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Distributional Impact of Fiscal Policies: A Survey of Methodological Approaches

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Distributional Impact of Fiscal Policies

A Survey of Methodological Approaches

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Abstract

This research paper is meant to be a guide for analysts and policymakers on available tools for assessing the distributional impact of existing fiscal systems as well as policy reforms. In particular, we present detailed overviews of fiscal incidence analysis (FIA) and tax-benefit microsimulation models (MSM). The paper also briefly reviews alternative approaches to value benefits from education, health, and infrastructure, as well as different methods to analyze the distributional impact of fiscal policy by gender. The paper includes examples of using FIA and MSM for policy analysis.

Keywords

Fiscal incidence, micro-simulation, taxes, transfers, inequality, poverty, gender, infrastructure

JEL codes

H22, H5, D31, I3, C81

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Résumé
Ce papier de recherche se veut un guide pour les analystes et les décideurs politiques sur les outils disponibles pour évaluer l'impact distributif des systèmes fiscaux existants ainsi que des réformes politiques. En particulier, nous présentons des aperçus détaillés de l'analyse de l'incidence fiscale (FIA) et des modèles de micro-simulation des avantages fiscaux (MSM). Le document passe également brièvement en revue des approches alter-natives pour introduire dans les modèles la valeur monétaire de l'éducation, de la santé et de l'infrastructure, ainsi que des différentes méthodes pour analyser l'impact distributif par sexe de la politique budgétaire. Le document présente également des illustrations d'utilisation de la FIA et des MSM pour l'analyse des politiques publiques.

Mots-clés
Incidence fiscale, micro-simulation, impôts, transferts, inégalité, pauvreté, genre, infrastructure

Introduction

By adopting the Sustainable Development Goals (SDGs) in September 2015, countries worldwide committed to making the world more just, eradicating poverty and hunger, reducing inequality, and achieving healthy lives, quality education, gender equality, and sustainable development. Countries also committed to promoting full-employment growth, decent work, peaceful societies, and accountable institutions, as well as strengthening global partnerships for sustainable development. One key factor necessary to achieve these goals will be the availability of fiscal resources to deliver the social protection, social services, and infrastructure embedded in them. A significant portion of these resources is expected to come from each country's fiscal system, complemented by transfers from wealthier countries. These goals shy away from acknowledging their trade-offs: for example, that devoting resources to eradicating hunger may mean fewer resources are available for infrastructure investment (or vice versa), that raising additional revenues domestically (including "green taxes") may hurt a significant portion of the poor or abate economic growth, or that protecting the elderly may mean protecting less of the young (or vice versa). Fiscal incidence analysis (FIA) and tax-benefit micro-simulation models (MSM) can contribute to quantifying these trade-offs and promote policy reforms based on evidence.

This paper is meant to be a guide for analysts and policymakers on available tools for assessing the distributional impact of existing fiscal policies as well as policy reforms. The main tools discussed here are FIA and MSM. The distinction of these two tools is not sharp-edged but they have clear different purposes. Fiscal incidence analysis is a method to allocate the burden of taxes and the monetized value of government expenditures to estimate the incidence of taxes and benefits and their impact on inequality and poverty. Tax-benefit microsimulation models are primarily used as a technique of ex-ante policy impact assessment – *i.e.* in predictions of the likely impact of a change in policy, prior to its implementation. The more typical FIA and MSM do not incorporate behavioral responses or general equilibrium or intertemporal effects. Both methods construct prefiscal and postfiscal income concepts. The main difference is that while fiscal incidence includes information in household surveys as the first choice (e.g., transfers reported by households), a microsimulation model programs the rules that define who would receive benefits or pay taxes (including assumptions of take-up and evasion). The presentation of the FIA method draws significantly from Nora Lustig (editor) *Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty*. Second Edition.

Brookings Institution Press, 2022, hereafter CEQ Handbook (Lustig, 2022). Volume 1, *Fiscal Incidence Analysis: Methodology, Implementation, and Applications* is a unique manual that explains the method and practice of fiscal incidence analysis in detail.[1]. For the main characteristics of the basic tax-benefit microsimulation models, we rely on Popova (2024).

The FIA and MSM, even if they incorporate behavioral responses and general equilibrium and intertemporal effects have other type of shortcomings. To name a few of the salient ones, typical FIA and MSM exclude corporate taxes and, because they usually rely on household surveys, the incomes and consumption of rich households are not captured well. FIA measures benefits from spending on education and health (in-kind transfer) at the average cost to government. In both typical FIA and MSM, household members are treated equally: *i.e.*, power dynamics within the household are ignored. The impact of fiscal policy focuses on income (or consumption) and other indicators of deprivation are not included. Thus, in addition to presenting the standard fiscal incidence analysis and micro-simulation models, this paper discusses methodological approaches to address their shortcomings or expand their scope. Specifically, we discuss how the construction of income concepts can be refined by incorporating undistributed profits and correcting for underreporting of top incomes in estimates of income inequality and fiscal redistribution. We review methods to estimate the benefits of in-kind spending beyond indicators of access and the average cost to government measure. We discuss methods to go from treating all household members equally (or through some form of arbitrary conversion such as adult equivalent units or economies of scale) to taking account agency dynamics within the household to generate gender-sensitive and age-sensitive fiscal incidence analysis. We also present methods to assess the effectiveness of fiscal policy in addressing multidimensional poverty. Part of these

1 Although meant to be a guide to completing a comprehensive fiscal incidence analysis (including the user-written software to calculate a range of key indicators),[1] Volume 1 can also be used as a stand-alone reference for those interested in methodological and practical approaches to carry out incidence analysis and assess the impact of fiscal policy on inequality and poverty. In the CEQ Handbook (Lustig, 2022), these comprehensive fiscal incidence analyses are called *CEQ Assessments.* Since the publication of the first edition in 2018, some of the methods to construct the core income concepts—the building blocks of fiscal incidence analysis—have changed. The updates are in the revised version of chapter 6 and the Information included in the CEQ Data Center on Fiscal Redistribution has incorporated them. We have also eliminated some inaccuracies and sharpened definitions. Important revisions were also made to chapters 7 and 8. The online-only part IV, "The *CEQ Assessment* Tools," was also thoroughly updated. Volume 1 has two new additional online-only parts: part V, the CEQ Data Center on Fiscal Redistribution, an information and monitoring system where results are presented at increasing levels of detail (from summary indicators to microdata), and part VI, which contains the CEQ Institute's microsimulation tools.

presentations is based on the CEQ Handbook Volume 2, *Methodological Frontiers in Fiscal Incidence Analysis* (Lustig, 2022) and some is based on new research undertaken by the CEQ Institute at Tulane University.

The paper then proceeds to discuss how the FIA tool can be used for policy analysis. Can standard fiscal incidence analysis be used for policy simulations? If the purpose is obtaining first orders of magnitude in contexts where the outcomes of the reform are not sensitive to the specifics of a tax or transfer rule (for example, the demographic composition of the household) or behavioral responses (for instance, reducing hours worked in response to an increase in a transfer), the answer is affirmative. We present examples of how the basic FIA can be used. The CEQ Desktop Tax Simulator (Enami, Lustig and Larroulet, 2022) is a spreadsheet-based tool that uses decile level data to quantify the impact of budget-neutral changes in direct transfers and/or subsidies on inequality, the poor, tax burdens, and other key indicators of alternative fiscal policy scenarios. We show how FIA at the decile level can be used to assess the impact of replacing existing cash transfers programs by universal basic incomes (Enami et al., 2023). We also show how to use relatively simple FIA and simulation techniques when information is scant; in particular, we show how to nowcast the impact of large, unprecedented macroeconomic shocks like the COVID-19 pandemic and the policy responses on living standards across the income distribution (Lustig, Martinez Pabon, et *al*., 2023).

For a more granular analysis of policy reforms, however, one should use tax-benefit MSM. The paper describes their main characteristics. In the context of examining the effects of fiscal policy reforms to accurately simulate fiscal liabilities and benefit entitlements, tax-benefit MSM require comprehensive information about the individual and household characteristics driving these entitlements and liabilities, including but not limited to household size and composition, market incomes, history of paying social insurance contributions, labor market status, disability status and so on. Based on this information and on legislative rules (and considering tax evasion and less-than-full take-up of benefits), tax-benefit models can then simulate the amount of fiscal liabilities and benefit entitlements at the tax-benefit unit level. Examples of these models are EUROMOD[2] and SOUTHMOD[3].

[2] See: https://euromod-web.jrc.ec.europa.eu/resources/model-documentation

[3] See: https://www.wider.unu.edu/project/southmod-simulating-tax-and-benefit-policiesdevelopment

The fiscal incidence analysis and several standard existing fiscal policy micro-simulation models such as EUROMOD and SOUTHMOD are not well-suited to examine policy reforms when behavioral responses are an intrinsic part of the analysis. A classic case are policy reforms such as carbon taxes or the reduction of energy subsidies designed to achieve more green-friendly consumption patterns. These policy changes are introduced precisely to induce behavioral responses. Thus, in such cases microsimulation models have to assume away perfectly inelastic demand functions. We will show how these more sophisticated versions of MSM can be used to estimate the distributional impact of carbon taxes in Pakistan (O'Donaghue et al., 2023).

The rest of the paper is organized as follows. Section one describes the fiscal incidence analysis (FIA) including its basic income concepts, allocation method, data requirement, robustness and limitations. Section two provides the details about microsimulation models (MSMs) including examples, data requirements, simulations of policies, quality assessment and validation. Section three elaborates about the key indicators produced by both FIA and MSM. Section four delves into frontier topics expanding the scope of FIA and MSMs including incidence of health, education, infrastructure spending, correcting of top income, gender incidence and multi-dimensional poverty. The last section describes how both FIA and MSMs can be used as policy analysis tools for the global challenges such as COVID-19 and climate change.

1. Fiscal Incidence Analysis

1.1 Description

Rooted in the field of public finance, fiscal incidence analysis[4] is designed to measure who bears the burden of taxes and who receives the benefits of government spending. In practice, fiscal incidence analysis is the method utilized to allocate taxes and public spending to households so that one can compare incomes before taxes and transfers with incomes after them.

Fiscal incidence analysis can be used to assess the redistributive impact of a fiscal system as a whole or specific fiscal instruments (e.g., eliminating tax exemptions or raising the value added tax (VAT) rate). In particular, fiscal incidence analysis is used to address the following questions: Who bears the burden of taxation and who receives the benefits of public spending? How much income redistribution is being accomplished through taxation and public spending? What is the impact of taxation and public spending on poverty and the poor? How equalizing are specific taxes and government programs?

To judge the impact of fiscal policies on inequality and poverty, governments need to measure the redistributive impact of the revenue and spending sides at once. Focusing on one side of the ledger of fiscal accounts can be seriously misleading. For instance, taxes may well be progressive (and equalizing), but if the poor pay taxes and the amount that they receive in transfers is not large enough to more than compensate for the taxes they pay, a progressive fiscal system may worsen poverty. An increase in VAT may be rejected on equity grounds as being regressive, but it actually may be desirable if the resulting revenues are used to finance cash transfers to the poor or primary school services in poor neighborhoods. Expanding social protection benefits such as pensions to low-income groups may help combat old age poverty. However, if this expansion needs to be financed with higher consumption taxes, a significant portion of the poor who are not eligible for pension benefits could be left worse off (at least, in the present).

[4] This section draws from Lustig (2021) and Lustig (2022).

The simplest version of fiscal incidence analysis just looks at what is paid and what is received without assessing the behavioral responses that taxes and public spending may trigger for individuals or households. This is often referred to as the "accounting approach." This approach takes private income as given and allocates taxes and public spending to individuals and families in different economic circumstances according to certain assumptions. Available fiscal incidence studies that use the accounting approach, however, do not constitute a mechanically applied accounting exercise. They analyze the incidence of taxes by their assumed economic rather than statutory incidence (i.e., where a tax is proximately levied).

The economic incidence of taxes and transfers depends on the elasticity of demand and supply of factors and goods. The accounting approach implicitly assumes zero (completely inelastic) demand price and labor supply elasticities which may not be far-fetched assumptions for analyzing effects in the short run. Under these assumptions, individual income taxes and contributions (both by employee and employer) are borne by labor in the form of lower wages, taxes on incomes from capital are borne by its owners, and indirect taxes/subsidies (on both final goods and inputs, using input–output tables for the latter) are fully shifted forward to consumers in the form of higher/lower prices.

On the transfers side, fiscal incidence studies that use the accounting approach assume that transfers do not induce individuals to work less than in the absence of transfers: that is, labor supply is assumed to be perfectly inelastic to an increase in non-work income (i.e., studies assume zero non-work income elasticity in labor supply). In addition, fiscal incidence studies—especially those for low- and middle- income countries—often take into account the lower incidence associated with consumption of own-production (quite common, especially in rural areas in developing countries), informality, and other forms of tax evasion due to corruption or poor enforcement schemes.

While ignoring behavioral responses and general equilibrium effects is a limitation of the accounting approach, the effects calculated with this method are considered a reasonable approximation of the short-run welfare impact.

Fiscal incidence analysis, however, can be designed to include behavioral responses and general equilibrium effects. It can be point-in-time or lifetime fiscal incidence analysis. That is, the analysis can assess a current system or estimate the potential or actual effects of particular reforms, taking into consideration lifetime earnings profiles. The analysis can assess the average incidence of a tax or benefit or it can assess the incidence on the margin. For example, although the average incidence of primary education spending in a low-income country may show that the main beneficiaries are from urban areas, expanding this spending could benefit the rural (poorer) population, making the marginal incidence more progressive than the average.

To measure the redistributive effect and poverty impact of taxes and benefits, the core building block of fiscal incidence analysis is the definition and construction of a prefiscal income concept and a postfiscal income concept—that is, income after taxes net of transfers. The construction of postfiscal income refers to the method of allocating the burden of taxes and the benefits of government spending to households.

More formally, define the prefiscal (before taxes and transfers) income of household *h* as I_h and taxes as T_i (where *i* refers to the range of taxes whose incidence is being analyzed) and transfers or benefits B_j (where *j* refers to the range of transfers whose incidence is being analyzed); define the "allocator" of tax *i* to household *h* as S_{ih} (or the share of net tax *i* borne by unit *h*); then, postfiscal income of household *h* can be defined as Y_h:

$$Y_h = I_h - \sum_i T_i S_{ih} + \sum_j B_j S_{jh}$$

Although this procedure may sound very simple, allocating taxes and transfers to households is the most challenging task of fiscal incidence analysis. Below we present a brief description of the fiscal incidence method.

1.2 Constructing the Core Income Concepts: The Bedrock of Fiscal Incidence Analysis

As mentioned, in the accounting approach there are no behavioral responses, no general equilibrium effects, and no dynamic effects associated with tax and transfers policy. In other words, the counterfactual income in the presence of a tax (transfer) is simply the pre-fiscal income minus (plus) the tax (transfer). Once the allocation judgments have been made, who bears the burden (receives the benefit) of a tax (transfer) in the accounting framework is altogether straightforward. Thus, the building block of fiscal incidence analysis is the construction of "income concepts." Starting from a pre-fiscal income concept or market income (mainly, income from labor and capital and private transfers), each new income concept is constructed by adding the relevant transfers and subsidies to and subtracting the corresponding taxes from the previous income concept. For example, to obtain the concept of disposable income, one needs to subtract direct personal income taxes and add cash transfers to market income; consumable income is generated by subtracting indirect (consumption) taxes and adding subsidies to disposable income; and final income is obtained by adding government spending on education and health to consumable income.

The construction of income concepts entails five main steps. The first step is to obtain access to a recent household survey (ideally, an income expenditure survey) for the country of interest.[5] The second step is to obtain budget data from administrative registries (for example, revenues collected by tax category, spending on cash transfers, subsidies, education, health, and housing, and so on) for the same year of the survey. The third step is to select which components of government revenue and spending will be included in the incidence analysis and to obtain detailed information on the qualitative and quantitative characteristics of the selected fiscal interventions. The fourth step is to allocate these fiscal interventions at the household level (more details on this below). By dividing income by the number of household members (or using an equivalence scale), taxes and transfers become allocated on a per person basis.

Once the allocation process is complete, the fifth step is to construct the income concepts that will be used to assess the impact of fiscal policy on the distribution of income and poverty as well as the contribution of each fiscal intervention to the fiscal policy–induced changes in inequality and poverty. The fifth step may involve the utilization of an input-output matrix (or a Social Accounting Matrix) to incorporate the indirect effects (i.e., through inputs) of indirect taxes and subsidies (Jellema and Inchauste, 2022). Including the indirect effects will affect the amount of taxes and transfers that are allocated to households, and, thus, their postfiscal income.

Recall that in the accounting approach no claim is made that the original or market income equals the true counterfactual income in the absence of taxes and transfers. It is a first-order approximation.

Among the salient conceptual challenges is whether social insurance contributory pensions should be considered as deferred or replacement income (and, thus, counted as part of pre-fiscal income) or a government transfer. In the incidence analysis literature, one can find both approaches: in some cases contributory pensions are considered deferred or replacement

5 For details, see the introduction and part IV of Volume 1 (the latter is available only online) in Lustig, 2022.

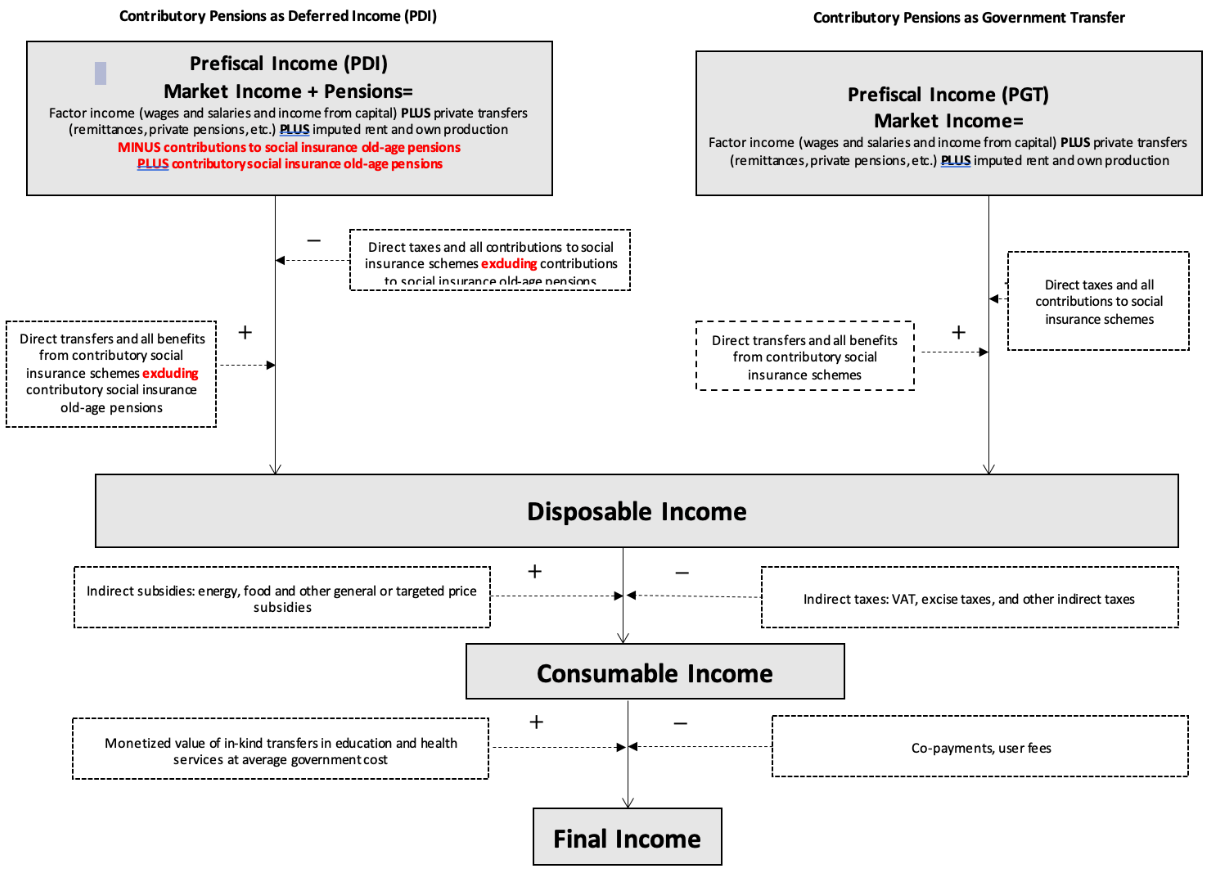
income, while in others—especially in systems with a large subsidized component—they are considered a pure government transfer. In the former case, contributions during active years are treated as a form of mandatory saving and, thus, subtracted from the pre-fiscal income concept to avoid double counting, while the income from pensions is treated as part of pre-fiscal income: that is, added to earnings, income from capital, and private transfers. When pensions are considered a government transfer, contributions are treated as any other direct tax and the income from pensions is added to other government transfers to obtain total transfers.

The true situation, however, is likely to be in-between the two cases for many individuals. Since contributions to the system during working years can count as "mandatory saving," whether an individual receives a transfer depends on the size of the replacement income and her life expectancy. However, to identify how much is a pure transfer (or tax) and how much is replacement income with cross-section household surveys is practically impossible.

A schematic presentation of the construction of income concepts can be seen in Figure 1.[6]

[6] Not all the fiscal incidence studies construct the four income concepts shown in Figure 1. For instance, EUROMOD (www.euromod-web.jrc.ec.europa.eu) (previously at the University of Essex presents results for European Union (EU) member countries up to disposable income only. So does the OECD Income and Wealth Distribution Database (www.oecd.org/social/income-distribution-database.htm). In contrast, the CEQ Data Center on Fiscal Redistribution at Tulane University (www.commitmentoequity.org/datacenter/)presents results for a considerable number of low-and middle-income countries for all four income concepts. Disposable income or consumption (per capita or equivalized) is the standard welfare indicator used to measure poverty and inequality in international databases, official statistics, and the bulk of poverty and inequality research. However, actual consumption of goods and services will be different if, for example, consumption taxes on food are exempt in one country (or period) but VAT is paid in another country (or period) even if disposable income is identical. Hence the importance of the concept of consumable income as an indicator of household welfare. Similarly, if in one country households have access to free publicly provided education and health services while in another country they don't, welfare levels will be different. Hence the importance of the concept of final income as an indicator of welfare.

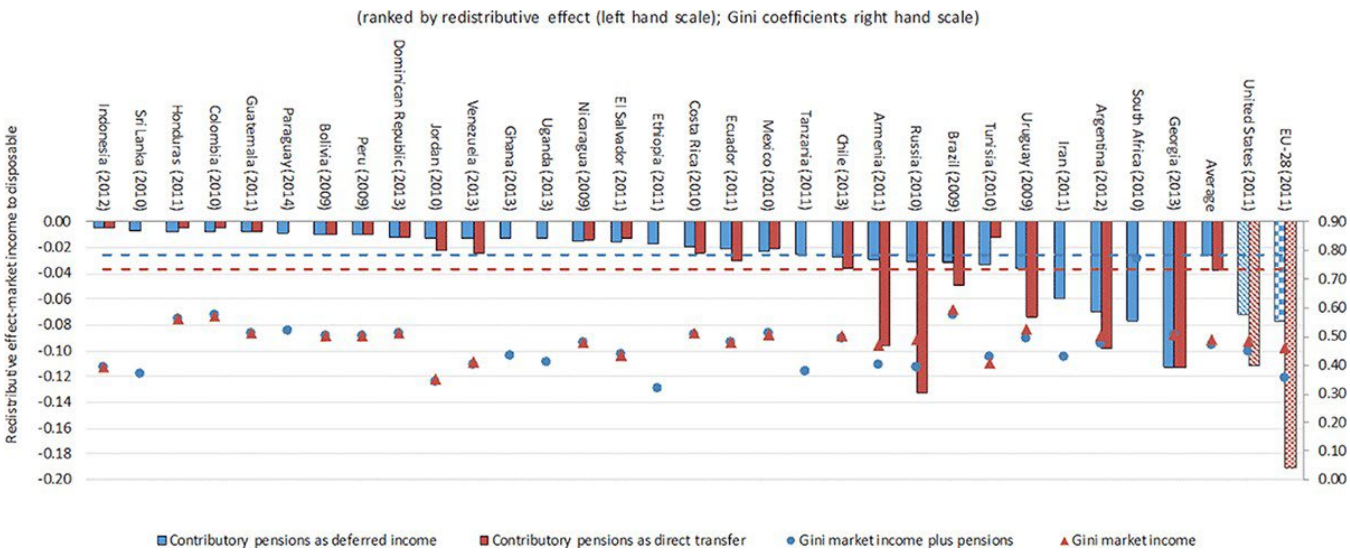
Figure 1. Construction of income concepts



Source: Lustig and Higgins (2022, figure 1-1)

Although the question whether a particular benefit is deferred income or a transfer also pertains to other components of public spending such as contributory health spending, disability benefits, and unemployment compensation, the assumption made about pensions significantly affects the order of magnitude of fiscal redistribution, especially in countries with a high proportion of retirees and generous contributory pensions. In Figure 2, one can observe that the redistributive effect (RE) with pensions as transfers is much higher (double or triple in some cases) for the EU, Russia, Armenia, the United States, Uruguay, and Argentina, for example. Why? In populations with a large proportion of retirees, if pensions are treated as a government transfer pre-fiscal or market income will be zero or close to zero for a large number of individuals. The fiscally induced inequality and poverty reduction then will be very large because the system will feature many of what one could call "false poor."

Figure 2. Redistributive effect under pensions as deferred income and pensions as government transfer



Source: Lustig (2018b, figure 10-8), based on country studies in CEQ Data Center on Fiscal Redistribution <http://www.commitmentoequity.org/datacenter>. For the EU (28 countries), this is authors calculation based on EUROMOD version G3.0.

Note: The RE is calculated as the difference between the Gini coefficient for disposable income minus the Gini coefficient for market income plus pensions (pensions as deferred income scenario) or minus the Gini coefficient for market income (pensions as transfer scenario).

To make the point of the "false poor" clearer, let's assume a pensioner had been earning a high wage during her working years and that, privately, she could have saved enough so that at the time of retirement her pension would have been at an x percent replacement ratio. Let's assume that instead she receives a pension from the social security system and that this is her only income. If her pension is treated as a pure government transfer, she will have been ranked among high wage earners during her working years and fall to the pre-fiscal destitute poor during retirement. This does not make sense.

Although any government tax or transfer might generate behavioral changes, social security is special in the sense that it is a lifelong contract between a working individual and society. Although a conditional cash transfer (CCT) or other cash transfer will likely induce some behavioral changes, not having a government-sponsored retirement plan would generate major behavioral changes in a significant part of the population. Since in the accounting approach behavioral responses are not modeled, the alternative is to present results for both scenarios—pensions as pure deferred or replacement income and pensions as pure government transfer—and treat the results as a lower and upper bound of the redistributive impact of the state.

1.3 Data Requirements and Data Challenges

Identifying who bears the burden of taxes and who benefits from government spending, or who the winners and losers of particular fiscal reforms are, requires the use of household-level data. Fiscal incidence studies use microdata from household surveys combined with budget data from fiscal accounts and other administrative registries (e.g., tax returns, social security records, etc.). The data requirements for a fiscal incidence analysis includes three main ingredients: a recent household survey (possible options: income–expenditure surveys, pure income surveys, pure expenditure surveys, Living Standard Measurement Surveys, and so on) representative at the national level; a detailed description of the characteristics of each tax and spending item to be included in the analysis; and audited or confirmed budget and administrative data for the survey year.

If the fiscal incidence analysis is to take into account the indirect effect of certain taxes or subsidies that are used as key inputs in the production of final goods (for example, duties on oil imports or fuel, electricity, and transportation subsidies), one would also need either a recent input–output table, a social accounting matrix (SAM), or a supply and use table (SUT). The incidence of indirect taxes (subsidies) with or without these indirect effects can be significantly different especially if the taxed (or subsidized) product is a pervasive input in production. When such is the case (as with electricity or fuel), consumable income calculated with the indirect effects can be quite different than if such effects are assumed away.[7]

Although the process of calculating the core income concepts seems utterly simple, in practice it is very complex even in the basic accounting approach. There are data challenges and conceptual challenges.

[7] For more details see Jellema and Inchauste (2022).

First, especially in low-income countries, the data is frequently absent, incomplete, and/or quite difficult to obtain. Although advanced countries (and most middle-income countries) collect household surveys periodically, that is not the case in low- income countries. A second problem is that, with exceptions, household surveys collect data on either income or consumption. Lack of data on consumption patterns implies that the incidence of consumption taxes and subsidies cannot be calculated, unless one resorts to "borrowing" information on consumption patterns from a similar country and/or using econometric techniques to predict consumption based on income. Even if surveys exist, in many countries governments still restrict access to the microdata, a factor that limits the ability of independent researchers to carry out an analysis of their own. Data limitations, moreover, affect more than the microdata. Especially (but not only) in low-income countries, total taxes collected by federal, state, and local governments and actual spending on education by level, for instance, may be impossible to obtain.

In addition, the empirical analysis is made more complicated because of inconsistencies between information obtained from microdata such as household surveys and that found in macrodata such as government budgets, administrative registries (e.g., tax returns), and national accounts. Two typical problems that arise are, for example, that the number of beneficiaries of a particular welfare program according to the household survey may differ substantially from the number recorded in administrative registries. A second and serious limitation of household survey data is the undercoverage and underreporting of top incomes. In part (but not only) due to the "missing rich" problem, for most countries in the world totals for household income and consumption from surveys do not match the equivalent totals from national accounts. To make matters worse, frequently discrepancies are not limited to levels of different types of household economic resources but extend to their changes over time.

Given these discrepancies between survey-based income and consumption data and National Accounts, which totals should one use in fiscal incidence analysis? Both approaches have been followed in the literature. Fiscal incidence exercises in WID.World, for example, scale up survey income totals to match National Accounts (and tax records and budgetary data) and produce distributional national accounts (DINA)[8]. However, scaling-up is not done mecha-

[8] Facundo et al., 2016. "Distributional National Accounts (DINA) Guidelines : Concepts and Methods used in WID.world," Working Papers 201602, World Inequality Lab.

nically (e.g., raising all incomes by the same proportion) but takes into account the fact that there is much more income missing at the top of the distribution, so researchers apply a combination of parametric and nonparametric methods to correct for the "missing rich." [9]

The discrepancies between surveys and administrative data affects fiscal interventions as well. A common problem that one faces while producing a fiscal incidence analysis (FIA) is that the totals for each fiscal intervention included in the analysis almost never equal administrative totals. Furthermore, the difference is not uniform across fiscal interventions, so it is not only the scale but also the composition of the fiscal system that are different. Some authors have dealt with this challenge by "forcing" totals to match.

However, this practice may introduce distortions as well. It should not be done mechanically. For example, let us suppose that spending and number of beneficiaries of a CCT (or other social assistance programs) in survey and administrative data differ. If there is enough confidence in the accuracy of that administrative data (which is not necessarily always the case) a correction for underreporting of beneficiaries using statistical prediction methods would be needed, for example. The same approach can be followed for number of taxpayers (for PIT, in particular). It is important to document what was done in sufficient detail so that it can be easily replicated it by others.

As discussed in chapters 1 and 6 of the CEQ Handbook (Lustig, 2022)[10], the monetized benefits from transfers in-kind (education and health, for instance) are typically calculated at the average cost to the government.[11] To avoid exaggerating the redistributive impact of these transfers, when constructing Final Income, in its initial studies the CEQ Institute at Tulane University proportionally scaled up pre-fiscal income to match administrative data and left education and health per capita spending as obtained from administrative accounts; this was done for inequality measures but not for poverty indicators.[12] Because this meant an ad hoc rescaling of total income (implicitly assuming a constant rate of underreporting across the income distribution) and other fiscal interventions, the 2018 edition of the CEQ Handbook[13]

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9 Lustig (2018). Cowell et al. (2022)

10 Commitment to Equity Handbook: Estimating the Impact of Fiscal Policy on Inequality and Poverty. Second Edition. Edited by Nora Lustig, Brookings Institution Press and CEQ Institute, Tulane University, 2022

11 For further details, see chapter 6, pages 278-293 in Lustig, 2022, op. cit.

12 This method was used in the CEQ working papers for Latin American countries published before August 2013 and the special issue of Public Finance Review: Nora Lustig, Carola Pessino and John Scott. The Impact of Taxes and Social Spending on Inequality and Poverty in Latin America: Argentina, Bolivia, Brazil, Mexico, Peru and Uruguay. Introduction to Special Issue. *Public Finance Review*, *42*(3), 287-303. May 2014.

13 Lustig, Nora, editor. 2018. Commitment to Equity Handbook. Estimating the Impact of Fiscal Policy on Inequality and Poverty. Brookings Institution Press and CEQ Institute, Tulane University.

(Lustig, 2018) recommended the opposite: to scale down education and health spending so that their ratio to Disposable Income from the survey was equal to the ratio of the two variables from National Accounts. The rationale was that if spending on education and health were not scaled down, the cost of production method would overestimate the redistributive effect of in-kind transfers that households received given that incomes in household surveys appear to be underestimated.

While this may be true, there is also an argument in the opposite direction: if in-kind spending is not imputed at actual government cost, the benefit to the household might be under-estimated. Recall that the rationale of using government cost to estimate Final Income is how much would the income of a household have to be increased if it had to pay for the free or subsidized public service (or the insurance value in the cases in which this applies to healthcare benefits) at the full cost to the government.

Presently, the CEQ Handbook (Lustig, 2022) recommends not to do any rescaling. Use income as reported in survey and education and health spending as reported in administrative accounts and no scaling at all at any level.[14]

1.4 Allocation methods

Comprehensive FIA attempts to cover a very broad spectrum of taxes and government spending. Taxes include personal income and payroll taxes, other direct taxes such as property taxes, and consumption taxes. Spending covers direct cash and near-cash direct transfers, indirect subsidies (especially on food, housing, energy, and agricultural inputs), and benefits from public spending on education and health. Spending on public goods such as defense and corporate taxes and subsidies are not usually included or, when they are, the allocation assumes that everybody receives the same per capita benefit or that the benefit equals the same proportion of prefiscal income across the distribution.

As a rule, if taxes and transfers are explicitly available in the surveys, one should use this information unless there are reasons to believe that it is not reliable. However, the information on direct and indirect taxes, transfers in cash and in-kind, and subsidies is often not collected in household surveys. In order to allocate the benefits of transfers and burden of taxation to

[14] It should be noted that— unless specified otherwise in the CEQ Metadata— the results shown in the CEQ Data Center on Fiscal Redistribution do not scale down in-kind transfers. (The CEQ Metadata has repository of information about the studies which were conducted with scaling down or up of in-kind transfers). To access CEQ Metadata table, please visit CEQ Institute webpage (https://commitmentoequity.org/datacenter) and click on the Metadata table

individuals included in the household surveys, the fiscal incidence methodology uses administrative data on revenues and government expenditures as well as knowledge about how the tax and transfer programs work, and allocate these taxes and transfers following methods that are described below. Thus, one of the most important aspects of FIA is a detailed description of how each component of income is calculated (for example, directly identified in the survey or simulated) and the methodological assumptions that are made while calculating it. In the methodological framework proposed by the CEQ Institute, these are included in section C of the *Master Workbook* (available online in Volume 1 of Lustig, 2022) and compiled for all available countries in the Metadata Table in Volume 1's part V (available online only).

In many cases, the authors must choose a method based on the institutional structure of the country and the data available. The approach proposed in the CEQ Handbook by Lustig (2022) relies on local experts as a crucial part of the research team for precisely this reason. In many cases, the researcher must exercise judgment based on his or her knowledge of the country's institutions, spending, and revenue collection, as well as on the availability and quality of the data. It is of the utmost importance to always describe what method was used for a particular tax or transfer, the reasoning for using this method, and—whenever possible—the sensitivity of the results to using alternative methods.

When taxes and transfers can be obtained directly from the household survey, we call this the "direct identification method." When the direct identification method is not feasible, there are several options—namely, *inference*, *imputation*, *simulation*, and *prediction (Enami, Higgins and Lustig, 2022)*. Note that the word "inference" here is unrelated to the concept of statistical inference. Moreover, the imputation method described below should not be confused with the imputation methods used to treat missing data in statistical analysis. In fact, what we call the "prediction" method belongs to the family of imputation methods used in statistical analysis.

As already mentioned, one of the biggest challenges for the *fiscal incidence studies* has to do with how to treat the differences in scale and structure between survey-based values and administrative registries. The causes for these differences are multiple including differences in definitions, but most prominently measurement errors due to under-reporting of certain income categories (for example, income from capital) and under-sampling of the rich in the surveys and measurement errors in national accounts. Whatever the cause, the study's author/s, will need to exercise judgment on whether to consider more valid the information in the survey or that coming from administrative accounts. This applies not just to amounts in currency but also to population totals. As mentioned, the number of beneficiaries from a particular program may be lower (or higher) in the survey than in administrative registries. The author/s should carefully document the rationale behind their decision.

Because the process of allocating taxes and transfers relies on assumptions that one cannot truly test or uses definitions for which there is no overriding consensus, it is recommended that robustness checks be carried out to assess the reliability of results. For example, use consumption instead of income, use equivalized income instead of per capita income, change assumptions about tax evasion or program take-up, assume ratios of taxes and transfers to Disposable Income are the same in the surveys as in national accounts, and so on.

1.1 Economic Incidence Versus Statutory Incidence

Statutory incidence refers to the rate of taxation established by law and where the tax is proximately levied. For example, in statutory terms, an excise tax might be collected from consumers. However, as formally shown by Harberger (1962) many decades ago, the actual burden in welfare terms—that is, the economic incidence—of a tax may be quite different from who mails the check to the tax authorities. In the case of an excise tax, the economic burden may fall entirely on the consumer, entirely on the producer, or on both, depending on demand (or supply) elasticities. In partial equilibrium analysis (and in competitive economies where markets clear), if demand is completely inelastic (or supply perfectly elastic), consumers will bear the entire burden of an excise tax: the price of the good at the cash register will increase exactly by the amount of the tax. If, on the other hand, demand is perfectly elastic (or supply completely inelastic), the prices on the shelf will not change but the price that producers receive will be reduced exactly by the amount of the tax. Beyond these two limiting cases, the fundamental principle is that taxes tend to be borne by the more inelastic consumers (or, more generally, demanders) or producers (or, more generally, suppliers). In the case of payroll taxes, for instance, the more inelastic labor supply versus labor demand is, the more the employer can transfer the burden of employer's payroll taxes to workers in the form of lower wages; that is, the burden is shifted backward to workers. Likewise, the burden of a tax on inputs (such as a gasoline tax on retailers) will be borne by the consumer in the form of higher prices the more inelastic his/her demand for the taxed good is vis-à-vis the supply elasticity.

In sum, the economic incidence depends on the elasticity of demand and/or supply of a factor or a good: the burden of taxes is borne by those who cannot easily adjust to the change in price induced by the tax. The economic incidence of taxes will also be affected by how revenues are used. In a general equilibrium analysis (which is necessary when taxes impact large parts of the economy), the economic incidence is also sensitive to a large number of elasticities. In open economies, the extent of factor mobility will affect on whom the burden of taxes fall. Finally, in a dynamic context, the long-run economic incidence will ultimately depend on how taxes affect capital accumulation and marginal productivities of factors of production.

As mentioned, the accounting approach in FIA (that is, studies based on the judgmental allocation of tax burdens across the income distribution) can be thought of as implicitly assuming: (i) completely inelastic demand functions so that the economic incidence of taxes on goods and services falls entirely on consumers: that is, the tax burden is shifted forward to consumers in full in the form of higher prices; and, (ii) completely inelastic labor supply functions so that payroll taxes are fully shifted backward to workers in the form of lower wages.

In addition, the actual incidence of taxes may differ from the statutory incidence because of tax avoidance and tax evasion. Especially in developing countries, a significant portion of economic activity may take place outside of the formal market (e.g., salaried workers, self-employed, or property owners who do not pay direct taxes or contributions to social security due to the state's inability to enforce the law) or outside the market altogether (e.g., own production of consumption goods such as small farmers or peasants cultivating corn, wheat, or other staples to feed their families). Due to limited state capacity or corruption, tax collection and the distribution of benefits (whether in cash or in kind) may operate very differently from the letter of the law.

In the case of transfers, the actual incidence can differ from the statutory rules because beneficiaries may choose to work less (thus, incomes after the transfer may not be equal to previous earnings plus the transfer) or there might be imperfect take-up of welfare programs. In the accounting framework it is assumed that individuals do not change their labor market behavior as a result of receiving a government transfer.

As indicated, in spite of its limitations, the accounting approach is considered a reasonable first-order approximation, and it is the most frequently used in practice. For example, when evaluating tax reform proposals, the U.S. Congressional Budget Office assumes that the personal income tax is fully borne by households, payroll taxes are fully borne by workers (both the employer and employee's share), excise taxes are fully borne by buyers, and corporate income tax is fully borne by the owners of capital (Salanie, 2011).

1.2 Robustness Checks and Validation

The information on direct and indirect taxes, transfers (in cash and in kind), and subsidies, however, is often not collected in household surveys or they are collected with error. To cope with the lack of information or its inaccuracy, researchers have proposed a number of methods that rely on statistical inference, data from external sources, and common sense. Because the process of allocating taxes and transfers relies on assumptions (judgment calls) that one cannot truly test using standard statistical testing methods, it is recommended researchers carry out robustness checks to assess the sensitivity of results. For example, one may want to change assumptions on tax evasion, informality, the size of the nonmarket economy, and/or program take-up rates. Each fiscal incidence exercise needs to be subject to thorough micro- and macro-validation processes. Whenever it is not possible to determine whether one source of information is more credible than another (e.g., there is a discrepancy in number of beneficiaries of a program between surveys and administrative registries but there is no way to tell which one is accurate), the fiscal incidence exercise should be carried out for both to obtain a range rather than produce a single number.

1.3 Limitations of the Accounting Approach in Fiscal Incidence Analysis

This section summarized the main conceptual components and assumptions, data requirements, and indicators utilized in fiscal incidence analysis based on the accounting approach. Ideally, fiscal incidence analysis should cover all the taxes and all the components of public spending. In practice, however, it usually includes only a portion of a government's budget. The difficulties are particularly strong when dealing with revenue and public spending items that are not easy to "assign" to households, as is the case with revenues stemming from taxing state-owned companies (quite significant in countries where natural resources are directly exploited by the state, for example) and spending on genuine public goods such as defense. If the excluded components are not distributional or poverty-neutral, then the full redistributive impact of the state—even within the confines of the accounting framework—may be quite different from those obtained from a fiscal incidence analysis that only partially covers taxes and transfers.

One key limitation of the accounting approach is that it ignores behavioral responses, general equilibrium effects, spillovers, and intertemporal redistribution. In some contexts, behavioral responses can be quite significant so results based on first-order approximation must be taken with great caution. For instance, a beneficiary of a means-tested transfer may decide to work less to avoid losing his eligibility; if schools offer free lunches, parents may decide to send their children to school to take advantage of them; access to local health clinics may induce parents to be more mindful of their children's health. In essence, these effects can alter the counterfactual income (i.e., the income without taxes and transfers) and, thus, modify not only the size but also the sign of the estimated fiscal redistribution. An alternative to the accounting approach is to model behavioral responses in the incidence analysis. This can be done in a partial equilibrium or general equilibrium framework. Intertemporal effects and lifetime tax incidence can also be established as long as there is the necessary data, because results depend critically on the lifetime earnings profile of household members.

Importantly, the accounting approach is also silent regarding the effects that the fiscal system has on macroeconomic stability and economic growth. A country may appear to do quite well on the equity front by devoting a significant portion of its income to spending on safety nets for the poor and on education and health. However, if this spending is financed by distortionary taxation, inflation, and/or unsustainable public debt, the end result may be disastrous for the poor.

Another limitation of the typical fiscal incidence analysis as we know it, is that benefits from government services are valued at average government cost. This assumption ignores quality issues and whether consumers' valuations of the benefits actually correspond to what it costs governments to produce the services.

A further limitation of the standard fiscal incidence analysis is that households are treated as unitary: that is, the analysis assumes that taxes (benefits) paid (received) by the household are equally distributed among the members of the household. Within-household distributional issues are ignored. In spite of all its limitations, standard fiscal incidence analysis is—for the time being—the best approximation to assess the distributional impact of the current fiscal system and the potential effects of reforms.

A summary of stylized facts is beyond the scope of this article. For an historical analysis of the progressivity of fiscal systems, the interested reader may want to consult Lindert (2004, 2017).

The references mentioned throughout this article also include numerous cases of fiscal incidence analyses for both advanced, middle-income, and developing countries. All the results are summarized in the data bases on fiscal redistribution housed in the CEQ Data Center on Fiscal Redistribution.

2. Tax-Benefit Microsimulation Models

2.1 Description

In their fullest form "…microsimulation models[15] … are tools that allow the simulation of the effects of a policy, on a sample of economic agents (individual, households, firms) at the individual level. This approach to policy evaluation is based on the representation of the economic environment of individual agents, their budget constraint in particular, and, possibly, their behavior. A 'policy simulation' then consists of evaluating the consequences of a change in the economic environment induced by a policy reform on a vector of indicators of the activity and/or welfare for each individual agent in a sample of observations. (Bourguignon (2006).

Microsimulation models (MSM) also come in "plain vanilla" form. In fact, the most commonly available tax-benefit MSM are static, without behavioral responses and without general equilibrium, macroeconomic, or dynamic effects. Moreover, the existing MSM usually exclude the allocation of education and health benefits and sometimes they stop at disposable income (that is, indirect taxes and subsidies are not always included in the analysis). As with the standard FIA, the typical MSM treats households as unitary. Thus, what is the advantage of a standard MSM over a standard FIA? The main difference between the two is that FIA was primarily developed as a tool to assess the characteristics of the existing tax-benefit system such as its progressivity and impact on inequality and poverty while MSM is a tool for describing how these distributions might change if the tax-benefit regime were to change. The microsimulation approach differs from the accounting approach FIA not in the way it calculates statistics on income and poverty, but in the way it deals with data on taxes and benefits.

To accurately simulate fiscal liabilities and benefit entitlements, tax-benefit microsimulation models require comprehensive information about the individual and household characteristics driving these entitlements and liabilities, including but not limited to household size and composition, market incomes, history of paying social insurance contributions, labour market status, disability status and so on. Based on this information and on legislative rules, tax-benefit models can then simulate the amount of fiscal liabilities and benefit entitlements at the tax-benefit unit level.

[15] This section draws from Popova (2024).

Tax-benefit microsimulation is primarily used as a technique of ex-ante policy impact assessment – i.e. in predictions of the likely impact of a change in policy, prior to its implementation. Tax-benefit MSMs seek to explain endogenous variables Y (e.g. disposable income) as a function of exogenous variables X (e.g. demographic and socio-economic characteristics of individuals and households) and system parameters P (e.g. tax rules) (Immervoll and O'Donoghue 2009). Both X and P may be varied. The models quantify the consequences, at the micro-level, of changes in tax-benefit policies, given that the characteristics of the underlying population remain constant, and vice versa. In other words, a microsimulation approach allows the researcher to conduct a controlled experiment by changing the parameters of interest while holding everything else constant and avoiding endogeneity problems in identifying the direct effects of the analyzed policy change.

By taking full account of interactions between all elements of the tax-benefit system, and of the diversity of characteristics in the population, tax-benefit MSMs contribute to a better understanding of complex systems, such as contemporary welfare states. Today, the uses of tax-benefit microsimulation extend well beyond ex-ante policy evaluation. For a review of the many ways microsimulation has been used in both academic research and policy analysis see Figari, Paulus et al. (2015). Furthermore, the latest developments in the field of microsimulation are being published in the International Journal of Microsimulation[16] established by the International Microsimulation Association (IMA).

In practical terms, a tax-benefit MSM is a computer code that calculates post-fiscal income for each micro-unit (individual, family or household) in a representative sample of the population. The calculation combines elements of income taken from the micro-data directly (e.g. employee earnings) with elements simulated by the model (tax liabilities and benefit entitlements). The method enables a researcher to make a detailed analysis of the revenue and distributional effects of an individual policy or a whole tax-benefit system, before and after a hypothetical (or actual) reform. The resulting taxes, benefits and income measures obtained at the level of individual agents can be aggregated at the level of population subgroups (e.g. to define the losers and winners in the reform) or at the macro-level (e.g. to define the cost of the reform for the state budget).

Tax-benefit MSMs represent a step forward, compared to traditional techniques of policy impact assessment. First, they can improve the accuracy of income information in surveys.

[16] See: https://www.microsimulation.pub/

For instance, household surveys typically do not take account of crucial elements of the welfare state, e.g. taxes and tax benefits. There is also evidence that some benefits, for example, means-tested ones, tend to be under-reported in surveys (Brewer, Etheridge et al. 2017), so MSMs can improve the accuracy of income measures at the bottom of the distribution. Moreover, given the time and monetary costs of carrying out a large-scale survey, the datasets available to researchers are often outdated in respect to the latest changes in policies, while MSMs can provide the up-to-date estimates. A popular alternative to using surveys in policy impact assessments is a 'hypothetical cases' approach, such as that applied by the OECD Tax-Benefit calculator[17]. While this approach gives a general idea about consequences of the analyzed reform, it can hide unexpected effects arising from certain combinations of individual characteristics. Additionally, even if various 'hypothetical cases' are considered, the results cannot be generalized to the whole population, so the overall welfare effect of a policy reform cannot be estimated accurately." Examples are presented in the Annex.

2.2 Main requirements for constructing a tax-benefit MSM

In order to contextualize the development of tax-benefit MSMs, we present an overview of the main steps that have to be considered when building a MSM. These include: (1) defining the scope of simulation, (2) simulating separate tax-benefit instruments and defining the order of simulations (3) preparing the input data, and (4) quality assessment/validation of model outputs.

2.3.1 Scope of simulation

The scope refers to the amount of policy that is simulated in the model. It may refer to:

- the proportion of the full extent of public policies covered by the model (e.g. direct taxes and transfers, indirect taxes and subsidies, provision of non-cash services such as health and education, or other public goods such as, for instance, regulation of rents, etc.).
- the proportion of tax-benefit instruments included in the concept of household post-fiscal income that can be simulated, as opposed to taken directly from the data.

[17] See: https://www.oecd.org/els/soc/benefits-and-wages/tax-benefit-web-calculator/

The scope depends on the purpose of the model. Typically, the aim of building a tax-benefit MSM is to simulate as many existing policies as possible. Some taxes and social benefits, however, cannot be (fully) simulated due to data constraints. Firstly, some policies may be beyond the scope of a model entirely, as there is little or no data for that purpose in household surveys. This almost always refers to corporate taxation, and quite often refers to indirect taxes and in-kind benefits (free or subsidized healthcare, education, etc.). Secondly, due to lack of relevant information in the input microdata, it may be problematic to model certain social transfers for narrow groups of the population (e.g. cash allowances for orphaned children, disability allowances) and transfers depending on the long-term contribution history (e.g. old-age pensions, unemployment benefits). Sometimes it is possible to model some policies only partially (e.g. by simulating the amount of a benefit for individuals that indicated the receipt of this benefit in the data, or by simulating the main conditions of the program and omitting those that are less relevant). If a policy cannot be simulated and information about this policy is available in the dataset, it can still be included in post-fiscal income, even though the rules governing it may not be changed by the model. Importantly, there is a trade-off between broadening the scope of a MSM and the quality of the estimates that may be achieved using extensive imputations and assumptions with little data to base them on.[18]

2.3.2 Simulation of policies

Taxes and social transfers can serve multiple objectives, including income maintenance, income smoothing, poverty alleviation, and the promotion of specific desirable behaviours, etc. The intricate array of these objectives, along with national, historical, and administrative constraints, can lead to a diverse spectrum of policy designs. In the context of developing a MSM the primary focus lies in examining the legislative detail and the mathematical structure of individual policy instruments, in order to facilitate coding of policies (O'Donoghue 2021).

In microsimulation modelling, an important concept is **the unit of analysis**, which pertains to the level of aggregation to which an instrument applies. The lowest unit of aggregation is the *individual*. For instance, social insurance benefits that depend on personal contributions are an

[18] It is important to ensure that income concepts in MSMs are flexible and adaptable to individual preferences. By ensuring income components are disaggregated at the lowest level possible, users can tailor definitions of pre-fiscal and post-fiscal income according to their own assumptions. For instance, while contributory pensions are typically regarded as government transfers in European countries, UKMOD treats occupational pensions, a significant part of contributory pensions, as private pensions included in market income. Nevertheless, if a UKMOD user prefers the European definition, they can easily switch. Ultimately, MSMs should empower users to conduct analyses according to their preferences, rather than being constrained by choices made by model developers.

example of individual benefits. The highest unit of aggregation is the *household*. Social assistance benefits often use the household as their unit of analysis. Another commonly employed unit of aggregation is the *benefit/tax unit*, typically denoting a nuclear-family unit consisting of spouses and dependent children. It is important to note that definitions of benefit units may vary a lot across countries. Some instruments may involve mixed units of analysis, for instance, benefits paid to individuals but conditioned on their household income.

The coding of nearly all social benefits typically involves four components:

(1) Eligibility: This defines who is entitled to receive the benefit.

(2) Means-test: A means-test assesses the financial resources or income of the recipient to determine eligibility or benefit amount.

(3) Base Amount: The base amount serves as a starting point for calculating the benefit.

(4) 'Equivalence Scale': This scale is used to determine the benefit amount by considering characteristics of the benefit unit, such as age, the number of children, and so on.

The payment amount is then calculated as the base amount multiplied by the equivalence scale, minus the means, multiplied by a withdrawal rate. The latter specifies how benefits decrease for each additional unit of means (i.e. earnings).[19]

Income taxation typically consists of the following four components:

(5) The income base on which taxes are imposed.

(6) Deductions from this income subject to taxation (i.e. tax allowances).

(7) The schedule tax rates at different levels.

(8) Any reductions in the tax liability (tax credits).

The structure of these components has an impact on the amount of taxation imposed and the redistributive nature of the tax system.[20]

[19] For the detailed description of each step see O'Donoghue (2021), chapter 3.

[20] The detailed description of microsimulation of direct taxes can be found in O'Donoghue (2021), chapter 4.

In the case of indirect taxes, such as excise duties, sales taxes, and value-added taxes (VAT), their simulation is comparatively simpler than that of direct taxes and benefits. Firstly, the amount of tax paid on a specific purchase is typically (though not always) uniform for all individuals. Secondly, the tax schedule is generally linear. However, exceptions to these rules exist. Certain price subsidies, considered negative indirect taxes, are accessible only to specific segments of the population and apply to a limited amount of expenditure. Additionally, durable purchases, like housing or cars, may be subject to non-linear tax schedules where rates are higher for more expensive purchases. For a detailed description of the microsimulation of indirect taxes, refer to Capéau, Decoster et al. (2014).

In order to comprehensively consider the interactions among all elements of the tax-benefit system within a MSM, it is essential to simulate separate policy instruments in a specific sequence known as **the policy spine**. Typically, the simulation sequence begins with social insurance contributions and direct taxes, given that they are calculated as a proportion of gross market incomes. Following this, social benefits that are not subject to taxation can be simulated after direct taxes. When a benefit forms part of the means-test for another benefit, it needs to be simulated first. In cases where social benefits are subject to taxation, they should be simulated before income taxes. Indirect taxes are typically simulated at the end of the policy spine.

2.3.3 Data requirements

In order to generate outputs for the distributional analysis, the input database of a MSM should possess several desirable properties (adopted from Figari, Levy et al. (2007)):

(1) It must be a recent, representative sample of households, large enough to support the analysis of small groups and with weights to apply to population level and correct for non-response.

(2) It must contain information on primary pre-fiscal incomes by source (e.g. gross income from employment and self-employment, investment income), with the reference period being relevant to the assessment periods for direct taxes and benefits. Ideally, taxable and non-taxable incomes should be recorded in separate variables. If certain benefits cannot be simulated (e.g. due to data limitations), information on the amount of these

benefits, gross of taxes, is required for each recipient. The definition of gross income may vary depending on the availability of data and the approach to measuring fiscal incidence of taxes and benefits taken by model developers[21].

(3) It must contain information about individual characteristics affecting tax liabilities or benefit entitlements (e.g. age, education, weekly hours of work, (in)formal employment status, disability status, civil servant status, etc.) for each household member, as well as information about within-household family relationships.

(4) It is desirable that information on consumed quantities and expenditures, disaggregated into categories which align at least approximately with goods subjected to different tax rates, is available in the same dataset in order to enable the simulation of indirect taxes such as VAT and excise duties.

(5) If a simulation of the monetary value of in-kind consumption of public services (such as education and healthcare) is considered, information about respondents' usage of public services and the user costs they have incurred at public institutions will be required.

All these criteria are rarely met in one data source and typically a significant amount of work must be done to transform available data into the required database. The most common **input data adjustments** that have to be made are presented in the Annex.[22]

More generally, surveys with detailed information on both income and expenditure are rare, and methods to link income and expenditure data from different sources are often required.

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[21] For example, in the tax-benefit models for the EU-27 and the UK described in section 1.3, pre-fiscal income is defined by default as the sum of gross employment and self-employment income (before employee and self-employed social contributions and income taxes), gross investment and property income, gross income from private pensions minus employee compulsory private pension contributions, received maintenance payments, and other private transfers minus maintenance paid. In the tax-benefit model for Ecuador, which is part of SOUTHMOD and LATINMOD models, employment and self-employment income are segmented into income from registered and unregistered activities (which facilitates the accurate simulation of the incidence of direct taxes); and pre-fiscal income additionally includes self-employment income from agriculture, auto-consumption, and income from abroad. In the EUROMOD spin-off model for Russia, pre-fiscal income additionally includes employer social insurance contributions, assuming that their burden falls on employees. It is worth noting that all the above-mentioned models allow the user to adjust the definition of pre-fiscal income, as well as the definitions of other income concepts, according to their own assumptions.

[22] For a comprehensive discussion of the data issues related to the simulation of direct taxes and benefits, refer to Figari, Iacovou et al. (2012). For the simulation of indirect taxes, see Capéau, Decoster et al. (2014).

Typically, if income and consumption are not available in the same survey, it is easier (and preferable) to base an MSM on an income survey, and impute consumption into the income survey, rather than doing otherwise. The simulation of individual-level programs, such as direct taxes and social insurance contributions, requires income data at the individual level, while consumption data are usually available at the household level only and is less relevant in assessing how individuals are treated by direct taxes and benefits. Imputation of income data into a consumption survey will require numerous assumptions that might compromise the quality of the MSM. For that reason, all the tax-benefit MSMs discussed in section 1.3 are either based on income surveys where expenditure is imputed from a household budget survey (as in the case of EUROMOD), or on surveys where both income and consumption/expenditure information are available (as in the case of SOUTHMOD and LATINMOD models).

However, in some countries, particularly low-income ones, only consumption/expenditure data may be collected in household surveys. Alternatively, even when both income and consumption data are available, the income data may be considered of low quality. In such instances, additional adjustments to input data are necessary and these will likely involve using external data, for instance, a secondary survey or administrative data on the characteristics of benefit recipients and taxpayers. Below we present some general recommendations for addressing such a case. These recommendations should be considered tentative and experimental, given the absence of literature on generating tax-benefit MSMs with consumption data only. The process will firstly involve defining household disposable income (1). Once it is defined, the next step is to work backward in constructing pre-fiscal income by simulating direct benefits (2), taxes and SIC (3). The simulation of indirect taxes with consumption data is usually straightforward.

(1) *Utilising consumption expenditure as a proxy for disposable income*

Given that consumption is closely related to income, consumption expenditure (net of expenditure on purchases of durables and housing) can serve as a rough proxy for disposable income. However, while a correlation exists between the two, factors such as savings, borrowing, and non-market incomes can influence this relationship. The best strategy of estimating disposable income using expenditure data will depend on the survey and external data that is available in each specific country context.

a. It is advisable to study historical data or patterns to discern correlations between income and consumption.

b. The analysis of additional socio-demographic variables that may impact the relationship, such as household size, education levels, and employment status, can enhance contextual understanding of the link between the two.

c. Consideration should be given to rescaling expenditure to align its mean and variance with those of disposable income if information about the distribution of disposable income is available.

(2) *Simulation of direct benefits*

a. Means-tested and proxy-means tested benefits can almost always be fully simulated using statutory rules, as their eligibility is typically defined using household disposable income and/or household composition variables (e.g., age and number of children, presence of disabled persons, economically inactive working age adults, etc.). A further correction for non-take-up may be particularly crucial, especially in a low-income country context.

b. Contributory benefits (especially pensions) are typically challenging to simulate using any cross-sectional survey (whether income-based on consumption-based). In MSMs based on income surveys, they are either taken directly from the data or partially simulated (i.e., the amount is simulated using statutory rules, while eligibility is taken from the data). If it is feasible to identify their potential recipients in the data, a partial simulation of contributory benefits might be also possible in consumption-based surveys.

(3) *Simulation of direct taxes*

The simulation of income taxes and SIC will firstly involve identifying individuals potentially paying them (as well as those potentially receiving employment income) using individual characteristics such as the relationship to the household head, age, education, employment status, informality status, etc.; and secondly, estimating the share of employment and self-employment income (including formal and informal income) in household disposable income[23]. Subsequently, individual income taxes and

[23] In the absence of reliable labor income data or the ability to match them into the primary dataset, an alternative method involves predicting the proportion of disposable income derived from employment versus self-

SIC can be estimated by inverting the rules of tax rates on employment and self-employment income. As in the case of means-tested benefits, a further correction for non-compliance may be necessary, especially in a low-income country context.

2.3.4 Quality assessment and validation

Validating the simulated tax and benefit amounts and the resulting income distribution is a crucial component in constructing a MSM. It is considered best practice to initiate this process by conducting **micro-validation** of the simulated tax and benefit instruments in order to assess the accuracy of the code. This can be achieved by examining the tax and benefit amounts generated by the model for hypothetical households. For example, in cases where child benefit amounts are subject to variations based on factors such as age, the number of children, and parental wages, one can create hypothetical households where these characteristics vary and compare their simulated amounts.

The second step in assuring the quality of a MSM is **macro-validation** of the simulated tax and benefit instruments and the resulting income distribution against external data. While the main purpose of a tax-benefit MSM is to assess the effects of hypothetical policy changes, hard evidence that the effects of changes in policies are simulated accurately is not available. Hence, quality assurance of the tax-benefit calculations rests on the documented validation of the baseline simulation. Ideally, the aim is to generate baseline results that are similar to estimates provided from independent official statistics (such as administrative data, National Accounts) for an equivalent policy system and time-period.

The quality of the baseline simulation can be established by:

(1) Comparing statistics on market incomes in the input data against National Accounts.

(2) Comparing statistics on the number of recipients/payers and spending/revenues for each tax-benefit instrument simulated or included in the model against administrative data.

employment income. For instance, this prediction can be done by regressing per capita disposable income on various household-level variables, including the number of wage earners, average education of wage earners, average age of wage earners, number of self-employed individuals, average education of self-employed individuals, and average age of self-employed individuals. The coefficients obtained from this regression can be applied to corresponding variables in each household, allowing for the prediction of the proportion of disposable income attributed to wages and self-employment income.

(3) Comparing statistics of the simulated income distribution, e.g. at-risk-of-poverty and income inequality indicators, against the distribution based on the input data and/or other survey data.

There is an important trade-off between simulating an accurate baseline and providing accurate estimates of the effects of policy reforms. A frequent issue encountered when utilizing microdata from surveys for microsimulation is the lack of alignment between aggregate values (e.g., gross earnings or income taxes) and estimates derived from National Accounts or other sources of macroeconomic statistics. In certain cases, it may be appropriate to calibrate the baseline distribution of simulated income and its components to correspond with the external data. Generally, however, such an approach is not advisable within the context of MSM as it has the potential to distort estimates of changes resulting from policy reforms (Figari, Paulus et al. 2015). A common solution involves extrapolating the relative changes in policies resulting from simulated policy reforms onto the variables sourced from official statistics. For instance, if the simulations indicate a 5 percent increase in budget expenditure for a particular program, this 5percent increase can be applied to the actual budgetary expenditure.

An important dimension of quality in the context of cross-country MSMs such as EUROMOD and its spin-off models is **the cross-country comparability of results** (Sutherland 2018). The comparable model outputs can be achieved by establishing standardized protocols and processes across all the countries included in the model, and by monitoring and reviewing their practical implementation. The availability of country-by-country documentation in a standardized format and content greatly facilitates the comparison of cross-country simulations. However, it is important to note that in the case of cross-country MSMs, ensuring comparability of results across countries may partially conflict with the objective of maximizing quality within each individual country. This is due to the differences in the design and complexity of tax-benefit policy systems, varying requirements for input data, and variations in the quality of available input data (Sutherland 2014).

Can existing fiscal incidence exercises be transformed into microsimulation models? The answer is affirmative and Daria Popova's paper "Guidelines for integrating a microsimulation model into the standard CEQ fiscal incidence exercise" was written with this objective in mind. The document serves as a guide for those looking to start using standard CEQ assessments for policy simulations or converting them into microsimulation models. The first part focuses on building a microsimulation model, offering an overview of microsimulation as a method for policy impact assessment. It discusses successful tax-benefit microsimulation models and outlines key requirements, including policy simulation, input data, and validation. The second part provides an overview of the CEQ approach in the context of its adaptability for policy simulations. It explores two contrasting cases, to illustrate the process of transforming a CEQ study into a microsimulation: a straightforward case (Russia) and a challenging case (Zambia). The concluding section provides an illustration of a policy simulation utilizing the CEQ for Zambia, with the goal of investigating the distributional implications of a hypothetical tax-benefit reform.

3. Key Indicators

As stated at the beginning of this article, the typical questions that fiscal incidence analysis and MSM meant to address include: Who bears the burden of taxation and who receives the benefits of public spending? How much income redistribution takes place? What is the impact of taxation and public spending on poverty and the poor? How equalizing are specific taxes and components of public spending? How progressive are spending on education and health? How effective are taxes and government spending in reducing inequality and poverty? Who are the losers and winners of tax and welfare programs reforms? Furthermore, will be the distributional impact of fiscal policy reforms.

Regarding assessing the winners and losers of fiscal reforms, all the non-anonymous indicators described below are useful to assess this. As a reminder to readers, some of the key indicators are anonymous while others are non-anonymous. Anonymous indicators are those which rank individuals (using household per capita or equivalized income) by the variable of interest (that is, by market income, disposable income, consumable income, and final income). Non-anonymous indicators are calculated with individuals ranked by the pre-fiscal income (e.g., market income), and this ranking is kept fixed throughout the incidence analysis. The latter can be viewed as indicators of "fiscal mobility" induced by the combined effect of taxes and transfers where mobility does not refer to changes over time but to "before–after" (fiscal policy) situations.

Also, it is important to note that all the indicators discussed in this section can be calculated for any type of fiscal incidence exercises and not just for the accounting approach. As long as one can generate results at the household level (or, if not at the household level, at least for grouped data by fractiles or bins), the indicators can be calculated for microsimulation models and the more elaborate fiscal incidence analyses that include behavioral responses, and general equilibrium and intertemporal effects.

Finally, although the typical fiscal incidence exercise focuses primarily on the impact on the personal distribution of income, one may also be interested in how taxes and transfers affect the welfare of different morally or institutionally relevant social groups such as groups of individuals differentiated by gender, ethnicity, or location. In the literature, there are examples of fiscal incidence analysis by sociodemographic categories. Fiscal incidence analysis by gender is one of the most challenging.

3.1 Who Bears the Burden of Taxation and Who Receives the Benefits of Public Spending?

The most common indicator used in fiscal incidence analysis since its inception consists in presenting the information of taxes paid and benefits received by decile, quintile, or income categories. With this information one can calculate a variety of indicators such as the ratio of each component of fiscal policy vis-à-vis pre-fiscal income (frequently called "incidence") and concentration shares (e.g., the distribution of each fiscal instrument across fractiles or income groups). If the incidence of a tax (transfer) increases (decreases) with income, the tax (transfer) is progressive.

3.2 How Much Income Redistribution is Being Accomplished?

To measure the extent of income redistribution, one can calculate any of the conventional inequality measures for each income concept and subtract one from the other to measure the sign and extent of redistribution. For example, subtracting a typical indicator such as the Gini coefficient for market from the Gini coefficient for disposable income shows how much redistribution is achieved by direct transfers and taxes, while the analogous calculation with disposable and consumable income Gini coefficients shows how much redistribution is achieved by indirect subsidies and taxes. Comparing market and final income Gini coefficients shows how redistributive the fiscal system is when considering all the analyzed instruments at once.

By definition, all standard inequality measures are anonymous. In other words, one does not know (actually, more strongly, one does not care) whether, for example, the poorest person using the disposable income scale is the same as the poorest person using the market income scale. However, an important desirable characteristic of fiscal systems is that they do not result in arbitrary switching of individuals' positions in the income scale. That is, unless there are reasons that justify the switch, the poorest person should not jump ahead of the second poorest person according to market income because of the impact of taxes and transfers.

In the literature, switches are called reranking and the extent to which these switches are absent is called horizontal equity. Reranking refers to the phenomenon when fiscal interventions arbitrarily alter the relative position of individuals (or households) across the distribution. In other words, reranking occurs if individual A was poorer than individual B before net taxes, but B is poorer than A after net taxes. The definition of horizontal equity postulates that the pre-fiscal policy income ranking should be preserved. In other words, if individual A was poorer than individual B in the pre-fiscal situation, individual A should continue to be poorer than individual B in the post-fiscal one. Reranking is interpreted as a measure of fiscally induced horizontal inequality. The more reranking there is, the more horizontal inequity. An indicator of the extent of reranking—that is, of horizontal inequity—is the Atkinson–Plotnick Index. By definition, the latter is a non-anonymous indicator.

Reranking has also powerful implications when assessing the contribution of a specific tax or transfer or combinations of them. In particular, reranking can potentially destroy the conventional public finance dictum that "for a given level of tax and spending, the more revenue collection is concentrated in more redistributive taxes (progressive income taxes) and the more spending is concentrated in more redistributive transfers (well targeted social transfers), the greater the redistributive impact of fiscal policy."

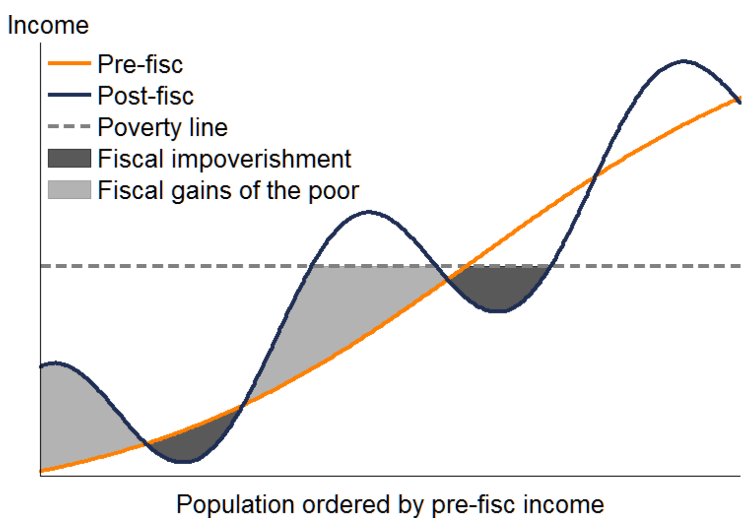
To illustrate, let's think of a hypothetical case in which following this dictum causes extreme reranking: that is, households switch places in such a way that the pre-fiscal richest becomes the post-fiscal poorest, the second pre-fiscal richest becomes the second post-fiscal poorest, and so on. Under such circumstances, any anonymous inequality indicator would show that the fiscal system's impact was exactly nil. Although such an extreme situation is not going to ever occur in real life, actual fiscal systems show quite a bit of reranking. Thus, in order to determine whether a particular change on a tax or a transfer is equalizing or not, one must resort to an empirical calculation since relying on the characteristics of such the tax or transfer (whether its size or progressivity) to predict the impact of changing them can yield the wrong results.

3.3 What is the Impact of Taxation and Public Spending on Poverty and the Poor?

Just as with inequality, one can assess the impact of the fiscal system by tracing out the change in poverty across income concepts with any of the standard poverty measures such as the headcount ratio, the poverty gap ratio, the squared poverty gap, and so on, and with international and national poverty lines. It is advisable to carry out dominance tests to assess whether poverty is unambiguously lower in one income distribution (e.g., disposable income compared with market income) than another for a range of poverty lines and broad class of poverty measures.

Poverty indicators are anonymous by definition. As a result, poverty comparisons are silent about whether pre-fiscal poor (non-poor) individuals were made poorer (poor) by the net effect of taxation and public spending. Even if a tax and transfer system unambiguously reduces poverty (and inequality), it has been shown that the system can make a portion of the poor poorer and some of the non-poor poor. To quantify this phenomenon one can use the newly developed indicator of fiscal impoverishment by Higgins and Lustig (2016). Figure 3 presents a (hypothetical) graphic representation of fiscal impoverishment and fiscal gains to the poor.

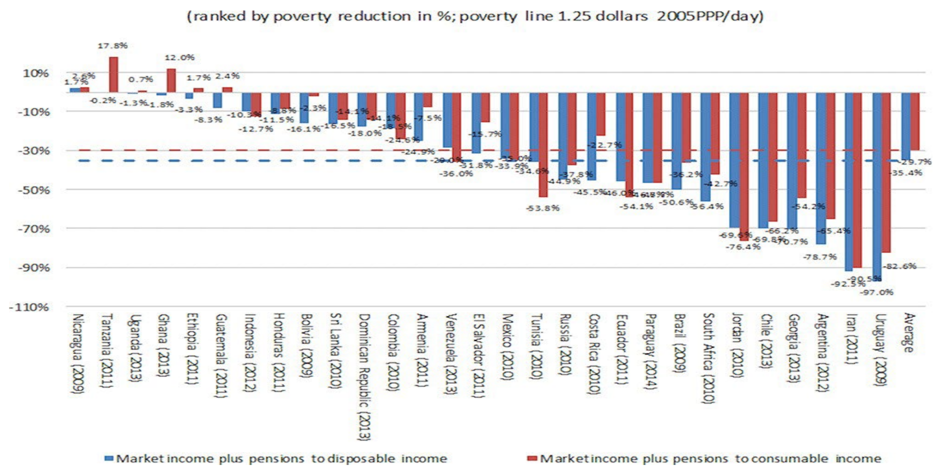
Figure 3. Fiscal impoverishment and fiscal gains to the poor



Source: Higgins and Lustig (2016, figure 1).

It is important to stress that fiscal systems may be equalizing but poverty increasing. How can that be? A simple example will help illustrate. Assume that net taxes are progressive and equalizing but that everybody is a net payer, including the poor. In such a world, fiscal policy would have reduced inequality but increased income poverty. Figure 4 illustrates how in some countries net indirect taxes increase poverty: the headcount ratio for consumable income is higher than for market income.

Figure 4. Fiscal policy and poverty reduction



Source: Lustig (2018b, figure 10-9).

Note: The vertical axis is the percentage change of the headcount ratio for disposable income and pre-fiscal income (blue bar) and for consumable income and pre-fiscal income (red bar). The number in parenthesis is the year of the survey.

3.4 How Equalizing are Specific Taxes and Components of Public Spending?

A fundamental question in the policy discussion is whether a particular fiscal intervention (or a particular combination of them) is equalizing or unequalizing. Traditionally, in the incidence literature this has been measured using typical indicators of progressivity such as concentration shares or summary indicators such as the Kakwani or the Reynolds–Smolensky indexes.

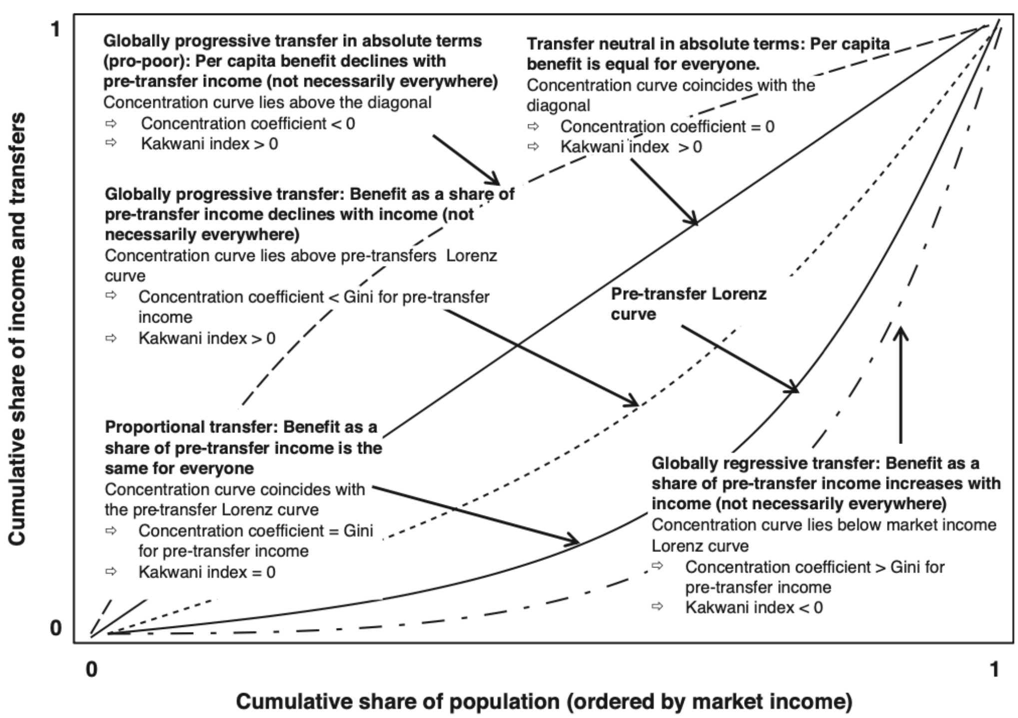
Kakwani (1977) was among the first to propose a measure of tax progressivity based on "disproportionality," that is, by the extent to which a tax distribution was not proportional to the distribution of pretax income. If the Kakwani index is positive (negative), the tax or the transfer in question is progressive (regressive). The Kakwani index for taxes is defined as the difference between the concentration coefficient of the tax and the Gini for pre-fiscal income. For transfers, it is defined as the difference between the Gini for market income and the concentration coefficient of the transfer. The concentration coefficient (also known as quasi-Gini) is calculated in a similar way as the Gini coefficient but it differs from the latter in that the households are always ranked by the income before taxes and transfers (pre-fiscal income).

The concentration curves show the distribution of a tax or a transfer with households ranked by pre-fiscal income.

Figure 5 illustrates graphically the case of transfers. Whenever the concentration curve for transfers lies above (below) the Lorenz curve of pre-transfer income, the Kakwani index will be positive (negative) and, thus, the transfer is progressive (regressive).

The Reynolds–Smolensky index is defined as the difference between the Gini coefficient of pre-fiscal income and the concentration coefficient of the post-fiscal income (income after a particular tax or transfer or all taxes and transfers combined, for example). If the difference is positive (negative), the tax or the transfer in question is progressive (regressive). Under no reranking, the Reynolds–Smolensky index is identical to the RE—that is, the change in inequality between pre-tax and post-tax income distribution measured in Gini points. Thus, in the absence of reranking, whenever the post-tax or post- transfer income Lorenz curve lies above (below) the pre-fiscal income Lorenz curve, the tax or transfer is progressive (regressive).

Figure 5. Progressivity of transfers: A diagrammatic representation



Source: Lustig (2018b, figure 1-3).

However, in a world with more than one fiscal intervention, it is no longer the case that a progressive (regressive) tax or transfer will be equalizing (unequalizing) by definition. In fact, it could be exactly the opposite. To my knowledge, the first author to note this counterintuitive result was Lambert (1985, 2001). Lambert shows that whether a particular tax or transfer (or any combination of them) exert an equalizing or unequalizing force depends not only on the characteristic of the fiscal instrument of interest but also on those of the rest of the fiscal system.

Put simply, Lambert's conundrum is the consequence of path dependency: a particular tax can be regressive vis-à-vis market (pre-fiscal) income but progressive vis-à-vis the income that would prevail if all the other fiscal interventions were already in place. It is important to note that counterintuitive results can occur in the absence of reranking. If there is reranking, then one cannot be sure what the effect will be even in the case of a single fiscal instrument.

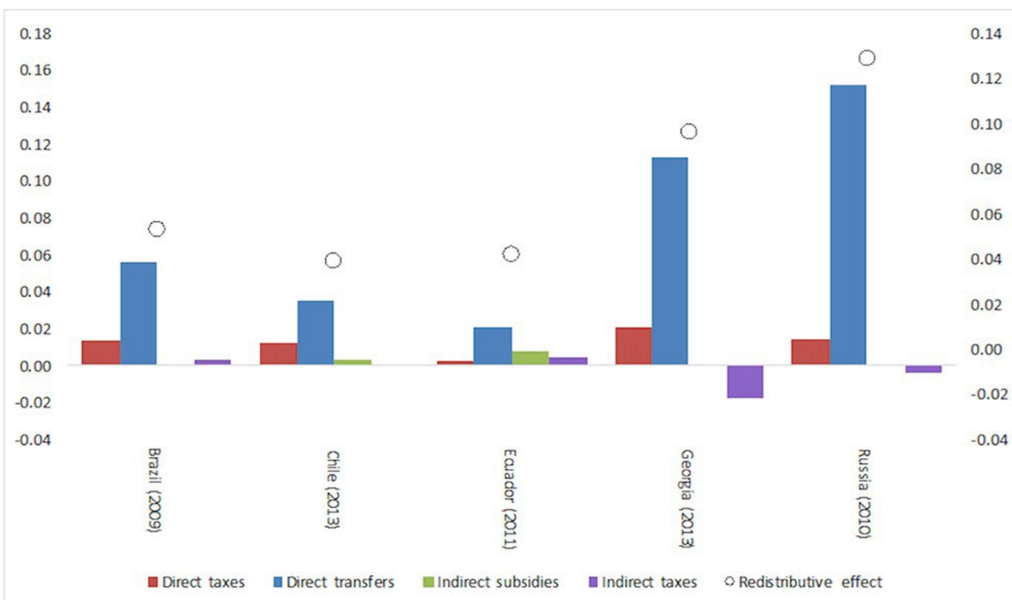
Given path dependency, how should one calculate the contribution (i.e., the sign and order of magnitude) of a specific tax or transfer on the RE (i.e., the difference between inequality indicators for selected income concepts)? In the literature, one often encounters the contribution calculated sequentially. That is, as the difference between inequality indicators with fiscal interventions ordered in a path according to their institutional design. For example, if direct transfers are subject to taxation, the sequential contribution of personal income taxes is the difference between market income plus transfers and market income plus transfers and minus personal income taxes.

Given path dependency, however, the result (in particular, the sign of the contribution) obtained by the sequential method can be wrong. It is important to note that the path dependency of fiscal interventions is independent of whether we can identify the institutional path accurately. For example, whether direct transfers are subject to taxation or not, the contribution of direct taxes to the RE can be equalizing or unequalizing (this is precisely the implication of Lambert's conundrum).

A sensible alternative is to use what in the literature is known as the marginal contribution. In the context of fiscal incidence analysis, the marginal contribution of a tax (or transfer) is calculated by taking the difference between the inequality indicator without the tax (or transfer) and with it. For example, the marginal contribution of direct taxes is the difference between the Gini for gross income (market income plus transfers) and the Gini for disposable income (market income plus transfers minus direct taxes). If the difference is positive (negative), then direct taxes are equalizing (unequalizing).

The marginal contribution has a straightforward policy interpretation because it is equivalent to asking the question: What would inequality be if the system did not have a particular tax (or transfer) or if a tax (or transfer) was modified? Would inequality be higher, the same, or lower with the tax (or transfer) than without it? As an example, Figure 6 presents the marginal contributions of direct and indirect taxes, direct transfers, and indirect subsidies for a sample of countries. As can be observed, direct taxes and direct transfers are always equalizing but indirect taxes are almost neutral (very slightly equalizing) in some cases (Brazil, Chile, and Ecuador) and unequalizing in others (Georgia and Russia, in this case).

Figure 6. Marginal contributions Note: The number in parenthesis is the year of the survey



Source: CEQ Data Center on Fiscal Redistribution <http://www.commitmentoequity.org/datacenter>. Based on Brazil (Higgins & Pereira, 2014); Chile (Martínez, Fuchs, Ortiz- Juarez, & Ortiz-Juarez, 2018); Ecuador (Llerena et al., 2015); Georgia (Cancho & Bondarenko, 2017); Russia (Lopez-Calva et al., 2017).

The marginal contribution should not be confused with the marginal incidence, the latter being the incidence of a small change in spending. The marginal contribution is not a derivative. Note that, because of path dependency, adding up the marginal contributions of each intervention will not be equal to the total change in inequality. That is its main limitation. Path dependency would require measuring the total average contribution by considering all the possible paths. An approach that has been suggested to calculate the contribution of each intervention in a way that they add up to the total change in inequality, is to use the Shapley value (used in game theory, for instance). Interpreting the meaning of a Shapley value for policy purposes is, however, difficult.

While it is mathematically possible for a tax or transfer to be progressive (using Kakwani) but unequalizing (and viceversa) to occur, how common are these inconsistencies in actual fiscal systems? Using a novel dataset that includes fiscal incidence results for 39 countries, Enami, Larroulet and Lustig (2022) find that the likelihood of the Kakwani index to be progressive (regressive) while the tax or transfer is unequalizing (equalizing) is minimal, except in the case of indirect taxes: in roughly 25 percent of the sample, regressive indirect taxes are equalizing. In sum, although the Kakwani index could yield interpretations that are inaccurate in actual fiscal systems, the risk seems small except for indirect taxes.

3.5 Vertical and Horizontal Equity

A well-recognized form of horizontal inequity is when fiscal interventions arbitrarily alter the relative position of individuals across the distribution: in other words, there is reranking. Reranking occurs if individual A was poorer than individual B before a fiscal intervention, but B is poorer than A after the intervention for no good reason.[24] The definition of horizontal equity postulates that the prefiscal policy income ranking should be preserved.[25] In other words, if individual A was poorer than individual B before fiscal interventions, individual A should continue to be poorer than individual B after the interventions.

[24] As an example of a "good reason," an individual could have greater needs due to the health characteristics of the individual, in which case reranking would not be considered a form of horizontal inequity.

[25] See Araar and Duclos (2013).

From theory, we know that the redistributive effect can be written as:

$$RE = VE - RR$$

where VE is equal to the difference between the prefiscal Gini coefficient and the concentration coefficient of postfiscal income with respect to prefiscal income; if there is no reranking, RE = VE by definition because the concentration coefficient for postfiscal income with respect to prefiscal income will be identical to the postfiscal Gini coefficient. RR is equal to the difference between the postfiscal Gini coefficient and the concentration coefficient for postfiscal income with respect to prefiscal income. The redistributive effect is diminished by reranking, as clearly shown in equation. The VE measure is the Reynolds-Smolensky progressivity index (RS) and the RR measue is known as the Atkinson-Plotnick index of horizontal inequity.[26]

[26] Atkinson (1980); Plotnick (1981).

4. Expanding the scope of FIA and MSM

4.1 Alternative methods to estimate benefits from transfers in kind: education, health, and infrastructure

A conceptual challenge of importance is which method should be used for allocating benefits from public spending on government services such as education and healthcare. In the literature, three approaches have been suggested: to value these services at the production cost to the government, at the opportunity cost in the private sector, or by the households' willingness to pay (Bastagli, 2015, p. 12). A basic definition utilized for the unit cost of providing a service is total gross government spending (that is, user fees or co-payments are not netted out) on a particular service divided by the number of users of that service. While this method has notable shortcomings (e.g., there is no account for differences in quality of the service), it amounts to asking a valid question: How much would the income of a household have to be increased if it had to pay for the free or subsidized public service at the full cost to the government?

Moreover, if the goal is to produce distributional national accounts—that is, to take the totals in government budgets and distribute them among households—combining the information of unitary production cost with the usage of the service appears to be a sensible option. If the goal is to determine how much these services are "worth" to households however, valuing services at production costs is not an appropriate method. Methods that estimate "willingness to pay" might be better suited. In sum, rather than choosing one method above others, researchers should use different methods depending on the question asked.

In the CEQ Handbook's Volume 2 (Lustig, 2022), there are four chapters that suggest alternative methods to value education and health. Here we summarize the two that apply both the average cost and alternative methods because they uniquely show comparisons.

4.1.1 Health: average cost, willingness and ability to pay, and health outcomes approach

In "The Effect of Government Health Expenditure on Income Distribution: A Comparison of Valuation Methods in Ghana," Jeremy Barofsky and Stephen Younger (Barofsky and Younger, 2022) describe and compare three approaches to measuring the distributional consequences of government health spending: average cost of provision (the one used conventionally and discussed above), willingness to pay, and health outcomes. The last two methods estimate the benefit of healthcare services to recipients rather than the cost to the government, thus addressing an important criticism of the standard approach. The authors provide example applications for each of these methods using a national cross-section from Ghana for 2012–13.

The willingness to pay uses actual demand for health services to estimate the benefits consumers receive from utilization. The demand estimates use survey respondents' choice of healthcare provider along the lines of the seminal papers by Gertler, Locay, and Sanderson (1987) and Gertler and van der Gaag (1990). Because consumers exhibit positive income elasticity for healthcare, if the poor and the rich exhibit the same level of health need, healthcare demand will be higher among the rich than the poor. Observed healthcare demand therefore reflects both an individual's willingness and ability to pay for care. Consequently, instead of referring to demand calculated using revealed preference as "willingness to pay," a more accurate term is "willingness and ability to pay." Estimates of a willingness and ability-to-pay model for outpatient services show that, on average, users value those services at less than what the government pays for them. The estimated marginal effects of health spending for outpatient care on inequality are modest and somewhat smaller than those for the average cost approach. However, as indicated this may be more a reflection of affordability than preferences.

In the second alternative method, dubbed the "health outcomes" approach, the authors estimate the monetary value of the improved health that publicly funded healthcare services generate. In particular, they estimate "the reduction in mortality produced by government spending across five health interventions and three causes of death and value this averted mortality in monetary terms using the approach of Jamison et al. (2013). We calculate mortality averted through government action by comparing the mortality rate that obtains with Ghana's current level of health intervention coverage against an assumed counterfactual mortality rate that would have occurred had health intervention coverage been at the lowest level observed among other West African nations. While it is also possible to generate such estimates for the mortality effects of entire health systems, our example estimates the value of mortality reduction from several specific health interventions, including the two largest causes of premature death in Ghana—malaria and HIV." (Barofsky and Younger, 2022, pp. 49)

In contrast to the willingness/ability-to-pay method, the health outcomes method finds that the marginal effects of health spending for three causes of death and five health interventions are very large. Remarkably, "the benefits to malaria control and treatment are so large that they swamp the distributional consequences of any other budget line or combination of budget lines…" (Barofsky and Younger, 2022, pp. 84)

While each of these alternative methods addresses some of the limits of the average cost approach, they have shortcomings of their own, both conceptual and practical. The chapter by Barofsky and Younger thoroughly discusses their shortcomings and provides a guide on how to determine which one to apply depending on the context.

4.1.2 Education: average cost, returns to schooling, private valuation of schooling

In "The Market Value of Public Education: A Comparison of Three Valuation Methods," Sergei Soares (Soares, 2022) compares three methods for valuing education services and their distributive impact in Brazil. The first method is cost of provision (the one used conventionally and discussed above) according to which education is worth what it costs the state to provide it; the second values educational services using the labor market as the measure of their worth (an application of Urzua, 2022); and the third matches private educational expenditures, paid for by students or their parents, with equivalent public education services, and then values the latter according to the price of the former. The two are matched using test scores, which of course means that this approach presupposes that test score data are a good proxy for schooling quality. the three methods imply three different valuations of the benefit to the household: schooling is worth what it costs the state to provide it; schooling is worth what the labor market says it is worth; and, schooling is worth what the private education market says it is worth.

In contrast to the findings for health, the results from all three approaches do not fall far from each other (at least in the case of Brazil). The imputed income from publicly provided education reduces inequality by between 3 and 4 Gini points and increases incomes by about 6 percent. The chapter concludes that the value of public education in Brazil is close to 6 percent of household income and that it is quite redistributive, whatever the valuation method used.

4.1.3 Infrastructure spending: access indicators, willingness-to-pay and the time-savings approaches

In "Extending Fiscal Incidence Analysis to government Infrastructure Spending," Jim Alm and Farah Khan (Alm and Khan, 2024) explore methods to measure the benefits of transportation infrastructure spending. One common approach is simply to determine which households have more or less access to different types of infrastructure. However, this "access indicators approach" does not necessarily allow the valuation of these programs for individuals. Recall that valuing and allocating the benefits of infrastructure requires addressing two basic challenges: one must measure the output (and so the true value) of these programs, and one must allocate (or assign) the benefits of these programs to individual recipients. One can of course always use the monetary amount of the expenditure (the government cost method discussed above for education and health) and this assumption is useful as a first approximation. One can also allocate the monetary amount to individual households by various methods. For instance, one can allocate the per capita benefit to households that report access to the infrastructure type of interest. However, just as with education and health, this approach has important limitations.

An alternative would be to use the willingness/ability to pay for infrastructure investment. In "The Market Value of Owner-Occupied Housing and Public Infrastructure Services," Sergei Soares proposes to use hedonic prices to find the market value (willingness/ability to pay) for piped water, sewage, garbage collection, fixed phone lines, and piped gas using data for Brazil for 1995, 2005, and 2015 (Soares, 2022). The approach followed is to use the market value of housing services to estimate what families would have to pay for their housing if they did not own it. The basic idea is to use the rental market and then apply the values paid by renters to owners of similar houses. It is a typical hedonic price approach. Once imputed rents are estimated (details of method are described in the chapter), calculating the value of public infrastructure services is also simple. Suppose the service whose value is to be calculated is piped water. To calculate its value, take the predicted rental value for a given owner-occupied house with access to water and subtract from it the predicted rental value for the same owner-occupied house with no water. The author finds that imputing the value of infrastructure housing service with this method results in a significant reduction in postfiscal inequality (overall and for each component) and that public infrastructure services have become more progressive as their expansion has brought these services to increasingly poorer households.

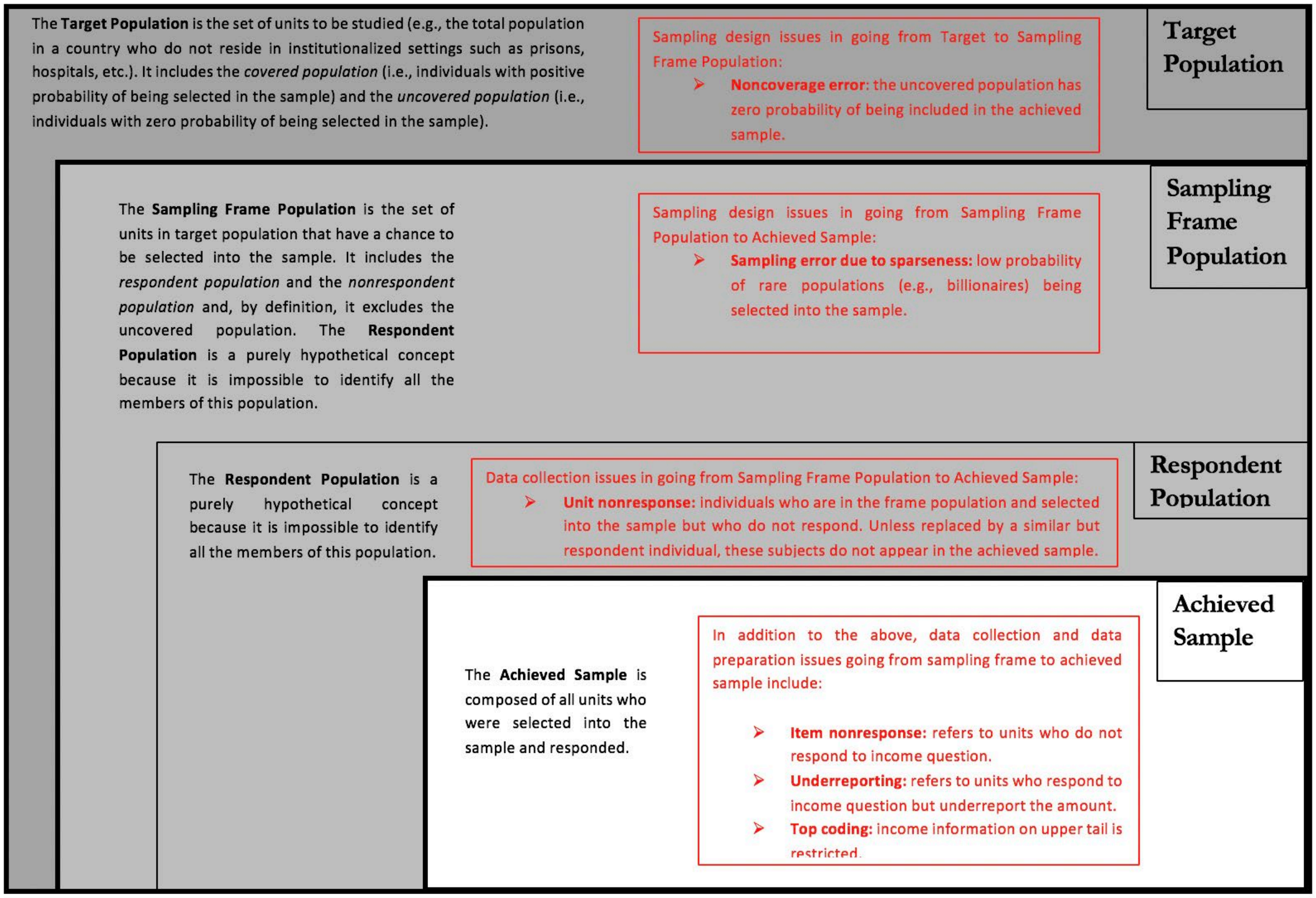
OAlm and Khan (2024) propose a third approach applicable to transportation infrastructure (but it could also be applied to access to piped water, for example). Investments in transport infrastructure may affect the welfare of individuals via several channels, all of which capture effects on the prices and costs of goods and services purchased and provided by individuals and also on their own productivity. First, infrastructure investments may reduce the cost of accessing health, education, and other social services, which may lead to more (or more frequent) investments in human capital such as education, health, culture, and recreation services. Second, as a result of investments in infrastructure, individuals may experience a higher marginal product of *paid* labor supplied to the labor market (e.g., their wage) that also increases the marginal product of *unpaid* labor supplied to the household, such as in providing household members with basic necessities such as food, water, shelter, care for dependents, and the like, as well in providing household members non-necessities that increase the individual and collective utilities of household members via sports, culture, recreation, trips/travel, and such. Third, individuals as consumers may experience lower prices for goods and services that use transport as a production input; that is, better road infrastructure can reduce prices of consumer goods and services and goods and services used as inputs by farmers and other producers. Fourth, individuals may experience a higher marginal product of labor with respect to paid labor supply. Finally, individuals with capital assets may experience a higher marginal product of capital (including on their land), especially individuals in their role as agricultural producers who receive higher farm-related prices due to improved transport infrastructure.

The times-savings approach uses geo-spatial data that allows both to measure individual access to transportation infrastructure and to estimate the time savings to individual households from these infrastructure programs in accessing, primarily, education and health. Transport infrastructure may reduce travel times and therefore effective distance which may also reduce overall access costs (actual and opportunity cost) for the users of education and health services. The value of time savings could be estimated using earnings and also by imputing a value to the added human capital that may be induced by the lower access to education and health costs. For the latter, one would need to explore possible valuations as the ones discussed above. This "time-savings approach" therefore has the potential to enable us to estimate the value of transportation infrastructure programs for individual households via their time savings and to allocate these time savings to the households.

4.2 Correcting for underreporting of top incomes and incorporating undistributed profits and the incidence of corporate taxes

Standard FIA and MSM use the information on income and consumption collected in household surveys. Household surveys, however, fail to capture top incomes well, either because rich individuals are missing or some income variables such as true measures of income from capital (including undistributed profits) are missing or underreported. As demonstrated in the literature, the misreporting of top incomes can bias survey-based income inequality measures. Lustig (2019) provides a fairly comprehensive survey of the methods that have been proposed to correct for measurement errors of top incomes. Figure 7 summarizes the causes of the latter.

Figure 7. The "Missing Rich" in Household Surveys: Causes



Note: Adapted by the author from Biemer and Christ (2008), Figure 17.1 and Groves et al. (2009). Definitions in black and type of errors or issues in red.

Coverage errors, unit or item nonresponse, underreporting and top coding will yield biased inequality measures.[27] Even if there are none of these errors in the achieved sample and, therefore, no bias in inequality estimates, sparseness in the upper tail can result in volatile inequality estimates due to sampling errors. Sampling errors create a serious challenge when one wants to estimate with precision the upper tail of the income distribution.[28] While sampling errors can be reduced through a priori sample stratification to ensure selection of observations from the rare population (e.g., billionaires), the data collection costs of oversampling the rich may be quite high.

[27] This is so because "... the missing-data mechanism is not MCAR (missing completely at random) and the complete cases are not a random sample of all the cases." (Little and Rubin, 2014, location 1195 in ebook).

[28] See, for example, Flachaire (2018).

Existing research has focused on addressing sampling errors due to sparseness in the upper tail as well as undercoverage, nonresponse (unit and item), top coding (as well as censoring and trimming), and underreporting.

There are a variety of approaches that have been proposed in statistics and the inequality measurement literature to address upper tail issues.[29] It is useful to distinguish between approaches that rely entirely on information on incomes (or consumption) contained in the survey in question and approaches that use external information from, for example, tax records and other administrative registries, National Accounts, rich lists, other surveys, house prices, etc. to replace, complement, correct or predict information on, in this case, incomes in the survey. Thus, based on the information source utilized to address the upper tail issues, the approaches can be classified into three broad categories. *Within-survey corrections:* researchers correct upper tail issues present in the surveys using parametric or nonparametric methods. *Alternate data:* researchers rely entirely on alternative data such as tax records instead of surveys.[30] *Survey-cum-external data:* researchers correct upper tail issues by combining surveys with external data using parametric or nonparametric methods.

Another key distinction among existing methods that correct is whether the method *replaces* the income observations in the upper tail or *reweights* (poststratifies) the population shares of the top and the nontop, increasing the former and reducing the latter.[31] The first approach assumes that the population shares of top incomes (the rich) and the rest (the nonrich) in the achieved sample survey are correct and that the problem lies in that (some of) the incomes captured in the upper tail are underreported or missing due to undercoverage, sparseness or unit or item nonresponse. The second correction approach assumes that the population weights for the rich and nonrich in the sample are incorrect due to coverage error or unit nonresponse: therefore, one must "add people" in the upper tail and, consequently, reduce weights at the bottom. Figure 8 summarizes the taxonomy just discussed.

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[29] Cowell and Flachaire (2015) classify the (right-)tail errors into two main types of "data problems:" *measurement error and data contamination;* and *incomplete data.* Their paper discusses a variety of methods to address them.

[30] In the past, before surveys became pervasive, researchers often relied on census data. See, for example, Fishlow's analysis of inequality in Brazil (Fishlow, 1973).

[31] This classification was also proposed by Hlasny and Verme (2015 and 2022). However, these authors do not make a reference to the main assumption that underlies their distinction.

Figure 8. Classification of Correction Approaches

<table>
<tr><th>Method</th><th>Within-survey</th><th>Alternate Data</th><th>Combining survey with external data</th></tr>
<tr><td>Replacing: assumes population shares (base weights) of rich and nonrich in sample are correct.</td><td>Replaces the top xpercent of the distribution by a parametric distribution (e.g., Pareto) or uses imputation methods to estimate missing data.</td><td rowspan="2">Data from tax records are used instead of surveys alone or in combination with wealth surveys and National Accounts.</td><td>Replaces the top xpercent of the distribution by a parametric distribution (e.g., Pareto), but parameters are estimated using external data (e.g., tax records).

Replaces incomes (e.g., means by centile) beyond a certain threshold using values obtained from external information (e.g., tax records or National Accounts).[32]</td></tr>
<tr><td>Reweighting: assumes population shares (base weights) of rich and nonrich in sample are NOT correct.</td><td>Replaces base weights with new weights that are the product of the base weights times the nonresponse adjustment factor times the poststratification weights to address noncoverage, unit and item nonresponse.</td><td>Reduces base weights of the bottom of the distribution to make room for new observations at the top. These new observations have income levels that were not in the achieved sample or survey. Information on incomes for these new observations is generated from external sources such as tax data.</td></tr>
</table>

Source: Lustig (2019), Figure 2.

Some authors have proposed combining both data and methods. In particular, Blanchet, Flores, and Morgan (2022) propose a correction strategy that combines data from household surveys and administrative data (tax returns) and reweighting *and* replacing methods.

[32] May or may not use interpolation methods to join the two distributions. May or may not combine with fitting a parametric distribution.

Corrected inequality measures, especially when combined data sources are used, can be very different than estimates obtained with uncorrected surveys. The corrected inequality measures are usually higher but not always. As was argued by Deaton (2005), the effect of correcting can go either way. Since the results are sensitive to the method, is there any particular method that should preferred to another? The answer is no. Although Flachaire, Lustig, and Vigorito (2022) show that for a particular type of data, the replacing method converges more quickly to the true distribution, this is not a general result. De Rosa, Lustig, and Martinez-Pabon (forthcoming) show how the corrected inequality measures are method- and data-dependent, so one cannot conclude that one method will yield higher or lower measures than uncorrected surveys. Or that one method should be preferred above others. These authors combine household survey and tax data for seven Latin American countries using different correction methods, and find that the ranges of estimates are wide, and that rankings vary. For example, for Argentina (2017), the unadjusted (i.e. survey-based) Gini is 47.7; the highest adjusted Gini is 52.9 (Blanchet, Flores, and Morgan 2022 method), and the lowest is 44.3 (replacing survey's incomes with tax-based incomes above an ad-hoc threshold (percentile 90), as in Jenkins, 2015) – lower than the unadjusted one. For Chile (2013), on the other hand, the unadjusted Gini is 52.4; the highest adjusted Gini is 63.2 (replacing incomes with threshold at percentile 90), and the lowest is 58.4 (replacing incomes above percentile 99). For Uruguay (2009), the unadjusted Gini is 50.6; the highest adjusted Gini is 68.4 (replacing incomes above percentile 90), and the lowest is 56.7 (Blanchet, Flores, and Morgan 2022).

Given the unpredictable pattern that correction methods yield and the fact that there is no statistical test to determine which method is more accurate in producing corrected inequality measures that are closer to the true unobserved inequality, the safer option is to present a range of corrected inequality measures rather than a single number.

The correction of household surveys to measure inequality is further extended to ensure that totals in the corrected survey match totals in national accounts. This is known as Distributional National Accounts. WID.World has produced DINA series for many countries in the world that show prefiscal and postfiscal inequality. The OECD DNA project has similar goals. The allocation of the difference between the corrected survey totals and national accounts, however, follows different assumptions whose validity cannot be fully tested in the absence of additional data on tax returns from corporations, and other pieces of information that may be impossible to get. Hence again the recommendation to provide separate estimates for the national-accounts adjusted data and rely on ranges rather than single number stands.

An important reason to do the extra step of matching the corrected survey-cum-tax income totals to corresponding income totals in the National Accounts is that in this way one can capture undistributed profits and include them in the total market (prefiscal) income of individuals. Since the rich tend to have large amounts of their income in the form of accrued rather than received income, adding undistributed profits is important for a truer estimate of the concentration of income at the top. It is also essential to include undistributed profits if one would like estimates of fiscal redistribution that incorporate the incidence of corporate taxes on individuals and households. The standard FIA and MSM reviewed above in general do not incorporate the incidence of taxes on undistributed profits in the analysis.

In DINA exercises the undistributed profits are allocated based on the distribution of capital and property income that emerges from correcting surveys with tax data on individuals (recall that this data does not include accrued incomes, only received (and declared) ones). A more accurate incorporation of undistributed profits may be accomplished if data from tax returns from businesses and corporations is used. For examples, see Candia and Engel (2022) for Chile and de Rosa and Vila (2023) for Uruguay.

An interesting question is whether misreporting of top incomes is the extent to which it affects the size of fiscal redistribution. Given that fiscal redistribution is determined by the size and progressivity of the fiscal system, one would expect that misreporting of top incomes should affect the magnitude of redistribution as well. This question is explored in De Rosa, Lustig, and Martinez-Pabon (forthcoming) using several within-survey and combined survey and tax data correction methods in seven Latin American countries for which the required data exists. (It is worth noting that counting on the CEQ Harmonized Microdata was key for this analysis because it ensured the cross-country comparability for construction of the uncorrected prefiscal and postfiscal income concepts). Because there is no analytical reason to prefer one correction method over another, the paper applies several methods to assess the sensitivity of results. In some countries the size of redistribution is similar for the uncorrected and corrected cases but in others it is not. The outcome of this exercise is, in a sense, troubling because results vary by country and by method, but the heterogeneity does not follow any identifiable patterns. That is for some countries one method yields the largest redistribution while in other countries a different method does. Similarly to what was found for inequality measures, the size of the adjustment on the redistributive effect and the top income share measures is method- and data-dependent. Again, it may be advisable to report a range of the redistributive effect rather than a single number given the uncertainty.

4.3 Beyond unitary households: gender-sensitive incidence analysis

Standard FIA and MSM treat the household as a unitary entity where all its members have equal (per capita) access to income and consumption, or they are weighted by an externally given parameter and income and consumption are expressed in adult equivalent units. However, in addition to biological differences given by age and gender, economies of scale, and preferences which translate into differences in consumption by household members, households have internal power dynamics which may result in an unfair distribution of economic resources. The primary aim of gender-sensitive fiscal incidence analysis is precisely to depart from the assumption of equal sharing in the household and assess how much of transfers, for example, accrue to specific household members, identified by their gender and age. This enables a more comprehensive evaluation of how redistributive instruments reduce the poverty of women or children compared to that of men or diminish inequality between genders.

Following Casale (2012), Glick et al. (2004), and Grown and Valodia (2010), a gender-sensitive fiscal incidence analysis is defined by whether the effect of taxes and transfers is reported by gender or in a gender-aware manner. One could classify the methods used to assess the incidence/fairness of the fiscal system into three broad groups.[33] The first one which we shall call "prototype households" approach relies on descriptive information about whether tax and benefit legislation contains specific provisions that treat men and women differently. The second approach which we shall call the "accounting method" assigns the burden of taxes and the benefits of transfers by gender. In general, because it is straightforward by nature, the categorization based on the gender of individuals is used primarily in studies that look at the incidence of public spending on education and health. In contrast, studies that focus on the impact of taxes and cash transfers, need to rely on approximations: i.e., defining the gender of the household by the relative presence or employment status of adult males and females. The latter defines prototype households and uses taxonomies based on sociodemographic characteristics of households such as sex (age, education, etc.) of the household head, single parenthood, with or without dependents, and so on to determine the distribution of tax burdens and benefits from transfers and identify if there are inequities associated with the household

[33] For a survey of approaches see Greenspun and Lustig.

characteristics which, for example, negatively affect females. These two approaches provide useful information. For instance, an analysis of the statutory PIT regimes may identify that second incomes are "punished" and this will have a deterring effect on (most likely) women's participation in the labor force. The second approach may identify that single-mother households receive more (or less) in net transfers than couple households with the same income per capita or that children from female-headed households school attendance is lower when controlling for income and other factors and so on.

These two methods, however, do not capture the agency dynamics within the household. For example, even if women receive a pension or a cash transfer, the use of the resources may be controlled by the head of household, usually a man in terms of power dynamics. Chiapori (2013) was among the pioneers in introducing analytical and empirical methods to estimate the actual sharing rules. These approaches rely on sharing rules that are endogenously determined using data on consumption items that surveys usually distinguish by gender and age (e.g., clothing). In the paper "Income sources, intrahousehold allocation and individual poverty" published in the Review of Income and Wealth in 2022, Olivier Bargain adapts models of intra-household allocation to account for women's and men's net-of-tax earnings and targeted benefits as determinants of the allocation function and applies them using household expenditure data for Argentina and South Africa, two countries that have transfer programs with benefits transferred to women. The paper finds that net of taxes earnings and benefits commanded by the wife are often positively related to her and her children's resources and illustrates how the wife's financial power -and its sources- may modify her consumption share and thus her individual poverty status.

4.4 Beyond income: fiscal policy and multi-dimensional poverty

FIA and MSM have focused on the impact of policy interventions on *income* poverty. This is insufficient for policy makers because income poverty does not capture other forms of deprivation that afflict the socially vulnerable. For instance, Alkire and Robles find there are 1.45 billion multidimensionally poor people in the world compared to about 760 million for the $1.90/day poverty line.[34] To be effective in combating poverty in all its forms, fiscal incidence analysis must overcome this shortfall. Multidimensional poverty recognizes that poverty has many forms and dimensions. It can reflect a lack of access to in-kind fiscal benefits such as public education and health insurance, or key services like water, sewerage, piped natural gas,

[34] Sabina Alkire and Gisela Robles, Global Multidimensional Poverty Index 2017, Briefing 47.

and electricity. It also considers access to housing, its quality, and security of tenure. The Oxford Poverty and Human Development Initiative (OPHI) is the global leader in measuring multidimensional policy.

In an international development agenda in which reducing multidimensional poverty is an explicit priority, a natural question is: what is the impact of the fiscal interventions over multidimensional poverty? In "Counting and Accounting: Measuring the Effectiveness of Fiscal Policy in Multidimensional Poverty Reduction," Maria Emma Santos, Nora Lustig, and Maximiliano Miranda Zanetti bring together OPHI's *counting* methodology of multidimensional poverty measurement with CEQ Institute's *accounting* methodology of fiscal incidence analysis (Santos et al., 2024). In particular, the authors propose indicators of impact and spending effectiveness of fiscal interventions for multidimensional poverty reduction.

The extension of the FIA methodology to the multidimensional poverty case is not straightforward. The information one can observe from household surveys (or census) data is the postfiscal matrix of achievements, in which each row is a household or individual, and each column is an indicator. To measure the fiscal incidence over multidimensional poverty one needs to somehow construct an analogous to the prefiscal matrix of achievements, essentially a counterfactual. Such an exercise is far from obvious for two reasons. First, for most relevant dimensions in the multidimensional space, policy interventions entail a zero-to-one change (e.g. no access *vs.* access to piped water), rather than marginal increments or decrements. In other words, pre-fiscal achievements cannot be simulated by subtracting certain magnitudes to a continuous cardinal variable. The authors thus propose to use cross sectional data at two points in time, considering the achievements at the initial point in time as the pre-fiscal matrix, and the achievements at the final point in time as the post-fiscal one.

The second issue is that achievements in the multidimensional context may have been granted or facilitated by a fiscal intervention, but not necessarily. Thus, the selection of the indicators to include in the multidimensional poverty index (MPI) that will serve as a metric, needs to be carefully done and informed such that the reduction in deprivation rates in those indicators can be reasonably attributed to the fiscal action. Natural candidates are access to public services such as water, sanitation sewage, natural gas and electricity. But other indicators may apply whenever there is information that a certain specific policy has taken place, say a social housing program.

The methodology proposed in this paper includes three indicators. First, following Alkire et al (2015), we note that the change in MPI's censored headcount ratios can be interpreted as an analogue of the marginal contribution indicator (Lustig, 2018 and 2022; see details above) in the multidimensional case, whenever such changes can be reasonably attributed to the fiscal action. Second, the authors propose impact and spending effectiveness indicators for the multidimensional poverty context that are analogous to those proposed by Enami (2018 and 2022) for the one-dimensional case. The impact effectiveness indicator is a tool for assessing how well has a certain budget been allocated to reduce multidimensional poverty, whereas the spending effectiveness indicator allows identifying the minimum budget that would have achieved the observed poverty reduction. The authors consider two alternative criteria to define the optimal distribution, which emerge from the fact that deprivations are eliminated at the household level, but households have different sizes. One criterion prioritizes maximising the MPI reduction, the other prioritizes reducing the deprivations among the most intensely poor which usually have larger households. When poverty is identified at the individual level or if household sizes are ignored, the two criteria coincide.

Implementing the proposed methodology requires cross-sectional household data alongside information on the cost of removing each deprivation at the household level, and information on the planned or executed public spending on the dimensions under analysis. The optimal distribution defined for evaluating ex-post the observed allocation of public budget can also be used prospectively as a policy tool for allocating budget. In other words, the methodology can be implemented *ex-post*, as an effectiveness assessment, as well as *ex-ante*, to guide a multidimensional poverty reduction program. The paper includes hypothetical examples as well as a guide on how to implement the approach with actual data.

This method could be considered another approach to valuing certain in-kind transfers. The outcome indicator in this case is the reduction in the postfiscal MPI (comparing MPI in two points in time). The method proposes to compare the actual reduction with an "optimal" hypothetical reduction under two criteria: how much MPI reduction could have been achieved with the same amount of spending if the latter were allocated to maximize MPI reduction and how much spending was needed to reduce MPI by the observed amount if the allocation follow the maximizing the reduction criterion.

5. Policy analysis

5.1 The accounting FIA as a policy analysis tool

FIA is a method to allocate the burden of taxes and the monetized value of government expenditures to estimate the incidence of taxes and benefits and their impact on inequality and poverty. Can standard fiscal incidence analysis be used for policy analysis? If the purpose is obtaining first orders of magnitude in contexts where the outcomes of the policy reform are not sensitive to the specifics of a tax or transfer rule (for example, the demographic composition of the household) or behavioral responses (for instance, significantly reducing hours worked in response to an increase in a transfer), the answer is affirmative.

If the outcomes of the policy reform are sensitive to the statutory rules, however, one should use the standard tax-benefit MSM.[35] In the context of examining the effects of fiscal policy reforms to accurately simulate fiscal liabilities and benefit entitlements, as discussed above tax-benefit microsimulation models require comprehensive information about the individual and household characteristics driving these entitlements and liabilities, including but not limited to household size and composition, market incomes, history of paying social insurance contributions, labor market status, disability status and so on. Based on this information and on legislative rules, tax-benefit models can then simulate the amount of fiscal liabilities and benefit entitlements at the tax-benefit unit level. Tax-benefit microsimulation is primarily used as a technique of ex-ante policy impact assessment – i.e. in predictions of the likely impact of a change in policy, prior to its implementation. The more frequently available microsimulation models do not incorporate behavioral responses. As with standard fiscal incidence analysis, these models construct prefiscal and postfiscal income concepts. The main difference is that while fiscal incidence includes information in household surveys as the first choice, a microsimulation model programs the rules that define who would receive benefits or pay

35 In its fullest form "…microsimulation models … are tools that allow the simulation of the effects of a policy, on a sample of economic agents (individual, households, firms) at the individual level. This approach to policy evaluation is based on the representation of the economic environment of individual agents, their budget constraint in particular, and, possibly, their behavior. A 'policy simulation' then consists of evaluating the consequences of a change in the economic environment induced by a policy reform on a vector of indicators of the activity and/or welfare for each individual agent in a sample of observations. …"François bourguignon and Amedeo Spadaro. 2006. "Microsimulation as a tool for evaluating redistribution policies," Journal of Economic Inequality, vol. 4, issue 1, pages 77–106.

taxes (including assumptions of take-up and evasion). Examples of these models are EUROMOD and SOUTHMOD.

Strictly speaking, the standard FIA is a rather coarse tool for policy analysis fundamentally because of two reasons. First, the assumption of no behavioral responses in the face of a change in how labor is taxed or how much a household receives in transfers may be more difficult to justify. Second, the typical FIA does not necessarily include details about the statutory rules that are beneath a particular tax or benefit. In fact, if the taxes or transfers are captured in the survey, the approach is to reflect them as is (as we indicated above). For a granular policy simulation, however, statutory rules may be essential. For example, a policy reform may affect the incidence of a tax based on household demographics (e.g., the treatment of secondary incomes, dependents, and so on). This is what a typical micro-simulation model will do (more on this below).

5.1.1 CEQ Tax Simulator

Having said this, microsimulation models entail a higher degree of complexity than the FIA accounting approach. And models with behavioral responses even more so. Thus, for a quick and rough estimate of the impact of some broad policy changes, FIA can be a useful alternative. Moreover, if one needs to assess winners and losers at, for example, the decile level, information obtained from standard FIA can be used in a rather simple way that will not require software beyond a spreadsheet app. An example is the CEQ Desktop Tax Simulator (Ali Enami, Nora Lustig and Patricio Larroulet).

This tax simulator is a spreadsheet-based tool that uses decile level data to quantify the impact of budget-neutral changes in direct transfers and/or subsidies on inequality, the poor, tax burdens, and other key indicators of alternative fiscal policy scenarios. The tool can be used to estimate distributional outcomes for any budget-neutral changes in transfers and/or subsidies, whether the latter are in response to shocks (economic crisis, natural disasters, and pandemics, for instance) or because the government would like to expand anti-poverty transfers or social protection schemes– including universal basic income programs– in a fiscally responsible manner. While this is the main objective of the simulator, it also allows the user to choose other non-neutral budgetary outcomes such as a higher or lower fiscal deficit. The tool is designed to estimate the new direct and/or indirect taxes while keeping their progressivity unchanged: that is, taxes are changed proportionally. However, it also permits changing the progressivity of taxes in two ways. First, the user can define a scenario in which the direct and/or indirect taxes are different from the baseline and the simulator would then change these new values proportionally to achieve its goal. Second, the user can set a maximum direct and/or indirect tax rate on any given decile. This feature makes it possible, for example, to set a cap on how much of the required increase in the tax burden falls on the lower deciles of the income distribution.

The advantage of the CEQ Tax Simulator is that the user can quickly generate approximate orders of magnitude of alternative fiscal policy scenarios with parsimonious data and without requiring programming skills. The limitation of the tool is that, since it is decile-based, it ignores within-decile information. As with any standard fiscal incidence analysis, the tool does not include embedded behavioral responses. However, the latter could be incorporated exogenously by, for example, changing pre-fiscal incomes because of the potential effects of higher (lower) taxes on labor supply.

A full-fledged demo was produced for Brazil to simulate the COVID-19 expansion of transfers and calculate the required increase in taxes to neutralize the increase in transfers. The tool was subsequently applied to Argentina, Ghana, India, Kenya, and South Africa. Once the data by deciles is available, getting the tax simulator ready for simulations takes approximately 15 minutes per country and each simulation takes less than a minute. This tool can become quite useful for staff in multilateral organizations, policymakers, and policy analysts.

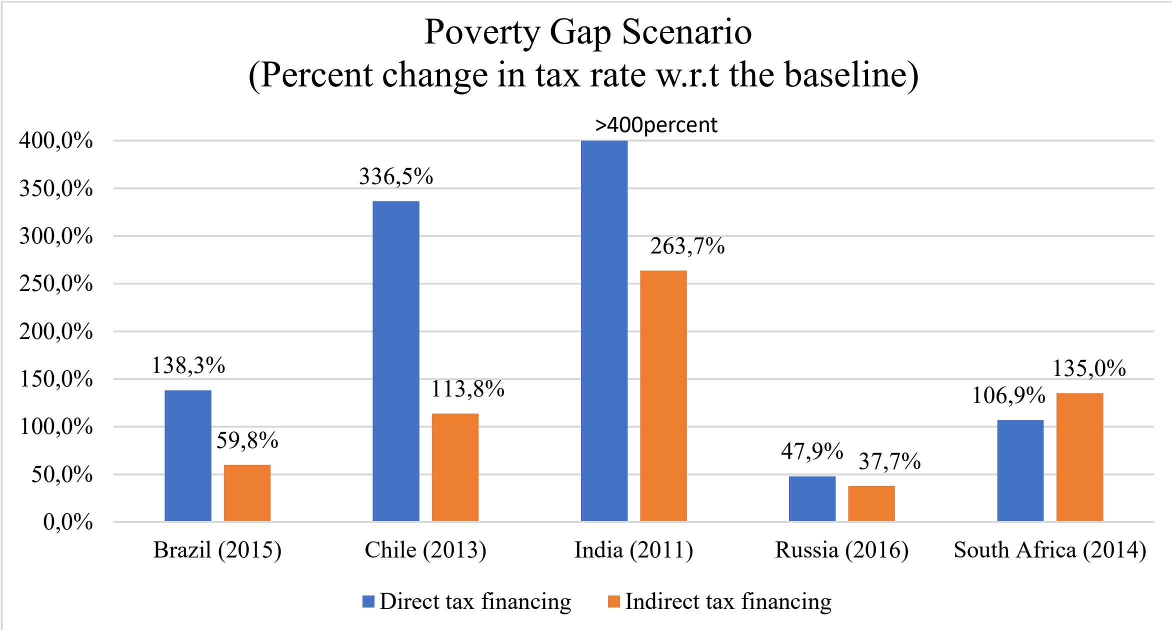
5.1.2 Applying FIA Results for Policy Analysis: Replacing Targeted Transfers by a Universal Basic Income (UBI)

The concern with errors of exclusion and stigma associated with targeted transfers and the recurrency of systemic shocks (economic crises, natural disasters, and so on) has prompted a wave of support for Universal Basic Income (UBI) programs. Replacing targeted transfers by a UBI in theory can provide an income floor or broad-based safety net for income related contingencies (which helps with consumption-smoothing), avoid errors of exclusion frequently observed in targeted programs, eliminate issues of stigma, entail administrative simplicity, and ensure more political buy-in because everybody could potentially receive a (net) benefit (Gentilini et al., 2019). In order to derive all these benefits and at the same time not hurt the poor by the switch, government spending may need to be higher than under the existing transfers system. However, expanding government spending may not be institutionally feasible or cause higher inflation and/or unsustainable debt levels. Thus it is critical to estimate how much taxes would need to be raised so that the policy change is budget neutral. If taxes would need to be raised significantly, there would be efficiency costs and significant political resistance.

Is it possible to assess the impact of a switch from a targeted program to a UBI using the results of a standard FIA? For a first order approximation of such a change, the answer is affirmative. An example of how FIA results can be used to assess policy scenarios can be found in the paper Universal Basic Income Programs: How Much Would Taxes Need to Rise? Evidence for Brazil, Chile, India, Russia, and South Africa (Enami et al., 2023). This paper analyzes the poverty and tax implications of replacing current transfers and subsidies by a budget-neutral (no change in the fiscal deficit) universal basic income program (UBI) in Brazil, Chile, India, Russia, and South Africa.

The paper relies on household surveys and administrative data housed in the World Bank's Atlas of Social Protection Indicators of Resilience and Equity (ASPIRE) and the fiscal incidence of taxes and consumption subsidies by decile from FIA studies available in the Commitment to Equity Data Center on Fiscal Redistribution (CEQ Data Center). The policy analysis considers three UBI transfers with increasing levels of generosity and identifies scenarios in which the poor are no worse off than in the baseline scenario of existing social transfers. It considers closing the fiscal gap with direct or indirect taxes or a combination of them. The main finding is that for poverty levels not to increase under a UBI reform, the level of spending must increase substantially with respect to the baseline. Accordingly, the required increase in tax burdens is high throughout. As shown in Figure 9, the increase in the average tax rate that would be consistent with not hurting the poor is almost universally above 30percent, limiting the feasibility of a UBI reform due to political resistance and efficiency costs. The paper also explores whether the fiscal gap could be absorbed through a higher deficit (lower surplus) or a reduction in government spending on other items, but both options appear to be challenging if not impossible.

Figure 9. Necessary Change in the Tax Rates to Achieve Budget Neutrality



Source: Enami et al. (2023). Figure 2, panel b.

Note: The incidence of direct taxes here is defined as the ratio of direct taxes to market income plus pensions. For the incidence of indirect taxes we use the ratio of indirect taxes to disposable income. Simulated scenarios displayed in this table are as follows: 1) Equivalent benefits: scenario in which each individual receives the average direct transfers and indirect subsidies of beneficiaries in the current system; 2) Poverty gap: scenario in which UBI transfer equals the average poverty gap for each country. See Appendix 3 (available in Supplementary Materials) for the decile-level tax rates in the baseline and the necessary change in tax rates to achieve budget neutrality.

5.2 MSM as a policy analysis tool

There is a vast body of work on MSM of different degrees of complexity used for policy analysis. Here we do not attempt to summarize it. For EUROMOD and its spinoffs the reader should refer to https://www.microsimulation.ac.uk/euromod/models/

In this section, we will illustrate the use of MSM in two very different contexts. We'll first review the application of microsimulation to assess the impact of a systemic shock like the pandemic in 2020 on inequality and poverty and the extent to which safety nets were able to mitigate these shocks. The second is an application of an MSM to estimate the trade-offs encountered between the effect on the poor and carbon footprints when introducing a carbon tax.

5.2.1 Assessing the impact of systemic shocks when information is scant and behavior of economic agents largely unpredictable/unknown: the case of COVID-19[36]

When the COVID-19 pandemic hit countries across the world, governments implemented lockdown policies of various degrees to contain the spread of the virus. Inevitably, these measures—combined with the supply and demand disruptions associated with the pandemic—caused a sharp reduction in economic activity, a fall in employment and income, and a rise in poverty and inequality. When the pandemic hit, there was an urgent need to be able to quantify its impact on living standards and poverty, and have rough estimates of how much safety nets would need to be expanded. Nowcasting this impact faced two significant challenges. First, the data was scant. Second, existing models used parameters, behavioral responses, and market- clearing assumptions that did not necessarily apply to the new circumstances. Given these restrictions, the first set of exercises was quite simple and, in particular, assumed that income losses were proportional. It was fairly obvious, however, that income losses would not be proportional. As an alternative, Musisi et al. (2020) and Lustig et al. (2020)[37] proposed a modeling framework to obtain meaningful, if tentative, estimates on how incomes and their distribution can be affected by such an unusual systemic shock. Specifically, these papers proposed a microsimulation methodology to nowcast the impact of the COVID-19 shock on inequality and poverty.

The methodology was subsequently proposed as a general approach in Lustig et al. (2023) to settings when data is scant and economic behavior is largely unknown (as it happened when the pandemic hit). The methodology proposed has relatively low information requirements and a parsimonious modeling framework introducing lots of flexibility and transparency. In particular, the information requirements are: a recent household survey, identification of sectors most/least affected by lockdowns (or other systemic shocks), and projections of aggregate GDP contractions. These three were available in the early days of the pandemic. With this information, one can nowcast a range of possible outcomes of the effects of

[36] This section draws from Lustig, Nora, Valentina Martinez Pabon, Federico Sanz and Stephen D. Younger. 2023. "The Impact of COVID-19 on Living Standards: Addressing the Challenges of Nowcasting Unprecedented Macroeconomic Shocks with Scant Data and Uncharted Economic Behavior." International Journal of Microsimulation, 16(1), 1-27. DOI: https://doi.org/10.34196/ijm.00273

[37] Albert Musisi, Wilson Asiimwe, Nicole Ntungire, Jakob Rauschendorfer, Priya Manwaring, and Stephen Younger. 2020 "Estimating Income Losses and Consequences of the COVID-19 Crisis in Uganda." CEQ Working Paper 97, Commitment to Equity Institute, Tulane University, forthcoming; N. Lustig, V. Martinez-Pabon, F. Sanz and S. D. Younger (2020). "The Impact of COVID-19 Lockdowns and Expanded Social Assistance on Inequality, Poverty and Mobility in Argentina, Brazil, Colombia and Mexico." COVID Economics: Vetted and Real-Time Papers, Issue 46, Center for Economic Policy Research (CEPR), 2020.

COVID-19 on inequality and poverty and a rough estimate of the extent social assistance would need to be expanded to mitigate the pandemic's effect on incomes. Information on the share of households who reported losing income became increasingly available. This type of additional information can be used to narrow the range of nowcasting outcomes to one. Moreover, a few months into the pandemic, there was also information on the actual expansion of social assistance, which can be used to assess how successful governments were in mitigating the impact of the pandemic.

This methodology has an important advantage compared to other "fast- delivery" exercises which assume that income losses were proportional. Based on existing information at the time, the distribution of income changed—and changed fast--during the lockdowns. In particular, "real- time" telephone surveys showed that the poorer and informal sector workers lost employment and income in a larger proportion due to the "COVID- 19 effect." The microsimulation framework proposed by Lustig et al. (2023) allows one to relax the equal loss assumption and incorporate distributional changes in the analysis. It also allows one to produce non- anonymous growth incidence curves to describe income losses across the pre-pandemic income distribution. Importantly, this framework can be easily adapted to different countries and contexts, has great flexibility, and allows one to incrementally fine- tune the projected effects as more information becomes available.

Broadly, the proposed method consists of simulating potential income losses at the household level using microdata from household surveys and other data sources (for example, in Latin America, the Latino barometro, collects data on the individual's education and that of his/her parents). The simulations first identify individuals whose income is "at risk" because they work in sectors in which COVID-19 lockdowns (and the ensuing economic impacts) have reduced or eliminated activity. The next step is to construct a simulated income distribution that incorporates those losses and compares it with the *ex-ante* distribution. The next step is to simulate a third distribution that incorporates the effects of the lockdown plus any new compensatory social assistance measures each government has taken. In addition to comparing standard distributional statistics for each income distribution, it is especially useful to examine income losses conditional on one's position in the *ex-ante* distribution. This framework allows analysts to link distributional issues to the macro discussion of fiscal consolidation and illustrate the dilemmas countries face when having to choose where to cut (choice between cash transfers and spending on education and health, for instance) or which taxes to increase since some of the latter may impoverish the poor or make nonpoor households poorer than other options. In other words, application of this framework is a crossfertilization between the microsimulation and the post-COVID analysis. The framework is also suited to assess trade-offs between alternative social protection schemes; in particular, it helps illustrate the trade-offs that a Universal Basic Income scheme entails in terms of poverty reduction and fiscal costs, for example.

5.2.2 Estimating trade-offs of "green" fiscal policies for a just transition.

Fiscal incidence analysis and several standard existing fiscal policy microsimulation models such as EUROMOD and SOUTHMOD have traditionally focused on static incidence analyses. Although some labor supply analyses have been undertaken, the frameworks currently do not have the capacity to undertake analyses of consumption related policy reforms when behavioral responses are an intrinsic part of the analysis. A classic case are policy reforms such as carbon taxes or the reduction of energy subsidies and/or carbon pricing designed to achieve greener consumption patterns. These policy changes are introduced precisely to induce behavioral responses. Thus, in such cases microsimulation models have to assume away perfectly inelastic demand functions. Demand systems need to be explicitly modeled. Furthermore, achieving a decarbonized society requires changes in many areas from transportation, through home energy use, industrial restructuring, electricity generation, dietary change, land use change, and alternative energy use. Many of these changes impose a cost or burden that is higher for some groups in society than others, resulting in policies which are environmental positive, but distributional regressive.

In the "The Distributional Impact of Carbon Taxes in Pakistan" by Cathal O'Donoghue, Beenish Amjad, Jules Linde, Nora Lustig, Denisa Sologon, and Yang Wang (2023), the authors used PRICES (Prices, Revenue recycling, Indirect tax, Carbon, Expenditure micro-simulation model) to simulate the distributional impact of carbon tax in Pakistan. Most domestic energy fuels including electricity are concentrated in the bottom of the distribution and motor fuels at the top, albeit with quite an imbalance in overall energy inequality. In addition, self-produced fuels such as firewood and agricultural residues mitigate the overall energy inequality at the bottom of the distribution. The carbon tax on direct expenditure is progressive but incorporating indirect impacts and a behavioral response reduces this effect.

The paper considers six mitigation options for simulating the impact of revenue recycling, incorporating benefits and tax related changes, and their impact on carbon emissions. The paper reports the distributional effect pre and post behavioral response and the share of winners and losers. In Pakistan the distributional impact of the revenue recycling measure has a larger effect on the net distributional impact than the carbon tax, which is relatively flat. Modelling the impact on carbon emissions, we find that the impact of the revenue recycling is relatively small relative to the price impact.

5.3 Nonstandard microsimulation tools: estimating the long-run impact of COVID-19 on human capital and inter-generational mobility

School closures and other lockdown policies implemented during the pandemic are likely to have long lasting impact on educational attainment and educational mobility. Estimating the impact of an adverse shock on education became particularly important with the school closures triggered as a policy response to contain the spread of the COVID-19 pandemic. What are the methodological options if one would like to nowcast the impact of an adverse shock on nonincome variables such as educational attainment? Neidhöfer, Lustig, and Tommasi (2021) proposed a method and apply to Latin America and the method is applied to Sub-Saharan Africa in "Nowcasting the impact of COVID-19 on education, intergenerational mobility and earnings inequality in Sub-Saharan Africa." By Guido Neidhöfer, Nora Lustig, and Patricio Larroulet, was published as the ZEW-Centre for European Economic Research Discussion Paper, (22-022) in 2022.

Broadly, the method consists of the following three steps. First, using data on parents and children's education and the standard methods to measure intergenerational mobility, the authors estimate the slope coefficient, correlation coefficient, and rank correlation for the most recent pre-pandemic cohort available (i.e. individuals born between 1987 and 1994).[38] Second, taking into account school closures and eventual re-openings, several indicators of offline and online learning, as well as other relevant characteristics, the authors simulate the heterogeneous impact by family background of COVID-19 school closures and other shocks on school achievements of these individuals. This step generates a counterfactual scenario. Third, the authors proceed to re-estimate the slope coefficient, correlation coefficient, and rank correlation for the counterfactual "post-pandemic" scenario. Additionally, they estimate the high-school completion rates for children of low- and high-educated parents for the observed and the counterfactual scenario and proceed to compare the two. The paper's findings for Latin America show that, despite that educational mitigation policies were able to partly reduce learning losses in some countries, the pandemic puts at risk the educational attainments of the most vulnerable and equality of opportunity. The likelihood of children from low educated

[38] Intergenerational mobility estimates from Neidhöfer et al. (2018) are available on http://mobilitylatam.website .

families to complete high-school could fall by 20 percentage points or more, reversing decades of progress made in Latin America in terms of access to education among children from disadvantaged households, and the average slope coefficient of intergenerational education persistence could rise by 7 percent from a regional average of 0.36 to 0.39. Results from Sub-Saharan Africa indicates that intergenerational mobility in education in sample countries is expected to decrease by 10 percent, while the likelihood of children from low-educated families to complete secondary education could decrease, on average, by 16 percentage points and effect of slope ranges between one percent increase in persistent, and an increase by almost 50 percent.

6. Concluding remarks

This paper is meant to be a guide for analysts and policymakers on available tools for assessing the distributional impact of existing fiscal policies as well as policy reforms. The main tools discussed here are fiscal incidence analysis (FIA) and tax-benefit microsimulation models (MSM). As we said in the introduction, the distinction of these two tools is not sharp-edged but they have clear different purposes. Fiscal incidence analysis is a method to allocate the burden of taxes and the monetized value of government expenditures to estimate the incidence of taxes and benefits and their impact on inequality and poverty. Tax-benefit microsimulation models are primarily used as a technique of ex-ante policy impact assessment – i.e. in predictions of the likely impact of a change in policy, prior to its implementation. Both methods construct prefiscal and postfiscal income concepts. The main difference is that while fiscal incidence includes information in household surveys as the first choice (e.g., transfers reported by households), a microsimulation model programs the rules that define who would receive benefits or pay taxes (including assumptions of take-up and evasion). Our paper includes a thorough overview of FIA and MSM. Every relevant methodological aspect is either fleshed out or readers are referred to other useful sources. The paper also presented data and software requirements as well as existing platforms which can be used to reduce the time involved in producing FIA and MSM.

In addition, our paper discussed how FIA and MSM can be used for policy simulation and analysis. We argued that if the purpose is obtaining first orders of magnitude in contexts where the outcomes of the reform are not sensitive to the specifics of a tax or transfer rule (for example, the demographic composition of the household is not important) or behavioral responses (for instance, reducing hours worked in response to an increase in a transfer), the answer is affirmative. We presented examples of how the basic FIA can be used. However, whenever the simulation results may be sensitive to the tax or transfer rule, one should use MSM and we described their main characteristics. Neither FIA nor standard MSM are well-suited to examine policy reforms when behavioral responses are an intrinsic part of the analysis, though.

Typical FIA and MSM have shortcomings. The salient one is that they do not incorporate behavioral responses, general equilibrium, or intertemporal effects. They are static and, in economists' jargon, the relevant demand and supply functions are implicitly assumed to be perfectly inelastic. Thus, the burden of direct taxes falls entirely on earners of the taxed income; that is, employers can shift the entire burden onto workers in the form of lower wages. Similarly, indirect taxes are paid entirely by consumers; that is, producers can shift the entire burden of sales taxes, VAT, etc., onto buyers in the form of higher prices in the full amount of the tax. (Analogously, the benefits from transfers are received entirely by the beneficiary households and savings from subsidies go entirely to buyers in the form of lower prices in the amount of the subsidy).

These assumptions may be appropriate for the short run. However, as time goes by, individuals and households may adjust their labor supply and consumption patterns thus shifting part of the burden to employers and producers. More importantly, there are clear cases in which one would like to model behavioral, general equilibrium, and intertemporal effects from the start. For example, one would like to assess the extent to which changing social security contributions affect informal employment, a question that is of quite relevance in the context of low- and middle-income countries. The assumption of inelastic labor supply functions must be replaced. Another area in which modeling behavioral responses is key is when assessing the impact of carbon (or other environmental) taxes or phasing out energy subsidies on the carbon footprint. The assumption of inelastic demand functions must be replaced to capture changes in consumption patterns and how these change the carbon footprint in turn. In the paper, we showed how MSM with behavioral responses could be used to estimate the distributional impact of carbon taxes with an application to Pakistan.

In the typical FIA and MSM exercises, corporate taxes are left out, top incomes are underreported, in-kind benefits in education and health are measured at average cost to government, infrastructure spending is excluded, household members are assumed to receive equal benefits, and the welfare indicator is income or consumption per person (or equivalized). Thus, in this paper we discussed how the construction of income concepts can be refined by incorporating undistributed profits (corporate income) and correcting for underreporting of top incomes in estimates of income inequality and fiscal redistribution. We showed that results are highly sensitive to the correction method. Unfortunately, there is no statistical or calibration method that can be used to decide which correction method is, pardon the redundancy, correct. Thus, analysts should report a range of results rather than a point estimate.

It should be noted that the issue of underreported income is just one of the elements that introduce uncertainty into the FIA and MSM results. A major challenge is that both the levels and structure of incomes and the components of fiscal policy (that is, total taxes by type, total transfers by type, etc.) can differ significantly depending on the source. For example, total personal income taxes or VAT shown in a FIA or MSM may not equal totals in administrative registries (tax returns, national accounts, and so on). Some of the difference is because the FIA and MSM were not modelled to capture the entirety of the fiscal intervention, so it is an expected discrepancy. Some of the discrepancy, however, can be due to measurement errors in the household surveys, the allocation parameters, and/or the administrative registries. Since it is difficult to disentangle the source, analysts are left to work with economic structures that are not necessarily accurate. This is very important in the context of analyzing the redistributive impact of fiscal policy because the latter depends on the size and progressivity of the fiscal policy components. If both size and progressivity are measured with error, the results of the analysis are subject to uncertainty. In the future, the FIA and MSM standard methodologies should include best practices on how to address measurement errors and validate results.

In the paper we also reviewed methods to estimate the benefits of in-kind spending beyond indicators of access and the average cost to government measure. The latter most likely does not reflect the welfare impact to the beneficiary. As an alternative, analysts have proposed to use the opportunity cost in the private sector and willingness to pay. These methods estimate the benefit of healthcare services to recipients rather than the cost to the government, thus addressing an important criticism of the standard approach. The problem with the latter is that because consumers exhibit positive income elasticity for healthcare, if the poor and the rich exhibit the same level of health need, healthcare demand will be higher among the rich than the poor. Observed healthcare demand therefore reflects both an individual's willingness and ability to pay for care. Consequently, instead of referring to demand calculated using revealed preference as "willingness to pay," a more accurate term is willingness **and ability** to pay. In the case of health benefits, another method that has been proposed is the "health outcomes" method: e.g., valuing the reduction in malaria-related mortality rates resulting from the introduction of bed nets. In contrast to the willingness/ability-to-pay method, the health outcomes method finds that the marginal effects of health spending can be very large. In the case of education, beyond schooling is worth what it costs the state to provide it; schooling is worth what the private education market says it is worth; schooling is worth what individuals are willing to pay; there is a fourth approach: schooling is worth what the labor market says it is worth. Each approach looks at a different angle of the valuation of education and they all provide useful information.

Spending on infrastructure such as water, electricity, sewage and sanitation, rural roads, telecommunications, public transport, and so on, often captures substantial resources of the government's budget and provide key services to the population. Access to infrastructure is unequal, especially between urban and rural areas. Thus, estimating the distributional impact of infrastructure spending is key. However, standard FIA and MSM exclude it because of the difficulties involved in allocating infrastructure benefits. In addition to the access and the willingness/ability to pay approaches, there is the times-savings approach which uses geo-spatial data both to measure individual access to transportation infrastructure and to estimate the time savings to individual households from these infrastructure in accessing education and health services, distribution centers for their goods, and so on. Time saved can be monetized in turn with information on earnings. This is an area of research that should be given high priority in the future.

Another area that should receive priority is generating the necessary data to apply methods that consider agency dynamics within the household so that one can move away from the unrealistic unitary household analysis and generate gender- and age-sensitive FIA and MSM as a standard practice. This would allow us to calculate individual-level poverty impacts of fiscal policy on women, children and the elderly that are now buried under the average effects of fiscal incidence analysis. Data shortcomings also affect the possibility of carrying out comprehensive FIA or MSM because typically some population groups are not included in household surveys. This is the case of refugees, a population group that has been growing over the years and for whom an assessment of the incidence of benefits and taxes could be important to have.

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ANNEX

A.1 Examples of Tax-Benefit Microsimulation Models

Some of the long-standing tax-benefit models that have been successfully used in research and policy analysis. It is noteworthy, there are a number of other tax-benefit models, not covered in this review, but they are proprietary, therefore the models and their documentation are not freely accessible neither for use nor for scientific scrutiny.

One of the oldest existing MSMs that covers the period starting in the 1960s to present time is **TAXSIM**, a tax simulator for the United States based at the National Bureau of Economic Research (NBER)[39]. General information on TAXSIM is provided in Feenberg and Coutts (1993). TAXSIM is a FORTRAN program, which calculates (federal and state) income tax liabilities from individual data. TAXSIM includes two interfaces (a web-based and a Stata interface) and supports a low level access to the model (a raw TCP/IP interface in this case) so that it can be used with other software. The program is hosted in a server and the code itself is not released or visible to the user. Activities of TAXSIM do not involve centrally organised production or enhancement of microdatasets for users. There are, however, ready-built codes available for creating TAXSIM datasets from commonly used survey datasets, e.g. Consumer Expenditure Survey, Current Population Survey and Panel Study of Income Dynamics. TAXSIM can be used to calculate average and marginal income tax rates and income tax elasticities. There is no separate working paper series for TAXSIM based work, though a bulk of it has featured in NBER Working Papers[40].

EUROMOD is the cross-country tax-benefit MSM for the European Union (EU), initially developed and maintained by the Institute for Social and Economic Research at the University of Essex, that is currently being developed and maintained by the Joint Research Centre (JRC) of the European Commission[41]. The construction and development of EUROMOD is documented in Sutherland and Figari (2013). The current version of EUROMOD covers all 27 EU countries. It simulates policy rules starting from 2007 or earlier, using European Union Statistics on Income and Living Conditions (EU-SILC) as the input data.

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39 See: http://users.nber.org/~taxsim/.

40 See: https://www.nber.org/papers?page=1&perPage=50&sortBy=public_date

41 See: https://euromod-web.jrc.ec.europa.eu/

EUROMOD provides fully developed and validated microsimulation models for EU countries on an annual basis. The model (in combination with input micro-data) produces output microdata containing simulated income components (individual policy instruments or sub-components) and standard income definitions (e.g. total means-tested benefits, employee social security contributions, and disposable income). All country models are constructed following EUROMOD Modelling Conventions[42] and are documented in EUROMOD Country reports.[43] Tax-benefit rules are coded using own developed modelling "language" with users having full access to and control over the coded rules – meaning they can change the tax-benefit calculations in a flexible way and apply alternative rules or assumptions as they wish. The EUROMOD custom built software is provided for free for registered users and can be used in combination with other statistical packages, such as Stata, R, SPSS.

Anyone with access to the EU-SILC data approved by Eurostat can obtain EUROMOD input datasets. Without (real) micro data, the EUROMOD model can still be applied to analysing hypothetical households similar to the OECD tax-benefit model (for the description of a EUROMOD tool that allows for that see Gasior and Recchia (2020)). In addition, EUROMOD software includes tools for calculating various summary statistics (e.g. inequality and poverty measures, average household income by income components and decile groups) and decomposing the effects of discretionary policy changes and automatic stabilizers (Paulus and Tasseva 2020), as well as add-ons to calculate indicators such as Net Replacement Rates, Marginal Tax Rates and to facilitate 'nowcasting' by modelling transitions from one status to another at the individual level (Navicke, Rastrigina et al. 2014). The research using the model can be found in the EUROMOD Working Paper Series[44].

UKMOD, a tax-benefit model for the UK and its constituent nations (England, Wales, Scotland, Northern Ireland)[45] originated from EUROMOD and since 2020 has replaced, as a stand-alone model, the UK component of EUROMOD (Richiardi, Collado et al. 2021). The most recent release of the model covers policy years from 2005 to 2026. Being developed at ISER, University of Essex, the model maintains all the flexibility of EUROMOD – policy scenarios can be created by implementing not only parametric changes, but also more structural reforms – and benefits from existing EUROMOD tools and add-ons that facilitate scenario analysis. Having retrained full interoperability with the EUROMOD models for the EU-27 countries, UKMOD is mostly appreciated by UK-based users interested in the impact of national and/or devolved policies in the UK

[42] See: https://euromod-web.jrc.ec.europa.eu/resources/model-documentation
[43] See: https://euromod-web.jrc.ec.europa.eu/resources/country-reports
[44] See: https://www.microsimulation.ac.uk/research-and-policy-analysis/publications/euromod-working-paper-series/
[45] See: https://www.microsimulation.ac.uk/ukmod/

and/or its constituent nations. The important advantage of UKMOD is that it provides an opportunity of running simulations on cross-sectional and longitudinal datasets. The cross-sectional version of UKMOD uses the Family Resources Survey (FRS) as its input dataset. The longitudinal version of UKMOD runs on the UK Household Longitudinal Study (UKHLS) data, currently covering the period 2009-2019. Moreover, UKMOD allows users to perform simulations using the Household Below Average Income (HBAI) data. This involves adjusting both the sample and income components to correct for the underrepresentation of high-income individuals in the FRS data.

While tax-benefit MSMs are routinely used by researchers and policy makers in rich countries such as the EU or OECD member states, until recently few low- and middle-income countries had access to such tools. Because of its generic structure and flexibility, EUROMOD has been successfully used as a platform on which to build microsimulation models for a number of European countries that are not part of the EU, such as Macedonia (Mojsoska Blazevski, Petreski et al. 2013), Russia (Matytsin, Popova et al. 2019), Serbia (Žarković-Rakić 2010), Turkey (Okan Erol 2022). Furthermore, the launch of SOUTHMOD and LATINMOD projects enabled the construction of tax-benefit microsimulation models for a large number of low- and middle-income countries in the Global South.

SOUTHMOD is a multi-country tax-benefit microsimulation model that has been developed using the EUROMOD platform by UNU-WIDER, the University of Essex, and Southern African Social Policy Research Institute (SASPRI)[46]. The motivation for using the EUROMOD platform and the challenges associated with adopting the EUROMOD software, structure, and guidelines in low-income countries are discussed in (Decoster, Pirttilä et al. 2019). SOUTHMOD models that are currently freely available to users include models for Ecuador, Ethiopia, Ghana, Mozambique, Namibia, Tanzania, South Africa, Uganda, Vietnam, Zambia. SOUTHMOD models have been instrumental in exploring issues that are at the forefront of the policy agenda in African countries. For instance, Gasior, Leventi et al. (2022) have assessed the distributional effects of existing taxes and benefits using SOUTHMOD models for six African countries: Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia. They found that apart from South Africa, these countries' tax-benefit systems have few poverty-reducing properties. This undesirable result is broadly due to the fact that the poor pay consumption taxes but receive very little in the form of cash transfers, the phenomenon which has been referred to as fiscal impoverishment (Higgins and Lustig 2016). Another example of a cross-country microsimulation study is Rattenhuber and Jouste (2019), who used four SOUTHMOD models (Ecuador, Ghana, Tanzania

[46] See: https://www.wider.unu.edu/project/southmod-simulating-tax-and-benefit-policiesdevelopment

and South Africa) to evaluate ex ante the expansion of a universal old-age pension. They show that universal pensions would significantly reduce poverty and inequality in settings in which no means-tested old-age pensions exist (such as Ghana and Tanzania), however at substantial costs.

LATINMOD is a multi-country tax-benefit microsimulation model for Latin American countries (Argentina, Bolivia, Ecuador, Colombia, Uruguay, Venezuela) sponsored by Centro Estratégico Latinoamericano de Geopolítica (CELAG), Quito, Ecuador, with the collaboration of EUROMOD[47]. Arancibia, Dondo et al. (2019) represents the first study making use of these microsimulation models to assess the redistributive role of tax-benefit systems in the region in a comparable manner. They further exploit the advantages of microsimulation models and perform a simulation exercise whereby the most progressive income tax system (Uruguay) is applied to the rest and assess its effect on inequality and revenue. Avellaneda, Chang et al. (2021) assess the role of tax-benefit policies in mitigating the effects of the COVID-19 crisis on the distribution of household disposable income in Colombia, Ecuador and Peru, using nowcasting techniques to adjust 2019 microdata to reflect the labour market and earnings situation observed in official labour force surveys collected during the pandemic. Their results show that COVID-related policies cushioned the effect of the crisis at the bottom of the distribution, while automatic stabilizers better mitigated the impact of the income shock at the top of the distribution. At the same time, the paper finds that social assistance programmes in place before the pandemic failed to act as automatic stabilisers due to their design as proxy means-tested benefits.

[47] See: https://www.celag.org/latinmod-un-simulador-integrado-de-politicas-fiscales-en-america-latina/

A2. Input data adjustments for Microsimulation Models

(1) *Net-to-gross income/expenditure conversion.* Microsimulation procedures require incomes to be input as gross amounts. In surveys, incomes are often collected and recorded net of income taxes and social contributions, and expenditures are recorded net of indirect taxes (VAT and excises). Therefore, the conversion of net income/expenditure to gross income/expenditure must be performed. This conversion can be achieved by applying inverted statutory tax rules or by using gross-to-net routines in an iterative procedure to find the corresponding gross value for a given net income/expenditure, as suggested by Immervoll and O'Donoghue (2001).

(2) *Adjusting the income/expenditure reference period*. Typically, surveys aim to measure either current incomes (e.g., incomes over the past month) or annual incomes (i.e., incomes over the past year). While annual incomes are more suitable for assessing the income tax base, they can be problematic for simulating means-tested benefits with a shorter reference period. Therefore, it is necessary to make adjustments to determine the average amount of each income source received in each month, rather than averaging over the year.

(3) *Aggregation within the household.* To accurately simulate all the components of the tax-benefit system, MSMs require that any income components paid to individuals should be attributed at the individual level. Only income paid on a household basis (such as housing benefits or social assistance) or expenditure should be attributed at the household level. Furthermore, it may be particularly relevant to consider the effects of policy in terms of individuals rather than the household as a whole. For instance, this consideration is crucial when studying the impact of policies on gender inequality within couples (Avram and Popova 2022).

(4) *Aggregation of income/expenditure variables*. MSMs require each income/expenditure component to be separately identifiable in the input data, even if it has a similar function to other components. For instance, those benefits that cannot be fully simulated should be separated from benefits that can be simulated. Moreover, different benefits may be treated differently by the rest of the tax-benefit system. In cases where benefits are aggregated in the data, e.g. by function, some imputation might be needed to split them appropriately. Similarly, if taxable and non-taxable components of income and expenditures are not recorded separately, imputation is needed to split them to enable the correct simulation of direct and indirect taxes.

(5) *Simulating the economic incidence of taxes*. If there is a high level of informality in the country, it might be desirable for the model to reflect the economic incidence of taxes rather than the statutory incidence. If all earnings are recorded in one variable, they should be split into earnings from formal and informal employment using the information that indicates the informality status of a respondent. This, for instance, will allow for simulating direct taxes for formal workers only. Likewise, distinguishing between formal and informal purchases is crucial for simulating the economic incidence of indirect taxes in developing countries, as these taxes are more frequently evaded by lower-income households compared to their wealthier counterparts.[48]

(6) *Treatment of expenditure on durables and housing.* The characteristics of specific goods may render it impractical and undesirable to incorporate their expenditure into simulations. Durable goods, for instance, are purchased much less frequently than nondurable goods, and reported expenditures on such items likely do not accurately reflect the average (annualized) spending by a household. The inclusion of housing expenditure poses particular challenges: it often constitutes a substantial proportion of overall expenditure, yet transactions are relatively infrequent among owner-occupiers. Therefore, it might be preferable to include a measure of durable goods consumption during the reference period and measures of imputed rent for owner-occupiers of housing instead of actual expenditures on these items during the reference period. The methodologies for these adjustments are available in the broader literature on welfare measurement.

(7) *Matching policy and income/expenditure years.* Ideally, policy simulations should be carried out using data on policies corresponding to the income/expenditure year of the underlying input data. This may not always be feasible due to a 2-3 year lag in the availability of survey data on incomes. Household budget surveys are even less frequently collected than income surveys. In such cases, all income/expenditure components extracted from the data must be adjusted to levels appropriate for the simulated policy year, using relevant indices (e.g., CPI or income growth indices) with as much disaggregation as possible. In addition, the sample may need to be reweighted to account for specific demographic and economic changes.

[48] Taxes on durables are not typically covered by MSMs or in fiscal incidence analyses, such as CEQ.

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