subsidy is counted as a budgetary outlay, it would be included in means-tested transfers. The premium assistance tax credits, however, will be counted as a reduction in federal taxes.

Figure 3.

Gross Income Framework for How Government Transfers and Taxes Affect Household Resources



Source: Congressional Budget Office.

Notes: Households are ranked by gross income, adjusted for household size differences. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Gross income is market income plus social insurance transfers. Social Insurance transfers consist of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits. Before-tax Income is gross income plus means-tested transfers. Means-tested transfers consist of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps. Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

Using this income concept, average Gross Income ranges from \$16,400 in the lowest income quintile (defined as the lowest fifth of the distribution of households ranked by their household-size adjusted gross income) to \$241,700 in the highest income quintile (see **Table 2**). This range

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is not significantly different than the range shown in **Table 1** when households are ranked by before-tax income, which includes means-tested transfers.

Table 2.

**Distribution of Household Income, Government Transfers, and Federal Taxes, 2006
Gross Income Framework**

Dollars	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
+ Means-Tested Transfers	8,000	3,000	1,600	1,000	800	2,800
- Federal Taxes	900	3,900	8,800	16,300	62,600	18,700
= After-Tax Income	23,500	35,900	52,200	73,400	179,900	72,800
Memo:						
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
Market Income	12,600	28,200	50,700	80,800	234,300	81,400
Social Insurance	3,800	8,700	8,800	7,900	7,400	7,300

Source: Congressional Budget Office.

Notes: Gross income is market income plus social insurance transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits.

Means-tested transfers consists of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by gross income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

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Federal tax rates by income quintile will be different when using gross income rather than before-tax income as the ranking measure and denominator. When gross income is used, federal tax rates range from 5.5 percent for the lowest gross income quintile to 25.9 percent for the highest gross income quintile (see **Table 3**). Means-tested transfer rates have not usually been calculated in the current CBO methodology using before-tax income as the ranking measure and the denominator in rate calculations because means-tested transfers are included in the before-tax income measure. But using a gross income framework, those means-tested transfer rates can be calculated. Means-tested transfers are highly progressive, meaning they go predominantly to low-income households. Medicaid is by far the largest means-tested transfer program, which accounts for more than half of means-tested transfers going to the lowest gross income quintile and is more than four times larger than the next largest means-tested transfer program—the Supplemental Nutrition Assistance Program (SNAP), formerly known as food stamps.

Table 3.

**Distribution of Means-Tested Transfer Rates and Federal Tax Rates 2006,
Gross Income Framework**

Percents	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
Means-Tested Transfer Rate	48.8	8.0	2.7	1.1	0.3	3.2
Medicaid	28.8	5.3	1.7	0.6	0.2	1.9
SNAP	6.7	0.4	0.1	0.0	0.0	0.3
Other Means-Tested Transfers	13.4	2.3	0.9	0.4	0.2	1.0
Federal Tax Rate	5.5	10.5	14.9	18.4	25.9	21.1
Individual Income Tax	-7.9	-0.9	3.0	6.1	14.4	9.2
Payroll Tax	9.7	8.9	9.4	9.8	6.0	7.6
Corporate Tax	1.3	1.3	1.5	1.8	5.1	3.6
Excise Tax	2.3	1.2	0.9	0.8	0.4	0.7
Net Tax and Transfer Rate	43.4	-2.5	-12.2	-17.3	-25.6	-17.9

Source: Congressional Budget Office.

Notes: All rates are calculated using gross income as the denominator. Gross income is market income plus social insurance transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Unemployment Insurance (UI) benefits.

Means-tested transfers consists of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.

Other means-tested transfers consist of housing assistance, energy assistance, supplemental security income (SSI), veterans' benefits, workers' compensation benefits, and TANF benefits.

Income groups are created by ranking households by gross income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

Strengths of Gross Income Framework

Because means-tested transfers are removed from the income measure used to rank households and used as the denominator to calculate tax and transfer rates, this framework would make changes in means-tested transfers easier to analyze because they do not cause a re-ranking of households, and would make means-tested transfer rates and net tax and transfer rates calculable on a consistent basis. Furthermore, by contrast to using a pure market income measure, a gross income measure keeps retirement income in the income base and mitigates the problem of classifying nearly all retired households as poor.

A gross income framework puts means-tested transfer policies on equal footing as means-tested tax policies. Under the previous distributional framework, identical policies can produce different (and often confusing) results depending on whether the policy is implemented as a transfer or as a refundable tax credit.

Under the current CBO framework, means-tested transfer and social insurance transfers have been grouped together and both are included in before-tax income. Having transfers included in before-tax income makes the calculation of transfer rates difficult to interpret because transfers would be included in both the numerator and the denominator of the calculation. By removing means-tested transfers from the ranking measure, that same measure (gross income) can be used as the denominator for the calculation of both means-tested transfer rates and net tax and transfer rates.

Shortcomings of Gross Income Framework

Moving away from using before-tax income that excluded means-tested transfers as a ranking measure and as the measure used to calculate federal tax rates will be a slight departure from that ability to pay concept. That departure, however, may be a worthwhile trade-off if the new distributional framework incorporates the ability to conduct a full fiscal impact analysis on household well-being.

Although Social Security and Medicare make up approximately one-third of the federal budget, analyzing the distributional effects of those two programs in a cross-sectional framework is problematic. Alternatively, using a framework examining the distribution of income, transfers, and taxes over one's lifetime, households could be ranked by their average lifetime incomes. Furthermore, present value calculations for the taxes paid and the benefits received could be made for those programs and lifecycle patterns would not distort the conclusions one might draw about the progressivity of the net benefits those programs provide. Because of data limitations and other modeling complexities, such a framework based on lifetime incomes and present value calculations of taxes paid and benefits received is very difficult to operationalize.

For the purposes of analyzing the effects of means-tested programs and taxes, Social Security and Medicare is included in the base income measure. That approach reflects the effects of the

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programs on the current circumstances of the beneficiaries, but does not necessarily reflect the appropriate net tax-benefit effects of those programs over one's lifetime.

However, Social Insurance programs do include some redistribution, even in a cross-sectional context. For example, Medicare's Part B premiums rise with annual income. And low-income Medicare beneficiaries are eligible for subsidies under the Medicare Part D prescription drug program through the Low-Income Subsidy (LIS) program. The gross income framework does not capture this redistribution, though in theory it could be adapted to, for example, by including the LIS program as a means tested transfer and the Part B premiums as a tax.

The gross income framework also introduces an asymmetry in the treatment of Social Insurance benefits and the taxes that finance them. Perhaps the ideal solution would be to divide both the Social Insurance taxes and benefits into a pure insurance component and a redistribution component, and remove the pure insurance component from the calculation altogether.²⁸ Such estimates, however, are beyond CBO's current capabilities.

Another shortcoming of a distributional framework based on gross income emerges when examining the net tax and transfer rate. The net tax and transfer rates across the distribution of households ranked by gross income appear to be very progressive. Using this ranking measure shows a net tax and transfer rate of over 40 percent for the lowest income quintile and at negative 25 percent for households in the highest income quintile. Furthermore, households in the second through fourth income quintiles are also shown to have negative net tax and transfer rates under this framework (although the net tax and transfer rate for households in the second income quintile is just slightly negative).

The presentation may lead to the perception that households in the upper 80 percent of the gross income distribution are only redistributing income down to households in the lowest 20 percent of households and receiving no other benefits from the government. The negative net transfer rates in the second and middle income quintiles, however, are attributable to only a portion of the federal outlays being allocated to households whereas nearly all federal revenues are being allocated. Approximately 40 percent of federal outlays can be classified as public goods, or public-goods-like, and are not allocated to households in most distributional analyses.

The degree of progressivity in the federal tax and transfer system depends to a large extent on if and how public goods are allocated to U.S. households. What assumptions one uses to allocate public goods to U.S. households will affect the conclusions one draws about the amount of income redistribution in the federal tax and spending system.

²⁸ This proposal is made in Driessen, Patrick, "Fiscal Modelling Fairness for Grandma", Tax Notes 148(3), July 20, 2015.

Market Income Framework

One possible change to our current method would use market income as the measure by which households are ranked and the denominator used in the calculation of tax and transfer rates. In a market income framework, households are ranked based on income before any direct transfers or taxes from the government. Some other researchers who conduct distributional analyses have referred to this income concept as “initial income” or “original income.” The sources of income included in market income may vary across the researchers conducting the distributional analyses. The concept used in CBO studies includes labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Also included in the CBO definition of market income are items that may not be commonly thought of as being part of income. For example, CBO includes taxes paid by businesses as part of market income because those taxes are ultimately borne by households in the form of reduced income.²⁹ CBO also includes in households’ market income employers’ contributions to employer sponsored health insurance, employees’ contributions to retirement plans, and employers’ share of payroll taxes paid on behalf of the workers.

Strengths of Market Income Framework

When considering a framework to present the distributional effects of government spending and taxes, a market income measure has some appeal. The measure is a proxy for how households would fare in the absence of any governmental intervention. The recent fiscal incidence studies published by the Tax Foundation (Chamberlain and Prante, 2007 and Prante and Hodges, 2013) and by the CBO use market income as the distributional framework for their analyses.³⁰

There are two basic strengths of using market income as the foundation of a distributional analysis. First, it is intuitively appealing to “start from the beginning” and to then layer in the distributional effects of governmental interventions (in the form of direct or indirect taxes and cash and in-kind transfers) and measure how those policies alter the distribution. The second strength of this measure is related in that because direct governmental policies are not included in market income, it allows analysts to calculate meaningful transfer rates, tax rates, and net tax and transfer rates for different segments of the population.

Shortcomings of Market Income Framework

There are two significant drawbacks to using a market income measure as the basis for distributional analyses. The implicit assumption in using market income as the framework for presenting the results of a distributional analysis is that the starting distribution absent any direct government interventions is what the “true” distribution of income would be in a world without

²⁹ CBO assumes that 25 percent of the corporate income tax is borne by labor and 75 percent is borne by capital and allocates those portions of the corporate tax to households based on each household’s share of total labor and capital income.

³⁰ CBO, *Distribution of Federal Spending and Taxes in 2006*, (November, 2013).

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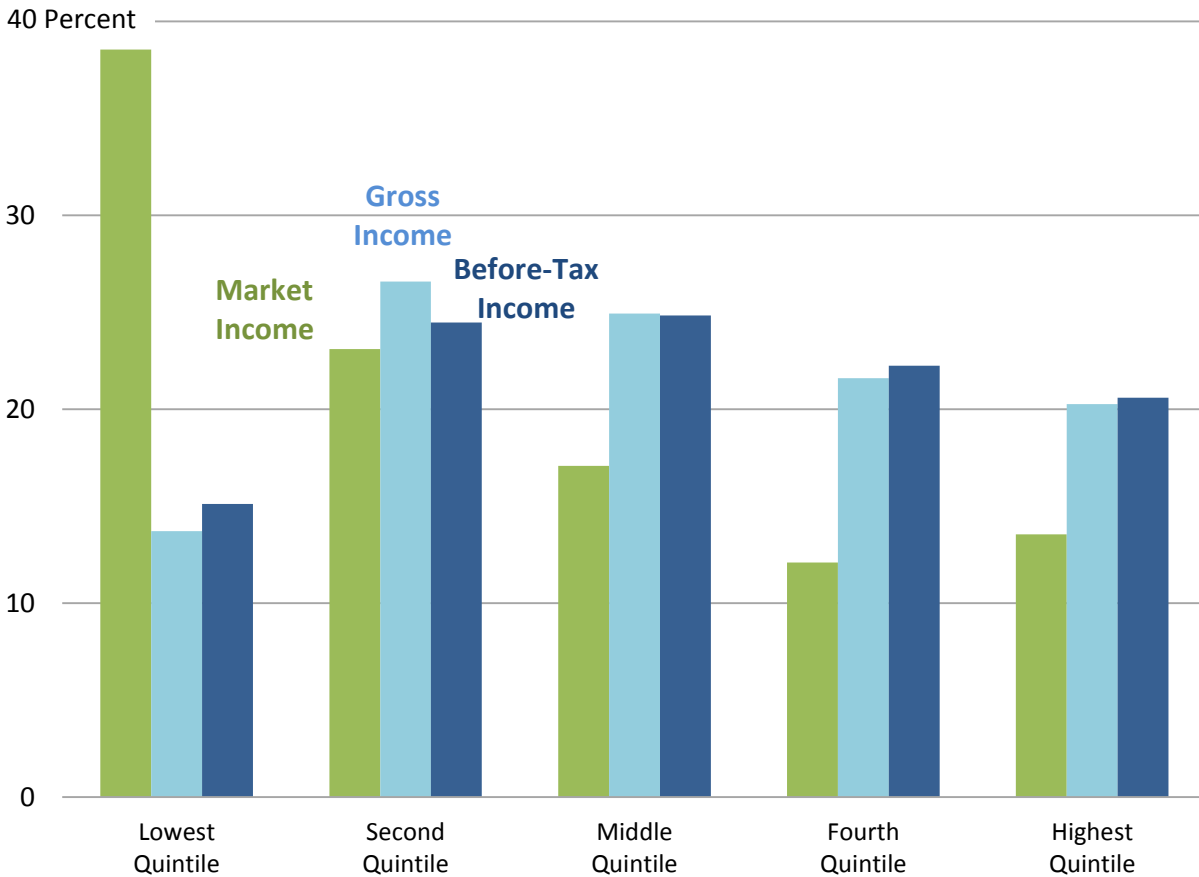
those governmental policies in place. This is not true. There are many other forms of less direct government interventions that help shape the distribution of market income. Regulatory, monetary, and trade policies each affect the distribution of market income and starting with a measure of “market” or “initial” or “original” income is potentially misleading for any such distributional analysis.

The second drawback is more serious than the first. There exists a distinct pattern in market income levels over one’s lifetime. In general, one starts his or her working career at relatively low earnings levels, then climbs the income scale through middle age, plateaus in pre-retirement years, and then dramatically reduces his or her market income in retirement. In a cross-sectional analysis (which examines the distribution of households in a single year), however, households are spread across the various life-cycle earnings stages. Some households consist of young singles just starting off their careers, others consist of middle-aged households at or near the peaks of their careers and earnings profiles, and others still are retired households no longer in the workforce.

Because of those lifecycle patterns, both young and elderly households will be classified as being poor if households are ranked solely on their market income levels. For example, elderly households are significantly over-represented in the lowest market income quintile. Although they account for approximately 20% of all households, they make up almost 40% of households in the lowest market income quintile (see **Figure 4**). Because of that significant shortcoming, in its 2013 report on the distribution of federal spending and taxes CBO analyzed the distributional effects of federal spending and taxes by market income quintiles only among non-elderly households.

Figure 4.

Concentration of Elderly Households Across Income Quintiles Under Alternative Ranking Measures, 2006



Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Gross income is market income plus social insurance transfers. Social Insurance transfers consist of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits. Before-tax Income is gross income plus means-tested transfers. Means-tested transfers consist of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.

Income groups are created by ranking households by gross income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

After-Tax Income Framework

At the other end of the income spectrum is a measure that includes the net effects of government transfers and taxes. In CBO analyses, this income concept is called “after-tax income,” and is equal to market income plus government transfers minus federal taxes.³¹ Many fiscal incidence studies conducted by foreign governments use “disposable income” as the framework for their analyses. In most cases, disposable income includes market (or “original”) income plus cash transfers minus direct taxes. In-kind benefits such as health, education, or housing benefits are not included. Similarly, indirect taxes such as corporate taxes and excise and value added taxes (VATs) are not included in disposable income. As such, disposable income can be considered as a partial after-tax measure.

Strengths of After-Tax Income Framework

Ranking households by after-tax or disposable income presents the distribution of economic well-being after some or all of the effects of government transfers and taxes have been taken into account. If the primary interest of the analysis is to assess how much dispersion there is in final resources, and after-tax income framework is most appropriate. This framework is also useful for tracking changes in the level of income inequality in a society over time.

A second strength of an after-tax income framework is that it makes assumptions about isolating the distribution of market income in the absence of any governmental institutions unnecessary. The counterfactual for a distributional framework based on market income, for example, is that the distribution of market income is what would exist if no government existed. That assumption, however, is a rather inaccurate one as there are numerous ways in which other governmental policies affect what is captured in the distribution of market income. An after-tax framework essentially takes the existing tax and transfer structure as a given, and could therefore be seen as more appropriate framework for considering transfer or tax policies that changes the size of government rather than a framework for analyzing the effects of government policies being added to an initial distribution of market income.³²

Shortcomings of After-Tax Income Framework

A distributional framework based on a measure of income that includes some or all of the effects of government transfer and tax policies suffers from a significant shortcoming. In such a framework, calculation of transfer rates, tax rates, and net tax and transfer rates produce difficult to interpret results because those governmental policies are included in both the numerator and the denominator for such calculations. In fact, most of the fiscal incidence studies that rely on

³¹ Because an ideal measure of income for use in distributional analyses of taxes is as broad as possible to provide a reasonable proxy for both overall economic welfare and ability to pay tax liabilities, government transfers include transfers from federal, state, and local governments. But because CBO reports focus exclusively on federal taxes, state and local taxes have not been included in CBO distributional analyses.

³² Gillespe, W. Irwin, 1965, “The Effect of Public Expenditures on the Distribution of Income: An Empirical Investigation,” in Richard A. Musgrave (Ed.) *Essays in Fiscal Federalism* (pp. 122-186), Washington, D.C.: Brookings Institution.

disposable income as the framework for their analyses do not calculate tax and transfer rates at all.

Comparison of the Alternative Frameworks

The choice of income measure used as the basis for a distributional analysis can substantially effect views about the inequality of underlying income (as well as the role of the tax and transfer system in reducing that inequality), average federal tax rates across the income distribution and the progressivity of taxes. Those differences in interpretations across the income measures derive from what income components are included in each measure as well as the reshuffling of the income groups when households are ranked by one measure versus another.

Measures of Income Inequality

At the most basic level, the inequality of market income is above that of gross income, and the inequality of gross income is above that of before-tax income. Expressed in terms of Gini coefficients, the Gini for market income is 0.586, for gross income is 0.521, and for before-tax income is 0.499. (The Gini coefficient is a commonly used measure of income inequality, and ranges from 0, if income was distributed equally, to 1, if one household earned all the income. It is often visualized as the twice the area between a 45 degree line and a Lorenz curve, which plots the cumulative distribution of income against the cumulative distribution of population.

Alternatively, it can be thought of as the as half of the relative mean absolute difference, which is average absolute difference in income between all pairs of households in the population, divided by average income, to normalize for scale.)³³

An analysis that begins with market income will show the greatest inequality and a substantial reduction in measured inequality from the transfer system. An analysis that begins with gross income will show less inequality, and the transfer system will have a smaller income inequality reducing effect than in an analysis starting with market income. That is because social insurance transfers (which are included in gross income) account for roughly three-fourths of the inequality reducing effect of the transfer system, in a cross-sectional context. Finally, an analysis that begins with before-tax income will show the least amount of income inequality, and is not well-suited for parsing out the inequality reducing effects of government transfers.

Average Federal Tax rates

In general, average tax rates appear lower under a broader income base. The difference is especially large when moving from market to gross income, because social insurance transfers are quite large (see **Table 4**). Average rates fall by 2.7 percentage points in the lowest income quintile, 2.4 points in the middle, and 0.8 points in the highest income quintile.

³³ For more details, see Jenkins, Stephen P. (2009) The measurement of economic inequality In: Salverda, Weimer and Nolan, Brian and Smeeding, Timothy M., (eds.) The Oxford Handbook of Economic Inequality . Oxford University Press, Oxford, UK, 40-6

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A similar, but smaller, dynamic occurs when adding means tested transfers to the income base and moving from gross to before-tax income. Average tax rates are lower for virtually all income groups, with the size of the decrease falling with income. One quite notable exception is the lowest income quintile, where average rates *rise* with the addition of means tested transfers. That increase is caused by a changing composition of the bottom quintile. Adding Medicaid moves many cash-poor people from the bottom to the second quintile. Replacing them in the bottom are households with higher cash income, and consequently higher tax rates.

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Table 4.

Distribution of Share of Income, Means-Tested Transfer Rates, and Tax Rates, 2006

	Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Shares of Income					
Market Income	2.2	7.2	12.7	19.9	58.8
Gross Income	3.0	7.0	12.4	19.6	58.6
Before-Tax Income	3.5	7.1	12.2	19.4	58.5
After-Tax Income	3.9	7.6	12.3	19.2	57.8
Means-Tested Transfer Rates					
Market Income	91.8	9.4	2.7	1.0	0.3
Gross Income	48.8	8.0	2.7	1.1	0.3
Before-Tax Income	n.a.	n.a.	n.a.	n.a.	n.a.
After-Tax Income	n.a.	n.a.	n.a.	n.a.	n.a.
Federal Tax Rates					
Market Income	8.2	11.9	17.3	20.3	26.7
Gross Income	5.5	10.5	14.9	18.4	25.9
Before-Tax Income	5.7	9.8	14.1	17.9	25.7
After-Tax Income	n.a.	n.a.	n.a.	n.a.	n.a.

Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

Income groups are created by ranking households by before-tax income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

Tax Progressivity

The measured progressivity of the tax system can look quite different depending on which original income measure taxes are measured against. One standard measure of the progressivity of taxes compares the Gini indexes for before-tax and after-tax income, essentially defining progressivity as the degree to which taxes equalize the distribution of income (often called the Reynolds- Smolensky index).³⁴ CBO has traditionally evaluated taxes against a measure of pre-tax income, with all transfer income included. By that metric, the tax system reduces the Gini by 0.040, from 0.499 to 0.459 (see **Table 5**). In contrast, the tax system reduces the Gini coefficient by only 0.026 points when measured against market income, and 0.037 points measured against gross income.

An alternative measure of progressivity, the Kakwani index, compares the tax concentration index to the Gini for income before taxes. (The tax concentration index is similar to a Gini index, but measures on the cumulative share of taxes paid, rather than income earned, with taxpayers ranked by pretax income). That index effectively defines progressivity as the degree to which tax payments are more concentrated than income. By that measure of tax concentration, the federal tax system also appears more progressive relative to broader measures of before-tax income than narrower measures. The tax concentration index is little changed across the alternative income measures. However, the inequality of base income to which the taxes are being compared varies, so the index changes.

That result occurs because most transfer income is not taxable. Moving from a market income measure to an income measure that includes transfers disproportionately adds income to the lower part of the income distribution. Inclusion of that additional income does little to alter tax payments, however. Tax burdens appear lower at the bottom of the distribution, where income has been added, and the same in the upper part of the income distribution, where both income and taxes are little changed. The result is a tax system that appears more progressive because tax rates have fallen at the bottom.

Part of that increase in measured productivity represents the interaction of the tax and the transfer system. When taxes are measured against before-tax income, the interaction of taxes and transfers is being implicitly captured in the tax term. When instead taxes and transfers are measured against market/gross income at the same time, and explicit interaction term can be calculated. *Need to see how big this is.*

³⁴ For a discussion of the progressivity indexes used here, see Kiefer, Donald W (1984), “Distributional Tax Progressivity Indexes”. *National Tax Journal* 37 (4). National Tax Association: 497–513.

Table 5.

Tax Progressivity Indexes, 2006

	Market Income	Gross Income	Before-tax Income
Gini for Base Income (G(Pretax))	0.590	0.522	0.499
Gini for Base Income less Taxes (G(Atax))	0.565	0.485	0.459
Reynolds Smolensky index (G(Pretax)-G(Atax))	0.026	0.037	0.040
Tax Concentration Index (C)	0.679	0.670	0.665
Kakwani index (C-G(Pretax))	0.089	0.148	0.166
Average Tax Rate	0.232	0.209	0.204

Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income.

Gross income is market income plus social insurance transfers. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits.

Before-tax Income is gross income plus means-tested payments and in-kind benefits from government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

Re-ranking

The differences between a distributional framework based on before-tax income and an alternate framework based on gross income can be significant. Removing means-tested transfers from the ranking measure will create a significant amount of shuffling of the composition of the income groups, especial at the lower end of the income distribution. Because of the removal of mean-tested transfers from the measure of before-tax income, almost one-fifth of the people in the lowest gross income quintile were in higher before-tax income quintiles (see **Table 6**). There is no fundamental economic change among those changing income groups—just a change in the income definition used to rank households. Because means-tested transfers predominantly go to households in the lower income quintiles, there is not much shuffling across income quintiles towards the top of the distribution.

Table 6.

Transition Matrix: Gross Income Quintiles to Before-Tax Income Quintiles, 2006

Gross Income Quintiles	Before-Tax Income Quintiles					Total
	Lowest Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Highest Quintile	
Lowest Quintile	81.2	14.5	3.9	0.5	0.0	100
Second Quintile	18.6	73.8	6.5	1.0	0.1	100
Middle Quintile	0.0	11.2	84.7	3.9	0.2	100
Fourth Quintile	0.0	0.0	5.5	92.8	1.7	100
Highest Quintile	0.0	0.0	0.0	2.0	98.0	100

Source: Congressional Budget Office.

Notes: Before-tax income is market income plus government transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Government transfers are cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

Gross income is market income plus social insurance transfers. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits.

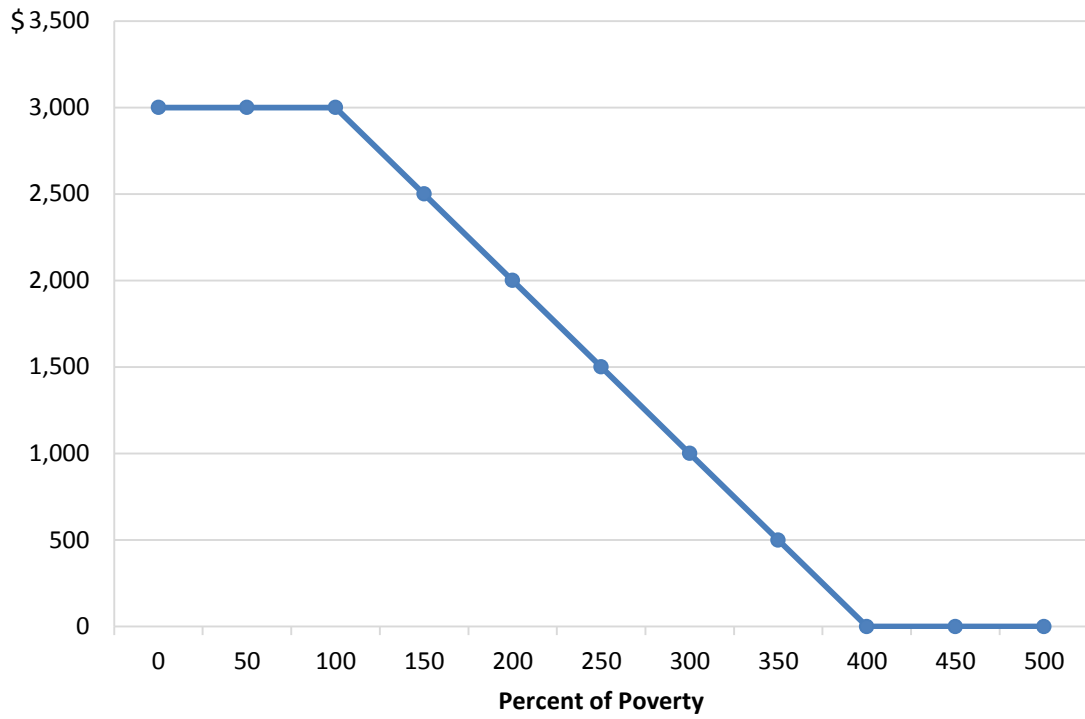
Quintiles (fifths) contain equal numbers of people.

Distributional Effects of a Hypothetical Policy Change

To compare and contrast the strengths and weaknesses of CBO’s current distributional framework with an alternate distributional framework where households are ranked by gross income, for illustrative purposes, we have simulated a simple policy change. The policy would provide \$3,000 for households with cash income below 100% of the poverty line. That benefit linearly phases-out to between 100% and 400% of the poverty line (see **Figure 5**). We show two separate implementations of that policy under each framework: one that has the policy implemented as a refundable tax credit to households and another that has the policy implemented as a direct cash transfer.

Figure 5.

Hypothetical Tax Credit/Transfer Policy



Source: Congressional Budget Office.

Using a Before-Tax Income Framework

When households are ranked by before-tax income, and the policy change is implemented as a refundable tax credit, the interpretation of the results is clear (see **Table 7**). Taxes for households in the lowest before-tax income quintile are approximately \$2,600 lower under the example policy; that decrease in tax falls off somewhat for the second income quintile (\$2,000), and then falls off sharply for the middle and fourth quintiles (approximately \$800 and \$200, respectively). The policy change lowers taxes for households in the highest income quintile by less than \$50 on average. Those tax reductions change the tax rate in the lowest income quintile from 5.7 percent to negative 6.4 percent, and the tax rate falls by almost half in the second quintile (from 9.8 percent to 5 percent), decreases slightly in the middle quintile, and has very small effects on the tax rates in the highest two quintiles.

The interpretation is not nearly as clean when the same exact policy is implemented as a direct, means-tested cash transfer (see **Table 8**). Because means-tested transfers are included in before-tax income and that income measure is used to rank households by quintile groups do not contain the same households before and after the policy shift. Attempting to compare a change in means-tested transfers using CBO's current framework produces some counter-intuitive results. Both market income and federal taxes are shown to change under this framework as a result of the implementation of a new means-tested transfer program. Those changes result solely because of the re-ranking of households resulting from the inclusion of more income in the before-income tax measure because of the policy change.

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Table 7.

**Distribution of Household Income, Government Transfers, and Federal Taxes, 2006
Before-Tax Income Framework with an Example Refundable Tax Credit Policy Change**

Dollars	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
Baseline Policy						
Market Income	14,700	28,800	49,400	79,700	234,100	81,400
+ Government Transfers	7,100	12,300	12,100	10,400	8,900	10,200
= Before-Tax Income	21,800	41,100	61,500	90,000	243,000	91,600
- Federal Taxes	1,300	4,000	8,600	16,100	62,500	18,700
= After-Tax Income	20,600	37,100	52,900	73,900	180,400	72,800
Federal Tax Rate (Percent)	5.7	9.8	14.1	17.9	25.7	20.5
Example Policy Change						
Market Income	14,700	28,800	49,400	79,700	234,100	81,400
+ Government Transfers	7,100	12,300	12,100	10,400	8,900	10,200
= Before-Tax Income	21,800	41,100	61,500	90,000	243,000	91,600
- Federal Taxes	-1,400	2,100	7,900	16,100	62,500	17,700
= After-Tax Income	23,200	39,000	53,600	74,000	180,400	73,900
Federal Tax Rate (Percent)	-6.4	5.0	12.8	17.8	25.7	19.3
Difference						
Market Income	0	0	0	0	0	0
+ Government Transfers	0	0	0	0	0	0
= Before-Tax Income	0	0	0	0	0	0
- Federal Taxes	-2,600	-2,000	-800	-100	0	-1,100
= After-Tax Income	2,600	2,000	800	100	0	1,100
Federal Tax Rate (Percent)	-12.1	-4.8	-1.3	-0.1	0.0	-1.2

Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income.

Government transfers are cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

Before-tax income is market income plus government transfers.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by before-tax income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

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Table 8.

**Distribution of Household Income, Government Transfers, and Federal Taxes, 2006
Before-Tax Income Framework with an Example Means-Tested Transfer Policy Change**

Dollars	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
Baseline Policy						
Market Income	14,700	28,800	49,400	79,700	234,100	81,400
+ Government Transfers	7,100	12,300	12,100	10,400	8,900	10,200
= Before-Tax Income	21,800	41,100	61,500	90,000	243,000	91,600
- Federal Taxes	1,300	4,000	8,600	16,100	62,500	18,700
= After-Tax Income	20,600	37,100	52,900	73,900	180,400	72,800
Federal Tax Rate (Percent)	5.7	9.8	14.1	17.9	25.7	20.5
Example Policy Change						
Market Income	15,300	28,400	48,800	79,400	234,000	81,400
+ Government Transfers	9,400	14,100	13,000	10,600	8,900	11,200
= Before-Tax Income	24,700	42,600	61,800	90,000	242,900	92,600
- Federal Taxes	1,300	4,000	8,600	16,000	62,500	18,700
= After-Tax Income	23,400	38,600	53,300	73,900	180,400	73,900
Federal Tax Rate (Percent)	5.2	9.4	13.8	17.8	25.7	20.2
Difference						
Market Income	600	-300	-600	-300	0	0
+ Government Transfers	2,300	1,800	900	300	0	1,100
= Before-Tax Income	2,900	1,500	300	-100	0	1,100
- Federal Taxes	0	0	-100	-100	0	0
= After-Tax Income	2,800	1,500	400	0	0	1,100
Federal Tax Rate (Percent)	-0.5	-0.4	-0.2	-0.1	0.0	-0.2

Source: Congressional Budget Office.

Notes: Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income.

Government transfers are cash payments and in-kind benefits from social insurance and other government assistance programs. Those transfers include payments and benefits from federal, state, and local governments.

Before-tax income is market income plus government transfers.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by before-tax income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

Using a Gross Income Framework

The same policy simulation is also presented using a presentation framework that uses gross income as the ranking measure, the denominator for rate calculations, and separates the distribution of refundable tax credits from the distribution of federal taxes. The policy is implemented as both a refundable tax credit (see **Table 9**) and a direct transfer program (see **Table 10**).

Under both implementations, the interpretation of the policy effects is clear: After-tax income increases by approximately \$2,700 for the lowest gross income quintile, \$2,000 for the second quintile, \$700 for the middle quintile, and less than \$50, on average for the top two quintiles. The distributions of means-tested transfers or federal taxes (through the change in refundable tax credits) change by those exact amounts for the respective implementations. Because means-tested transfers are removed from the ranking measure, there is no re-sorting of households post-policy change and no anomalous changes occur in gross income or federal taxes.

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Table 9.

**Distribution of Household Income, Government Transfers, and Federal Taxes, 2006
Gross Income Framework with an Example Refundable Tax Credit Policy Change**

	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
<i>Baseline Policy</i>						
Dollars						
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
+ Means-Tested Transfers	8,000	3,000	1,600	1,000	800	2,800
- Federal Taxes	900	3,900	8,800	16,300	62,600	18,700
= After-Tax Income	23,500	35,900	52,200	73,400	179,900	72,800
Percents						
Means-Tested Transfer Rate	48.8	8.0	2.7	1.1	0.3	3.2
Federal Tax Rate	5.5	10.5	14.9	18.4	25.9	21.1
Net Tax and Transfer Rate	43.4	-2.5	-12.2	-17.3	-25.6	-17.9
<i>Example Policy Change</i>						
Dollars						
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
+ Means-Tested Transfers	8,000	3,000	1,600	1,000	800	2,800
- Federal Taxes	-1,800	1,900	8,100	16,300	62,600	17,700
= After-Tax Income	26,200	37,900	52,900	73,400	179,900	73,900
Percents						
Means-Tested Transfer Rate	48.8	8.0	2.7	1.1	0.3	3.2
Federal Tax Rate	-10.8	5.0	13.6	18.4	25.9	19.9
Net Tax and Transfer Rate	59.7	3.0	-11.0	-17.3	-25.6	-16.7
<i>Difference</i>						
Dollars						
Gross Income	0	0	0	0	0	0
+ Means-Tested Transfers	0	0	0	0	0	0
- Federal Taxes	-2,700	-2,000	-700	0	0	-1,000
= After-Tax Income	2,700	2,000	700	0	0	1,100
Percents						
Means-Tested Transfer Rate	0.0	0.0	0.0	0.0	0.0	0.0
Federal Tax Rate	-16.3	-5.5	-1.2	0.0	0.0	-1.2
Net Tax and Transfer Rate	16.3	5.5	1.2	0.0	0.0	1.2

Source: Congressional Budget Office.

Notes: Gross income is market income plus social insurance transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits.

Means-tested transfers consists of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by gross income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

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Table 10.

**Distribution of Household Income, Government Transfers, and Federal Taxes, 2006
Gross Income Framework with an Example Means-Tested Transfer Policy Change**

	Quintiles					All Households
	Lowest	Second	Middle	Fourth	Highest	
Baseline Policy						
Dollars						
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
+ Means-Tested Transfers	8,000	3,000	1,600	1,000	800	2,800
- Federal Taxes	900	3,900	8,800	16,300	62,600	18,700
= After-Tax Income	23,500	35,900	52,200	73,400	179,900	72,800
Percents						
Means-Tested Transfer Rate	48.8	8.0	2.7	1.1	0.3	3.2
Federal Tax Rate	5.5	10.5	14.9	18.4	25.9	21.1
Net Tax and Transfer Rate	43.4	-2.5	-12.2	-17.3	-25.6	-17.9
Example Policy Change						
Dollars						
Gross Income	16,400	36,800	59,400	88,700	241,700	88,700
+ Means-Tested Transfers	10,700	5,000	2,300	1,000	800	3,900
- Federal Taxes	900	3,900	8,800	16,300	62,600	18,700
= After-Tax Income	26,200	37,900	52,900	73,400	179,900	73,900
Percents						
Means-Tested Transfer Rate	65.2	13.5	3.9	1.1	0.3	4.4
Federal Tax Rate	5.5	10.5	14.9	18.4	25.9	21.1
Net Tax and Transfer Rate	59.7	3.0	-11.0	-17.3	-25.6	-16.7
Difference						
Dollars						
Gross Income	0	0	0	0	0	0
+ Means-Tested Transfers	2,700	2,000	700	0	0	1,100
- Federal Taxes	0	0	0	0	0	0
= After-Tax Income	2,700	2,000	700	0	0	1,100
Percents						
Means-Tested Transfer Rate	16.3	5.5	1.2	0.0	0.0	1.2
Federal Tax Rate	0.0	0.0	0.0	0.0	0.0	0.0
Net Tax and Transfer Rate	16.3	5.5	1.2	0.0	0.0	1.2

Source: Congressional Budget Office.

Notes: Gross income is market income plus social insurance transfers. Market income consists of labor income, business income, capital gains (profits realized from the sale of assets), capital income excluding capital gains, income received in retirement for past services, and other sources of income. Social Insurance transfers consists of Social Security Old Age, Survivors, and Disability Insurance, the average market value of Medicare benefits, and Unemployment Insurance (UI) benefits.

Means-tested transfers consists of cash payments and in-kind benefits from federal, state, and local governments. The two largest programs in this category are Medicaid and the Supplemental Nutritional Assistance Program (SNAP), formerly known as Food Stamps.

Federal taxes include individual income taxes, payroll taxes, corporate income taxes, and excise taxes.

After-tax income is before tax income minus federal taxes.

Income groups are created by ranking households by gross income, adjusted for household size. Quintiles (fifths) contain equal numbers of people.

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Appendix - Methodology

Data

CBO’s regularly released distributional analyses rely on data from two primary sources. The core data come from the Statistics of Income (SOI), a nationally representative sample of individual income tax returns collected by the Internal Revenue Service.³⁵ The number of returns sampled has grown over the time period studied, ranging from roughly 90,000 in some of the early years to more than 300,000 in the later years. The data used in this report—to produce illustrative examples of the various distributional frameworks—come from the 2006 public use version of the SOI data. Although there have been many significant economic and federal policy changes that have taken place between 2006 and 2016, the strengths and shortcomings of alternate distributional frameworks apply in both periods.

Tax return information is supplemented with data from the Annual Social and Economic Supplement to the Census Bureau’s Current Population Survey, which contains survey data on the demographic characteristics and income of a large sample of households. The two sources are combined by statistically matching each SOI record to a corresponding CPS record on the basis of demographic characteristics and income. Each pairing resulted in a new record that takes on some characteristics of the CPS record and some characteristics of the SOI record.³⁶

The first step in the matching process is to align the unit of analysis by constructing tax-filing units from CPS households. A tax-filing unit is a single person or a married couple plus their dependents, and often differs from a CPS family. To construct tax units, household heads and their spouses are considered to be primary filing units. We apply tax rules to see if other members of the household can be claimed as dependents (in order to be a dependent, a person must meet certain age, relationship, and income requirements). We assign people who meet the dependent tests as dependents while those not meeting the test we classify as separate tax units. In cases where multiple people could potentially claim a dependent, we assume that the household chooses the arrangement that results in the most advantageous tax situation – for example, an unmarried cohabitating couple with two children might each claim a child and file as a head of household if it lowers their combined taxes.

Next, we divide tax-filing unit records in each file into fifteen demographic subgroups, based on marital status, the number of dependents, and whether the primary taxpayer or their spouse is age 65 or greater. Records from the two files are then matched within the same demographic cell, with certain exceptions. Because the CPS contains fewer head of household (single parent with children) tax-filing units than the SOI, we match some single childless CPS records, and some married CPS records with head-of-household filers on the SOI. The deficit in head-of-household

³⁵ For a complete description of the SOI file, see Internal Revenue Service, 2012.

³⁶ For a general description and evaluation of statistical matching, see Cohen 1991 and D’Orazio, Di Zio, and Scanu, 2006.

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filers on the CPS likely reflects some combination of misreporting of filing status on the SOI and a failure of the algorithm that creates tax units for the CPS to account for complex living arrangements.

Within each demographic subgroup, we fit an ordinary least squares regression model on the SOI. The model predicts total income as a function of all the income items that are common to both the SOI and the CPS (wages, interest, dividends, rental income, business income and losses, pension income and unemployment insurance). We apply the coefficients from that regression to the records in both files to construct a predicted income variable, and sort records in both files in descending order by the predicted value. The SOI record with the highest predicted income is matched to the CPS record with the highest predicted income. Of the two records, the one with the lower weight is matched to only one corresponding record. The record with the higher weight is “split”, and is available (with its weight reduced) to be matched to the next record in the other file. (In practice, the highest income SOI records have very low weights, so the top CPS record can be matched to many SOI records). We repeat that process until all the SOI records are exhausted. Residual CPS records (those with the lowest predicted income) are assumed to represent households that did not file a tax return.

Each matched pairing results in a new record with the demographic characteristics of the CPS record and the income reported in the SOI. Some types of income, such as certain transfer payments and in-kind benefits, appear only in the CPS; values for those items were drawn directly from that survey. Income values for CPS records that represent non-filing units are taken directly from the CPS.

Next, we rebuild households from tax-filing units based on the relationships as reported in the CPS. In general, CPS tax filing units will have been “split”, or matched to multiple SOI records. In households where multiple split tax units are present, multiple instances of the household are created, covering all possible combination of tax units, with the weight appropriately allocated.

Measuring Income

This analysis uses three measures of household income: market income; market income plus government transfers (referred to as before-tax income); and market income plus government transfers, minus federal taxes paid (referred to as after-tax income).

Market income includes the following components:

- *Labor income*: Cash wages and salaries, including those allocated by employees to 401(k) plans; employer-paid health insurance premiums (as measured by the CPS); the employer’s share of Social Security, Medicare, and federal unemployment insurance payroll taxes; and the share of corporate income taxes borne by workers.
- *Business income*: Net income from businesses and farms operated solely by their owners, partnership income, and income from S corporations.

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- *Capital gains*: Profits realized from the sale of assets. Increases in the value of assets that have not been realized through sales are not included in market income.
- *Capital income (excluding capital gains)*: Taxable and tax-exempt interest, dividends paid by corporations (but not dividends from S corporations, which are considered part of business income), positive rental income, and the share of corporate income taxes borne by capital owners.
- *Other income*: Income received in retirement for past services and other sources of income.

Gross Income consists of market income plus social insurance benefits. Social insurance benefits consist of cash payments from Social Security (which includes workers', spouses', survivors', and disability benefits) and unemployment insurance, and benefits provided by Medicare (measured by the Census Bureau's estimates of the average cost to the government of providing the insurance).

Means-tested Government transfers consist of cash payments Supplemental Security Income, Temporary Assistance for Needy Families (and its predecessor, Aid to Families with Dependent Children), veterans' programs, workers' compensation, and state and local government assistance programs. It also includes the value of in-kind benefits, such as Supplemental Nutrition Assistance Program vouchers (formerly known as food stamps), school lunches and breakfasts, housing assistance, energy assistance, and benefits provided by Medicaid, and the Children's Health Insurance Program (measured by the Census Bureau's estimates of the average cost to the government of providing that insurance).

Federal Taxes consist of individual income tax liabilities, payroll taxes, corporate income taxes, and excise taxes. Those tax sources account for approximately 95% of all federal revenues, on average. The remaining federal revenue sources not allocated to U.S. households include the estate and gift tax, Federal Reserve investment returns remitted to the Treasury, and other miscellaneous fees and fines. Payroll taxes include taxes that go toward funding the Social Security trust fund, the Medicare trust fund, and unemployment insurance trust funds. The federal portion of the unemployment insurance payroll tax only covers administrative costs for the program; state-collected unemployment insurance payroll taxes are not included in CBO's measure of federal taxes.

After-tax income is the sum of market income and government transfers, minus federal taxes paid. This analysis includes four federal taxes: individual and corporate income taxes, social insurance (payroll) taxes, and excise taxes. Those taxes have generally accounted for over 95 percent of federal revenues. Some smaller tax sources (estate and gift taxes, customs duties, Federal Reserve earnings, miscellaneous receipts) are omitted, either because of uncertainty surrounding their incidence or difficulties in estimating their distribution.

Incidence of Federal Taxes

Households are assumed to bear the economic cost of the taxes they pay directly, such as individual income taxes and the employee’s share of payroll taxes. Employers are assumed to pass on their share of payroll taxes to employees by paying lower wages than they would otherwise pay, so the employer’s share of payroll taxes is included in household before-tax income and in household taxes.

Excise taxes are generally assumed to fall on households according to their consumption of taxed goods (such as tobacco and alcohol). Excise taxes on intermediate goods, which are paid by businesses, were attributed to households in proportion to their overall consumption. We assume that each household spends the same amount on taxed goods as the average for households with comparable income and demographics as reported on the Bureau of Labor Statistics’ Consumer Expenditure Survey.

Far less consensus exists about how to allocate corporate income taxes (and taxes on capital income generally). In this analysis, we allocated 75 percent of the burden of corporate income taxes to owners of capital in proportion to their income from interest, dividends, rents, and adjusted capital gains. Capital gains are adjusted by scaling them to their long-term historical level given the size of the economy and the tax rate that applies to them—rather than actual capital gains so as to smooth out any large year-to-year variations in the total amount of gains realized. We allocated 25 percent of the burden of corporate income taxes to workers in proportion to their labor income.

Changes in CBO’s Distributional Analyses Over Time

Over the past several decades, the frameworks used by analysts conducting distributional analyses have evolved along several dimensions. The change in framework considered in this paper is not out of the ordinary in the way researchers have reassessed their views on the most informative way to treat various components of distributional analyses. Changes over time may be attributable to advances in collecting better data and new research on the economic incidence of various taxes. There is a constant tension between how a researcher would optimally measure economic resources and the data and methods available to do so.

Over the years, CBO has made adjustments to how it calculates and presents distributions of household income and federal taxes. Some of those methodological changes have resulted in significantly different interpretations of trends in household income and how federal taxes affect U.S. households. Below is a chronology of the major methodological changes made in CBO’s analyses of the distribution of household income and federal taxes.

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October 1987

CBO publishes “The Changing Distribution of Federal Taxes: 1975-1990”.³⁷ That analysis was based primarily on incomes as reported on the CPS, though adjustments were made to ensure consistency with income as reported on the SOI. The analysis used a measure of cash family income, which included cash, but not in-kind transfers. Estimates of the employer contribution to payroll taxes as well as federal corporate income taxes were added to family income to arrive at a pre-tax measure. Incomes were not adjusted for family size. For most taxes, the incidence assumptions were largely the same as used today. However, results were presented under alternative incidence assumptions for the corporate income tax: allocated fully to capital income and fully to labor income.

February 1988

CBO publishes “Trends in Family Income: 1970-1986”.³⁸ That analysis begins the practice of adjusting income for family size. Those adjustments are made by dividing income by the poverty threshold for a family of that size. Incomes are adjusted for inflation using the CPI-X1.

May 1998

CBO publishes “Estimates of Federal Tax Liabilities for Individuals and Families by Income Category and Family Type for 1995 and 1999.”³⁹ The primary tables in that publication are based on unadjusted family income and on Adjusted Gross Income, though an Appendix contains estimates with family income adjusted for the size of the family. The analysis assumes that the burden of corporate income taxes falls on families and individuals in proportion to their realized income from capital.

October 2001

CBO publishes “Effective Federal Tax Rates, 1979-1997”.⁴⁰ That report made several changes to the methodology:

- Households, rather than families, are used the primary unit of analysis.
- Income measures now include in-kind income from government transfer programs, such as food stamps and SNAP, rent subsidies, Medicare, and Medicaid, and CHIP as well as health insurance premiums paid by employers. CBO used the so-called fungible value of Medicare, Medicaid, and CHIP as defined and estimated by the Census Bureau.
- Households are ranked by income adjusted for household size. That adjustment is made by dividing household income by the square root of household size.
- Both cash income and the payroll tax base include imputed pretax contributions made by families to 401(k)-type retirement funds.
- Dollar amounts are adjusted for inflation using the CPI-RS.

³⁷ <https://www.cbo.gov/publication/16367>

³⁸ <https://www.cbo.gov/publication/20884>

³⁹ <https://www.cbo.gov/publication/10811>

⁴⁰ <https://www.cbo.gov/publication/42875>

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- The SOI and CPS were combined using a statistical matching procedure, rather than a series of adjustments to the CPS to make it consistent with the SOI.

July 2012

CBO publishes “The Distribution of Household Income and Federal Taxes, 2008 and 2009”.⁴¹

That report made several changes to the methodology:

- CBO began allocating 75 percent of the corporate income tax to capital income and 25 percent to labor income.
- CBO began including in household income the full value of Medicare, Medicaid, and CHIP, defined to equal the Census Bureau’s estimate of the average cost to the government of providing that insurance.
- CBO began adjusting for the effects of inflation using the personal consumption expenditures price index.

⁴¹ <https://www.cbo.gov/publication/43373>

Appendix - Other Dimensions by Which Distributional Frameworks Vary

In addition to the choice of income measure analysts use to rank households by in their distributional analyses, there are at least two other dimensions by which distributional frameworks differ: The unit of analysis used in the distributional framework and the adjustments made to income to take account of size differences in the given unit of analysis (see **Appendix Table 1** for a summary of income measures used by a variety of researchers and government agencies producing distributional analyses, as well as differences in the units of analysis and adjustments made to income to account for differences in the size of the units of analysis).

Units of Analysis

CBO uses the household as the unit of analysis for its distributional analyses. A household consists of the people who share a housing unit, regardless of their relationship. Analyzing income and taxes on a household basis is most useful if households make joint economic decisions, which is probably true in most cases but not all (such as group houses). A household can consist of more than one taxpaying unit, such as a married couple living with an adult child. In those cases, the income and taxes of each taxpaying unit are added together. Most distributional analysis done by foreign governments and international organizations also use the household as the unit of analysis, including the U.K., Australia, New Zealand, OECD, and the IMF, and is the unit recommended by the United Nations for compiling national statistics.⁴²

Some research organizations use units of analysis other than households. Treasury uses family units in their distributional analyses, which is similar to household units in many respects but excludes unrelated persons living together. IRS, JCT, and TPC all use tax filing units as the unit of analysis in their distributional analyses. Households and families may include more than one tax filing unit.

Adjustments Income to Account for Differences in Unit Size

Households with identical income can differ in ways that affect their economic status. For example, a larger household (or family or tax filing unit) generally needs more income to support a given standard of living than a smaller one does. However, economies of scale in some types of consumption—housing, in particular—can mean that two people generally do not need twice the income to live as well as one person who lives alone. Therefore, to rank households by their standard of living, it is appropriate to divide household income by an adjustment factor that is between 1 (which is equal to unadjusted household income and would not capture the greater needs of larger households) and the number of people in the household (which would produce household income per person and would not capture the benefits of shared consumption).

⁴² United Nations Economic Commission for Europe. Canberra Group Handbook on Household Income Statistics, 2nd edition. Published: January 2012. <http://www.unece.org/index.php?id=28894>

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Appendix Table 1.

Frameworks for Distributional Analyses

Organization / Author	Income Measure for Ranking	Broad Category	Unit	Adjustment
Internal Revenue Service Statistics of Income	Adjusted Gross Income (AGI)	market income	Tax Units	none
Piketty & Saez	Family Market Income. A measure of cash market income, both including and excluding capital gains, before individual income taxes. Excludes non-taxable fringe benefits and all government transfers.	market income	Tax Units	none
Joint Committee on Taxation	Expanded Income: The income concept used to place tax returns into income categories is adjusted gross income (AGI) plus: [1] tax-exempt interest, [2] employer contributions for health plans and life insurance, [3] employer share of FICA tax, [4] worker's compensation, [5] nontaxable Social Security benefits, [6] insurance value of Medicare benefits, [7] alternative minimum tax preference items, [8] individual share of business taxes, and [9] excluded income of U.S. citizens living abroad.	market income / gross income	Tax Units	none
Treasury	Cash Income consists of wages and salaries, net income from a business or farm, taxable and tax-exempt interest, dividends, rental income, realized capital gains, cash and near-cash transfers from the government, retirement benefits, 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 on a pre-tax basis.	before-tax income / gross income	Families	divide by square root
Urban-Brookings Tax Policy Center	Expanded Cash Income. ECI equals federal adjusted gross income (AGI) plus various income sources that are either excluded or deducted from AGI, including 1) excluded health, retirement, and other employee fringe benefits, 2) tax-exempt interest, 3) non-taxable pension and retirement income, 4) above-the-line adjustments, 5) cash and cash-like transfer payments, and 6) the employer share of payroll taxes and imputed corporate income tax liability	before-tax income / gross income	Tax Units	none

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CBO Current	<p>Before-tax income:</p> <p>Labor Income, including: Cash wages and salaries, including amounts allocated by employees to 401(k) plans; employer-paid health insurance premiums; the employer's share of Social Security, Medicare, and federal unemployment insurance payroll taxes; and the share of corporate income taxes borne by workers. Business income, capital gains and other capital income, retirement and other income.</p> <p>Cash transfers, including: Payments from Social Security, unemployment insurance, Supplemental Security Income, Temporary Assistance for Needy Families (and its predecessor, Aid to Families With Dependent Children), veterans' programs, workers' compensation, and state and local government assistance programs.</p> <p>In-Kind transfers, including: The cost of Supplemental Nutrition Assistance Program vouchers (popularly known as food stamps); school lunches and breakfasts; housing assistance; energy assistance; and benefits provided by Medicare, Medicaid, and the Children's Health Insurance Program.</p>	before-tax income / gross income	Households	divide by square root
United Kingdom	<p>Disposable Income: Post cash benefits (including retirement) and direct taxes, before indirect taxes (VAT) and in-kind transfers (health spending, etc.)</p>	after-tax income	Households	modified OECD (previously used even more complex McClements scale)
Australia	<p>Private income: Wages and salaries, profit/loss from own unincorporated business, net investment income and private transfers. It also includes net imputed rent for owner occupied dwellings and for subsidized private rentals.</p> <p>Disposable Income: Private income plus cash benefits from government minus personal income taxes.</p> <p>Final Income: Disposable income plus in-kind transfers minus taxes on production. (Taxes exclude corporate taxes and spending/transfers exclude spending on public goods.)</p>	after-tax income	Households	modified OECD equivalence scale (0.5 second adult, 0.3 kids)
New Zealand	<p>Disposable Income: Market income net of cash transfers and direct taxes. In-kind and indirect taxes are allocated in "final income" but not used for distributional ranking.</p>	after-tax income	Households	divide by square root
OECD	<p>Disposable Income: Earnings, capital income, self-employment income, cash transfers including retirement</p>	after-tax income	Households	divide by square root
International Monetary Fund	<p>Disposable Income: after direct taxes and cash transfers</p>	after-tax income	Households	modified OECD
Hassett & Mathur	<p>Consumption Expenditures.</p>	consumption	Households	per-capita

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Fullerton & Rogers

Lifetime Income. Lifetime potential earnings, including the value of leisure.

lifetime income

Households

head-of-household
earnings only

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<http://elsa.berkeley.edu/~saez/saez-UStopincomes-2010.pdf> (accessed June 6, 2012).

Fullerton and Rogers, *Who Bears the Lifetime Tax Burden?* (Washington, DC.: Brookings Institution, 1993).

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Various adjustments factors, known as “equivalence scales” are in use today.⁴³ CBO adjusts for household size by dividing household income by the square root of the number of people in the household, counting adults and children equally. Household income is divided by the square root of the number of people because the square root is the mid-point in the between the two extremes of unadjusted household income and per capita household income:

$$\sqrt{n} \equiv n^{0.5}$$
$$n^0 < n^{0.5} < n^1$$

In CBO’s distributional tables, income is adjusted for differences in household size only for the purpose of ranking and placing households into income groups. The income measures presented within those tables are not adjusted for household sizes. Furthermore, CBO’s distributional analyses construct income groups based on percentage rankings of household income adjusted for household size. CBO shows households in adjusted household income quintiles and provides additional detail for households in the top income quintile (the 81st to 90th percentiles, the 91st to 95th percentiles, the 96th to 99th percentiles, and the top 1 percent). Each quintile contains approximately 20 percent of the noninstitutionalized U.S. population and each percentile contains 1 percent of the population. Because household sizes vary, each adjusted household income quintile contains a slightly different number of households.

The most recent distributional analyses by Treasury and OECD also adjust for household or family size by dividing income by the square root of the number of people. By contrast, recent studies by the U.K. and Australia use a more complex adjustment called the “modified OECD” equivalence scale (ironically, no longer used by OECD), which gives a half weight to the second adult and a 0.3 weight to each child. Analyses by TPC, IRS, Piketty and Saez, and JCT all use tax units as their units of analysis and do not make any adjustment for differences in tax unit size.

⁴³ For a comparison of various types of equivalence scales, see OECD Note, “What are Equivalence Scales?” <https://www.oecd.org/els/soc/OECD-Note-EquivalenceScales.pdf>